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GROUP COMPOSITION AND FRIENDSHIP AMONG OLIVE BABOONS (*Papio anubis* Lesson, 1827) IN KAINJI LAKE NATIONAL PARK, NIGERIA

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ABSTRACT

Primate population studies have provided baseline data on the number of animals that can be monitored. Primate inventory is essential for the evaluation of population dynamics. However, there is no such regular inventory of olive baboons (Papio anubis) in Kainji Lake National Park (KLNP). This study centered on the group composition and interaction among groups of olive baboons in KLNP. Direct count method was used to determine the population structure of identified olive baboon groups. A group was identified in each of the four Ranges (Oli, Doro, Kali and Kemenji) where olive baboons were found distributed. Census was conducted in the morning (630-730hrs) and evening (1830-1930hrs) during the dry season for a period of three months (February - April). Analysis of variance (ANOVA) was used to determine the differences between the sampling periods, age groups and sampling locations. Linear regression analysis was used to determine the relationship between different age groups. There were 48 individuals in four olive baboon groups identified with adult male to female ratio of 1:2.13. There was no significant difference between the sampling periods. There was significant difference between the sampling locations. There was a positive demographic relationship (r^2:0.25) between adult male and female olive baboons. Adult male and female olive baboons had close social interaction among each other. Olive baboons in KLNP had an optimum sex ratio. Adult male and female baboons cultivated friendships and were socially integrated. Observations and experimental studies on friendships between adult male and female should be conducted to substantiate the perceived benefits of social interaction in the study area.

Keywords: friendship, group composition, Kainji Lake National Park, olive baboon.

INTRODUCTION

Primates have been counted and studied for over five decades as part of scientific research into their ecology, behaviour and conservation. Different inventories have attempted to obtain measurement of relative abundance, density or total population. Counting of primates is vital for many fields of biology and many studies are indicating their findings on the underlying population density or abundance of the primate populations, whether ecological or social, which depends on knowing the population density and range sizes at any one site. An insight into the causes of variation in primate behaviour is often premised on the knowledge of dynamic rates of competition, which is also linked to primate density. Conservation of a primate species is very much dependent on knowing how many individuals there are globally as well as within individual populations. Primate population ecology could also give a clue into how disease affects primate populations. Many primates are threatened by extinction and therefore it is

important that their populations are monitored over time to assess how they are changing (Plumptre *et.al*.2013).

Primate population studies have provided baseline data on their density or total number that can be monitored in the future and it also creates an avenue for the assessment of the contribution of different habitat to primate conservation. Primate inventory is equally essential for the evaluation of their population dynamics, that is, the changes in number that might have occurred after a previous census. Population dynamics is the variation in the population size and also in sex-age compositions, reproduction and mortality rates, and qualities of animals in populations. An appraisal of population trends, especially where inventories are conducted frequently, is advantageous to primate conservation principles. This will guide conservation managers in taking decisions when deciding on the most appropriate conservation method to adopt as it relates to each wild animal species and also to assess the impact or success of such conservation actions. Monitoring primate populations should be a regular activity wherever there are long term field sites. For instance, the outcome of chimpanzee census in Uganda was used to develop a five year national strategic action plan for chimpanzees. Census can be a useful tool to attract attention and generate debate about what should be done to conserve primate species (Plumptre and Cox, 2006). Regular monitoring of primates can equally be an indicator of the changes taking place in a particular habitat, often times, as a result of human disturbances such as logging, hunting and conversion of forest to agricultural lands. Furthermore population estimates across time will determine whether numbers of a particular species are being maintained, in decline or in recovery. Additionally, establishing accurate numbers for each species is a critical step for conservation and wildlife policies (Beehner *et.al.* 2007).

Olive baboons (*Papio anubis*) are in the Class *Mammalia* and belong to the Order *Primata* along side with man. The individual hairs are green-grey with rings of black and yellowish-brown giving the coat a multi-colour appearance from up-close (Groves, 2001). Although Olive baboons live in a variety of habitats across their broad range they are usually referred to as savanna species, inhabiting open grassland near wooded areas. Kainji lake National Park (KLNP), Nigeria, located in the boundary between the North and South of Guinea Savanna, plays host to Olive baboons. There is no regular inventory of olive baboons and other wild animal species in Nigeria which is crucial for effective monitoring and management of their population. Studying group composition of olive baboons in KLNP will provide baseline data for their subsequent monitoring and much more inform a definite basis for their management in KLNP. Olive baboons are social animals that interact among each other, sometimes very intimately. These friendships evolve with attendant intrigues which call for understanding. This study therefore focused on the group compositions and interactions among groups of olive baboons in KLNP.

MATERIALS AND METHODS

Study Area

Kainji Lake National Park was established in 1979 by the merger of two former non- contiguous Game Reserves (Borgu and Zugurma) into one entity. It covers a total area of 5,340.82 km^2. The two sectors (Borgu and Zugurma) of KLNP lie approximately between latitudes 9°40'N and 10° 30' N and longitudes 3° 30' E and 5° 50' E (Aremu, *et. al*., 2000). KLNP is situated in the boundary between the North and South of Guinea Savanna. Riparian Forests occur on the banks of larger water courses. Generally, the vegetation is described as been Northern Guinea Savanna types which as formations of mosaic of plant communities contrasting in structure. The topography of the park is gently undulating with general decrease in elevation from West to East. Some areas are hilly with the highest elevation of about 300-350m above sea level (Ayeni, 2007).

The park is drained by a network of rivers and streams, all of which empty into the rivers Oli, Timo and Doro The drainage in Zugurma sector consists of Manyara and Ruwa Zorugi Rivers. The park has a yearly circle of dry and wet season based on Northern Savanna climate. The wet season begins from April to October while the dry season is from November to early April with a short harmattan period between mid-December and February. The annual rainfall ranges from 975mm to 1220mm. KLNP has 59 plant families. The dominant tree species include; *Burkea africana, Detarium microcarpum, Afzelia africana, Isoberlina*

tomentosa, *Acacia spp.* etc. There are over 66 species of large mammals belonging to 13 artiodactyls, 10 carnivores and 5 primate species.

The park is rich in bats, birds and insects. In addition, there are 62 species of fish belonging to 20 families and 28 species of reptiles and amphibians. Examples of the animal species in the park include Roan antelope (*Hippotragus equinus*), Olive baboon (*Papio anubis*), Patas monkey (*Erythrocebus patas*) Buffalo (*Syncerus caffer*), Senegal (*Kobus kob*), Hippopotamus (*Hippopotamus amphibus*) etc. (Ayeni, 2007).

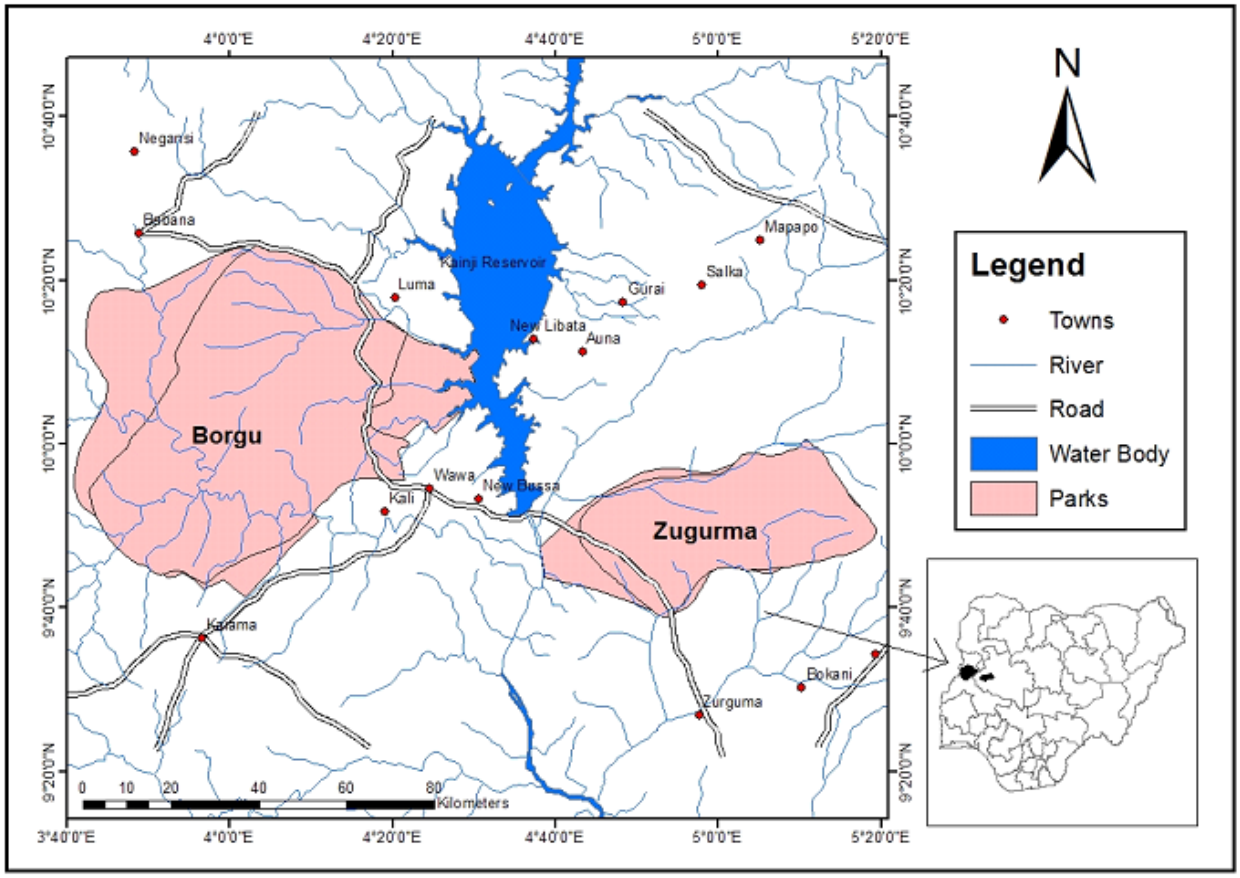

Fig. 1. Map of Kainji Lake National Park

Data Collection

This study is a preliminary report of an ongoing research on the ecology of olive baboons in KLNP that began in 2012. Data were pooled from the first dry season within duration of three months (February to April)

In order to identify each distinctive group of olive baboons in KLNP, their sleeping sites were identified. Sleeping site, food and water are the three major resources that contribute to the survival of wild ranging baboons (Crook *et.al.* 1968 and Whiten *et.al.* 1987). Baboons return to sleeping sites every night which serves as a base line for the study of their distribution and abundance.

Their sleeping sites were identified through trailing system and auditory clues. Trailing system involved following behind the animals or tracing their movement through their foot prints and fresh feacal droppings, preferably in the evening for olive baboons, from drinking sites to their sleeping sites. Often times, olive baboons retire from water points in the evening to their sleeping sites. On the other hand, identification of olive baboons' sleeping sites through auditory clue was by tracking their vocalization such as long alarm calls, warning barks and other forms of vocal communications they made right from their sleeping sites before departure for foraging in the morning. Their vocalizations were monitored from 0500hrs. Olive

baboons sleep between 1900 and 0600 hours the following morning (Markham *et.al*. 2013).

Direct count method was used to determine the population structure of the identified olive baboon groups. This method involved the counting of all the animals directly sighted. This aimed at counting all the individuals that occurred in an area. Direct count of Olive baboon is suitable and possible when these animals congregate within a relatively small area or key sites such as sleeping sites and water holes (Mcneilage *et al*. 2001). The sleeping sites served as counting areas (Beehner *et. al.* 2007). Direct count of Olive baboons in the study area was carried out in the sleeping sites earlier identified.

The study was carried out in four identified Ranges (Oli, Doro, Kali and Kemenji) out of the six Ranges in Borgu sector of the park where the olive baboons were found distributed. These ranges were the areas intensively used by olive baboons. This is in line with Adeyemo (1992).

Four groups of olive baboons (one group from each range) were identified and counted. Counting was carried out in the morning between 630hrs and 730hrs while the focal animals were still in their sleeping sites before foraging and in the evening between 1830hrs and 1930hrs on return from foraging and other daily activities. Records were taken from tolerant and considerable distances away from the animals. This was to avoid the study animals from being agitated/frightened and to ensure that the observers were not attacked by the animals under study.

Data Analysis

Analysis of variance (ANOVA) was used to determine if the differences between the sampling periods, age groups and sampling locations were significant. Linear regression analysis was used to determine the relationship between different age groups.

RESULTS

Group composition of olive baboons in Kainji Lake National Park

Presented in table 1 is the group composition of olive baboons in the study area. The adult male to female ratio was 1:2.13. The groups consisted more of adult female baboons. The linear regression analysis indicated that there was a positive demographic relationship (r^2: 0.25) between adult male and female baboons in the focal groups.

Table 1: Group composition of olive baboons in KNLP

Month	Adult male	Adult female	Sub-Adult	Infant	Total
February	8	20	13	10	51
March	9	17	12	8	46
April	7	14	15	12	48
Mean	8	17	13	10	48
Sex ratio	1: 2.13				

Spatial distribution of olive baboons in KLNP

Indicated in table 2 is how the study animals were spatially distributed across the park. The largest focal group of olive baboons was sighted in Oli while the least was recorded in Kemenji.

Table 2: Spatial distribution of olive baboons in Kainji Lake National Park

Sampling location	February	March	April	Total	Mean
Doro	16	11	15	42	14
Oli	13	18	15	46	15
Kali	12	10	13	35	12
Kemenji	10	7	5	22	7
Total	51	46	48	145	48

Analysis of Variance for sampling period and age groups

The result of the analysis of variance (ANOVA) to determine the difference between the sampling periods and age groups of olive baboons in the study area is presented in table 3. There was no significant difference between the sampling periods but there was a significant difference between the age group of the animals.

Table 3: ANOVA for Sampling period and age groups

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	
Rows	3.166667	2	1.583333	0.322034	0.736464	5.143253	Not significant
Columns	140.25	3	46.75	9.508475	0.010705	4.757063	Significant
Error	29.5	6	4.916667				
Total	172.9167	11					

Analysis of Variance for Sampling period and sampling location

The result of the analysis of variance (ANOVA) to determine if there was any difference between the sampling periods and sampling location is presented in table 4. There was no significant difference between the sampling periods but there was a significant difference between the sampling locations.

Table 4: ANOVA for Sampling period and sampling location

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	
Rows	110.9167	3	36.9722222	5.43265306	0.038057	4.75706	Significant
Columns	3.166667	2	1.58333333	0.23265306	0.799257	5.14325	Not significant
Error	40.83333	6	6.80555556				
Total	154.9167	11					

DISCUSSION

The male to female ratio of olive baboons in Kainji Lake National Park, Nigeria being 1:2.13 is in accordance with what was reported for hamadryas baboon (Papio *hamadryas hamadryas*) in Central Eritrea which was referred to as being a female biased population (Zinner, *et al.*, 2001). It is also in line with the findings of Adeyemo (1992) who reported that sex ratio of olive baboons in Old Oyo National Park varied from 1:1.7 to 1:2.2 The basis for the high female to male ratio was not farfetched. This could be explained through social organization of the olive baboons. Adult males defend the group against invasion by other males in search of sexual partners within another group. They leave their natal groups at puberty to avoid inbreeding. Conventionally, male olive baboons and other social animals avoid breeding with members of their kin by migrating to another group before mating (Greenwood, 1980) but when this custom is not observed, it often results into early fetal loss and longer interbirth intervals for the female animal (Muniz *et al.*, 2006). The process of defending the group against other male intruders and avoiding inbreeding by migrating to other groups is often met with aggression and agonistic behavior which makes them vulnerable to life threatening scenarios that sometimes lead to death. In extreme cases, it could culminate into decimation of the male population. On the contrary, female baboons remain in their natal groups almost all through their entire life span and by implication, the risk of extermination through confrontations is minimal or almost non- existent. These, perhaps explain why there are more female baboons in the study population.

Adult males also defend the group against predation. In a similar study, Kifle *et al.* (2013) premised an extremely high female to male ratio of baboons on an increasing predation pressure on sub adult males by dogs and leopards. The attack on sub adult males would inadvertently reduce the number of sub adults that would make it to adulthood. Additionally, adult males are more adventurous and

audacious than females when it comes to raiding crops, which further exposes them to risk of depredation by farmers. Furthermore, female baboons reach sexual maturity at about the age of six years unlike their male counterparts that attains sexual maturity between eight and ten years. Despite the study population having a high female to male ratio, the population was adjudged viable because olive baboons operate a promiscuous mating system. The presence and the number of infants were also indicators of the habitat quality.

Result of the statistical analysis revealed the relationship between the different age groups. There was a positive relationship between the population of adult females and adult males. There existed not only demographic relationship but also social relationship between adult males and females. The two sex groups were observed relating closely with each other in the study area. It is noteworthy to state that these close associations often referred to as "*friendship*" were not peculiar to olive baboons alone. These friendships could also be found in most other primate species. (Ostner *et al.,* 2013 and Massen *et al.,* 2013) and might culminate into long term bonding (Strum 1974). In fact, two-thirds of primate genera display permanent or year round friendship between adult males and females (van Schaik and Kappler, 1997). For example, savanna baboons; *Papio cynocephalus* are known for high level association between anoestrous female and some adult males (Bercovitch, 1991). Female non human primates develop strong ties with kin and other group members (Silk *et al.,* 2003). Although our field observation revealed that the social relationships were mutual and reciprocal, the friendship seemed more pertinent to adult female olive baboons. This submission was further echoed by other researchers. (Dunbar, 1991) reported that friendship between adult male adult female of different non human primates played a vital role in the daily lives of female primates. He further stated that females formed close and long lasting relationship with other group members and spend quality time grooming and resting together. These relationships have been noted to have adaptive consequences for females. In other words, adult female olive baboons are believed to be direct beneficiaries of heterosexual relationships. For instance (Archie *et al.,* 2014, Silk *et al.,* 2010) reported that social relationships affect or predicts adult survival in wild female baboons and consequently longevity is enhances. Wild female baboons also benefit from friendship with male baboons in form of bi-parental offspring care, whereby there is an attachment of adult male baboons to infant which advances into subsequent nurturing of juveniles. These adult male companions equally defend offspring during agonistic interactions (Palombit *et al*. 1997, Ostner, *et al.,* 2013, Langos, *et al*., 2013 and Archie *et al*., 2014). This was exemplified in Kainji Lake National Park by adult male baboons backing infants or infants clinging to the abdominal part of the adult male during instances of perceived danger or threat to life.

With high female to male ratio of the olive baboon groups, it becomes logical and inevitable for adult females to develop friendship with adult males in order to have unfettered access to potential mates. Female baboons' friendship with their male counterparts has reproduction implications as it contributes to their reproductive success. Adult female baboons also place premium over their friendship with male baboons for the benefit of reduction in harassment from other dominant or high ranking females in the group. Similar to this benefit are minimized risk of exposure to predation and other stress related behaviours. Wild female baboons also cultivate friendship with male baboons for the privilege of protection against infanticidal males and to facilitate infant survival (Palombit *et al*. 1997, Silk *et al*. 2003).

A good number of these primatologists had only reported the importance of female baboon friendship with their male counterparts hypothetically or in form of 'perceived benefits'. However, certain researchers have gone a step ahead to test and confirm these hypotheses through field observations and experiments. Prominent among them was the result of the findings of Archie *et al.* (2014). They considered if the magnitude of social connectedness of female baboons with opposite sex conspecifics in Amboseli, Kenya contributed to their survival. They discovered that high level of affiliative social behavior with adult males decreased the risk of death of female baboons by 45%. In essence, they confirmed the hypothesis that social connectedness of female baboons with conspecific opposite sex afforded them the fitness benefit of increased survival.

In another vein, Palombit *et al*. (1997) considered the benefit of social interaction to female baboons in South Africa with three hypotheses; *female baboons derive male protection against infanticidal males, females escape harassment by dominant females and adult male bonding to an infant which transcends into subsequent care of juveniles*. They were however only able to substantiate the 'anti-infanticidal' hypothesis. Similarly, Silk *et al.* (2003) established the hypothesis that social integration of female baboos not only favourably impacted but was also a significant predictor of infant survival.

In all of these, it is essential to point out that these perceived and established benefits of female baboons are often group and site-specific. For instance, a female baboon in a group having a fairly balanced male-female ratio may not cultivate friendship with male baboons for the benefit of access to mating partners unlike a female baboon in a group having an exponentially high female to male ratio group. Likewise, a female baboon in a group utilizing a habitat that does not overlap with another group will not consider social integration for the purpose of avoiding infanticidal males. External or intruding male baboons from other groups have the tendency to indulge in infanticide in a bid to divert the attention of the nursing mother from the infant and thereafter secure such attention.

CONCLUSION

Olive baboons in Kainji Lake National Park have an optimum sex ratio which reflects a viable and conducive habitat. There was a positive demographic relationship between adult male and female olive baboons. Adult male and female olive baboons had close social interaction among each other. Adult male and female baboons cultivated friendships and were socially integrated. Research on population dynamics of olive baboons in KLNP should be sustained so as to have a trend analysis of their population ecology and dynamism. Observational and experimental studies on the friendship between adult male and female baboons should be conducted in order to substantiate the perceived benefits or the basis for social interaction in the study area.

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