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DAILY ACTIVITY BUDGET OF MONA MONKEY (*CERCOPITHECUS MONA SCHREBER*) IN IBODI MONKEY FOREST, OSUN STATE, NIGERIA

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ABSTRACT

The Mona monkey (*Cercopithecus mona*) are widely distributed in Nigeria having urban, peri-urban and wild populations but with little or no knowledge about their activities in the country. Daily activity budget of the animal was studied in Ibodi Monkey Forest, Osun State, Nigeria in February and June 2013 to determine the behavioural categories and daily activity budget. Direct observations were undertaken for twenty days, 10 days each in both dry and rainy seasons. T statistic was applied in the analyses of the dataset obtained at $P < 0.05$. Eight activities namely; locomotion, resting, feeding, playing, vocalization, grooming, agonistic and mating were observed in both dry and rainy seasons. Mona monkey used most of their time for moving (32%), followed by feeding (25%), then resting (23%) while playing and grooming had 11% and 6% respectively. During the dry season, the highest period was also expended on locomotion (37%), followed by feeding (32%), then resting (16%) while playing, vocalization, grooming and agonistic had 5%, 6%, 2% and 2% respectively, while none on mating. The t statistics of the daily activity budget between rainy and dry seasons revealed that locomotion ($t = -0.12$, $P = 0.90$), feeding ($t = -0.95$, $P = 0.37$), and agonistic ($t = 0.77$, $P = 0.45$) were not significantly different ($P > 0.05$), while resting ($t = 8.16$, $P = 0.00$), playing ($t = 18.22$, $P = 0.00$), vocalization ($t = -11.35$, $P = 0.00$), grooming ($t = 11.95$, $P = 0.00$) and mating ($t = 2.27$, $P = 0.04$) were significantly different over seasons ($P < 0.05$). A judicious use of this information will aid the development of the site ecotourism purposes and ensure effective conservation and management of this species in perpetuity at the site.

Keywords: Direct observation, locomotion, ecotourism, management

INTRODUCTION

Time budget is a quantitative description of how animals apportion their time for feeding and other activities (Ramachandran, 1998). Patterns of daily activity and behaviour can vary widely between species and these activity budgets help in the understanding of the life history and ecological adaptations of animals (Jonsson and Afton, 2006). Time activity budgets reflect on a combination of factors including individual physical condition, food availability, social structure and environmental conditions (Peres, 1993; Passamani, 1998; Asokan and Ali, 2010). Time is a limited resource for all animals

and its partitioning is influenced by sociality (Pollard and Blumstein, 2008). An understanding on how primates divide up their activities throughout a day and a year is important to understand their lifestyles and to generally indicate how primates interact with their environment and invest energy and time for survival and reproduction (Defler, 1995).

Time allocation may also be a critical factor that influences the evolution of group size (Pollard and Blumstein, 2008). Studies have shown that primate social behaviour is more or less similar to human behaviour such as eating, playing,

fighting, keeping the baby and others (Kamarul *et al.*, 2012). Activity budgets for primates in disturbed areas such as human settlements are different from those in their natural habitat (Krebs and Davies, 1993). Many serious ecological changes had occurred due to the increasing human population and development of agricultural areas (Kamarul *et al.*, 2012). Primates have to change their daily behaviour according to the environment to ensure their survival.

Collecting information on activity budgets of wild animals, especially the temporal organization of contrasted behaviours, are of prime importance to understand the processes of acquisition and allocation of resources in relation to physiological status and environmental conditions (Lagarde *et al.*, 2008). In natural conditions, recording accurately activity budgets is often a particularly difficult and time-consuming task. Little or no knowledge had been acquired on the daily activity budget of Mona monkey (*Cercopithecus mona*) in Nigeria. As a matter of fact, this shortcoming is due to the time consuming, rigorosity and high technology associated with the behavioural studies of this animal.

Muchmore, the loss of tropical forests is occurring at a rate of 1.1% per year (FAO, 2000) and has resulted not only in a decline of forest habitat, but also in fragmentation of the landscape (Wong and Sicotte, 2007). Sacred forests in Nigeria including Ibodi are not an exception to this devastating phenomenon. Forest fragmentation may cause local extinctions or a loss of genetic diversity (Sauer, 1998). Before local extinctions occur, habitat fragmentation can have other more subtle effects on the activity and the movements of the animals in their habitat. Many primate species including *C. Mona* live in what appear to be sub-optimal habitats, yet seem to be able to survive.

Conscious efforts towards documenting how *C. mona* fare in these circumstances of forest losses can contribute to our understanding of what would constitute the minimal conditions allowing survival in the short term, and guide conservation decisions regarding investment towards the preservation and possibly enhancement of small forest fragments. Studies

on the behaviour of *C. mona* in Sacred forest fragments in comparison to larger forest blocks can give an indication of habitat quality (such as food availability, density and distribution) at least in the short term (Menon and Poirier, 1996; Zarette *et al.*, 2000). In an instance, the proportion of time spent travelling or feeding may increase if species must spend more time searching for foods or are eating lower quality foods (Menon and Poirier, 1996; Onderdonk and Chapman, 2000). An increase in the amount of time spent foraging may result in a decline in social activity (Clarke *et al.*, 2002]. Lower food availability and density may result in longer day journey lengths, suggesting that individuals have to travel more to meet their nutritional requirements (Watts, 1991; Gillespie and Chapman, 2001). The objective is to identify the behaviour categories that has characterized the presence of Mona monkey in Ibodi Sacred Forest despite its closeness to large human settlement and with a dynamic agricultural activities. This study will also provide information on the daily activity budget of *C. mona* which can be an important tool to develop the ecotourism potentials and ensure effective conservation and management of this species in perpetuity at the site.

MATERIALS AND METHODS

Study area

The study area is situated within Ibodi, Osun State, Southwest Nigeria. It lies between latitude 7° 34' 60" North of the Equator and longitude 4° 40' 60" East of the Greenwich meridian. Ibodi town is bounded in the East by Ilesa, Odo Igbo and Irogbo, in the south by Ifewara, Iwara, Itagunmodi, in the west by Osu and Iloba, while it is surrounded in the north by Ila, Oke Osin and Iregun (Fapounda, 2005). Muchmore, the study area has an altitude of 456m above sea level and situated within the rainforest vegetation belt of Nigeria. Temperature ranges from 21 – 28°C with high humidity (Fapounda, 2005). The area enjoys tropical climates within the two distinct seasons. The rainy season falls between April and October, while the dry season falls between November and March. The South-westerly winds and the North-easterly winds blow the rainy and dry seasons respectively (Cohen and Goldman, 1991).

Ibodi is an agrarian town with people solely depending on agriculture to survive. Specifically, arable crop production such as cereals (maize), root and tubers (yam, cassava and cocoyam) and vegetable (tomatoes, okro, pepper, and leafy vegetables) are majorly cultivated. Also, few of the residents are made up of civil servants, hunters and traders.

Behaviour scanning method

Daily activity budgets observation was made from morning, 0600 hours until 1800 hours for 2 to 3 days a week. Twenty days of observation were carried out in February (Dry season) and June (Rainy season), 2013, making up of Daily scan of 10 days each in both seasons. Preliminary non formal observation was carried out to determine the behaviour categories of the subjects (Md-Zain *et al.*, 2008) in January 2013. The study location was transversed into three transects with the total length of 800m. Binocular was used if the study group was at a far distance and the observer faced obstacles to approach the group. Quantitative data was recorded through scans which were taken every 15 minute throughout the full-day (Fashing, 2001). Activities such as feeding, resting, moving, social; as defined by Teichroeb *et al.*, (2003) were recorded for the first 5 individuals spotted in the group/sub- group. Five minutes were allowed for finding the individuals and the group/sub- group was circled between scans to get a random selection of individuals. Once an individual was spotted, the observer waited 5 seconds before recording the behaviour to ensure eye-catching behaviours were not over-represented (Teichroeb *et al.*, 2003). In order to reduce bias, the surveys were stopped when the weather became cloudy or during rain as subjects were usually partially obscured or moved completely out of sight

According to Guo *et al* (2007), activities are: resting; this is when a monkey was stationary or sleeping, locomotion; when a monkey was travelling, feeding; when a monkey was actively manipulating potential food items, ingesting or masticating food, grooming; this is an activity that takes place when a monkey was embraced by the other monkeys in the troop.

Statistical analysis

T statistic was applied to analyze the behaviour dataset obtained. This non- parametric test was used in order to analyze the significance difference of activity budgets between the rainy and dry seasons. Each activity was compared between seasons (seasons and time blocks pooled), using t-tests. All the analysis was performed by MINITAB statistical software. All comparisons were tested at $P < 0.05$ and the results of the above analysis each were interpreted using standard statistical procedures (Zar, 1999).

RESULTS

The time expended on different activities by *C. mona* in Ibodi Monkey Forest during the rainy season are presented Figure 2. Eight activities namely; Locomotion, resting, feeding, playing, vocalisation, grooming, agonistic and mating were observed. The highest period was expended on locomotion (32%), followed by feeding (25%), then resting (23%) while playing and grooming had 11% and 6% respectively. The least period was expended on three activities; vocalisation, agonistic and mating which had 1% each. The time expended on different activities by *Cercopithecus mona* in Ibodi Monkey Forest during the dry season were presented in Figure 3. Eight activities namely; Locomotion, resting, feeding, playing, vocalisation, grooming, agonistic and mating were also observed. The highest period was expended on locomotion (37%), followed by feeding (32%), then resting (16%) while playing, vocalisation, grooming and agonistic had 5%, 6%, 2% and 2% respectively. No period was expended on mating. The average duration expended per day on different activities by *Cercopithecus mona* over seasons in Ibodi Monkey Forest are presented in Table 2. During the rainy season, locomotion (5.01 ± 0.33 hours) had the highest average daily duration, while mating (0.06 ± 0.01 hours) had the least. Moreso, locomotion (5.05 ± 0.07 hours) had the highest average daily duration in the dry season, while mating (0.02 ± 0.01 hours) had the least.



Source: Fayenuwo, 2014

Figure 1: Location of Ibodi Sacred Forest in Osun State, Nigeria

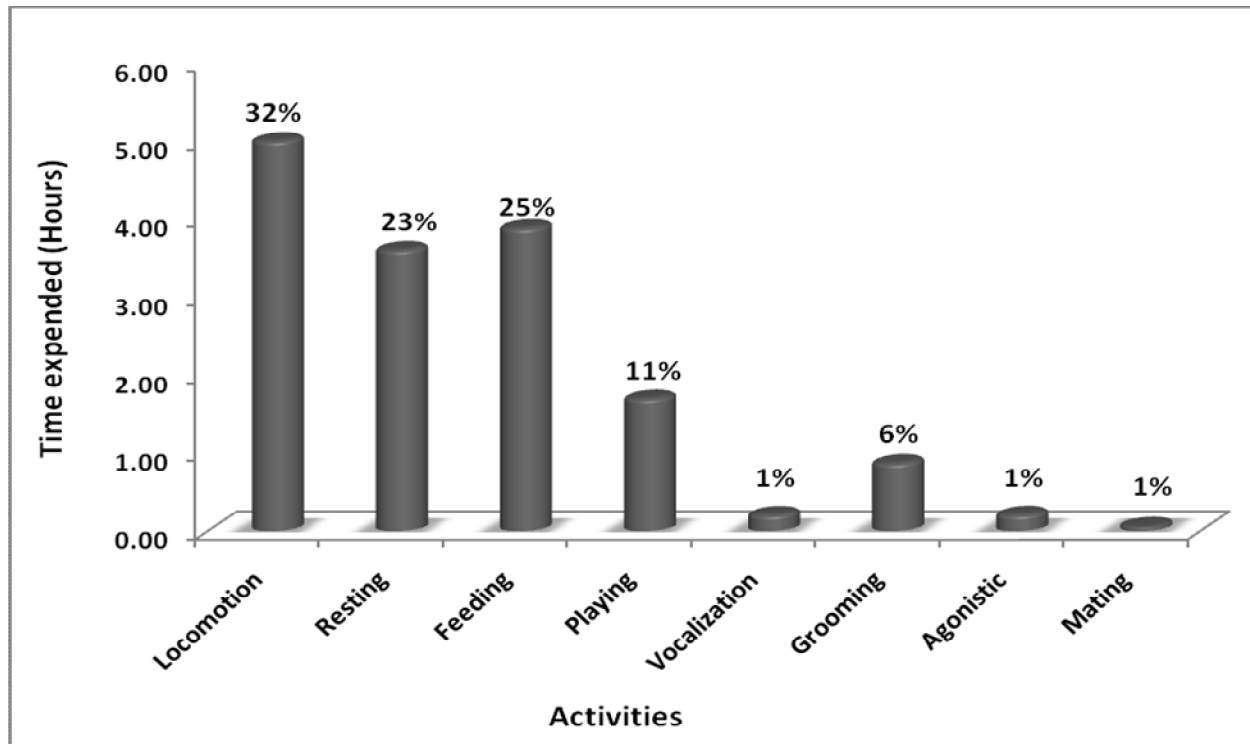


Figure 2: Time expended on different activities by *Cercopithecus mona* in Ibadgi Monkey Forest during the rainy season

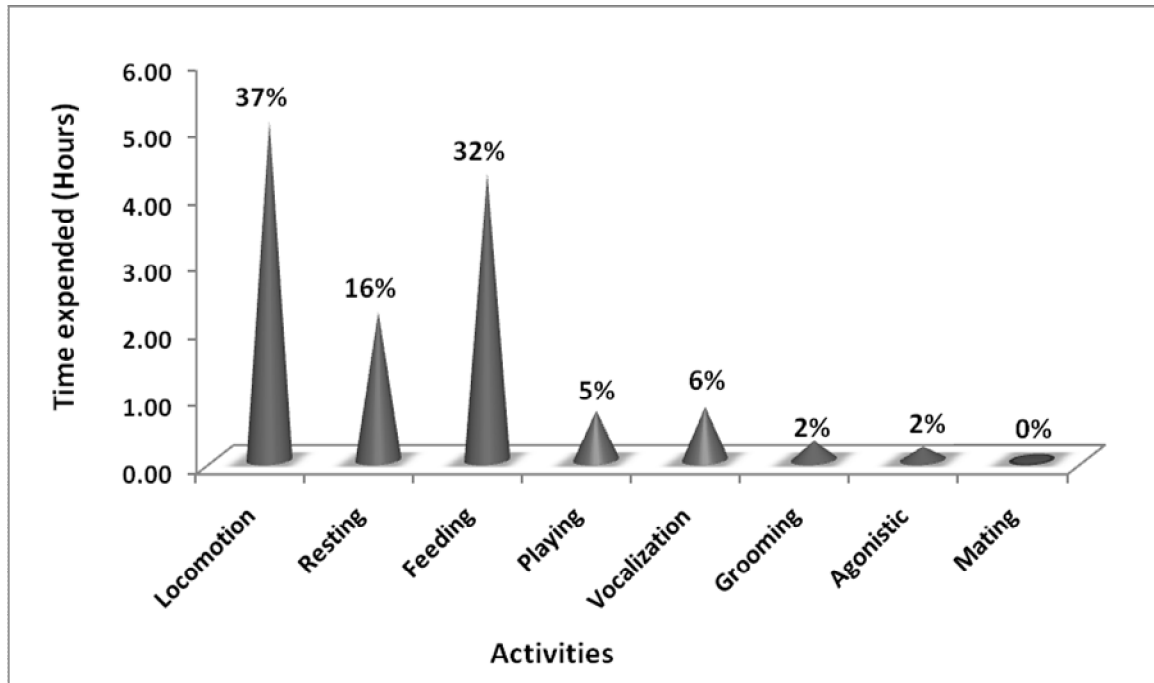


Figure 3: Time expended on different activities by *Cercopithecus mona* in Ibodi Monkey Forest during the dry season

Table 2: Average duration expended per day on different activities by *Cercopithecus mona* during the rainy and dry seasons in Ibodi Monkey Forest

Activities	Average daily duration (Hours)	
	Rainy season	Dry season
Locomotion	5.01 ± 0.33	5.05 ± 0.07
Resting	3.61 ± 0.15	2.21 ± 0.09
Feeding	3.88 ± 0.39	4.26 ± 0.10
Playing	1.70 ± 0.04	0.73 ± 0.03
Vocalization	0.21 ± 0.02	0.79 ± 0.05
Grooming	0.88 ± 0.04	0.28 ± 0.03
Agonistic	0.21 ± 0.01	0.19 ± 0.02
Mating	0.06 ± 0.01	0.02 ± 0.01

Note: Observation hours = 560 hours
 Mean ± Standard Error at 95% Confidence limit

Table 3: T statistics of the average duration expended per day on different activities by *Cercopithecus mona* between rainy and dry seasons in Ibodi Monkey Forest

Activities	Df	t values	p values
Locomotion	9	- 0.12	0.90 ^{ns}
Resting	14	8.16	0.00*
Feeding	10	-0.95	0.37 ^{ns}
Playing	17	18.21	0.00*
Vocalization	12	-11.35	0.00*
Grooming	17	11.95	0.00*
Agonistic	13	0.77	0.45 ^{ns}
Mating	17	2.27	0.04*

Note: * means there is significant difference (p <0.05)
 Superscript “ns” signifies there is no significant difference (p >0.05)

Table 4: Paired samples t statistics of the time budget per activity of *Cercopithecus mona* between the rainy and dry seasons in Ibodi Monkey Forest

Seasons	Average time per activity (Hours)	T value	P value
Rainy	2.21 ± 0.73		
Dry	1.93 ± 0.75		
		0.27	0.79 ^{ns}

Note: superscript “ns” signifies there is no significant difference (p >0.05)

Table 3 shows the t statistics of the average duration expended per day on different activities by *Cercopithecus mona* between rainy and dry seasons in Ibodi Monkey Forest. It was observed that locomotion (7) had the least degree of freedom, while playing, grooming and mating had the maximum of 17 each. Three activities (locomotion, feeding and agonistic) showed no significant difference (p>0.05) over seasons. However, five activities (resting, playing, vocalisation, grooming and mating) were significantly difference (p<0.05) over seasons. Table 4 shows the paired samples t statistics of the time budget per activity of *Cercopithecus mona* between the rainy and dry seasons in Ibodi Monkey Forest. Rainy season (2.21 ± 0.73 hours) had the highest average time per activity, while the dry season (1.93 ± 0.75 hours) had the least average time per activity. Nevertheless, there was no significant difference in the total

time per activities of *Cercopithecus mona* between the rainy and dry seasons (p>0.05).

DISCUSSION

Locomotion: A large portion of daily activity budget for *C. mona* in Ibodi Sacred Forest was expended locomotion since Mona monkeys are always at alert, agile and ready to move at the slightest disturbance. This supports studies conducted by Suhailan (2004) and Sia (2004) on long-tailed macaques that showed locomotion to have the highest portion of daily activity budget in local residence areas. Active movements are strategy to escape predation in many monkey species. In this study, locomotion of *C. mona* tends to be higher during the dry season than the rainy season, and it is significant over the seasons, this may be as a result scarce food sources during the dry season. They have to move further in order to find food needed for additional energy required as a result of brighter

condition of the period. This is true as locomotion pattern is greatly influenced by food sources distribution (O'Brien and Kinnaid, 1997). Human activities such as urbanisation, agricultural activities and logging/ flitching in the Ibodi Sacred Forest are always on the increase in the dry season making food sources to be more dispersed. These disturbances invariably increased the time expended on locomotion.

Feeding: *Cercopithecus mona* spent less time feeding compared to locomotion. Feeding behaviour was recorded as the second highest activity in both rainy and dry seasons. This was similar to studies conducted by Suhailan (2004) and Tuan-Zaubidah (2003) on long tailed macaques. Time expended on feeding by *Cercopithecus mona* was higher during the dry season than the rainy season, although the differences were insignificant. This cannot be unconnected with the high metabolic rate of food in animals during a low humid and high temperature conditions. Thereby, this always resulted in an increased appetite for food by animals during the dry seasons. In course of the observation, *C. mona* were seen to have spent more time feeding when food was available. The animal in the study area consumed food such as leaves, fruits, tubers of the following plants; *Ficus mucoso*, *F. exasperata*, *F. capensis*, *F. thonningii*, *Musa sapientum*, *Theobroma cacao*, *Dioscorea spp*, *Manihot sp*, *Elaias guineensis*, and junk foods usually obtained from the garbage cans in the adjoining buildings. Feeding sometimes causes conflicts among the individuals as animals were seen competing for food. This occurrence was mostly seen in the dry season. It was observed that gathering of food was mostly dominated by higher ranking *C. mona*.

Resting: Resting activities took different amount of time for *C. mona* in both rainy and dry seasons, in which their differences were quite significant. It was observed that the higher the resting, the lower the time expended on feeding. This confirmed the assertion made by Kurup and Kuram (1993) that the time spent for feeding was inversely related to resting. Also, an increase in behaviour causes a decrease in other

behaviours (Jaman and Huffman, 2008). *Cercopithecus mona* in Ibodi sacred Forest were observed to have spent less time resting in the dry season because they spent much time feeding and searching for food sources. It was also seen that the resting periods come after feeding. Most resting behaviour in *Cercopithecus mona* occurs when food sources appear unlimited. During resting time, the animal usually sleep, lie down and sit without doing anything. The *Cercopithecus mona* usually rest on tree branches of woody plants such as *Citrus sinensis*, *Harungana madagascariensis*, *Garcinia kola*, *Cola acuminata*, *Milicia excelsa*, *Zanthoxylum lepriurii*, *Ficus thonningii* and many others. More resting period were observed in *Cercopithecus mona* of Ibodi Sacred Forest during the rainy season than the dry season.

Playing: Playing is a frequent social activities recorded among sub- juveniles, juveniles and infants. The juveniles exhibit the most playing activity. Playing behaviour may form part of social competition and juveniles are in an active period of learning the ways of social relationship (Kipper and Todt, 2002). In the study, this activity was higher in the rainy season than the dry season and the differences were very significant. The activity is a means to generate more warmth during this cold season, thereby aiding the homeostatic regulation of their bodies. Generally, males are seen to play more than females of the same age. Mothers are also seen playing with their infants. Some playing behaviour exhibited by *Cercopithecus mona* were chasing, biting without causing harm, wrestling, swinging on tree branches and playing with objects (such as flowers and fruits). Tail-pulling was also observed in the study.

Vocalisation: *C. mona* were observed to produce vocal sounds while eating and playing. The activity was seen to be higher in the dry season than the rainy season, and their differences were very significant. This can be connected to the fact that vocalisation was usually produced during agonistic interaction and food competition; which are distinguishing features of dry season. The vocalisation was also produced after and during mating. This is

because females make calls which may be hormonally control during copulation as reported by Engelhardt *et al.*, (2005) in long-tailed macaques. Vocal activities were also produced in order to raise alarm about predator and human presence.

Grooming: Time allocated for grooming varies between rainy and dry seasons. The highest percentage of time for grooming was recorded in the rainy season, and their differences were very significant. This activity may be used to generate warmth and remove insects/ dirt from the fur of the animal mostly during the rainy season due to the cold condition and closed nature of the study area's vegetation in this season respectively. *Cercopithecus mona* usually engaged in grooming after feeding and while resting. This activity was usually done either on tree branches. Mothers are usually found grooming their infants. Moreso, this activity usually occurred between females. This supported the findings of Brent and Viera (2002) that the male long tailed macaques do not often groom each other in the wild.

Agonistic: Despite the fact that the time expended on agonistic by *Cercopithecus mona* in the rainy season was slightly higher than that of the dry season, the differences were insignificant. Agonistic behaviour occurred when *Cercopithecus mona* were struggling for food and were trying to gain mates. Sussman *et al.* (2003) also found that aggressive behaviour occurred while gaining food and mates. The animals were seen chasing and sometimes biting others. This activity appeared more in males of long- tailed macaques than females according to the findings by Brent and Viera (2002). Juvenile males usually show their aggressiveness to the sub- juvenile males and females. Aggressive behaviour observed from the animal included showing their tooth to each other, chasing and biting. It sometimes occurred in order to defend food sources by *C. mona*.

Mating: Mating comprised only a small portion in daily activity of *C. mona*. Males in the study area usually exhibited more sexual drive than females. During mating, males are seen perched on the back of the female body. This finding

also supported the work of Brent and Viera (2002) who reported that male long tailed macaques exhibited more sexual behaviour than females. In this study, it was observed that females mostly preferred to mate with any available adult males. This negated the earlier assertions of Van Noordwijk and Van Schaik (1999) and De Ruiter *et al.* (1994) that female primates which live in multi-male group focused on copulating with dominant males.

CONCLUSION

It is interesting to know that there are significant differences in some specific activity pattern of Mona monkeys over seasons e.g. mating in Ibodi Sacred Forest. Even though other activities may be varied to accommodate basic essentials of living and this might be one of the reasons why the species widely distributed in Nigeria, especially when considering its natural behaviours and lifestyles. Generally, the less competitive a species is in its daily activity when interacting with its environment, the more likely the chance of its survival. Nevertheless it is doubtful to affirm that Monas will continue to survive in this modified human environment if most of its natural food sources are depleted. It will take a long term study of the animal at the site to draw conclusion on whether or not Monas will continue to survive in the forest. Nevertheless a judicious use of the results of this study will aid the development of the site and many other fragmented sites to ensure effective conservation and management of the species in perpetuity as one of the most widely distributed monkeys all over its ranges.

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