



(RESEARCH ARTICLE)



## Study of the diurnal activity pattern of the Buffon's kob (*Kobus kob kob*, Erxleben, 1777) in the Niokolo Koba National Park, southeast Senegal

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### Abstract

A study of the abundance of Buffon's kob (*Kobus kob kob*) in Niokolo Koba National Park, in the central zone, was carried out by counting the number of individuals and observing diurnal activities. The aim was to obtain information on abundance, but also to determine the species' main activities. The methodology employed in the study is that of Altman, 1974, which consists of finding diurnal activity patterns recorded by direct observation with the naked eye and/or binoculars from 6am to 6pm. The data obtained after the fieldwork and the duration of each activity will enable us to calculate the ratio to the total observation time per day. The number of individuals counted was 79. There are 20 adult males (25.3%), 36 adult females (45.5%) and 11 juveniles (13.3%). Sub-adults represent 12.61%, or 10 individuals. Two unidentified sub-adults were observed. The Kountadala pond has the highest number of individuals observed. Feeding is the main activity (53.2%), followed by sleeping (23.9%), walking (5.22%) and running (3.25%). Other activities such as standing are 4.3%, agonistic behavior and vigilance are less than one percent. Feeding is the main activity in the morning, afternoon and late evening. Resting is the dominant activity at mid-day when temperatures are high.

**Keywords:** Abundance; Diurnal activities; Buffon's kob; Niokolo-Koba National Park

### 1. Introduction

Niokolo National Park's Senegal is home to bio-indicator species such as the Buffon's kob (*Kobus kob kob*) (Renaud et al, 2006). Information relating to its diurnal activities, social structure and count is of paramount importance for good conservation management of the species. An assessment of the biodiversity of a protected area is only important if one of its component species is created to know which species are present and which are most abundant in the area (Sutherland, 2004), and effective management requires reliable density information to help managers make informed decisions (Rija & Hassan, 2011; Young et al. 2010).

The Buffon's kob (*Kobus kob kob*) is a medium-sized antelope, with females similar to males but smaller and lacking horns (Dorst & Dandelot, 1970). Females and young males are brown in color. They have white throats, eyes, inner ears and bellies, and black legs (Estes, 1992). The bushy tail is white underneath and ends in a black tip. Buffon's kob is the most common antelope in West and Central Africa (Kingdon, 1997), with a distribution that extends from Senegal, Gambia and Cameroon in West Africa, to Chad and the Central African Republic in Central Africa (Mayaka et al. 2004). Its range is limited by vegetation, mountain ranges, deserts, river systems and human expansion (Kingdon, 1997).

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The Buffon's kob is classified as "Least Concern" in terms of conservation status, but is vulnerable to habitat loss and hunting in most African countries due to the highly palatable nature of its meat (IUCN, 2008).

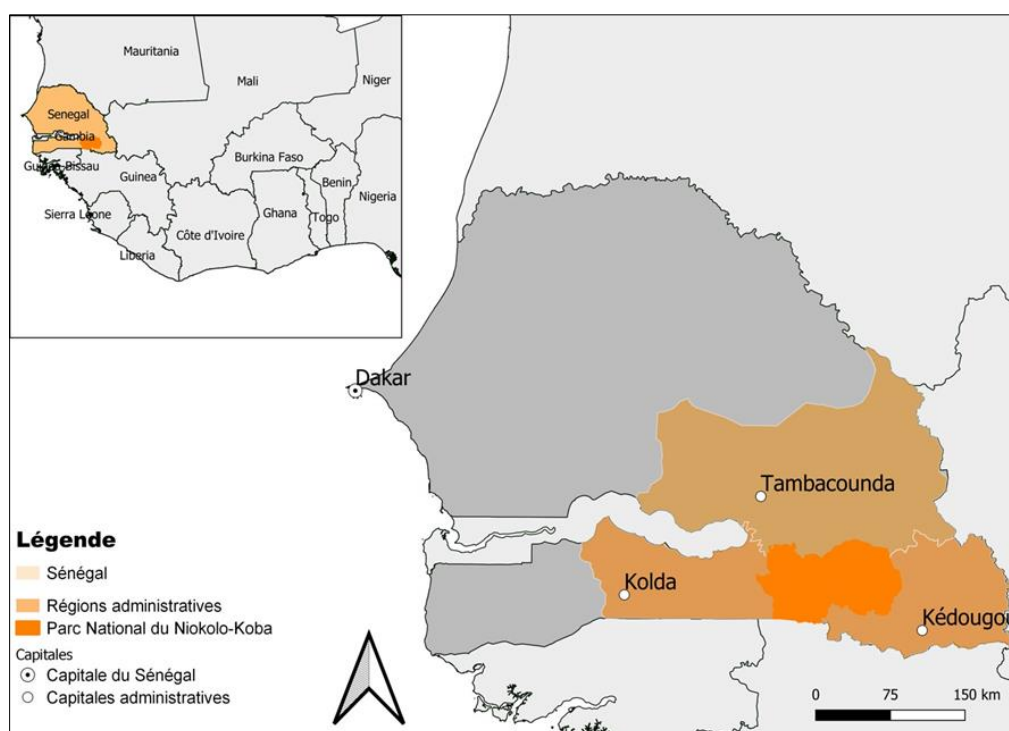
The objective of this study is to make observations to determine the diurnal activity pattern, i.e. to find the main activity from 06:00 to 18:00 according to the protocol of Altman, 1974, of the Buffon's kob population in the Niokolo Koba National Park Biosphere Reserve, more precisely at the level of the ponds in the central zone.

## 2. Materials and methods

### 2.1. Study area

The Niokolo Koba National Park is the biggest protected area in Senegal, covering 913,000 acres and located in south-eastern Senegal. The area was declared a national park in 1954 and was accepted as a biosphere reserve and listed as a World Heritage Site in 1981; however, it was only added to the List of World Heritage in Danger in 2007. (Howard et al. 2007).

The Sudanian climate (900-1200 mm rainfall, rainy season from June to October, temperatures from 25 °C in December to 33 °C in May) promotes transitional vegetation between the Sudanian savannah and the Sudano-Guinean savannah. It corresponds to the tropical climatic zone with a dry winter season, according to Köppen's classification.



**Figure 1** Location of the Niokolo-Koba National Park Biosphere Reserve in Senegal (Panthera, Senegal, 2021)

The vegetation is a mosaic of wooded savannah (the dominant tall grass is *Andropogon gayanus*, and the tree species are *Piliostigma thonningii*, *Pterocarpus erinaceus*, *Pericopsis africana*, *Bombax costatum*, *Burkea africana*, *Prosopis africana*, *Strychnos spinosa*), herbaceous savannah (the dominant grass species are *Cymbopogon giganteus*, *Schizachyrium sanguineum* and *Panicum anabaptistum*, and the tree species are *Cymbopogon giganteus*, *Schizachyrium sanguineum* and *Panicum anabaptistum*, and tree species : *Combretum glutinosum*, *C. nigricans*, *C. micranthum*), interrupted by gallery forests (*Borassus aethiopum*, *Ceiba pentandra*, *Cola cordifolia*, *Detarium senegalense*, *Khaya senegalensis*, *Raphia sudanica*) along the Gambia, Koulountou and Niokolo rivers. (Gueye et al., 2021).

There are 80 species of mammal recorded in the NKNP, including nine species of antelope (including the roan antelope, (*Hippotragus equinus koba*); the western hartebeest, (*Alcelaphus buselaphus major*); and the defassa waterbuck (*Kobus ellipsiprymnus defassa*), the West African buffalo (*Syncerus cafer brachyceros*), the hippopotamus (*Hippopotamus amphibious*), a few rare individuals of African elephant (*Loxodonta africana*) as the most important great herbivores,

the West African lions (*Panthera leo leo*), the leopards (*P. pardus*), wild dogs (*Lycaon pictus*), spotted hyenas (*Crocuta crocuta*) as the most important carnivores, and baboons (*Papio papio*) as the most abundant primates. (Renaud et al, 2006; Rabeil et al., 2018; Gueye et al., 2021).

## 2.2. Data collection

A collection of data on diurnal activity patterns will be recorded by direct observation according to Altman, 1974, with the bare eye and/or binoculars. The individual animal or group was selected at random and stratified according to age and sex. Small individuals were recorded as juveniles/unknown sex, medium individuals with horns were recorded as sub-adult males, medium individuals without horns were recorded as sub-adult females, large individuals with horns were recorded as adult males, and large individuals without horns were recorded as adult females. Each observation was recorded at intervals of 5 minutes, 15 minutes apart, from 06:00 to 18:00, according to Mesele and Afework, 2012). The following observable activities were recorded: feeding, walking, lying down, standing, drinking, running, vigilance and defecation.

Observations will be made in the central zone of NKNP where it is likely to find Buffon's kob and by targeting the Simenti, Kountadala, Woeni, Dalafouroumté, Niananka ponds.

## 2.3. Data analysis

We determined a number of observations equal to 8 hours per day for 10 days, either on a group of individuals or a solitary individual. The observation time for each activity of the individual(s) observed is mentioned during the observation. At 100%, which corresponds to the total duration of the observation per day (i.e. 8 hours), by determining the duration of each activity (field sheet attached) and using a rule of three, we will establish the proportion of each activity and ultimately find the main activity of the species during the day.

$$\text{Percentage of activity} = \frac{\text{duration of observed activity (in minutes)}}{\text{total observation time per day (in minutes)}} \times 100$$

## 3. Results

### 3.1. Abundance of Buffon's kob

In total we did 16 visual contacts at the main pools in the central zone of the Niokolo Koba National Park. 20 adult male Buffon's kob individuals, 36 adult females, 11 juveniles and 12 sub-adults including 4 males, 6 females and 2 undetermined individuals (table 1). The largest number of individuals was observed at the Kountadala pond and the smallest at Woeni and Dalafouroumté. There were more females than males and not many juveniles or sub-adult males and females. The total number of individuals observed was 79.

Adults represented 70.8% of the observed population (n = 56), sub-adults 12.65%, juveniles 13.9% and undetermined individuals 2.53%. The sex ratio was heavily imbalanced in favour of females (36 to 20). Sometimes groups of more than 10 individuals were observed, as shown in Figure 2. Solitary males were also observed in the protected area. (Figure 6).

**Table 1** Observations on Buffon's kob

Marshes of NKNP	X	Y	Number individuals	Adults Males	Females Adults	Juveniles	Sub-adults males	Sub-adults Females	Sub-adults Indeterminate
Simenti	0684844	1441130	16	2	10	1	2	1	
Woeni	0693375	1441260	12	5	4	2	1	x	x
Kountadala	0683369	1441241	30	9	11	5	1	2	2
Niananka	0682855	1442637	7	1	4	1		1	X
Dalafouroumté	0691359	1441055	13	2	7	2		2	X
Male solitaire	0684273	1441030	1	1					





**Figure 2** A herd of Buffon's kob all grazing at Kountadala morning (source: Fall, 2023)



**Figure 3** A herd of male cobbler lying down at pond in the around 2 p.m. at the Kountadala pond (Source: Fall, 2023)



**Figure 4** Two male sub-adults playing in the morning at Simenti (source: Fall, 2023)



**Figure 5** Two males fighting (agonistic behaviour) at Simenti pond (source: Fall, 2023)



**Figure 6** A solitary male encountered on the move near the lion's camp post (source: Fall, 2023)

### 3.2. Diurnal activities of the Buffon's kob

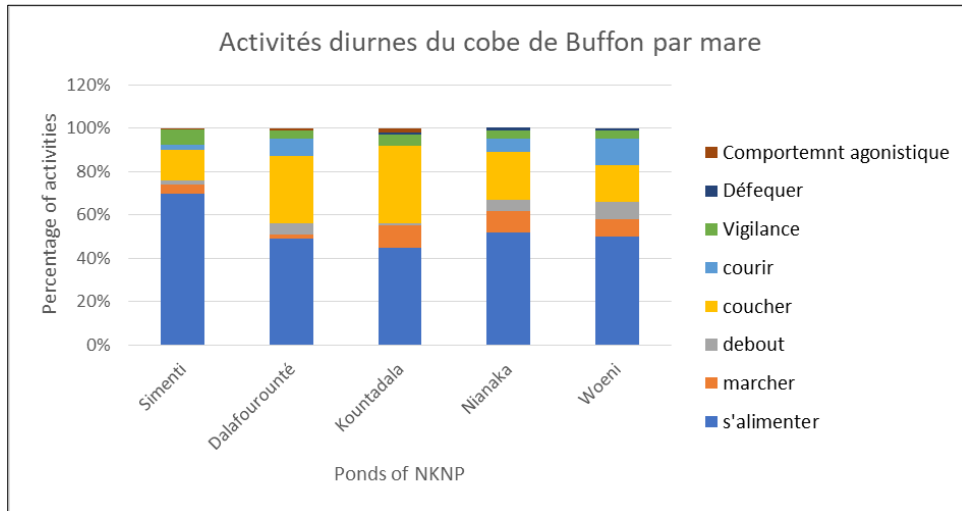
The main diurnal activities that are part of the species' behaviour are:

Feeding, which includes eating (grazing) and drinking (water-related).

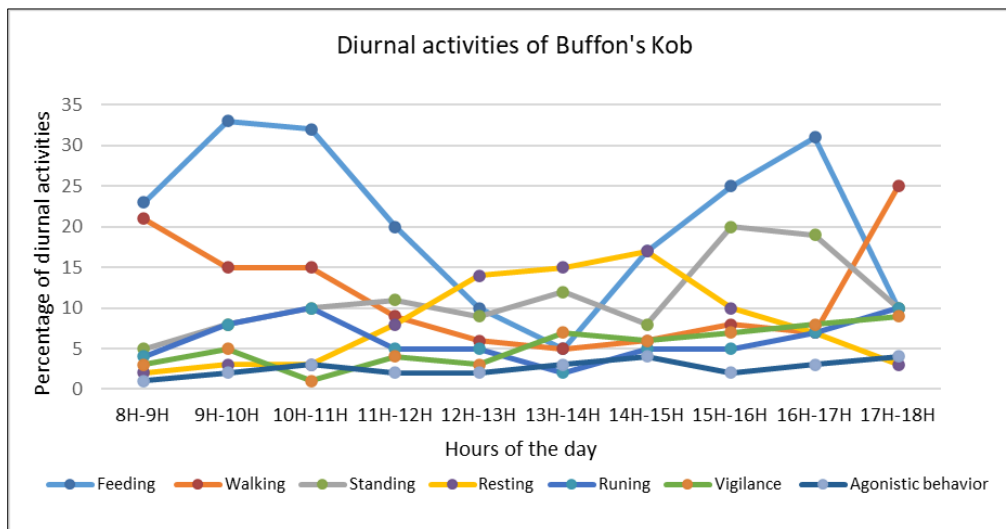
Walking, standing, lying down, running, vigilance, defecation and agonistic behaviour (when two individuals fight).

In all the pools, the dominant daytime activities were "feeding" and "lying down", with the remaining activities accounting for less than 10% (Figure z).

The results showed that feeding was the main activity (53.2%), followed by lying down (23.9%), walking (5.22%) and running (3.25%). Other activities such as 'standing' are 4.3%, agonistic behaviour and vigilance are less than one percent (figure 7). Eating is the main activity during the morning and afternoon and a little late in the evening. Bedtime is the dominant activity at midday when temperatures are high. Activities such as walking or running are also carried out with some intensity in the morning. Other lesser behaviours are also carried out, such as agonistic behaviour, i.e. two people fighting (figure 8). Nevertheless, fighting behaviour has been observed at Simenti between two males and according to Olajessu (2022), when it has occurred, it is mainly between males defending their territory (territoriality), to displace and replace the adult male with a new young emerging male. (Figure 5).



**Figure 7** Daytime activities of the Buffon's kob at each pond in the central zone of the park



**Figure 8** Diurnal activities of Buffon's kob in NKNP

## 4. Discussion

### 4.1. Abundance, distribution and social structure of the Buffon's kob

The interactions and social organisation of certain animals vary. Some move in pairs, while others move in groups, as in the case of primates and buffalo (Olajessu et al, 2022). However, as demonstrated by our results in Niokolo Koba National Park, Buffon's kob can move in pairs, solitary individuals or even more than ten individuals. All this depends on the

prevailing conditions in the animal's environment, such as hunting intensity, habitat quality and other external factors (Han, Blank, Wang, Yang, Da Silva & Alves, 2019). Observations in NKNP have shown that *Kobus kob kob* can be found in herds of more than 30 individuals in certain pools in the central zone of the protected area, and this attitude is explained by Olajesu et al., 2019 by the fact that they feel safe. However, according to these authors, the opposite effect is noted when they are in less secure areas, i.e. kobs move in pairs or in small numbers. The observations were made in the ponds in the central zone of the park where kobs can be found and this is explained according to Mansson et al., (2012), the fact that individuals in the species' population are attracted to or survive better in habitats with favourable conditions (availability of food resources and a predation-free environment), which are important factors influencing their distribution. The concentration of cobe activity in the central part of the reserve could be attributed to the presence of favourable resources: reeds and grasses and permanent pools. The high-quality vegetation attracts populations of large herbivores (Olf et al. 2002). A few solitary males were encountered and observed and in most cases in open areas and according to Antwi et al. (2017), kobs showed a greater preference for open areas than dense vegetation, probably because they are more protected in open or sparse vegetation than in dense vegetation, as they tend to detect predators easily from a distance and flee when they are attacked..

#### 4.2. Diurnal activities

Our results revealed that cynomolgus cob populations spend most of their time on activities such as feeding which are corroborated by studies by Macdonald, (2004); Antwi et al. (2017) and those of Olajesu et al., (2022) which state that peak feeding and social activities for kobs occur early and late in the day in Lake Kainji National Park, Nigeria. It peaks during the morning and afternoon before sunset so the kobs were mainly active during the day (diurnal), grazing early in the morning and late in the afternoon. At midday between (12:00-14:00 GMT), 'bedtime' activity was predominant with most kobs lying either on fresh grass or under trees most of the time when temperatures are high. Our results are corroborated by those of Antwi et al, 2017, a case study from Shai Hills Resource Reserve, Ghana, he found that kobs were mostly active during the day (diurnal), grazing early in the morning and late in the afternoon (bimodal feeding). Other activities such as running or walking will be reduced and this is explained by the fact that kobs avoid dehydration of their bodies and to keep them cool they lie on fresh grass or in the shade (Estes, 1991). Without an optimal supply of water, kobs, as most mammals, can suffer from heat stroke or muscle cramps, which are fatal to their survival. (Olajesu et al., (2022).

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## 5. Conclusion

During our study, we identified and numbered 79 individuals at the five ponds we visited. The observations indicate that the Buffon's kob population in the central zone is very stable and viable. The Kountadala pond recorded the highest number of individuals counted. The activities of the Buffon's kob in the Niokolo Koba National Park consist mainly of feeding (grazing and drinking) during the early morning and afternoon and taking a rest during the hot hours of midday. Unfortunately, the number of juveniles recorded in this study is very low, so very strict monitoring is required. Periodic assessment of the kob population (quarterly counts) should be encouraged in order to determine the growth rate and make informed management decisions. The central zone of the park is a very important habitat for the conservation of bio-indicator species such as the Buffon's kob. Their conservation would contribute to the proper management of the protected area's ecosystems. This species always attracts large numbers of ecotourists who want to see it in large numbers, especially during the dry season.

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## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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## Annex

### Field data sheet

Numéro de fiche :				x=	y=	date :		de	h	mn	à	h	mn	
Groupe	Individus	Structure sociale	Temps D'observations pour chaque activité	Observations	nourrir	Marcher	Couché	Debout	Boire	Courir	Vigilance	Défequer	Comportement agonistique	autres