

POPULATION STRUCTURE AND DISTRIBUTION OF BUFFON KOB (*Kobus kob kob*) WITHIN OLI COMPLEX IN KAINJI LAKE NATIONAL PARK, NIGERIA

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ABSTRACT

Regular survey of wildlife population and community structure is a primary step in achieving conservation objectives of protected areas. Although Buffon's kob has been categorised as vulnerable, there is limited information about its population status in Kainji Lake National Park (KLNP). Hence, population structure and distribution of kob in Oli Complex, KLNP were investigated. Oli Complex KLNP was stratified into five sites: Gilbert Child (GC), Shehu Shagari (SH), Mamudu Lapai (ML), Hussaini Mashi (HM) and Mara Tsaude (MT). Kob species in KLNP were monitored using variable line transect method on a 5km transect-belt per site. The kob population within transect were assessed for abundance, density, distribution and structure (sex and age) using standard procedures. Sample collection covered wet (WS) and dry (DS) seasons and lasted for 24 months. The Kob species diversity was determined using Shannon-Weiner and Simpson indices. Data were analysed using descriptive statistics and ANOVA at $\alpha_{0.05}$.

Kob abundance was least in ML (16.0 ± 0.49) and highest in GC (429.0 ± 22.24) during WS, while it ranged from 64.0 ± 4.70 (ML) to 422.0 ± 32.48 (SH) in DS. Kob population distribution varied significantly across the sites with ML having the least (4.1%), while GC had the highest (39.5%). Population density ranged from 0.06 kob/km^2 (ML) to 0.34 kob/km^2 (HM); Shannon-Weiner index was least in ML (3.04) and highest in GC (4.09) but Simpson was least in ML (0.92) and highest in SH (0.97). Male/female ratio was 1:3 (ML and HM) and 1:7 (GC and SH). Adult/juvenile ratio was higher (3:1) in SH and ML, while GC, HM and MT had the least (2:1). Group size per site ranged from 3.08 (ML) to 9.19 (GC).

Buffon's kobs were moderately distributed in Oli Complex. Forage abundance and perennial waterhole was an indicator of kob abundance and distribution

KEYWORDS: Buffon's Kob, Population Structure, Distribution, Oli Complex, Kainji Lake National Park
serious effect on the park's image. Kobs generally have patch distribution ranging from Senegal and Guinea-Bissau to Uganda, southern Sudan, and south-east Ethiopia. However, the Buffon's kob (*K.kob kob*) has the widest distribution range, from Senegal to Central

INTRODUCTION

Nigeria is blessed with a unique array of natural resources including a lot of fauna and flora resources [1] that are so myriad, these resources form an important center of biodiversity of tropical rainforest, coastal plains, mangrove, and the savanna zone [2]; but it is regrettable that Nigeria already lost about 90% of its forest which rated it as having the highest deforestation rate [3]. As the habitats of wild species are being destroyed by anthropogenic activities especially hunting in the protected areas, it is inevitably paramount to have a checklist of the current status and distribution of the fauna present.

Kobs are one of the flagship species of Kainji lake National park and if this species are affected, it will have

African Republic and DR Congo. They are now extinct in the Gambia and Sierra-Leone and most likely in southern Mauritania [4]. East [4] estimated numbers of Buffon's Kob at 95,000 and generally declining (with the exception of a few protected areas). Kobs can reach high densities when well protected in areas of favorable habitat, ranging from 15-40 animals/km²; however, in areas of heavy hunting pressure, densities decline to less than 1/km².

The highest densities of Kob (1,000/km²) have been reported around drinking sites in the dry season. According to East [4], grasslands; seasonal floodplains and grasslands near water within savanna woodlands and riverine grasslands as well as floodplains of major rivers are their favorite habitat. Kobs are almost exclusively grazers, and confined to regions that have year-round access to water. This however described why they are mostly found in the Olly complex. This complex is the only location with perennial water source in the sector of the park. Wide studies on Kob is available from countries like East and South Africa, for instance, the study of Hank [5] and Spinage [6], but very little or none in West Africa, especially in Nigeria. There is very scanty information about the habitat characteristics that is, ecological status and population attributes of the species. The available information on the kob in Nigeria is very old, dating back 1985 by Okaeme [7]. And other researchers like Happold, [8] and Meduna *et al.*, [9]. It is therefore necessary to carry out the population status of Kob in Kaiji Lake National park for proper management and also to know the militating factors on their growth and distribution.

STUDY AREA

The study was conducted in Kainji Lake National Park (KLNP) under the Borgu sector of the park. The park is located at Latitude 9° 50' 19" N and Longitude 4° 34' 24" E. KLNP is located in the North West central part of Nigeria between Niger and Kwara States. It is a savanna environment with a total area of 5,340.82sq km [10]. It is made up of two contiguous sectors; the Borgu and Zugurma Sectors. The Borgu sector is currently 3,970.02sq kilometers and it is bordered on the East side by the Kainji Lake and on the West side by the republic of Benin. It is situated in Borgu, Kaiama, and Baruten Local government of Nigeria and Kwara states respectively. Zugurma sector on the other hand occupied a relatively smaller area of 1,370. 8sqm and it is situated in the Mariga Local Government of Niger State. It is bordered by Kontangora River on the North West side and by Mayara River on the North Side [11]

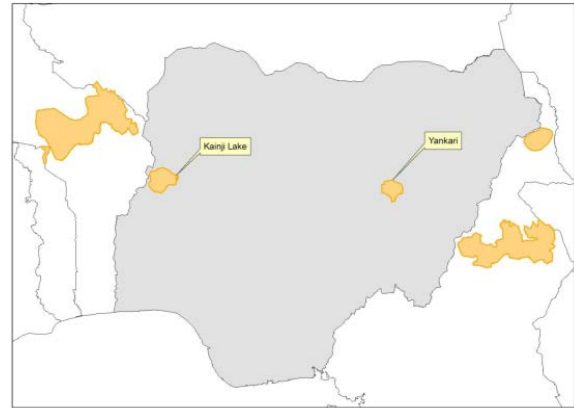


Figure 1: Map of Nigeria showing the location of Kainji Lake National Park

Source: Lameed & Jenyo-Oni [12]

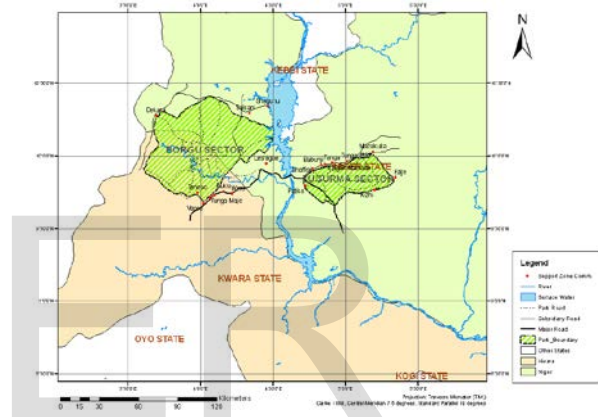


Figure 2: Map of Kainji Lake National Park showing Borgu and Zugurma Sectors

SOURCE: Tuna [13]

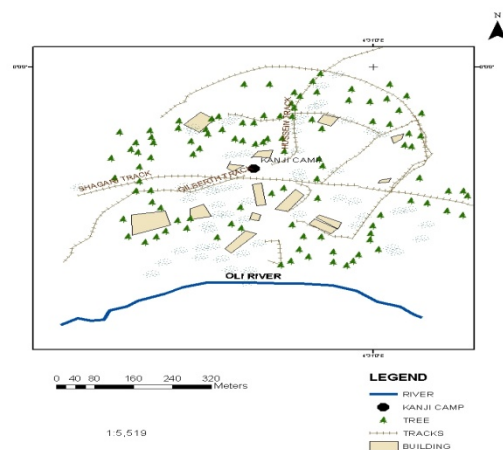


Figure 3: Map showing Oli Complex within the Borgu Sector of Kainji Lake National. MATERIALS AND METHODS

Data Collection

The study was conducted from September 2012 through August 2014 during dry season and wet season for 14 days in each month. Since it is not allowed to cut transect nor to leave designated roads and tracks in the National park, transects followed already existing jeep tracks/roads used by the park management (14). Oli Complex was stratified into five Sites, each within an existing jeep track (based on KLN master plan, that is, vegetation types and water availability) namely, Gilbert Child (GC), Shehu Shagari (SH), Hussein Mashi (HM), Mamudu Lapai (ML), and Mara Tsuade (MT).

With the aid of a Global Positioning System (GPS), a transect of 5km was established per site and censured for Kob species, morning counts (07.00 – 10.00h) and evening counts (15.00 – 18.00h) during each of the dry season and rainy season. King Census method of enumeration was employed for the count. A transect was censured per day. The dry season census was limited to December through March, while the raining season census spanned between June and September. During each count, the site, vegetation type, starting time, weather, date, observer(s) and sheet number were recorded in the animal observation sheet.

Transect was walked swiftly at a predetermined speed (approximately 2.0km per hour) and counting was carried out on both sides of transect (truncation point of 100m perpendicular distance (w)). Manual counter and a 10 x 40 binoculars were used to enhance counting and observation. Whenever a larger herd of animals was encountered, counting was done twice before arriving at a mean value at the sighting point. Apart from records of distances (sighting and perpendicular), estimated for each wildlife species, the age and sex of Buffon's kob as well as the activity on sighting along with cluster type and size were recorded. At the end of census exercise, the transect width was calculated, that is, the mean of the sighting distances for each wildlife species.

Data Analysis

The results were collated and means determined. A 2-way analysis of variance using the SAS computer program (2010) and SPSS 13.0 was used to analyse the result.

RESULT

A total of 818, 634, 80, 354 and 133 Kobs were counted at Track Gilbert child (GC), Shehu shagari (SH), Mamudu Lapai (ML), Husein Mashi (HM) and Mara Tsude (MT) respectively; giving a total of 2739 Kobs. The female is consistently higher than the males across all the sites (Table 1). GC had the highest mean for female (133 ± 14.09), followed by SH (119 ± 38.37) while the least was observed in ML (13 ± 7.03). Male was highest in GC ($20 \pm$

2.91), followed by HM and SH (17 ± 6.73 and 16 ± 3.88 respectively) while the least were recorded in MT and ML (6 ± 1.89 and 4 ± 1.93 respectively). The result also reveals the male-female ratio between the sites, where 1:7 recorded in GC and SH was the highest, next was 1:5 observed in MT while the least was 1:3 observed in ML and HM. The sex ratio was significantly different ($p \leq 0.05$) for GC, SH and MT, but not for ML and HM. The mean value for adults far exceeds that of juvenile in all the sites (Table 2). Though the ratio of adult to juvenile were not significantly different across the sites, yet, it is worthy of note that it was higher in SH and ML (3:1) but lower in the remaining sites, that is GC, HM and MT (2:1)

Table 1: Sex Distribution of Kob in Oli Complex, KLN

Site	Male to Female Ratio			p-value
	Male	Female		
GC	20±2.91	133±14.09	1:7	0.000*
SH	16 ± 1.88	119 ± 38.47	1:7	0.037*
ML	4 ± 1.93	13 ± 7.03	1:3	0.301ns
HM	17 ± 6.73	51 ± 17.48	1:3	0.122ns
MT	6 ± 1.89	27 ± 4.38	1:5	0.012*

Table 2: Age Distribution of Kob in Oli Complex, KLN

Site	Adult	Juvenile	Adult to Juvenile Ratio	p-value
GC	76.63 ± 25.42	51.25 ± 9.44	2:1	0.461ns
SH	67.50 ± 26.39	23.50 ± 4.99	3:1	0.279ns
ML	8.83 ± 3.72	3.25 ± 1.25	3:1	0.365ns
HM	34.13 ± 10.77	20.25 ± 14.99	2:1	0.472ns
MT	16.63 ± 4.49	7.50 ± 4.03	2:1	0.225ns

Figure 3 presents the comparative densities of the seasonal distribution of kob by sex. Highest density is observed among females in HM with the Raining season (RS) towering above all; followed by female in the Dry Season (DS) of HM. But females in ML and SH of DS are higher than, those in RS. Female densities are higher in all sites than male density. Female densities of GC in both seasons have equal densities. The least female density is found in RS of ML. male densities were consistently lower in all sites, highest male density across the sites is in the DS of HM, followed by the male density of its RS. Smallest male density is observed in GC. HM has the highest density for both adult and juvenile in the seasons, both are almost equal in RS but adult is greater

than juvenile in RS. DS has greater densities than RS with adult having higher density than juvenile, except GC and MT with greater juvenile than adult. The least density is observed in RS of ML (adult & juvenile).

Figure 5 illustrates the number of sighting and abundance of kobs across the sites in Oli Complex, SH had the highest frequency (110) but ranked second in abundance (634) after GC, 818 kobs but 89 sightings. HM ranked third both in frequency and size while ML had the smallest frequency and population size. The ratio of the size to sighted number is also significant in relating the groupings in the species. GC has the highest ratio of 1:9 with SH following (1:6) while ML is the least with 1:3.

Table 3 is the population estimates of kob across the sites in the study area. The highest mean was recorded in GC (68 ± 15.31), followed by SH (53 ± 18.36) but ML had the least Mean population of 7 ± 2.56 . The population Means are significantly different ($p \leq 0.05$) from one another. When separated by Duncan's, three distinct groups were identified (a, b, ab/ac).

Table 4 presents the kob species diversity indices across the sites in Oli Complex. The taxa ranges from the least in ML (31) to the highest in SH (110). Dominance varies from 0.03 in SH to 0.07 in ML Simpson index ranges from the least in ML (0.927), followed by MT (0.953), next was HM (0.969) and the highest index was SH (0.974). Shannon-Weiner index recorded the least value in MT (3.3) and the highest in SH (4.1). The degree of evenness was lowest in GC (0.51), followed by SH (0.54), while the highest was recorded in MT (0.69). The least value for species richness (Menhinick) was found in MT (3.32) and the highest was in SH (4.36). Equitability index was least in GC (0.85) and highest in MT (0.90). In table 5, the encounter rate, density and abundance of kob in KLN was compared across the strata. ML had the least encounter rate of 0.20, followed by MT (0.33), next is HM (0.89), followed by SH (1.59), and the highest encounter rate was recorded in GC (2.05 kob/km). The net rate for kob in the Complex was 5.44. The density also followed similar pattern, ranging from the least in ML (0.06) to the highest in GC (0.29 kob/km²). Overall density was 0.96 kob/km². The overall encounter rate and density were comparable as shown.

DISCUSSION

Kobs were sighted more often nearer to the waterhole most especially in the dry season whereas it is more distributed in the wet season, this account for the large numbers observed in site GC and SH as well as part of HM. This observation is in agreement with previous results which opined that kobs are never far away

from perennial water as reported by Poche [14] and Anadu *et al.* [15]. Track GC, SH and part of HM is characterized with abundant grasses coupled with lots of space and its advantageous location of about 100m close to the perennial water source makes it a suitable environment for Kobs as they spent most of their time feeding and preventing been eaten by a predator which confirms the findings of MacDonalds [16]. Kobs in this study were exclusive grazers as they were never sighted browsing, both in the dry and wet seasons, though they look haggard and hungry in the dry season, and cover more distances in search of fresh forage. Kobs look more robust and healthy as they feed well and move less in the wet season. Site ML and MT is further away from water source and it is more of dense woodland, therefore it support less of kob but more of the larger ungulates like roan Antelope, hartebeest and buffalo which were sighted more often in these sites. Migration due to seasonal variation and otherwise had been reported in kobs distributional pattern, but poaching and livestock grazing (competition with cattle) had greatly diminished the range of kobs in the park as they were no longer found in some of their usual habitat and part of the park. Studies of some researchers have also reported that overexploitation of forest, urbanization, resource extraction; mining, construction, farming and Illegal hunting of wildlife most especially herbivorous ungulates like kobs has greatly affected their distribution and structure [17] [14] [18] [19] particularly because of their docile nature.

Anadu & Green, [19] whose report was limited to Nigeria, also reaffirmed that kob has largely been eliminated outside conservation areas. The situation was suspected to be worse today with a lot of advancement in hunting techniques and poaching strategy unfolding daily. The report of this work had confirmed this to be worse than it was imagined. Kobs were not only eliminated outside the parks but are now restricted mainly to Oli Complex (Oli range) [20], that is, the animal has become rare and vulnerable to extinction in some areas (ranges) even within the park.

There were marked differences in the sex structure of kobs across the sites. The ratio of male to female was very high in the study area (1:7) this however revealed that Kobs maintains large harem and territoriality within their population. This means that to every single male, there were seven females. This result is in agreement with other works, which maintains that the numbers of female were in multiples and consistently higher than the number of the male [21] [14] [22]. This is a positive ratio as kobs were known for high reproductive performance [7] leading to increased population via production of strong and viable population from active female population, as was reported by Stubblefield [22]. Provided all other factors remain the same, the

population is to increase by that same factor, resulting in a stable and progressively satisfying population. This result agrees with Stubblefield [22] that reported a ratio of 2:5; and Rduch [23] in their works on giant eland and puku antelopes respectively.

The ratio of adult to juvenile was high in this present study, confirming the report of Happold and Philip [20]; Poche [13] [21], that adult were many while young ones were but few. This also recorded a positive ratio of adult to juvenile kob in the study area, implying steady growth every year as the young matures to reproductive age, at the same time preventing overcrowding or ensuring that the carrying capacity of the particular ecosystem is not exceeded. Mathematically, the population increased geometrically. Kob has been reported to be all year-round breeder as calves were observed every month of the year [21], while Okaeme, [7] also reported kob to breed all the year round with peak periods coinciding with the season of rain and abundant forage. The females breed annually resulting in high population of kobs in KLNP, showing that it is highly prolific as reported by Okaeme [7]. Poche (21) reported six wildlife species to be all year round breeders, Giraffe, Buffalo, Red flanked duicker, Grey duicker, Buffon's kob and Red fronted gazelle. Rainfall had been correlated with distribution and calving periods by several authors [24] [25] [26] as this was observed during the study.



PLATE 1: Herd of Kob at the waterhole (Oli River).



PLATE 2: A territorial male at Oli Complex, KLNP

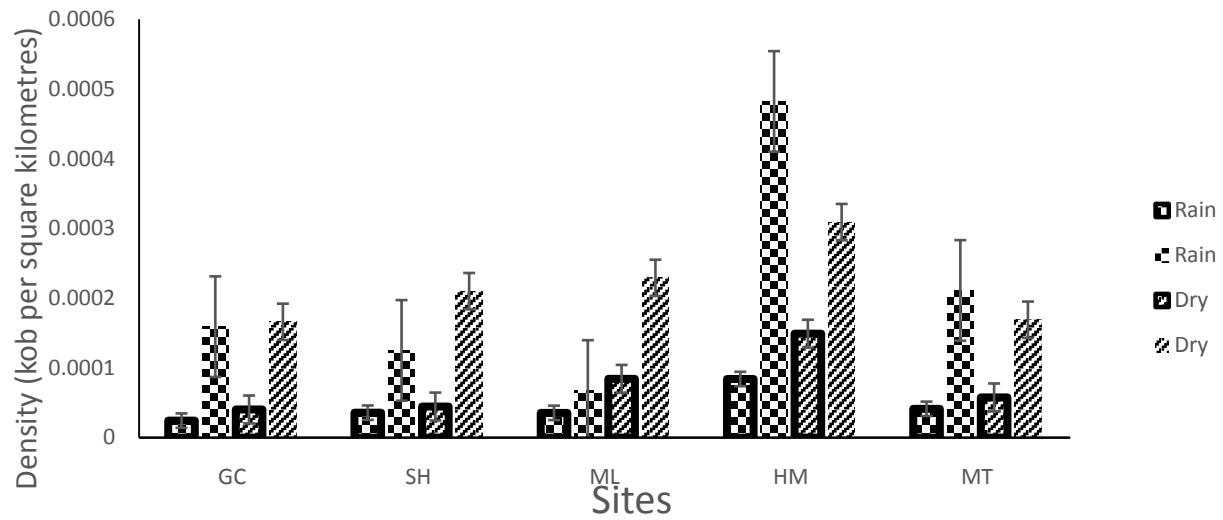


FIGURE 3: Comparative Densities of seasonal distribution of Kob (Sex)

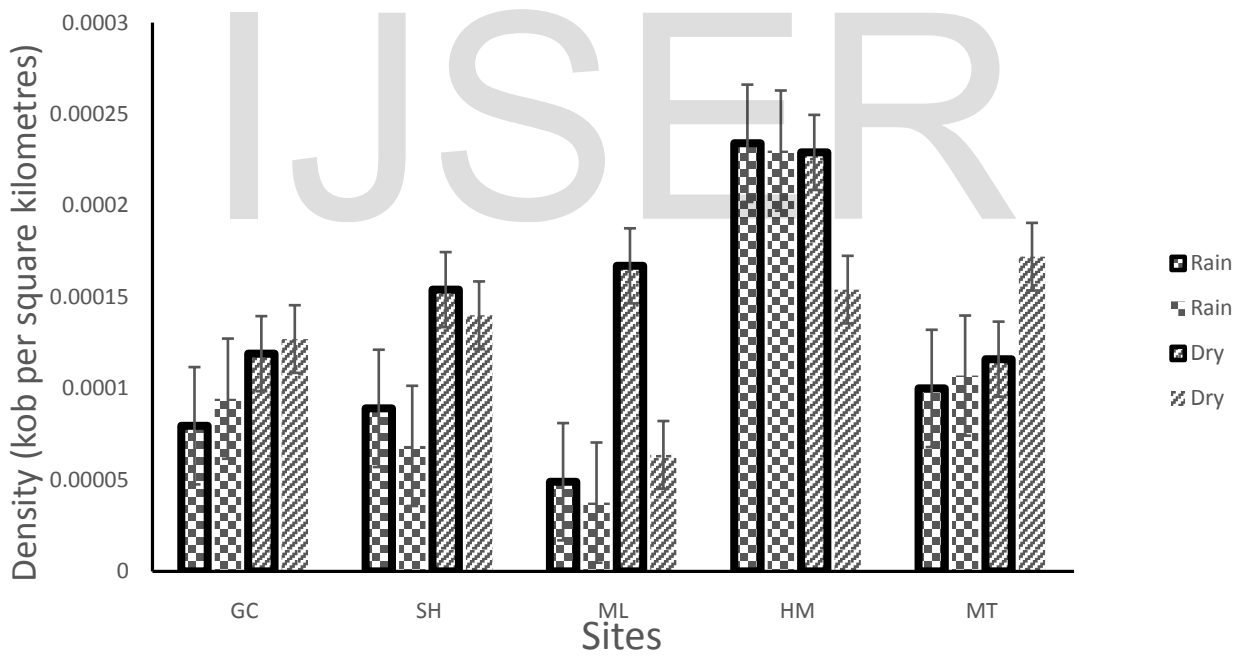


Figure 4: Comparative Densities of the Seasonal Distribution of Kob (Age)

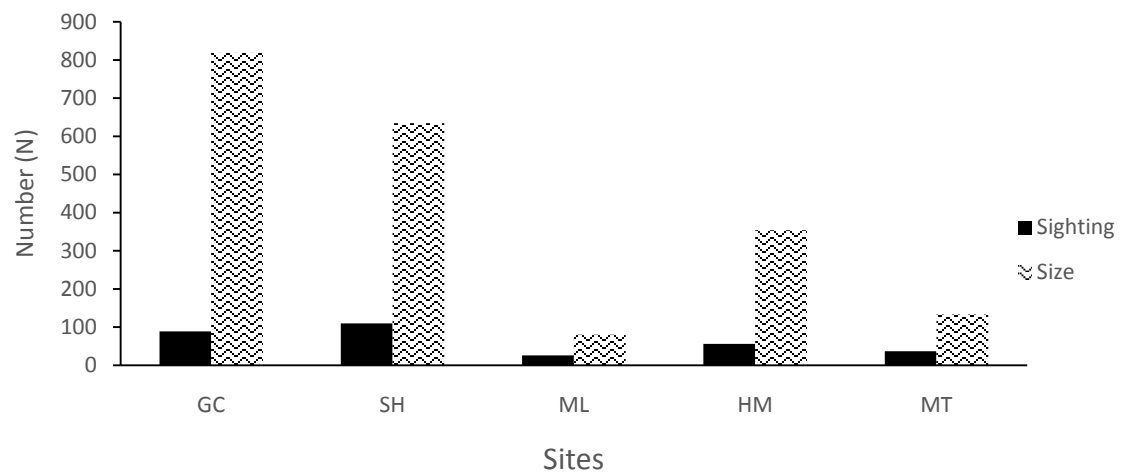


Figure 5: Number of sightings and population size of kobs observed in the study area

Table 3: Population estimate of Kob in Oli Complex of KLNP

SITE	MEAN POPULATION	p-value
GC	68± 15.31c	0.001*
SH	53± 18.36bc	
ML	7± 2.56a	
HM	30± 8.57ab	
MT	14± 3.43a	
TOTAL	34 ± 5.82	

*Significant at $p = 0.05$ Values with same letter are not different.

Table 4: Kob Species Diversity Across The Sites In Oli Complex

	GC	SH	ML	HM	MT
Taxa_S	103	110	31	71	38
Individuals	821	634	80	340	131
Dominance_D	0.02714	0.02592	0.07281	0.03095	0.04668
Simpson_1-D	0.9729	0.9741	0.9272	0.969	0.9533
Shannon_H	3.962	4.088	3.037	3.771	3.28
Evenness_e^H/S	0.5104	0.5422	0.6725	0.6117	0.6994
Brillouin	3.765	3.83	2.58	3.474	2.903
Menhinick	3.595	4.369	3.466	3.851	3.32
Margalef	15.2	16.89	6.846	12.01	7.589
Equitability_J	0.8549	0.8698	0.8845	0.8847	0.9017
Fisher_alpha	31.12	38.44	18.57	27.32	17.96
Berger-Parker	0.06577	0.06467	0.1875	0.07353	0.08397
Chao-1	134	149.4	46	107.9	68.6

Table 5: Herd size, Encounter rate and Density of kobs in Oli Complex, KLNP

SITE	ECOUNTER RATE Kob/km	DENSITY Kob/km ²	ABUNDANCE
GC	2.05	0.29	818±40.52
SH	1.59	0.19	634±31.40
ML	0.20	0.06	80±3.36
HM	0.89	0.34	354±17.53
MT	0.33	0.08	133±6.59
TOTAL/AVERAGE	5.05	0.96	2019±99.40

CONCLUSION

The distribution of kob is wide spread within the Complex but moderately and not equally distributed within the sites. Presence of water appear to be a significant factor in the distribution of animals most especially during the dry season, while the population is altered during the wet season in an unexpected pattern due to migration of this animals for security (protection) reasons. HM and MT are dense woodland, especially, km3 to km5 in HM. But the two sites originates from the river, whereas MT is across the river and farther from the camp (sanctuary), HM is on the same side (the Oli Camp made up the first km of HM) of the Oli river as the camp and closer thereby making it a safe haven for wildlife especially during the wet season. Therefore, more kobs migrate into these strata, GC, SH and HM, which can be said to be concentrated kob area, but ML is 14km away from the Oli River apart from been a dense woodland, which accounted for the very low/least kob population recorded for it. Both MT and ML are more of dense woodland and further from Oli river and the camp (km 14), hence, semi-intensive areas. It's been discovered that more of the wildlife species were migrating towards the camp. Three major reasons can be adduced for this, (i) safety- from both predators as well as illegal hunters, (poachers), (ii) perennial water source and, (iii) visibility, as buttressed by Macinnon [27]. Even though there are pockets of waterhole during the wet season in other areas of the park, Kobs are hardly sited in other ranges and this is heavily due to the fact that they have been disturbed by poachers over the year as a result they could be found mostly in the Olly complex not only as a product of the presence of the perennial water available but as a result of the maximum protection and undisturbed environment. It is however important management takes into consideration this problem because unless it is addressed, animals will only be seen when in Olly complex and this is not too good as the park generally should be a sanctuary and a conservation ground for wild species.

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