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Abundance and Distribution of Kob (*Kobus kob* Erxleben, 1777) in Kainji Lake National Park, Nigeria

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ABSTRACT

Study on the distribution and abundance of *kob* (*Kobus kob*) in Borgu Sector Kainji Lake National Park was carried out. The studies was undertaken to derive information on the abundance of *kob* in Kainji Lake National Park and also determine the distribution of *kob*, in the area. The methodology employed in the study includes the use of direct method of census. Line transects was established using a stratified random sampling procedure. The data collected were analyzed using the formula - Total Population Ý = R·Z and the program DISTANCE. The result gathered revealed that each of these habitats contains ample number of *kob* throughout the year. The total estimated population of *kobs* censured in all the unit area = 9432 *kobs* /3970.02 km^2, while the mean estimated population density is 0.09 ± 0.05 per km^2, and the mean estimated population was 392 ± 210.11. There is therefore a 95% certainty that the true population size lies between 109.78 and 107.15 confidence limit. There is a high significant different at ($P < 0.05$) between the habitat types on kob abundance between the various habitat types in KLNP. The distribution of the kobs indicates that they are clumped in distribution, having an average cluster size of 14.617 in wet season and 18.067 in the dry season,. In a nut shell if the *kobs* herd is maintained in the reserve. Eco-tourism based on *kobs* watching to yield economic benefit to Kainji Lake National Park, Niger state and the Nation at large will be achieved. Therefore there should be extended mentoring programme to all the sectors of the park. This will go a long way to check illegal activities such as over grazing, poaching and tree logging that is affecting kobs population in Kainji Lake National Park.

***Keywords*:** abundance, distribution, kob, Kainji Lake National Park, *Kobus kob*

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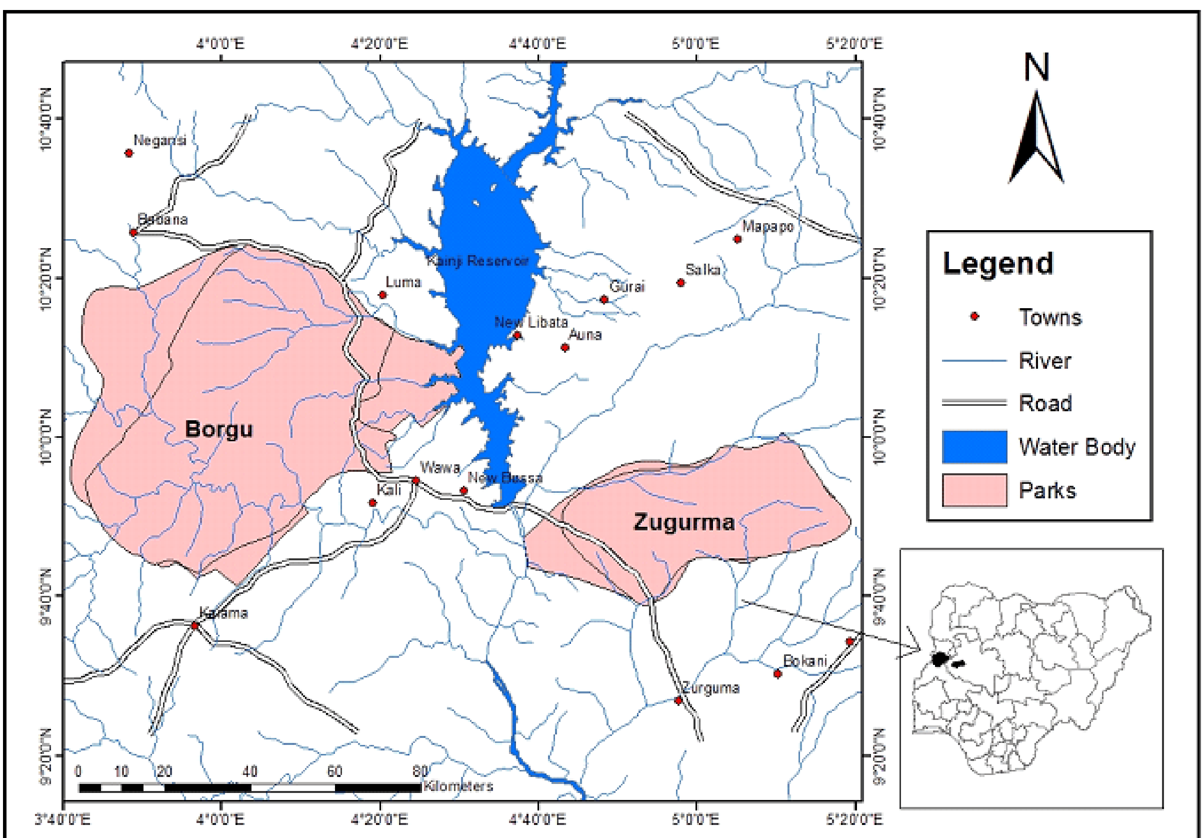
1. INTRODUCTION

The conservation importance of an area is typically determined by assessing its biodiversity by creating a species list to know which species are present and which is more abundant in the area (Sutherland 2004). Previous studies on ungulate populations have shown that effective conservation and management necessitates reliable information on density to help managers in making informed decisions (Rija and Hassan, 2011; Young *et al*., 2010).

Knowledge of distribution and abundance, of the population density or the population size is virtually important and indispensable. On that basis only, the ecology of the animal and its relationship with its environment can be fully explored. Estimating populations is important for management and conservation of wildlife (Shorrocks *et al.*, 2008), especially in the light of the growing loss of biodiversity due to human influence (Buckland *et al.*, 2006).

Kobus kob is a medium-size antelope, females similar to male but smaller in size and without horns. The male have thick, lyrate horns that curve backward, forward and tip up forming an "S" shape (Kingdon 1997). The *Kobus kob* is the most common antelope in the west and central Africa (Kingdon 1997), its distribution extends from Senegal, Gambia to Cameroon in West Africa; to Chad and Central African Republic in Central Africa (Mayaka *et al.*, 2004). *Kobus kob* distribution within its range is limited by vegetation, mountain ranges, deserts, river systems and human increase (Kingdon 1997).



Map 1. Kainji Lake National Park, Nigeria

Kobus kob is one of the most common antelope found in Kainji Lake National Park (KLNP) and has always been a point of attraction to park visitors. A major problem facing wildlife conservation in Nigeria is the increasing rate of habitat loss or modification due to human activities (Ogunjemite *et al.*, 2007). This has affected wildlife resources within these ecological systems leaving only remnant populations of wildlife resources in protected areas including the National Parks.

The monitoring of wild animal population programme such as Kob is essential in order to measure progress and plan for future conservation action (Berger 2001). The study on the distribution and abundance of Kob in Kainji Lake National Park will help to know in which habitat type the species is higher in population and in which they are less.

The Study Area

Kainji Lake National Park is located between latitudes 09°40' N - 10°30' N and longitudes 03°30' E - 5°50' E. The park covers a total area of 5340.82 sq.km. The Kanji Lake National park was established in 1979 (under decrees 46 of 29th July, 1979), thereby making Kanji lake National park one of the most important National park in Africa, as is highly endowed with many flora and fauna resources,. It is made up of two non-contiguous sectors, the Borgu and Zugurma sectors. The Borgu sector lies astride the Borgu and Baruten local government area of Niger and Kwara states respectively. It is bordered in the east by the Kainji Lake and in the west by the Republic of Benin (Map 1).

2. METHODOLOGY

Research Design

Transect method according to AWF (1996); Buckland *et al.* (2004) was employed. Already existing transects and trails transects was used for this study. Out of a total of ten (10) accessible transect in the Borgu sector of Kainji Lake National Park. Five transect namely, (A) Hussaini Masha track-45km, a Mixed *Deterium* woodland located at Coordinates N09°91.462' & E003957.22', (B), Gilbert Child track – 44 km, a *Terminalia* Reparian woodland located at Coordinates N09°91.289' & E003955.23' (C) Shehu Shagari track – 25 km, a Reparian *Acacia* woodland located at Coordinates N09°91.119' & E003957.57'(D), Mamudu Lapai track -29 km, a Mixed *Afzelia* woodland located at Coordinates N09°97.358' & E004037.54' and (E) Awal Ibrahim track -22 km, an *Isoberlinia/ Afzelia* woodland located at Coordinates N09°99.046' & E004069.38' were randomly selected for the study in the area. Line transect method was chosen because the method can be used to cover long distances relatively quickly. Already established tracks was used as transect routes. All sampling stations were referenced using Global Positioning System GPS. Observations were made between 07:00-12:00 h and 16:00-18:00 h.

Data Collection Techniques

Line transect sampling method used indicates that the distances sampled are distances of detected kobs from the line along which the observer travels. Transects at the starting point were more than 200m apart from each other, decreasing the likelihood that a kob will be counted on more than one transect. Transects was traversed at approximately 5-10 km/h, using both a four wheel drive and foot walk. The researcher and two field assistants aided with binoculars'

(Zeiss Dialyt 10×40) for viewing and observing the animals, traverse transects with a vehicle (four wheel drive) stopping at intervals to observe and count all groups of kob seen. The distance from the transect line to the centre of the group was measured and the number of kobs seen in the group recorded (Plumptre & Reynolds, 1994; White 1994). Transects count was done five days in a month for a period of 24 months to obtain enough detections for the distance analysis and to account for varying detectability of animals. Censuses were conducted for 12 months in the wet season and 12 months in the dry season. Each site was visited for five days in a month during both seasons. The censuses were conducted in the morning (6.00 am to 12.00 noon) and evening (4.00 pm to 6.00 pm) during each day of visit. Transects that were walked in the morning were also repeated in the evening considered the peak hour of activities. This accounted for differences in animal activity/ behaviour at the different times. Buckland *et al*. (1993) recommend a sample size of 60 – 80 encounters. The sighting distance, cluster size was recorded once kob was detected. Ancillary information such as number of individuals of the species, and species activities when first sighted was also.

Data Analysis

The Program DISTANCE (model *Version* 7.0, *Release1*) was used to estimate the abundance of kob in the study area. Density was calculated using the computer software program DISTANCE (Buckland *et al.* 1993), using the formula.

$D = N/ (2Lwp)$

where

D - Density
N - Number of objects detected
L - Length of transect
w - Critical width of transect
2Lw - Area of detection zone
P - Detection probability

Density of animal = Number of objects detected (N)/ Area of detection zone and the detection probability (i.e. critical width (w) multiplied by transect length)

This was combined by method described by Norton-Griffiths (1978), used to calculate the abundance of kob in each and all habitat zone. The method is mathematically stated thus;

Total Population $\acute{Y} = R \cdot Z$

where;

R = estimate of average density of kob per unit area
R = total animal counted

Total area searched

$R = \Sigma y \div \Sigma z$
S_y^2 = Variance between animal counted in all units.

$S_y^2 = {}^1/n\text{-}1\ (\Sigma y^2 - (\Sigma y)^2/n)$
S_z^2 = Variance between the area of all sample units.
$S_z^2 = {}^1/n\text{-}1\ (\Sigma z^2 - (\Sigma z)^2/n)$
S_{zy} = Co-variance between animals counted and the area of each unit.
$S_{zy} = {}^1/n\text{-}1\ (\Sigma z\, y - (\Sigma z)\cdot(\Sigma y)/n)$

Population variance

$$\text{Var}(\acute{Y}) = \frac{N(N-n)}{n}\,(S_y^2 - 2\cdot R\cdot S_{zy} + R^2\cdot S_{zy}^2)$$

Population standard error **S**E = $\sqrt{\text{Var}(\acute{Y})}$

95% confidence limit of ($\acute{Y}$)

$\acute{Y} = \pm\, t\cdot SE(\acute{Y})$

t = n-1 degree of freedom

where

N = total number of units from which sample was drawn
Z = area of census zone
n = number of units sampled
z = area of each sample unit
y = number of kob counted in each sample unit

The distribution pattern of Kobs was investigated using the the multivariate analyses techniques of Principal Component Analysis- (PCA) (Hill, 1973, Mainly, 1994). and the ratio: method:

$$R = (mean\ distance) \times \sqrt[2]{density}$$

3. RESULTS AND DISCUSSION

From the result and from the study carried out the number of kob species counted are totaled 1960. Table 16 shows the estimated population density of kob censured in all the unit area. The table shows that the mean estimated population density of 0.09 ± 0.05 per km^2, while the mean estimated population was 392 ± 210.11, the confidence limit is 107.15± 109.78, having a population variance of 15365.65 and population standard error SE of 123.96.

The variance between animal counted in all units is 768320 and the variance between the areas of all sample units is 1361250000, while the co-variance between animal counted and the area of each unit is 32340000.

The result is presented in the tables, and charts below:

Table 1. Estimated population abundance of Kobs censured in KLNP.

Parameters	Estimates
Total population estimated of Kobs	= 9431
Mean Estimated Population (Mean ± SD)	392 ± 210.11(0.09 Kob per km^2)
Variance between animal counted in all units.	Var. = 768320
Variance between the areas of all sample units.	= 1361250000
Co-variance between animal counted and the area of each unit.	= 32340000
Population variance	Var(Ý) = 15365.65
Population standard error SE = √Var(Ý)	= 123.96

Table 2 shows the density & abundance of kobs using the program DISTANCE, with 95% confidence interval in wet and dry seasons, the result shows that the estimated density of kobs in the wet season is 99.52 kobs per 165 km^2, with 95% CI of 43.486 to 227.76, and an average cluster size 14.62. The AIC provides a relative measure of fit. The model with the smallest AIC provides, in some sense, the best fit to the data and here it is 432.82 and the Delta = 0 refers to the best model.

The encounter rate (n/L), which is the number of kobs per kilometer of transect is 0.36364 at confidence interval, 0.24279 to 0.54464, the same number of kobs was spotted at the same effective strip width 28.48m of the line. The coefficient of variation for D (CV) in the wet season is 0.435. While the estimated density of kobs in the dry season is 102.71 kobs per 165 km^2, with 95% CI of 57.05 to 184.92. The encounter rate is 0.36 per km transect at confidence interval, 0.24279 to 0.54464. The coefficient of variation for D (CV) in the dry season is 0.29.

Table 2. Estimated Population Density & Abundance of Kobs in the Wet and Dry season in Borgu sector KLNP.

Parameter Estimation Specification Half-normal/Cosine	Wet season Estimation	Dry season Estimation
Parameter = Total number of parameter	3	3
Minimum AIC	0	0
Akaike information criterion	432.82	443.78
Effective Strip Width (or Effective Detection Radius for line transects)	28.48	33.68

Estimate of the density of kobs /km^2	99.52	102.71
Lower 95% confidence limits of D	43.48	57.05
Upper 95% confidence limits of D	227.76	184.92
Coefficient of Variation for D	0.43	0.29
Effort = total length of the transects (m)	1650000	1650000
Number of transects	5	5
Encounter rate (n/L or n/K or n/T)	11.3	23.9
Cluster size	18.7	53.1

Fig. 1 shows the Quantile–quantile (q–q) plots corresponding to fits of a half normal model to line transect data in the Wet season. qq-plot compares the actual observations (red dots) with the expected values predicted by the detection function (blue line). If the fit was perfect, all the red dots would lie exactly on the blue line. In our case, a large number of dots between 0.0 and 0.6 are well away from the line. The model fit seems less satisfactory. These data show evidence of too few detections close to the transect line, relative to what would be expected under the half-normal model, qq plot, it shows a severe spread away of *Kobs* at 0 distance of the transects in the Wet season.

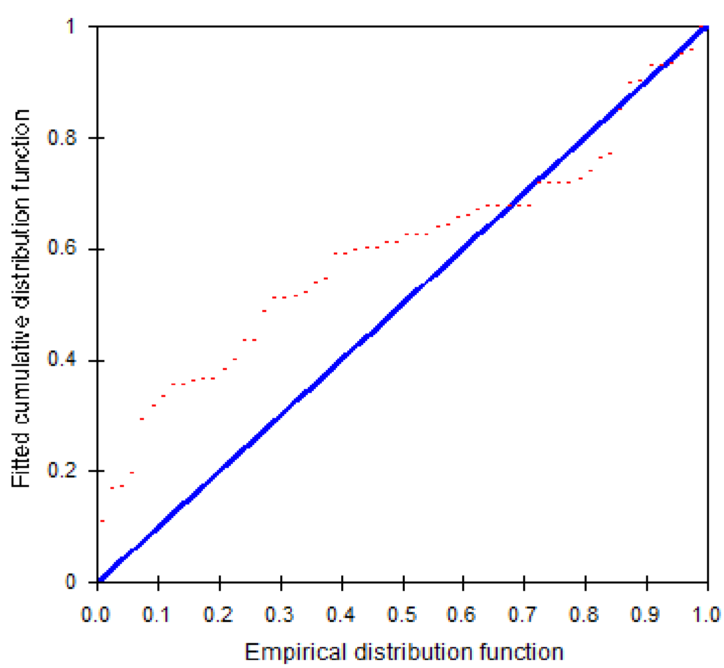


Fig. 1. Quantile–quantile (q–q) plots corresponding to fits of a halfnormal model to line transect data in the Wet season

The Fig. 2 shows the detection probability of *Kobus kob* in Kainji Lake National Park Nigeria in the Wet season. From the result, the histogram (blue) shows the distribution of the observations. The curve (red) is the fitted detection function. The result shows that the frequency of observations is very low close to the transect, and increases with increase in distance and highest at distance 20m, while it recorded fewer and fewer observations as the distance gets larger, up to 40m . Between 35m and 40m, the pattern is not so clear.

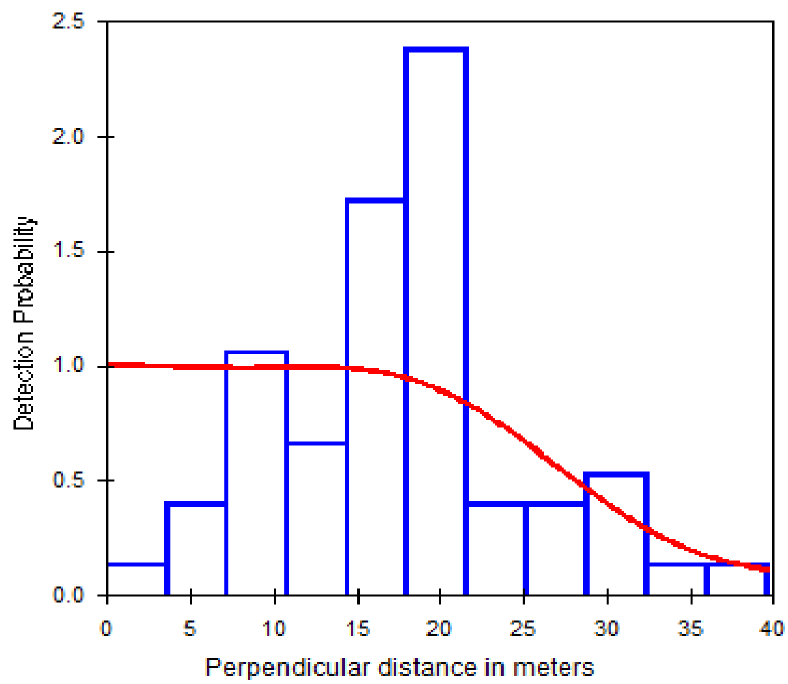


Fig. 2. Detection probability of Kobs in Kainji Lake National Park Nigeria in the Wet season

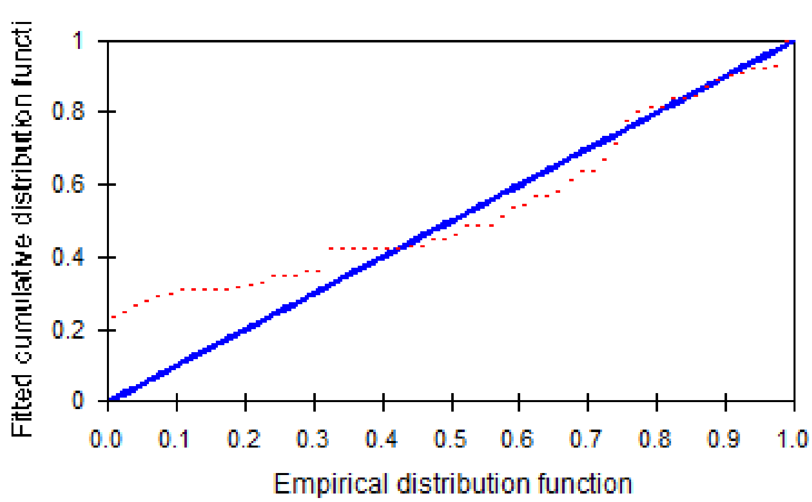


Fig. 3. Quantile–quantile (q–q) plots corresponding to fits of a half normal model to line transect data in the dry season.

Fig. 3 shows the Quantile–quantile (q–q) plots corresponding to fits of a half normal model to line transect data in the Dry season. In this result, the model fit seems satisfactory more than in the wet season, although the data show evidence of too few detections close to the transect line, relative to what would be expected under the half-normal model. qq plot, shows a severe spread away of *Kobs* at 0 distance of the transects in the dry season

The Fig. 4 shows the detection probability of *Kobus kob* in Kainji Lake National Park Nigeria in the dry season. From the result, It shows that there was no detection at the beginning of the transect, the frequency of observations at 15-18m of the transect was highest, with fewer and fewer observations as the distance gets larger, up to 40m.

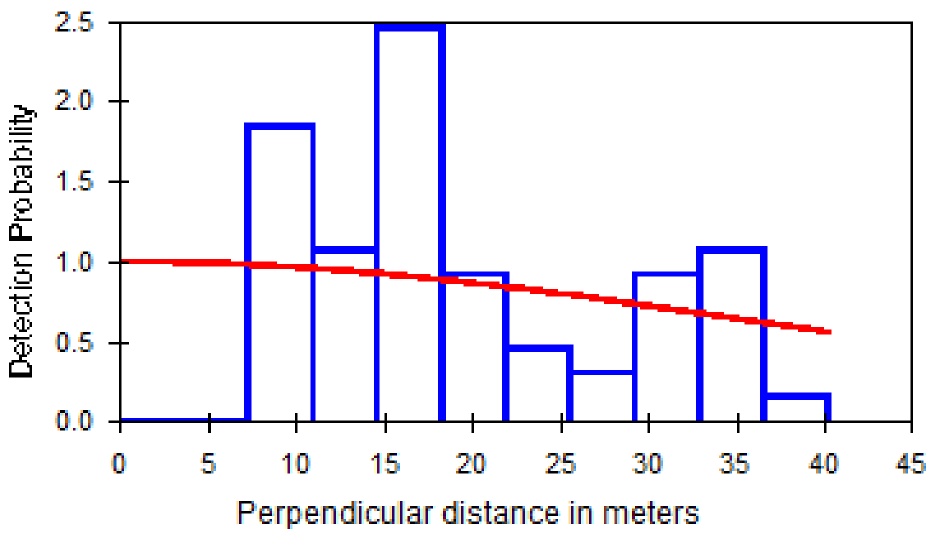


Fig. 4. Detection probability of Kobs in Kainji Lake National Park Nigeria in the dry season

Fig. 5 shows the wet season principal component analysis of kob composition and distribution in the five habitat types in the study area. The first two components of the PCA explained 90.27% of the variation in the wet season. Results of principal components analysis (PCA) showed a clear difference in kob composition and distribution between habitat types in the wet season.

The first axis indicates a clear separation between the riparian vegetation (Shehu Shagari C), and other habitats. This fail into the component 1 axis. The habitat type (A and B) has a clear separation from other habitats but fail into the component 2 axis. Habitat type (D and E) also fail into the component 2 axis.

The spatial distribution of kob per months indicates that habitat characteristic and quality determine the distribution of kobs both in time and season. The months of July is highly separated from the other months being in the component 1 axis along increasing gradient 16%, while the months of May and June on the same axis but at a decreasing gradient level. The months of August, September and October fail into the component 2 axis.

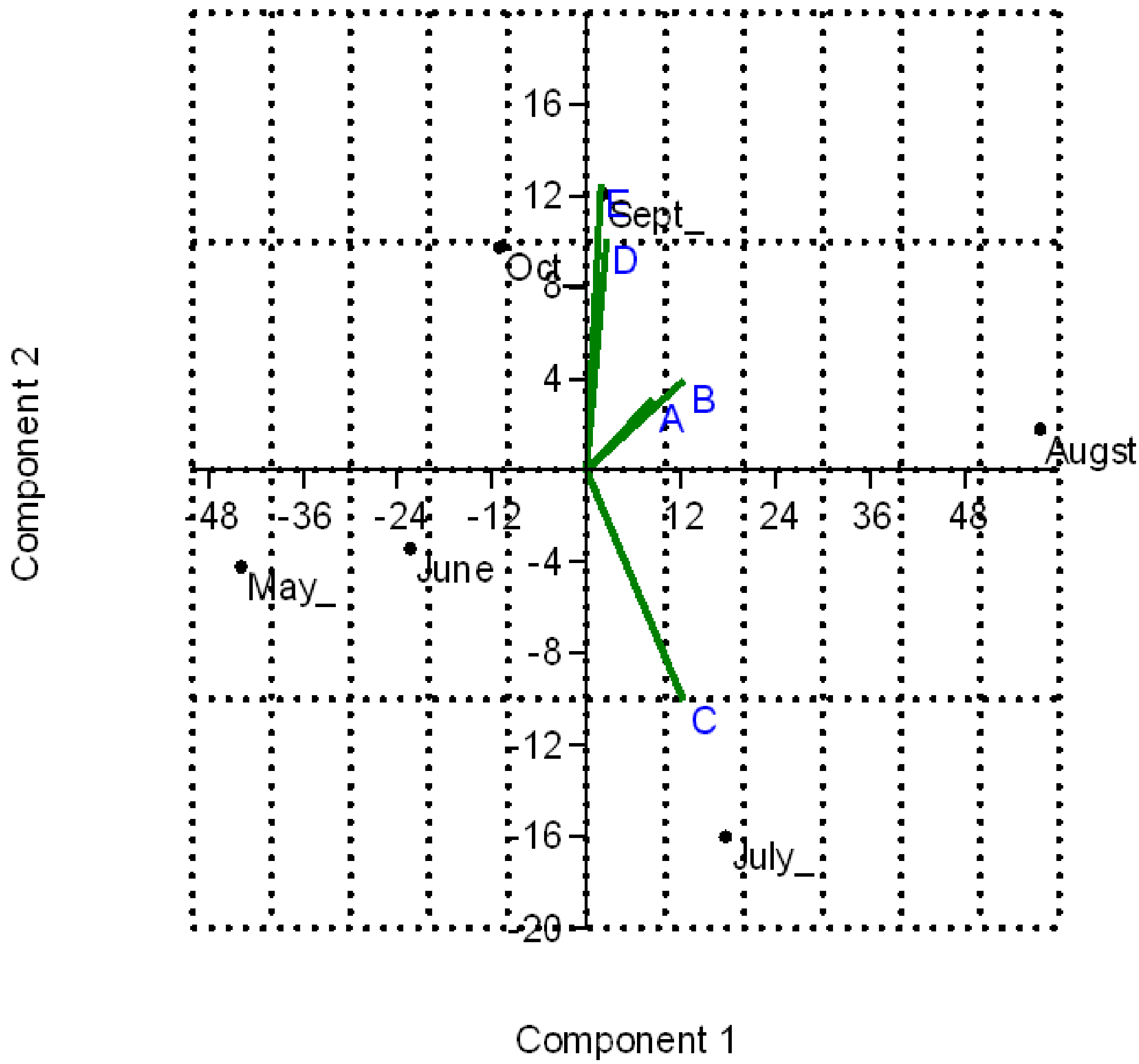


Fig. 5. Wet Season Principal Component Analysis of Kob Composition and Distribution in the five habitat types in the study area.

Note: A = Mixed *Deterium* wood land, B = *Terminalia* Riparian wood land, C = Riparian *Acacia* wood land, D = Mixed *Afzelia* wood land, *E = Isoberlinia/ Afzelia* wood land.

Fig. 6 shows the dry season principal component analysis of kob composition and distribution in the five habitat types in the study area. The result shows that the first two components of the PCA explained 93.96% of the variation. The first axis indicates a clear separation between the riparian vegetation (Shehu Shagari track- C and Gilbert Child track- B) and the other habitat types. These habitat types fail into the component 1 axis. The habitat type (A) which lies at the centroid of the gradient also fail into the component 1 axis. Habitat type (D and E) highly separated from the other habitat types fail into the component 2 axis. The months of January and December is highly separated from the other months being in the component 1 axis along increasing gradient 20%, and 64% respectively.

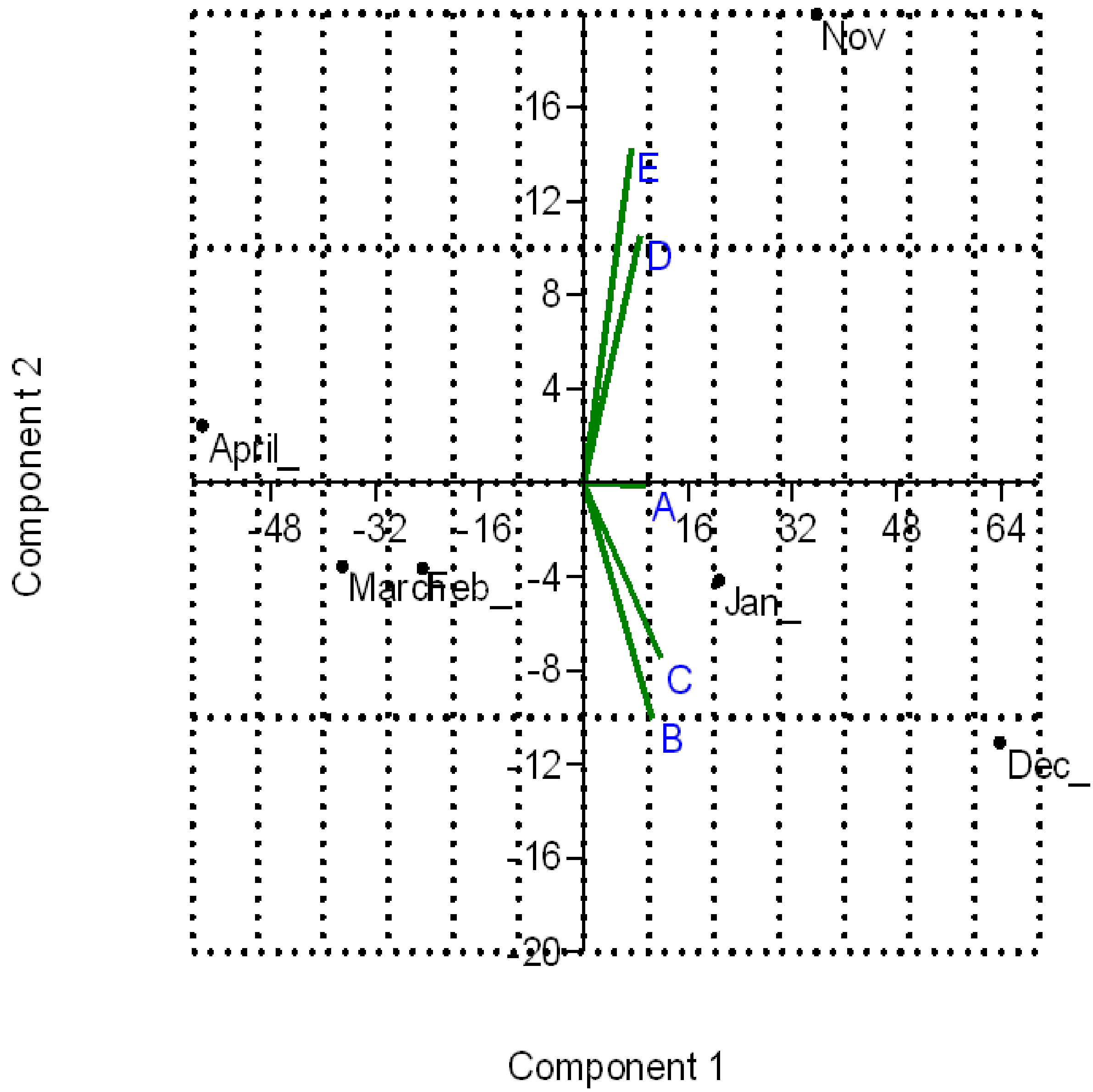


Fig. 6. Dry season Season Principal Component Analysis of Kob Composition and Distribution in the five habitat types in the study area.

Note: A = Mixed *Deterium* wood land, B = *Terminalia* Riparian wood land, C = Riparian *Acacia* wood land, D = Mixed *Afzelia* wood land, *E* = *Isoberlinia / Afzelia* wood land.

Table 3 show the shape/pattern of kob distribution in Borgu sector KLNP in wet and dry seasons. The result shows that kob in KLNP is highly clumped in distribution, having calculated ratio: R less than 1 in both wet and dry seasons.

The total population calculated ratio: R is 0.42103 indicating a clumped distribution, also in both wet and dry seasons the calculated ratio: R is less than 1 having 0.629415 and 0.340213 respectively indicating a clumped distribution.

Table 3. Shape/Pattern of Kob Distribution in Borgu Sector KLNP in Wet and Dry Seasons**.**

Season	**Cal. R < 1**	**Remark**
Total population	0.42103	Clumped
Wet season	0.629415	Clumped
Dry season	0.340213	Clumped

Table 4 shows the problems facing kob in the study area. The table shows that the major problems facing kob in the study area is cattle grazing having 41.37% being the highest, followed by illegal hunting having 29.49%, the other problems includes tree logging having 23.74%, Illegal entry 2.88% and diseases1.08%, while illegal fishing and predation forms the least having 0.72% respectively.

Table 4. Factors affecting Kobs in the Study Area.

Problems		2015	2016	Total Arrest	Percentage (%)
External problems	Illegal Hunting	48	34	82	29.49
	Cattle Grazing	40	75	115	41.37
	Tree Logging	54	12	66	23.74
	Illegal Fishing	0	2	2	0.72
	Illegal entry	8	0	8	2.88
Internal problems	Predation	1	1	2	0.72
	Disease	1	2	3	1.08
				278	100

Source: External Problems. KLNP 2015&2016
Field survey

4. DISCUSSION

The findings from this study indicates that the mean estimated population density of kobs is 0.09 ± 0.05 per km^2, while the mean estimated population was 392 ± 210.11. This finding agrees with Fischer and Linsenmair (2002) report that in African protected areas, the lowest densities of kobs recorded are less than 1/km^2. Mayaka *et al.* (2004) report that, in the nearby country, Benoue National Park, Cameroon, a density of 1-12 kob/ km^2 is recorded. The findings also indicate that the true population lies within a wider range having a high confidence limit (Norton-Griffiths 1978). The true population size lies between 109.78 and 107.15 confidence limit. There is high variation between the transects as indicted by the total population co-variance having a positive value (Var(Ý) = 15365.66) suggesting that the estimates from the transects are widely spread away from the mean value, hence, this agrees with Norton-Griffiths (1978) assertion that variation is measured by the variance and when the the variance is high, that means that there is greater spread of estimates above the mean. There is a high significant difference at ($P<0.001$) between the habitat types in both kob composition and distribution, also there is variations between the habitat types in terms of species distribution. While in the model DCV -. Coefficient of Variation for Density per km^2 in wet and dry season is 0.404 and 0.318. In distance model, when DAIC = 0 it is for the best model. Hence the application of this model is in accordance with the distance model (Buckland *et al.* 2004). There is a high significant difference at ($P<0.001$) between the habitat types in both kob composition and distribution in wet and dry season.

The estimated population of kobs in the wet season is 99.52 kobs/165km^2 and in the dry season is 102.71 kobs /165km^2, this follows with Balmford (1992) report that *Kobus kob* thomasi density reaches 136-182 kob/km^2, the highest among none-migrating ungulates in Uganda National Park.

The estimated density of kobs is more in the dry season than in the wet season in the study area. The least number of kobs were sighted at Awal Ibrahim and Mamudu Lapai track. In the months of January to March fewer numbers of kobs were observed throughout the study area, but in April to May kobs numbers started increasing, while in November Youngs and Calves were seen in large number especially in areas that were not far from the river indicating that it is their period of parturition. The present population of kob in Kainji Lake National Park is stable, having a constant mortality and fertility rates, and no migration, a fixed age distribution and constant growth rate. Hence Kobs are still widely distributed and not endangered (Kingdom, 1997) even in Kainji Lake National Park.

Pattern of Kob Distribution in Borgu Sector of Kainji Lake National Park in Wet and Dry Seasons

The abundance and distribution of wildlife species differs among biomes, Principal component analysis (PCA) was used to identify the main variations in the kobs composition/ abundance and distribution (Dray 2003; Chamaillé-Jammes 2016). Principal component shows that observation with the greatest habitat value, population variance and abundance will lie on the first axis called component 1, while component 2 contains greatest habitat value but less population variance and abundance (Dray 2003). Thus in the wet season riparian vegetation (Shehu Shagari C) shows a great habitat value highly separated from other habitat types and having high kob composition with a component loading of 0.6265 variations and is therefore a very important habitat for kob conservation. Habitat B and A is moderately valued as it appears in component 2 with high kob composition having a component loading of 0.6312 and 0.4287 variation respectively, while habitat type D and E shows less habitat value, separated from others and has no significant value in terms of kob inhabitation and abundance which appears in component 2 having a component loading of less than 0.2 variations. The months of September, August, October and July shows a great number of kobs presence though in peak of rainy season, it is therefore important that adequate protection of kobs species in these months are maintained. The dry season principal component analysis of kob composition and distribution in the five habitat types in the study area shows that in the dry season, habitat type C and B shows a great habitat value, highly separated from other habitat types and having high kob composition with a component loading of 0.5468 and 0.4854 variations respectively and is therefore a very important habitat for kob conservation. The habitat type (A) which lies at the centroid of the gradient shows has a high kob composition having a component loading of 0.4383 variations. Habitat type D and E shows a great habitat value highly separated from other habitat types but has little value in terms of kob inhabitation having a component loading of 0.3992 and 0.33374 variations respectively, thus the habitat type D and E has less habitat value with low kob composition and therefore not significant to kob conservation in the area. The months of November, December and January shows a great number of kobs presence and therefore is a good month for tourist visitation to the park.

The distribution of the kob indicates that kobs in Kainji Lake National Park are clumped in distribution as was observed during the study in all the habitat types having distribution ratio R less than 1 in both wet and dry seasons. The Coefficient of Variation for Density is also less than 1 in all the years and seasons thereby indicating clumped in kob distribution in Kainji Lake National Park. The finding also shows that the quantile–quantile (q–q) plots corresponding to fits of a half normal model to line transect data indicates (a) That the model fit seems satisfactory in the dry season than in the wet season, although the data show evidence of too few detections close to the transect line, relative to what would be expected under the half-normal model.

Effect of Human Activities on Kob Abundance

Even with the abundance in population, kobs still face problems arising from human activities. These problems ranges from poaching, grazing, bush burning and logging. Bolger *et al.* (2008) stated that there are three human activities that contribute to the decline of ungulates: activities such as overhunting, anthropogenic barriers and habitat loss. In Kainji Lake National Park the populations of kobs are currently decreasing because of poaching in the area. Kobs have decreased markedly in numbers across their various woodlands, and their distribution has been increasingly fragmented, as a result of over hunting for meat and the expansion of settlement and livestock (IUCN 2010). The population is likely to become increasingly fragmented until they are confined to those areas where there is effective control of poaching and encroachment by livestock and settlement.

Human activity is greatest at Shehu Shagari zone where it was observed that rangers and poachers frequently have an encounter most often. Hunters were apprehended in the month of April. Items confiscated from them include cutlasses and wire snare. Grazing was eminent as herdsmen and their animals were often seen especially along Hussaini Masha and Awal Ibrahim track. Many herdsmen were often arrested and prosecuted by park authority almost on daily bases. A total of 115 herdsmen were arrested and prosecuted by park authority between 2015-2016. Human activities contribute to the decline of kob population in the park, activities such as poaching, anthropogenic barriers and habitat loss through overgrazing and deforestation by the surrounding communities. Kobs as much as possible avoid foraging in areas of higher human activities as well as predation risk during dry seasons, when food resources become scarce, rather they are seen converging within the camp activity area were they feel protection is guaranteed. Hence they are close to humans in uniform and will not run even at a close range but rather preferred to watch for other movement.

Frequent bush burning is experienced in the park and these had tremendous effect on the trees. Continued and frequent burning can be especially detrimental to species regenerating vegetatively or from seed. Early succession plant communities are characterized by annual forbs and grasses, and are typically first to colonize a site following some form of soil disturbance. Kainji Lake National Park is engrossed with the habit of frequent fire burns every year, this has contributed to the immense bare ground seen in the area, each year tender trees as well as older trees are burnt, many of the trees species either die or resulted to stunted growth as being evident in Habitat A, B and C. Bush fire has become a common practice by the park and very much pronounced in the kob courts. Such uncontrolled grass burning under the dry season conditions affect the overall kob movements, perhaps causing depletion of forage in the entire park.

Logging were noticed around Hussaini Masha and Awal Ibrahim boundaries, were the sound of chain saw was heard very often, this agrees with KLNP report that logging activities are becoming a menace at the boundary axis of the park. The presence of the loggers who are in need of large woods and with the noise of the chain saw scare the wild animals including kobs away from the area to an area where they will receive adequate protection.

The number of arrests made, and the cash received in fines realized from these arrests, are negligible when compared with the number of animals that are being killed illegally every day, especially during the dry season. Hence illegal activities greatly affects the abundance and distribution of the kobs and other animals in the study area, and constitutes an important factor in determining population levels, in addition to the other crucial factors, such as water, food, and cover as well as climate change.

5. CONCLUSIONS

The total population of kob censured in Kainji Lake National Park is very high. These observations have indicated that the population of kobs at Borgu sector was very stable and viable. In the wet and dry seasons, the habitat C and B shows a high component separation with high kob composition, having the greatest habitat value, such as an acidic soil that fevours high quality grass growth food resource for kobs, effective management protection of wildlife from poarchers, availability of salt lick supplement and cover. These sites are therefore a very important habitat for kob conservation. In terms of the kob species composition in Kainji Lake National Park, the Gilbert Child track (B) and Shehu Shagari track (C) will always attract many ecotourist who are interested in seeing more kobs in their high number, than will the other three habitat types were the kobs population is low. Also kob being a star species that every tourist will want to watch thereby makes the park a high tourist appeal location where tourist can tour especially around the designated kob courts and within a kilometer square will sight clusters of kobs during the dry seasons.

Recommendations

From the study the following recommendations are made:

- **Use of distance:** To allow simple and accurate abundance determination in wildlife studies I strongly recommend the use of DISTANCE model in analyzing results so that the probability of observing an object within the circle or strip can be estimated.

- **Adequate Monitoring of the Whole Park;** Trans-boundary anti-poaching progragrams should be enhanced so as to stop entering by foreigners into the countries park to poach. The park should extend its monitoring programme to all sectors of the Park. There should be extended mentoring programme to all the sectors of the park. This will go a long way to check illegal activities such as grazing and poaching.
- **Creation of Water points;** Ensure water availability for wildlife during dry periods: creation of shallow water holes randomly across all the habitat types will enable kob use all the habitats effectively and as well reduce clustering around the river Oli, this will boost the kob population.
- **Stopping all forms of grazing inside the park**; illegal grazing of livestock in the park could be solved by assisting the herd's owners to establish ranchers or fodder's banks for the feeding of their animals especially during the dry seasons.

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