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Population Parameters and Biomass of African Buffalo (*Syncerus caffer*) in Kainji Lake National Park, Nigeria

¹O. T. Aremu, ²S. A. Onadeko, ²B. A. Ola-Adams and ²E. I. Inah

¹Department of Forestry and Wildlife, Faculty of Agriculture, University of Benin, Benin City, Nigeria

²Department of Forestry and Wildlife Management, College of Environmental Resources Management, University of Agriculture, Abeokuta, Nigeria

Abstract: The study examined some population parameters such as relative abundance, distribution, population composition and biomass of *Syncerus caffer* in Kainji Lake National Park. Six, 4×4 km transects were constructed in the Park with an effective study area of 96 km². Transects were traversed twice a month for 12 months. Estimates were based on direct censusing techniques only. The results revealed that riparian forest and woodland habitat harboured the highest population of *Syncerus caffer* in both dry and wet seasons 9 and 5 groups, respectively with a total of 149±8.17 individuals, while *Diospyros mespliformis* dry forest harboured the least of 20±2.84 individuals. Population compositions of *Syncerus caffer* were significantly difference (p<0.05) in both dry and wet seasons. A total *Syncerus caffer* biomass of 54.57±10.9 kg km⁻² was recorded in the Park. Measures for adequate conservation of existing *Syncerus caffer* population in the Park are discussed.

Key words: Abundance, buffalo, distribution, population, biomass, national park

INTRODUCTION

Bushmeat is traditionally an important source of protein and income for many much communities in developing countries including Nigeria (Njiforti, 1996). For instance in Botswana over 50 species of wild animals provides animal protein exceeding 90 kg/person/year. In Ghana, Liberia, Botswana and Nigeria about 75, 70, 60 and 20% of the population, respectively depend largely on bush meat for animal protein (FAO, 1989; Anadu *et al.*, 1988). In Nigeria estimates of the values of bushmeat has been put at N20 million, N300 million and N2.1 billion in 1970, 1988 and 2000, respectively (Charter, 1970; Anadu *et al.*, 1988; Martin, 2000). Nigeria has an estimated 274 mammal species including *Syncerus caffer* belonging to 13 orders, 42 families and 133 genera, over 20,000 insect species, 839 bird species, 109 snake species and over 20 species of primates (Happold, 2000). Afolayan (1992) and Onadeko (2004) reported that human activities such as deforestation, burning of vegetation, mining, poaching, industrialization and pollution have resulted in loss of wildlife habitats and reduction in wildlife population in Nigeria. Milliken (2004) reported that unregulated domestic wildlife product markets across Africa are fueling a significant portion of wildlife poaching in Africa for instance, the markets consumed up to 12,000 Elephants annually from estimated population of between 400,000 and 660,000 Elephants.

African Buffalo (*Syncerus caffer*) belongs to the family Bovidae, shoulder height is between 1.0 and 1.67 m, head and body length is between 2.1 and 3.0 m, tail length is between 0.75 and 1.1 m and the weight of adult bull has been estimated to be between 600 and 900 kg, with life expectancy of between 18 and 20 years. Their habitats range from forest to open savanna (Field, 1986; Jean and Pierre, 1970).

The objectives of this study are to determine the relative abundance, distribution and biomass of *Syncerus caffer* in the Park. The study is also intended to prescribe how the existing population of *Syncerus caffer* in the Park could be effectively conserved.

MATERIALS AND METHODS

Study site: Kainji Lake National Park (9°40'-10°30' N, 3°30'-5°50' E) has a total land area of 5,340.83 km² with Borgu sector comprising 3,970.83 km² (74.3%) and the Zuguma sector covering an area of 1,370 km² (25.7%). The vegetation of the Borgu sector has been described as northern savanna (Keay, 1989) and according to (Afolayan, 1978; Milligan, 1978) the six main vegetation communities in Borgu sector are (i) *Burkea africana*/*Detarium microcarpum* woodland savanna (ii) *Diospyros mespliformis* dry forest (iii) Riparian forest and woodland (iv) *Terminalia macroptera* tree savanna (v) *Isoberlina tomentosa* woodland (vi) *Isoberlina doka*

savanna woodland. The Oli river flows from the Republic of Benin through Borgu sector into the Niger river. In the dry season, the river breaks into pools, which hold water throughout the year and serve as the only source of water for the wild animals. Long-term annual rainfall is between 900 and 1,100 mm. The Park is blessed with diverse faunal resources including *Syncerus caffer*, *Hippotragus equinus*, *Alcelaphus bushelaphus*, *Kobus kob*, *Papio anubis*, *Panthera leo*, *Hippopotamus amphibious* and *Crocota crocuta* among others. Floral resources in the Park include *Burkea africana*, *Terminalia aricennoides*, *Diospyros mespliformis*, *Entanda africanan*, *Vitex domiana* and *Anogeissus leiocarpus* among others.

Methods: A total of six, 4×4 km transects were laid in the Park with total effective study area of 96 km². Each transect was allowed to rest for 4 days after construction before data collection to reduce human disturbance and to allow wild animals to return to their initial home range. The six transects were traversed twice a month for 24 months (January 2003 and December 2004 between the hours of 7.00 to 13.00 h and 16.00 to 19.00 h with an average walking speed of 2.5 km h⁻¹. Periods of walking were interspersed with periods of silent watch and rest to increase the possibility of detecting animals that might hide or flee upon the approach or movement of the observers. The counts of individuals/group were made conservatively by only including individual seen. Binoculars (Zeiss dialyt 10×40) were used to observe, count and detect presence of *Syncerus caffer*. Animal sensing was based on direct count only.

Animal sighted was identified as outlined and recommended by Jean and Pierre (1970). Information collected on any group of *Syncerus caffer* sighted include date and time of sighting, sighting single and distance, population structure such as adultmales, adultfemales, subadult males, sub adult females and juveniles, habitat and sex which was determined by the presence of sex organs and udder. Perpendicular distance was calculated as $\sin \theta \times \text{sighting distance}$ where θ is the sighting angle as recommended by Dunn (1993). The following assumptions were made as recommended by Burnham (1990), Seber (1982) and Dunn (1993). Animal positioned directly over the transect line are not missed, animals are seen before they flee, none is counted twice, animals are distributed at random with respect to the transects and with equal probability of been sighted. To prevent and minimize bias, errors and double counting, observers remained on the transects during data collection and no observation was made while returning on the transects as recommended by Dunn (1993). Biomass estimate

was made as recommended by Dunn (1993) and Freese (1988) as follows $\text{individual km}^{-2} \times \text{adult weight (kg/individual} \times 0.75) = \text{kg km}^{-2}$, mean adult weight of 700 kg was used as recommended by Estes (1990). All data collected were subjected to analysis of variance (ANOVA) at $p < 0.05$ and Duncan multiple range test contrasts as recommended by Steel and Torrie (1980).

RESULTS AND DISCUSSION

Abundance and distribution: The results revealed that riparian forest and woodland habitat harboured the highest population of *Syncerus caffer* in both dry and wet seasons 9 and 5 groups, respectively representing 99 ± 4.75 and 50 ± 3.42 individuals, respectively. Followed by *Terminalia macroptera* tree savanna habitat, which harboured 7 and 3 groups of *Syncerus caffer* in both dry and wet seasons, respectively. The least population of *Syncerus caffer* was recorded in *Diospyros mespliformis* dry forest which only harboured a total of 4 groups in both dry and wet seasons. A total of 53 groups of *Syncerus caffer* were sighted in the Park representing 487 ± 21.03 . The relative abundance was estimated to be $163 \text{ } 1000 \text{ km}^{-2}$ (Table 1).

Population structure: In the dry season adult females constituted the highest percentage (27.70%) of the *Syncerus caffer* population structure, followed by juveniles (25.21%) while subadult males constituted only (11.63%) of the population. Also, in the wet season adult females, juveniles and subadult females constituted 32.80, 24.8 and 20.0% of the population, respectively (Table 2 and 3). There was a significant difference ($p < 0.05$) in the mean population structure of *Syncerus caffer* in both dry and wet seasons (Table 4).

Biomass: The total biomass of *Syncerus caffer* in the Park was $54.51 \pm 10.9 \text{ kg km}^{-2}$ while the mean biomass per habitat was $9.09 \pm 1.82 \text{ kg km}^{-2}$ (Table 5). Highest population of *Syncerus caffer* (14 groups) representing 149 individuals recorded in forest and woodland habitat may be attributed to the fact that the habitat provide enough food, water, cover and breeding space for herbivores in the Park including *Syncerus caffer* throughout the year because of the presence of river Oli which runs through the length of this habitat which improves the habitat quality season when food quality and quantity of other habitats in the Park must have been limited in addition, when other smaller rivers and streams such as Nanu, Timo and Mensi must have dried up. These observations were earlier reported by Milligan (1978), Afolayan (1978), Aremu (2001) and Aremu *et al.* (2002).

Table 1: Mean relative abundance and distribution of *Syncerus caffer* in dry and wet seasons in Kainji Lake National Park

Habitat	Dry		Wet	
	g.s.	ind	g.s.	ind
Badmw	7.0	63±3.41	2.0	18±1.89
Dmdf	3.0	21±1.84	1.0	9±1.0
Rfw	9.0	99±4.75	5.0	50±3.42
Tmts	7.0	70±4.00	3.0	24±2.0
Itw	8.0	64±3.55	1.0	10±1.0
Idsw	5.0	45±2.16	2.0	14±1.01
Total	39.0	362±19.71	14.0	125±10.32
Mean	6.5	60±3.29	2.3	20±1.72

Relative abundance 0.163±0.013 groups km⁻²; Badmw-*Burkea africana*/*Detarium microcarpum* woodland savanna; Dmdf-*Diospyros mespiliformis* dry forest; Rfw-riparian forest and woodland; Tmts-*Terminalia macroptera* tree savanna; Itw-*Isobertina tomentosa* woodland; Idsw-*Isobertina doka* savanna woodland; g.s.-Group sighted; ind-individuals

Table 2: Population composition of *Syncerus caffer* in dry season in Kainji Lake National Park

Habitat	Am	Af	Sam	Saf	J	n
Badmw	8.00	17.00	9.00	12.00	17.00	63
Dmdf	2.00	6.00	2.00	6.00	8.00	24
Rfw	13.00	29.00	11.00	22.00	24.00	99
Tmts	9.00	21.00	9.00	16.00	15.00	70
Itw	7.00	15.00	6.00	17.00	15.00	60
Idsw	5.00	12.00	5.00	11.00	12.00	45
Total	44.00	100.00	42.00	84.00	91.00	361
Mean	7.33	16.67	7.00	14.00	15.17	
Percentage	12.19	27.70	11.63	23.27	25.21	

Badmw-*Burkea africana*/*Detarium microcarpum* woodland savanna; Dmdf-*Diospyros mespiliformis* dry forest; Rfw-riparian forest and woodland; Tmts-*Terminalia macroptera* tree savanna; Itw-*Isobertina tomentosa* woodland; Idsw-*Isobertina doka* savanna woodland; Am-adultmales; Af-adult females; Sam-subadult males; Saf-subadult females; J-juveniles; n-number sampled

Table 3: Population composition of *Syncerus caffer* in wet season in Kainji Lake National Park

Habitat	Am	Af	Sam	Saf	J	n
Badmw	3.00	6.00	1.00	3.00	5.00	18
Dmdf	2.00	2.00	0.00	3.00	2.00	9
Rfw	8.00	15.00	4.00	10.00	13.00	50
Tmts	3.00	10.00	2.00	4.00	5.00	24
Itw	1.00	4.00	0.00	2.00	3.00	10
Idsw	2.00	4.00	2.00	3.00	3.00	14
Total	19.00	41.00	9.00	24.00	31.00	125
Mean	3.17	6.83	1.50	4.17	5.17	
Percentage	15.83	32.80	7.02	20.0	24.80	

Badmw-*Burkea africana*/*Detarium microcarpum* woodland savanna; Dmdf-*Diospyros mespiliformis* dry forest; Rfw-riparian forest and woodland; Tmts-*Terminalia macroptera* tree savanna; Itw-*Isobertina tomentosa* woodland; Idsw-*Isobertina doka* savanna woodland; Am-adultmales; Af-adult females; Sam-subadult males; Saf-subadult females; J-juveniles; n-number sampled

Table 4: Effect of seasons on population composition of *Syncerus caffer* in Kainji Lake National Park

Season	Grp	Mgrp	Am	Af	Sam	Saf	Juv
Dry	0.95 ^a	7.17 ^a	1.54 ^a	2.38 ^a	1.17 ^a	2.12 ^a	1.94 ^a
Wet	0.45 ^b	3.63 ^b	0.92 ^b	0.92 ^b	0.78 ^b	1.08 ^b	1.92 ^a

Grp-group; Mgrp-mean group size; Am-adultmales; Af-adultfemales; Sam-subadult males; Saf-subadult females; Juv-juveniles; Mean values with the same letter(s) are not significantly different

Table 5: Estimate of *Syncerus caffer* biomass in Kainji Lake National Park

Habitat	Biomass (kg km ⁻²)
Badmw	19.18±1.57
Dmdf	3.74±0.84
Rfw	16.32±2.98
Tmts	11.11±1.86
Itw	7.93±1.99
Idsw	6.23±1.66
Total	54.57±10.9
Mean	9.09±1.82

Badmw-*Burkea africana*/*Detarium microcarpum* woodland savanna; Dmdf-*Diospyros mespiliformis* dry forest; Rfw-riparian forest and woodland; Tmts-*Terminalia macroptera* tree savanna; Itw-*Isobertina tomentosa* woodland; Idsw-*Isobertina doka* savanna woodland

A total of 39 groups representing 362 individuals of *Syncerus caffer* were sighted in the dry season, while only 14 groups representing 125 individuals were sighted in the wet season. This may not be unconnected with the fact that in the dry season many thickets and vegetation must have been burnt to increase visibility for game viewing for tourists. This therefore make sighting of wild animals easier, where as in the wet season the vegetation is usually over grown making sighting of wild animals very difficult due to poor visibility (Onadeko *et al.*, 1998). Adult females, subadult females and juveniles constituted higher proportion of the population structure in both dry and wet seasons, 27.70 and 25.21%, respectively. Adult males and subadult males constituted the least 12.19 and 11.62% proportion of the population structure due to the fact that they are usually susceptible to poaching (Muchaa and Ngamdjui, 1999). Highest Biomass of 16.82 (±2.98) kg km⁻² estimated in the riparian forest and woodland habitat may be due to high habitat quality of the vegetation community.

CONCLUSIONS

The *Syncerus caffer* relative abundance of 0.162±0.013 groups km⁻² in the Park was considered fairly large enough to support the effective population size in the near future. Notwithstanding, environmental changes such as fire, diseases, poaching, illegal grazing and habitats destruction may reduce *Syncerus caffer* population size and threaten their survival in the Park. Riparian forest and woodland habitat should be completely protected so that it could continue to serve as refuge to high population of wildlife species in the Park.

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