

Population estimate of forest buffalo (*Synceruscaffernanus* Boddaert, 1785) in Okomu National Park, Edo State, Nigeria

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ABSTRACT

The study on the population estimate of the forest buffalo (*Synceruscaffernanus*) was carried out to provide a baseline data for *in-situ* conservation of the species in and around Okomu National Park (ONP). Fifteen (15) transects of 4.0km each were randomly selected from 25 transects in the four ranges of ONP for data collection on 17th July (1st census) and 27th September (2nd census), 2012. Population parameters estimated were herd density, herd size and total population size. Data generated were analyzed with density equation, chi-square (χ^2) ($p = 0.05$) and standard error (SE) of the mean. A total population size of 60.81 ± 0.61 individuals was estimated from the survey while the average herd density of the species was 0.09 ± 0.01 herds / km² with a total of 19.08 ± 2.12 herds in the park. Though Arakhuan (0.12 ± 0.02 herd / km²) and Iguowan (0.12 ± 0.01 herd / km²) recorded the highest herd density, the ranges did not differ significantly ($p > 0.05$) in herd density. Average herd size of 3.19 ± 0.29 individuals / herd was also recorded for the species. The ranges did not differ significantly ($p < 0.05$) in herd size, though Babui recorded the highest herd size of 4.00 ± 0.00 individuals / herd while Iguowan, Julius Creek and Arakhuan recorded 3.25 ± 0.53 , 3.25 ± 0.53 and 2.25 ± 0.18 individuals / herd respectively. Further studies are needed to estimate more parameters like home range, sex ratio and other ecological requirements of forest buffalo in the area of study.

Key words: Population estimate, herd density, herd size, forest buffalo, Okomu National Park.

INTRODUCTION

The forest buffalo, sometimes called the dwarf buffalo (*Synceruscaffernanus* Boddaert, 1785) is the smallest and the only subspecies of the African buffalo (*Synceruscaffer*) that inhabits the rainforests of Western and Central Africa (Korte, 2008a; Melletti, 2011). The African buffalo being the only extant member of the genus *Syncerus* (Wilson and Reeder, 2005) is of *Least Concern* (LC) status according to

IUCN (2010) and also one of the least understood of the large, African, forest mammals (Melletti, 2011). According to East (1999), the total population of African buffalo based on subspecies is as follows: *Synceruscafferbrachyceros* (Sudan buffalo) – 27,000; *Synceruscafferaequinoctralis* (Central African buffalo) – 133,000; *Synceruscaffercaffer* (Cape buffalo) – 670,000 and *Synceruscaffernanus* (forest buffalo) -

60,000. The protected areas, especially of West Africa, harbor about 75% of the forest buffalo where they are threatened by habitat loss and hunting pressure (IUCN, 2010; East, 1999; and Kingdon, 1997). Surprisingly however, little is known about the population characteristics and habitat requirements of forest buffalo, like most endangered species, found in protected and unprotected areas of the rainforest zone of Nigeria (Botkin and Keller, 1997).

Most national parks and game reserves in Nigeria have little or no records of animal population abundance and distribution. Though the forest buffalo is of great conservation importance, it is noteworthy that its population has not been documented in any rainforest protected area in Nigeria including Okomu National Park. The few works and reports on *in-situ* conservation with emphasis on population status of some wildlife species other than the forest buffalo (*Syncerus caffer namus*) in Okomu National Park include Ajayi, et al. (2011), Akinsorotan, et al. (2011), Anadu and Oates (1982). Knowledge of abundance of forest buffalo is necessary if effective conservation of the subspecies is required. This research, therefore, was conducted to provide baseline information vital for effective conservation of the forest buffalo in the area of study.

MATERIALS AND METHODS

The study was carried out in Okomu National Park. The protected area lies 45km west of Benin City and is in Ovia South-West Local Government Area of Edo state, Nigeria. The park is approximately 212km² in size and lies between longitude 5° and 5° 30' East and between latitude 6° and 6° 10' North (BirdLife International, 2013). It is bounded in the West by Okomu River, in the North and East by Okomu Oil Palm Estates and in the South by Okomu-Mile 3 Road. The park was originally a wildlife sanctuary established by the former Bendel State Government through Legal

Notice Number 198 of 1986. The Federal Government of Nigeria took over its management and upgraded it to the status of a national park in 1999 through the promulgation of Decree 46 of 1999. It derives its name from River Okomu which flows southwest to join the Osse River.

The climate and vegetation of the study area are typical of a humid lowland tropical rainforest ecosystem (Orhierre, 1992) with mean annual rainfall of between 2,100mm and 2,500mm, which falls highest in June, July, September and October (Akinsorotan, et al., 2011; Ikhuoria, 1993). The driest period is January – March while the mean monthly temperature is 30.2°C. Relative humidity is about 65% during the afternoons and throughout the year. The soils of the area are ferrallitic and composed of quartzite and kaolin from tertiary secondary sedimentary rocks (Ikhuoria, 1993). Despite heavy logging operations by the African Timber and Plywood Company (AT & P) in the area between the 1920s and 1980s, the area still remains one of the least disturbed representatives of the rainforest ecosystem west of the River Niger (Ejidike and Okosodo, 2007). The area contains a unique assemblage of plants, some of which are endemic to the study area. Typical tree species in the study area include *Astonia boonei*, *Azelia africana*, *Cleistanthus pentandra*, *Triplochiton scleroxylon*, *Terminalia superba* and *Nauclea diderichii*.

Fauna species according to Anadu and Oates (1982), Akinsorotan, et al. (2011) and Ajayi, et al. (2011) include *Cercocebus torquatus* (Red-capped mangabey), *Cercopithecus erythrogaster* (White-throated monkey), *Cercopithecus nictitans* (Putty-nosed monkey), *Cercopithecus mona* (Mona monkey), *Cephalophus* species (duikers), *Osteolaemus tetraspis* (dwarf crocodiles) and endemic butterflies, especially the large lurid glider (*Cymothoe hypatha okomu*).

Method of data collection

The line transect sampling as described by Jayaraman (1999) was used to obtain estimate of buffalo abundance in the area of study. Fifteen (15) transects were randomly selected from a total of twenty-five (25) transects in the four ranges of Okomu National Park as follows: Iguowan (3), Babui (3), Julius Creek (3) and Arakhuan (6).

Transect lengths of 4.0km and widths of 0.02km were systematically spaced at approximately 1.0km from each other. Distances along transects were marked with flagging tapes at intervals of 0.5km for easy identification of animal locations on transect. Each transect was covered by an observer and the census was done simultaneously in all the fifteen transects to avoid the incidence of double location. To obtain estimate of population parameters, census was conducted on 17th July 2012 (1st census) and 27th September, 2012 (2nd census).

According to Jayaraman (1999), line transect method has the following general setting and assumptions: if one has an area of known boundaries and size (A) and the aim is to estimate the abundance of a particular wildlife species population in the area the use of line transect sampling requires that at least one line of travel be established in the area. The number of detected animals (s_i) is noted along with the perpendicular distances (x_i) from the line to the object (animal). Otherwise, the sighting distance r_i and sighting angle θ_i are recorded from which x_i can be arrived at using the formula $x = r \sin(\theta)$. Let n be the sample size. The corresponding sample of potential data is indexed by $(s_i, r_i, \theta_i, i = 1, \dots, n)$. A graphical representation of line transect sampling is shown in Figure 1.

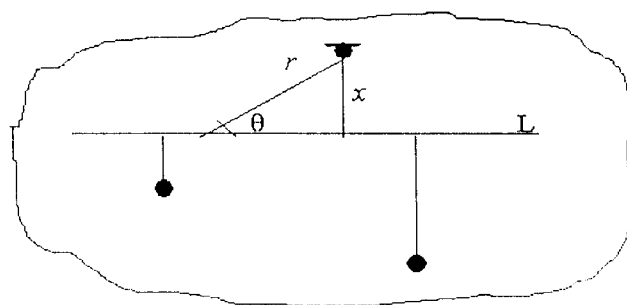


Fig. 1: Pictorial representation of line transect sampling. Source: Jayaraman (1999)

Data analysis

Results obtained were used to estimate the density of the species. Estimate of density was computed using the density equation according to Jayaraman (1999):

$$D = \left[2\pi L^2 \sum_{i=1}^n \frac{x_i^2}{n^3} \right]^{-0.5}$$

Where D = density of species, L = transect length (km), x = perpendicular distance (km) and n = number of observations.

The relative standard error or coefficient of variation (CV) of the density estimate is given by the equation

$$CV(D) = 100 \sqrt{\frac{1}{n} + \frac{1}{2n}}$$

Chi-square analysis (χ^2) and standard error (SE) of the mean were used to compare data generated from the four ranges of the park.

RESULTS

The density estimate parameters from the various ranges of Okomu National Park in the first census are shown in Table 1. A total of 23 (see figures of range total in parentheses) buffalos were sighted in eight observations from the 15 transects in the first census. In the second census, a total of 20 buffalos were

sighted in eight observations (Table 2). As shown in Table 3, average herd density from the two censuses according to ranges were Iguowan (0.12 ± 0.01 herd / km²), Babui (0.08 ± 0.01 herd / km²), Julius Creek (0.04 ± 0.01 herd / km²) and Arakhuan (0.12 ± 0.02 herd /

km²). The average for the entire park was 0.09 ± 0.01 herd / km² with a total of 19.08 ± 2.12 herds. There is no significant difference among the ranges and between the two censuses ($p < 0.05$) in relation to herd density of buffalo.

Table 1: Density estimate parameters of forest buffalo (*Syncerus caffer nanus*) in Okomu National Park (first census)

Range	Transect no.	Sighting angle	Sighting distance (km)	Perpendicular distance (km)	Herd density (number of herds / km ²)
Iguowan	1	66°	0.8100	0.75 (5)	0.10
	2	-	-	-	
	3	78°	0.5316	0.52 (3)	
Babui	4	72°	0.5783	0.55 (4)	0.06
	5	-	-	-	
	6	-	-	-	
Julius Creek	7	-	-	-	0.04
	8	74°	0.8739	0.84 (4)	
	9	-	-	-	
Arakhuan	10	-	-	-	0.09
	11	-	-	-	
	12a	68°	0.9707	0.90 (3)	
	12b	85°	0.7830	0.78 (2)	
	13	71°	0.7298	0.69 (4)	
	14	-	-	-	
	15	75°	0.6004	0.58 (1)	

Figures in parentheses = number of individuals sighted per observation.

Table 2: Density estimate parameters of forest buffalo (*Syncerus caffer nanus*) in Okomu National Park (second census)

Range	Transect no.	Sighting angle	Sighting distance (km)	Perpendicular distance (km)	Herd density (number of herds / km ²)
Iguowan	1a	69°	0.5570	0.55 (2)	0.13
	1b	65°	0.5407	0.49 (3)	
	2	-	-	-	
	3	-	-	-	
Babui	4	-	-	-	0.10
	5	-	-	-	
	6	72°	0.3470	0.33 (4)	
Julius Creek	7	78°	0.9201	0.90 (1)	0.04
	8	-	-	-	
	9	-	-	-	
Arakhuan	10	-	-	-	0.14
	11	70°	0.8457	0.66 (1)	
	12	-	-	-	
	13a	85°	0.7428	0.74 (1)	
	13b	73°	0.5751	0.55 (4)	
	14	67°	0.6301	0.58 (1)	
	15	76°	0.5050	0.49 (3)	

Figures in parentheses = number of individuals sighted per observation

Table 3: Herd density of forest buffalo in Okomu National Park

Range	*HD ₁	HD ₂	(Average HD)±SE
Iguowan	0.10 (0.10)	0.13 (0.13)	0.12 ± 0.01
Babui	0.06 (0.07)	0.10 (0.09)	0.08 ± 0.01
Julius Creek	0.04 (0.03)	0.04 (0.05)	0.04 ± 0.00
Arakhuan	0.09 (0.10)	0.14 (0.13)	0.12 ± 0.02
HD Park average			0.09 ± 0.01

*HD = herd density. HD Park total = HD Park Average X 212 km² (area of park) = (19.08 ± 2.12) herds
 Figures in parentheses are chi-square (χ^2) expected values. $\chi^2_{\text{cal}} = 0.0096$, $\chi^2_{\text{tab}} = 7.82$ at 3 df.

The average herd sizes for the four ranges are as follows: Iguowan (3.25 ± 0.53), Babui (4.00 ± 0.00), Julius Creek (3.25 ± 0.53) and Arakhuan (2.25 ± 0.18) individuals per herd (Table 4). For the entire park, the average herd

size was 3.19 ± 0.29 individuals per herd while the total population size was 60.87 ± 0.61 individuals. The ranges and two censuses did not differ significantly ($p < 0.05$) in relation to herd size of buffalo.

Table 4: Herd size (HS) (number of individuals / herd) of forest buffalo in Okomu National Park

Range	HS ₁	HS ₂	(Average HS) \pm SE
Iguowan	4.00 (3.70)	2.50 (2.80)	3.25 ± 0.53
Babui	4.00 (4.55)	4.00 (3.45)	4.00 ± 0.00
Julius Creek	4.00 (3.70)	2.50 (2.80)	3.25 ± 0.53
Arakhuan	2.50 (2.56)	2.00 (1.94)	2.25 ± 0.18
HS Park Average			3.19 ± 0.29

Total number of individuals = HS Park Average X HD Park total (Table 3) = (60.87 ± 0.61) individuals
 Figures in parentheses are chi-square (χ^2) expected values. $\chi^2_{\text{cal}} = 0.26$, $\chi^2_{\text{tab}} = 7.82$ at 3 df.

DISCUSSION

This study shows that there were about 60.87 ± 0.61 forest buffalos in Okomu National Park at the time of census. The study also reveals that the average herd density of forest buffalo in Okomu National Park was 0.09 ± 0.01 herds / km² (i.e. between 0.08 and 0.10 herds / km²). This translates to 19.08 ± 2.12 herds, taken the area of the park into cognizance. Though there is no significant difference ($p < 0.05$) between the ranges and between the two censuses, herd density (in decreasing order) according to ranges are Arakhuan (0.12 ± 0.02 herd / km²), Iguowan (0.12 ± 0.01 herd / km²), Babui (0.08 ± 0.01 herd / km²) and Julius Creek (0.04 ± 0.01 herd / km²).

The average herd size of 3.19 ± 0.29 individuals/herd recorded for this survey is lower than that of Nowak (1991) but slightly falls within the range of 3 – 25 individuals / herd recorded for forest buffalo by Melletti, et al. (2007a; 2007b) and Korte (2008b) in

Dzanga-Ndoki National Park in Central African Republic and Lope National Park in Gabon respectively. Kingdon (1997) gives the maximum group size for forest buffalo as 12, composed of related females and their offspring with attendant males. According to Nowak (1991), forest buffalo are found in smaller herds than their savanna relatives, usually with 8-20 related individuals. Chi-square (χ^2) statistical analysis showed that the ranges did not differ significantly ($p < 0.05$) in herd size, though Babui Range recorded the highest herd size of 4.00 ± 0.00 individuals / herd. Estimates of 3.25 ± 0.53 , 3.25 ± 0.53 and 2.25 ± 0.18 individuals / herd were recorded for Iguowan, Julius Creek and Arakhuan Ranges respectively.

From the data obtained, the population density of forest buffalo in Okomu National Park is low. Though the park is presently recovering from anthropogenic pressures (which were very common in the area before

the establishment of the protected area) arising from land encroachment for farming, poaching activities, illegal logging and collection of non-timber forest products which may be responsible for the low density, it is worthy to note that the area is still a biodiversity hotspot as declared by the International Union for Conservation of Nature and Natural Resources (IUCN).

Though population estimate of the species is low, the data generated from this study may be insufficient to make a final conclusion on population estimate of forest buffalo in Okomu National Park. A prudent approach to forest buffalo conservation in the area should involve continual scientific research programs as these will clarify causes of decline and also identify the ecological requirements of the species that will encourage survival. Further studies are needed to estimate home range, sex ratio and other ecological indices of forest buffalo in Okomu National Park.

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