

Distribution and status of the African forest buffalo *Syncerus caffer nanus* in south-eastern Nigeria

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Abstract Although not categorized as threatened on the IUCN Red List, the African forest buffalo *Syncerus caffer nanus* is declining across its range. In Nigeria its distribution, abundance and status are virtually unknown. We conducted interviews with experienced hunters, and field surveys (linear and recce transects), to study the buffalo's distribution and ecology in the montane forests of Cross River State. General linear modelling indicated that the number of individuals varied significantly across survey areas and habitat types but not with the survey period, and there was no study area \times study period interaction. Buffalo were found most commonly in mature and secondary forests. Given the species' scattered distribution, fragmentation of its habitat, and the relatively low numbers observed, Nigerian populations require a separate, regional categorization on the IUCN Red List.

Keywords Buffalo, conservation ecology, Cross River, forest, habitat, *Syncerus caffer nanus*, West Africa

The forest buffalo *Syncerus caffer nanus* is one of the largest ungulates in West African forests but numbers have declined as a result of poaching and deforestation, and the conservation status of the subspecies is poorly known (Blake, 2002; Melletti et al., 2007a,b, 2009a,b; Korte, 2008a,b). In Nigeria there is little information on the distribution, abundance and status of the species (Cornélias et al., 2014).

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Here, we present ecological and distribution data on the forest buffalo in south-eastern Nigeria (where remnant patches of rainforest are concentrated) based on field surveys and interviews with local hunters. Our aims were (1) to determine the presence and status of buffalo in the various forest blocks of Cross River State, and (2) to describe the habitat requirements of these populations. Cross River State is the only area in Nigeria where the forest buffalo occurs (E. A. Eniang et al., unpubl. data).

Field surveys were conducted in the Oban and Boshi Okwangwo Divisions of the Cross River National Park (c. 1,000 km²; Fig. 1a), in the neighbouring Obudu Cattle Ranch, in the Mbe Mountains, and in the Afi River Forest Reserve. This area, at an elevation of 150–1,700 m, lies north and east of the Cross River and extends along the border with Cameroon. Below 500 m the vegetation is mostly Guineo-Congolian high forest, with a closed canopy and emergent trees of up to 40–45 m height. Above 500 m there is Plateau forest, with abundant epiphytes and lianas. The study area includes four forest reserves, with mountainous and relatively inaccessible terrain: Afi River Forest Reserve, and three reserves in the Boshi Okwangwo Division of the Cross River National Park. Local people practise traditional agriculture, including burning activities, around the reserves.

Following interviews with local hunters we selected four areas on the basis of the reported frequency of buffalo occurrence: the Oban Division of the National Park, Mbe Mountains, the Boshi Okwangwo Division and Obudu Cattle Ranch (Fig. 1a). We surveyed these areas during November–December 2001, June–August 2005, June–August 2009 and September–October 2013. We spent 10 consecutive days in each survey area in each year, assisted by experienced hunters. By conducting recce transects in all areas we were able to identify predetermined or existing trails or river courses to survey by line transects. Recce transects were conducted opportunistically, depending on the landscape characteristics; when possible, line transects were conducted on the same day as the recce transects. On each day of surveying we conducted one randomly chosen diurnal (07.00–12.00) and one randomly chosen nocturnal (19.30–23.30) line transect survey (each 5 km in length). At night we used existing trails and carried out spot checks at salt licks, open fields and swamps, and river crossing points. We used hunters' carbide head lamps and rechargeable flood lamps. The line transect surveys were conducted at different locations each day. The total effort was 160 field

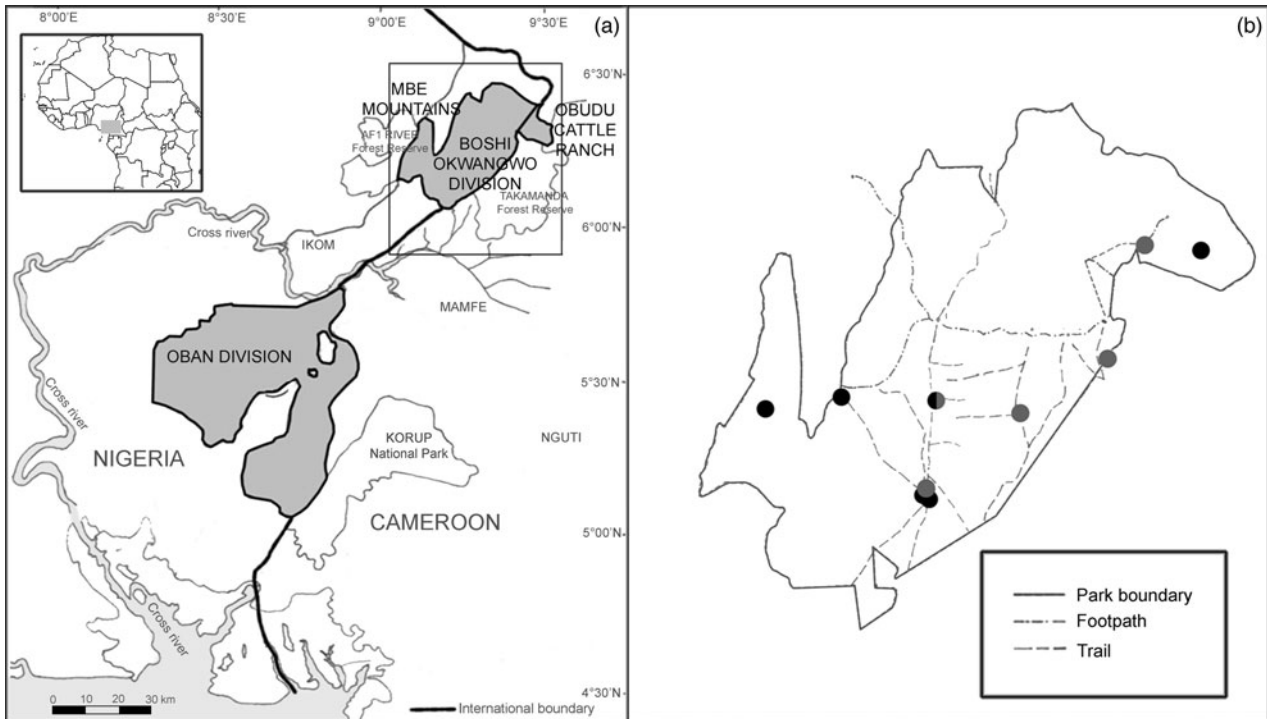


FIG. 1 (a) Location of the sites surveyed for forest buffalo *Syncerus caffer nanus* in Cross River State in south-eastern Nigeria. (b) Trails in Boshi Okwangwo Division where transect surveys were carried out, and locations where forest buffalo were sighted during recee transects (grey circles), line transects (black circles) or both (grey/black circles).



PLATE 1 A forest buffalo *Syncerus caffer nanus* traded in a local market in Cross River State, Nigeria (Fig. 1); 16 November 2002.

days, divided equally between wet and dry seasons and study areas. We also surveyed the bushmeat markets throughout the study areas and interviewed poachers and sellers of

buffalo carcasses, recording the locations where buffalo were caught (Plate 1).

Locations where buffalo were observed (Fig. 1b; Table 1) were recorded using a global positioning system. Presence data included all indicators of buffalo presence (direct observations, hoof prints, faeces, vocalizations, and carcasses and trophies kept by hunters and poachers) but we report only direct observations here because we recorded these at all locations where we found other signs. We attempted to confine the surveys to the same time interval each day to ensure data collection was consistent and unbiased but on some days circumstances required that we started earlier or later; for example, if we heard vocalizations at our night camps we attempted to follow the direction of sound before dawn, hoping to sight the group.

Our records of numbers of buffalo are estimates because it was difficult to count individuals as they ran through the forest. To minimize the risk of double-counting individuals we noted the location and the approximate group size; if the number of individuals differed from an earlier encounter we considered it was probably a different group. These data were validated by comparing age and sex distributions across groups.

We recorded vegetation data at each location where buffalo were observed, including dominant tree species and the type of undergrowth. Each buffalo sighting was assigned to

TABLE 1 Numbers of forest buffalo *Syncerus caffer nanus* sighted in four areas of the Cross River National Park and adjacent areas in Nigeria (Fig. 1) during both recce and line transect surveys, by study site and period, with habitat type indicated for each.

Study site	No. of buffalo per km of transect			
	Nov.–Dec. 2001	June–Aug. 2005	Sep.–Oct. 2009	June–July 2013
Oban Division	19 (12 in mature forest, 7 in secondary forest)	15 (9 in mature forest, 6 in secondary forest)	8 (mature forest)	11 (mature forest)
Mbe Mountains	9 (6 in mature forest, 3 in secondary forest)	13 (3 in mature forest, 10 in secondary forest)	6 (mature forest)	8 (mature forest)
Boshi Okwangwo Division	8 (5 in mature forest, 3 in secondary forest)	6 (mature forest)	7 (5 in mature forest, 2 in secondary forest)	13 (7 in mature forest, 3 in secondary forest, 3 in agricultural land)
Obudu Cattle Ranch	3 (savannah)	4 (savannah)	1 (savannah)	0

TABLE 2 Results of general linear modelling of the effects of habitat type, survey area and survey period on the number of forest buffalo observed at four study sites (Table 1, Fig. 1).

Source	Type III sum of squares	df	Mean square	F
Corrected model	392.438	6	65.406	8.370
Intercept	0.000	1	0.000	0.000
Mature forest	27.847	1	27.847	3.564
Secondary forest	60.226	1	60.226	7.710
Agricultural land	4.323	1	4.323	5.532
Savannah	10.460	1	10.460	1.339
Study area	0.000	1	0.000	5.134
Year	0.000	1	0.000	0.000
Year × study area	88.063	9	9.785	2.439
Error	0.000	9	0.000	
Total	1,465.000	16		

one of the following habitat type categories: mature forest, secondary forest, savannah or agricultural land.

There were some limitations that may have affected our data. In conducting systematic surveys with the help of local guides at Obudu Cattle Ranch we were unable to explore some steep escarpments where buffalo were heard. In the core areas of buffalo presence, as reported by local people, in Oyi-Mache and Boshi Okwangwo there were no trails and, given time and financial limitations, our surveys were confined to streams and river courses and existing paths.

We used Spearman's rank correlation coefficient to investigate correlation between survey period and number of buffalo observed, and a general linear model with a Poisson error structure to analyse the effects of survey area and period on the number of individuals observed. The number of individuals observed varied significantly across the four survey periods (Spearman's $r = -0.80$, $P = 0.083$). The general linear model indicated a statistically significant effect of survey area and habitat, but not of survey period or the survey area × survey period interaction, on the number of buffalo observed (Table 2). A greater number of individuals were observed at Oyi-Mache and a lower number at Obudu Cattle Ranch, relative to the other two sites, independent

of survey period. Most records were from mature forest (65.6%), followed by secondary forest (25.9%); there were few records from savannah (6.1%) and agricultural land (2.3%).

The presence of buffalo was generally well known to hunters and local people in the study area. Farmers and hunters consistently reported that the seasonal movements of buffalo are in part determined by the collection of non-timber forest products (e.g. *Irvingia*, *Prunus*, *Raphia*) by local people, especially during June–October, which drives the buffalo to seek refuge in the nearby Takamanda National Park in Cameroon. We observed buffalo only rarely in savannah, although they have been reported from forest clearings and savannah elsewhere (Melletti et al., 2009a); this may be attributable to anthropogenic disturbance and possibly overhunting.

The apparent frequency of occurrence of buffalo varied across forest zones but there was no decreasing trend over time. In three of the four surveyed areas direct sightings were not rare, and therefore the forest buffalo may be a potential flagship species for ecotourism development programmes, particularly in the Obudu Cattle Ranch escarpment area.

Buffalo are only occasionally targeted by hunters in the study area. This is because of the difficult terrain and the traditional system of having to share the meat with a large number of community members. Tradition demands that the hunter must send several parts of any animal hunted to family elders, regardless of how far away they reside. Hunters therefore target small to medium sized mammals (e.g. monkeys, cane rats, antelopes) to minimize the expense of delivering parts of the hunted animals to relatives living in distant places. However, forest buffalo are threatened by conflict with cattle herds. Fulani herdsmen reported that since early 2001 fights have occurred between buffalo and cattle, and that they responded to the conflict by setting wire snares along trails and shooting buffalo. The effects of such conflicts require further investigation.

Although *Syncerus caffer* is categorized as Least Concern on the IUCN Red List (IUCN SSC Antelope Specialist Group, 2008), the Nigerian populations appear to be threatened. Given their scattered distribution, fragmented habitat and relatively low numbers, we suggest that the Nigerian populations require a separate, regional categorization on the Red List. We propose a categorization of Vulnerable according to criteria D1 & D2 (IUCN, 2014), based on records of < 1,000 mature individuals (D1) and presence at < 5 locations (n = 4 according to our studies).

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References

- BLAKE, S. (2002) Forest buffalo prefer clearings to closed-canopy forest in the primary forest of northern Congo. *Oryx*, 36, 81–86.
- CORNÉLIS, D., MELLETTI, M., KORTE, L., RYAN, S.J., MIRABILE, M., PRIN, T. & PRINS, H.H.T. (2014) African buffalo *Syncerus caffer* (Sparrrman, 1779). In *Ecology, Evolution and Behaviour of Wild Cattle. Implications for Conservation* (eds M. Melletti & J. Burton), pp. 326–372. Cambridge University Press, Cambridge, UK.
- IUCN SSC ANTELOPE SPECIALIST GROUP (2008) *Syncerus caffer*. The IUCN Red List of Threatened Species 2008: e.T21251A9260904. <http://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T21251A9260904.en> [accessed 2 March 2016].
- IUCN (2014) *Guidelines for Application of IUCN Red List Criteria at Regional Levels*. http://www.iucn.org/about/work/programmes/species/our_work/the_iucn_red_list/resources/guidelines_application/ [accessed 23 March 2016].
- KORTE, L.M. (2008a) Habitat selection at two spatial scales and diurnal activity patterns of adult female forest buffalo. *Journal of Mammalogy*, 89, 115–125.
- KORTE, L.M. (2008b) Variation of group size among African buffalo herds in a forest–savanna mosaic landscape. *Journal of Zoology*, 275, 229–236.
- MELLETTI, M., MIRABILE, M., PENTERIANI, V. & BOITANI, L. (2009a) Habitat use by forest mammals in Dzanga-Ndoki National Park, Central Africa Republic. *African Journal of Ecology*, 47, 797–800.
- MELLETTI, M., PENTERIANI, V. & BOITANI, L. (2007a) Habitat preferences of the secretive forest buffalo (*Syncerus caffer nanus*) in Central Africa. *Journal of Zoology*, 271, 178–186.
- MELLETTI, M., PENTERIANI, V., MIRABILE, M. & BOITANI, L. (2007b) Some behavioral aspects of forest buffalo (*Syncerus caffer nanus*): from herd to individual. *Journal of Mammalogy*, 88, 1312–1318.
- MELLETTI, M., PENTERIANI, V., MIRABILE, M. & BOITANI, L. (2009b) Effects of habitat and season on the grouping of forest buffalo resting places. *African Journal of Ecology*, 47, 121–124.

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