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PATTERN AND EXTENT OF THREATS TO AFRICAN BUFFALO *(Syncerus caffer)* IN KAINJI LAKE AND OKOMU NATIONAL PARKS IN NIGERIA

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ABSTRACT

The study investigated the type, pattern and magnitude of threat factors in Kainji Lake and Okomu National Parks, Nigeria. Field Practical observation and socioeconomic data were adopted for the present study. A total of 60 and 42 field officers from the two Parks were interviewed. Seventeen potential threats that causes *Syncerus caffer* population decline were identified during the field work and eleven major threats through socioeconomic data. The most dangerous threat includes: shortage of fund, illegal grazing, illegal hunting and illegal cutting of trees. The study indicates that *Syncerus cafferi* are at risk and, that threats vary based on the ecological zone. Kainji Lake National Park was highly subjected to livestock grazing and hunting while Okomu National Park was prone to illegal cutting of trees. The Kruskal – Wallis test showed that, for both PASI and PARTI, threat scores were higher in both Parks (PASI - r (4) = 0.93, P = 0.0052, PARTI – r = 11.39, P = 0.0021. Multi-sectorial approach and support zone community involvement, are key factors to manage national parks effectively and to reduce prevalent anthropogenic activities resulting to population decline of *Syncerus caffer* in their habitats.

Keywords: African buffalo, mean cluster size, population status, encounter rate

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INTRODUCTION

The understanding of the types, pattern, and extent of threats to biological resources is a crucial step towards effective protected area management (Mohammad *et al*. 2014). Globally, the disappearance of wildlife, most especially, in protected areas usually occur as a result of natural and human-induced disturbances at various scales. However, the magnitude of disturbance from interrelated anthropogenic factors is the principal threat (Chape *et al*., 2008, Bengtsson *et al*. 2003). Habitat destruction and unsustainable hunting as well as overdependence on other wildlife resources, have caused several declines in wildlife populations and contributed immensely to the degradation of many forest ecosystems (Baldus, 2008; Brooks *et al*., 2002). The effect is more alarming in the tropical regions (Leuschner *et al*., 2013). The rate of increase in human population growth and economic development most especially in developing countries, has severe effects on depletion of biodiversity resources (Kideghesho, 2009; Michel, 2008). Africa is known to be unique among the continent blessed with rich and extraordinarily diverse biodiversity resources (Heller *et al*., 2012). Despite the legal status, protected areas are experiencing significant threats in various forms due to rapid human

population growth throughout the continent of Africa.

Today, the viability of large mammals in Africa is uncertain (Craigie *et al.,* 2010). Cataclysmic population sizes of wild large mammal declines have been documented across regions around Congo and Gabon (Walsh *et al.,* 2003; Plumptre *et al*., 2016), Cote d'Ivore (Campbell *et al.,* 2008), Kenya (Ogutu *et al*., 2012; 2016; Ripple *et al*., 2016) and Nigeria (Jayeola *et al*., 2012; Henschel *et al.,* 2014). It has been on record that 59% decline in populations of large mammals in the continent of Africa occurred between 1970 to 2005 while 85% decline was all alone documented more specifically for West Africa (Ripple *et al*., 2015). Consequently, it is foreseen that Africa, a continent once rich and diverse in large mammal species and their geographical distribution over the last millennium, will soon be reduced to pockets of large mammal diversity living at low population sizes in protected areas (Caro and Scholte 2007, Collen *et al*., 2009, Smitz *et al*., 2014).

Wildlife assessments conducted in Nigeria have revealed that the African buffalo is found in Kainji Lake and Okomu National Parks (Aremu *et al.,* 2007; Akinsurotan *et al*., 2011; Edet and Odunlami, 2013). The most recent IUCN census data estimates the global African buffalo population to be approximately 398.000 – 401.000 number of matured individuals (IUCN, 2019).

Identification of threatening factors existing in the protected areas such as national parks is very crucial to the effectiveness of biodiversity conservation efforts. Moreover, successful wildlife management and species recovery plans will highly depend on measuring of the protected area susceptibility index to the threat factors (Kiringe and Okello, 2007).

This paper reports the findings of a comprehensive assessment of threats to African Buffalo in Kainji Lake and Okomu National Parks, Nigeria. Identify the key wildlife threats factors to African buffalo, to rank the two parks on the relative severity of threat factors and to determine the seriousness of each of the threat factors across the parks.

MATERIALS AND METHOD

Study Area

Kainji Lake National Park

Kainji Lake National Park was established in 1979 by the merging of the two former Game Reserves –Borgu Game Reserve (located in Niger and Kwara State) and Zugurma Game Reserve (located in Niger State), the two sections had been gazetted in 1962 and 1971 respectively as Game Reserves by the then Northern Regional Government. It is the first National Park and the second largest of all the seven National Parks in Nigeria (Ezealor, 2002; Ayeni, 2007; Amusa *et al.,* 2010). KLNP is located between latitude 9^{o} 40' and 10^{o} 30'N and longitude 3^{o} 50' E and has a total landmass of 5,370.82km^2 (Ezealor, 2002; Ayeni, 2007). It extends 80km in an east-west direction and about 60km northsouth. It consists of two sectors, the Borgu sector and Zuguruma sector. It has a total landmass of 5,370.82km^2 (Tuna, 1992).

Okomu National Park

Okomu National Park (Figure 2) originally gazette as a Wildlife Sanctuary is the last set of National Park and became a full-fledged National Park on 26thMay 1999 through the provision of Decree 46 of 1999 (now Cap N65 LFN 2004). It is the smallest Park of all the seven National Parks in Nigeria and was originally gazetted as a wildlife sanctuary in 1986 and became a full-fledged National Park in 1999 (Akinsorotan *et al.,* 2011). Okomu National Park lies between North latitudes 6^{0}15' and 6^{0}25'; and East longitudes 5^{0}9' and 5^{0}23'. The Park has total area coverage 202.24 km^2 made up of 100 compartments of about 1.6km^2 each. It is bounded in the west by the Okomu River and in the north east and south by the series of straight cut lines. The Park is about 60 Km North West of Benin City (Omorodoion, 1991; Orhiere and Ohenihen, 1991).

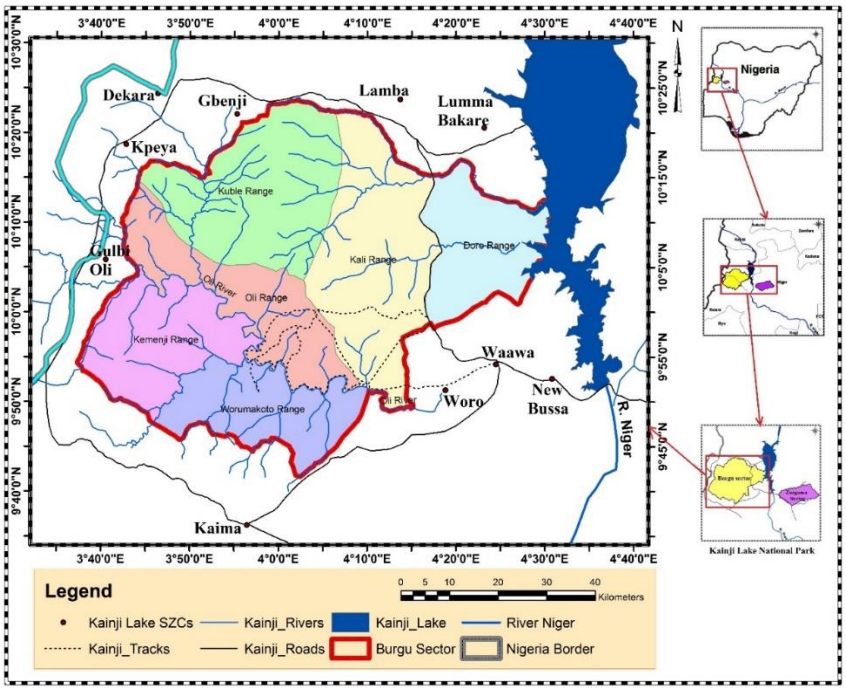

Figure 2: Borgu Sector of Kainji Lake National Park, Niger State Nigeria

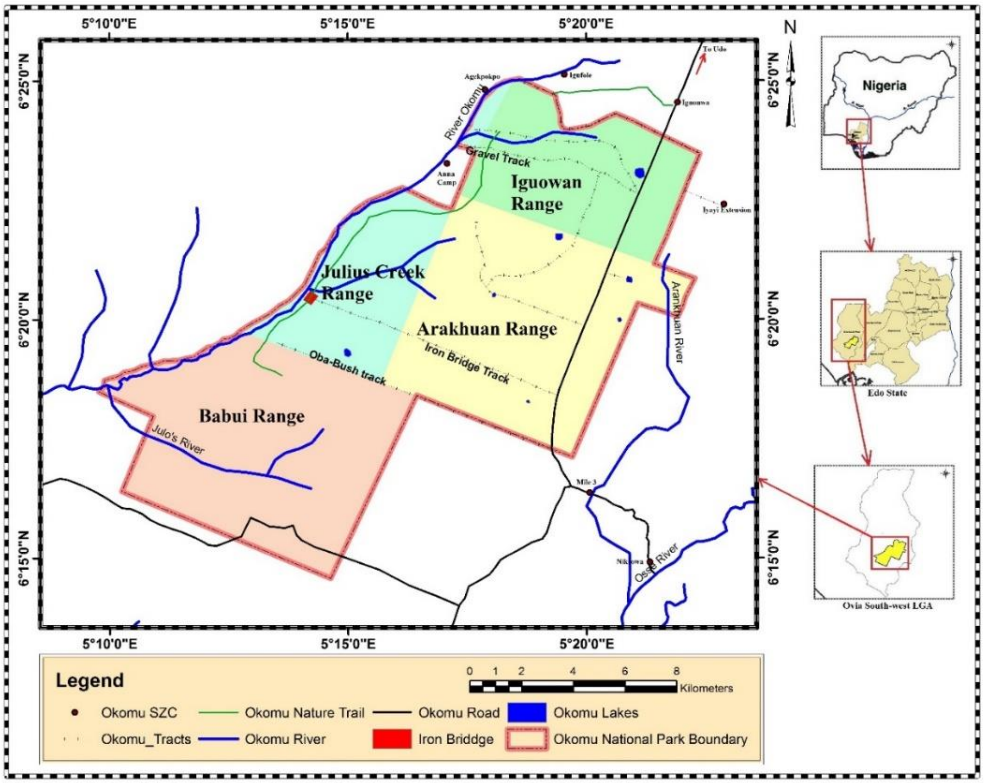

Figure 2: Map of Okomu National Park, Udo – Benin City in Edo State, Nigeria

Data Collection

The study was conducted from November 2017 to June 2019 to investigate the threat factors to African buffaloes and their relative severity in Kainji Lake and Okomu National Parks, Nigeria. A reconnaissance survey was carried out to identify the main threatening factors of African buffaloes in the study area. Buffalo threat factors at both study locations were identified through direct field observation and desk review methods. The relative severity was determined by categorizing the key threatening factors acquired from record of arrests in the Parks as at January 2000 – December, 2018 in the Parks. Consequently, those main threats were sorted out for ranking of level of severity. The direct field observation was carried out both during buffalo population survey and habitat assessment. During the survey the nature and frequency of threat were recorded. The threats factors were grouped into two; direct threats, with short-term and immediate effects on specie populations (i.e. removal and killing of individual buffalo) such as subsistence and commercial hunting, snares, firearm, feral dogs, and human trails/footprints, water pollution, hunters camp are indirect threats, with long-term effects that drive buffalo population declines, such as illegal farming, collection of fuel wood, fire, mining, logging and human settlement density, infrastructure, and cattle grazing (Tranquili *et al*., 2014). Data was also collected by using semi – unstructured questionnaire and observation checklists as described by (Mengistu *et al*., 2017). Purposive sampling method was adopted. The respondents were field personnel which includes: Park Officers, Park Rangers and Researchers who were considered to be knowledgeable as a result of their long serving experience in ecology resource management of the Park over time. In the present study 25 field officers were selected from each Park. Respondents from each Park were provided with ranks on threat and severity score sheet to assess on the threat factors to African buffalo in their habitat where they have been serving officially. Scoring for each threat factor was arranged numerically as from 1 as the lowest threat level and 5 as the highest as described by (Chowdhury *et al.,* (2016), this was assumed to be adequate for the purpose of assessing status and threat index of protected areas (Mengistu *et al*., 2017). Furthermore, questionnaire were filled with on – site spot assessment supervision of respondents.

Statistical Analysis

Data were analyzed using the Paleontological Statistics Software (PAST) computer software program for scientific data analysis. The descriptive statistics such as bar chart and percentages were used to present data on the trend of arrests and number of poachers arrested. Encounter rates of threat per kilometer walked during the field work assessment was calculated as:

Encounter rate (ER). = (n/L).

∑Observations / Distance travelled

Where n = number of observed objects; L = total length travelled

Threat factors and severity index

Data on threat indicators to African buffaloes and the vulnerability of the Parks to these threats were analyzed adopting the procedure of Okunlola and Tsujimoto (2009) and Chowdhury *et al.,* (2016).

i. Relative Threat Factor Severity Index, RTFSI = (The mean score for a particular threat factor) / (The maximum possible score, 5).
ii. Mean score of each threat factor = Sum of all the scores for that particular threat / Total number of the respondents (102)
iii. Protected Area Relative Threatened Index (PARTI) = Total score of all the threat factors from the respondents of a given protected area / Total responses (30)
iv. Protected Area Susceptibility Index (PASI) = the number of threats mentioned for each protected area, divided by 10 (the total number of threats listed), to provide the proportion of threats mentioned for that protected area.

RESULT

Kainji Lake and Okomu National Parks were prone to various forms of threats (Table 1 & 2). The threat indices of Cattle routes (0.27/km) and looped trees (0.27/km) had the highest encounter

rate among the 12 threat factors recorded in dry season during the present study in Kainji Lake National Park. This is followed by the herd of cattle's (0.18/km), snares (0.11/km), individual encountered (0.11/km) and gun shots (0.09/km) while hunters' camp (0.01/km) recorded the lowest encounter rate during this period. The findings showed that only 9 threat indices were recorded in wet season while herd of cattle had the highest encounter rate of (0.12/km) followed by cattle routes (0.08/km), individual encounter (0.04/km) and fishermen (0.04/km). Empty shell of cartridges and cattle grazers' camp had encounter rate of 0.03/km each while gunshots, human trails and hunters camp had the lowest encounter rate of 0.02/km each during wet season in the present study (Table 1).

Table 1: The Encounter Rate of Anthropogenic Activities in the Habitat of *Syncerus caffer* in Kainji National Park during the Dry and Wet season

Threat indices	Dry Season	E/R Dry	Wet Season	E/R Wet
Fishermen	46±11.0	0.08	22±12.0	0.04
Cattle grazers' camp	41±4.0	0.07	16±2.0	0.03
Cattle routes	156±4.0	0.27	44±3.0	0.08
Empty shell cartridges	29±3.0	0.05	16±3.0	0.03
Gun shots	52±11.0	0.09	10±1.0	0.02
Herd of Cattles	100±15.0	0.18	67±7.0	0.12
Human trails	27±1.0	0.03	6.5±3.5	0.02
Hunter's camp	15±2.0	0.02	9.5±1.5	0.02
Looped trees	156± 4..0	0.27	0	0
Snares	53.5±5.5	0.11	0	0
Extracted tree for honey	41.5±2.5	0.07	0	0
Individual encountered	58±6.0	0.1	19±2.0	0.04

Mean ± standard error, E/R = Encounter rate

In Okomu National Park, the study revealed that logging had the highest encounter rate of (0.41/km) of threat indices amidst the 7 threat factors observed in dry season in the habitat of *Syncerus caffer nanus* during the present study. This is followed by hunter's footprint (0.12/km) while NTFPs had lowest encounter rate of 0.02/km. The result also revealed that logging had the highest encounter of 0.20/km and this was followed by gun shots (0.04/km) while spent cartridges had the lowest encounter rate of 0.01/km in the wet season (Table 2).

Table 2: The Encounter Rate of Anthropogenic Activities in the Habitat of *Syncerus caffer nanus* in Okomu National Park during the Dry and Wet season

Threat indices	Dry	E/R Dry	Wet	E/R Wet
Farming	11	0.03	8	0.02
Hunting camp	20	0.05	8.5	0.02
Spent cartridges	25.5	0.07	7	0.01
Hunters footprint	47.5	0.12	8.5	0.02
Logging	158	0.41	76	0.20
NTFPs	8	0.02	8.5	0.02
Gun shots	36	0.10	13.5	0.04

Mean ± standard error, E/R = Encounter rate

Figure 3 and 4 present trends of arrested of poachers on various poaching activities in KLNP and ONP between 2000 -2018. The findings showed that in KLNP the highest number of arrests was made in the year 2001 (229) and this was followed by 2007 (187), 2014 (132) and 159

in 2018. The study revealed that the lowest arrest was made in 2009 with only 67 poachers arrested (Figure 3).

In ONP, the study revealed that the highest number of arrests was made in the year 2003 (27) and this is closely followed by 25 arrests in 2018 while the lowest arrest occurred in 2002 with only 8 poachers (Figure 4).

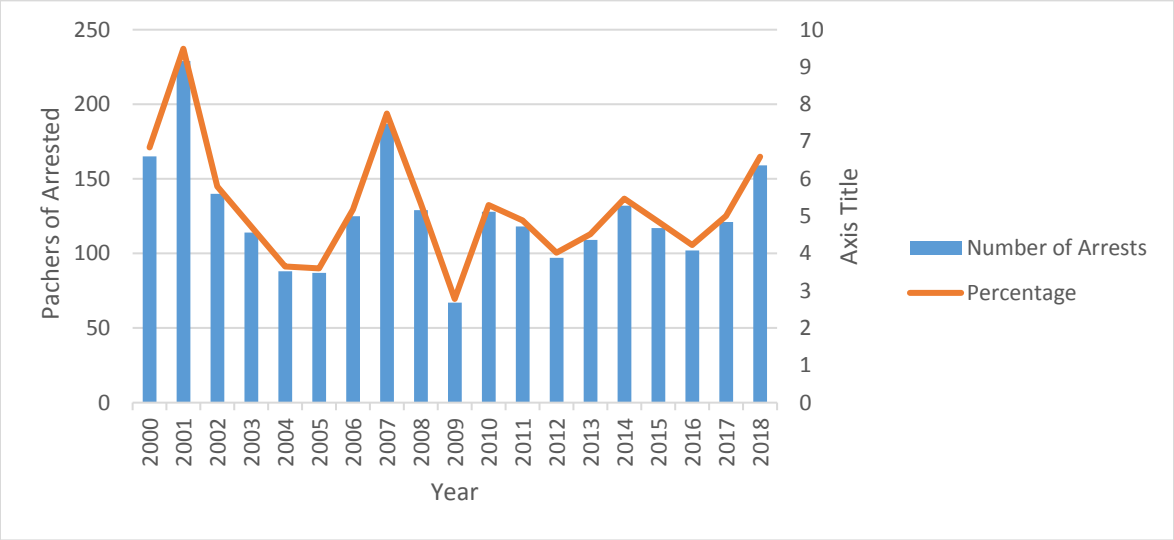

Figure 3: Trend of Arrests in Kainji Lake National Park

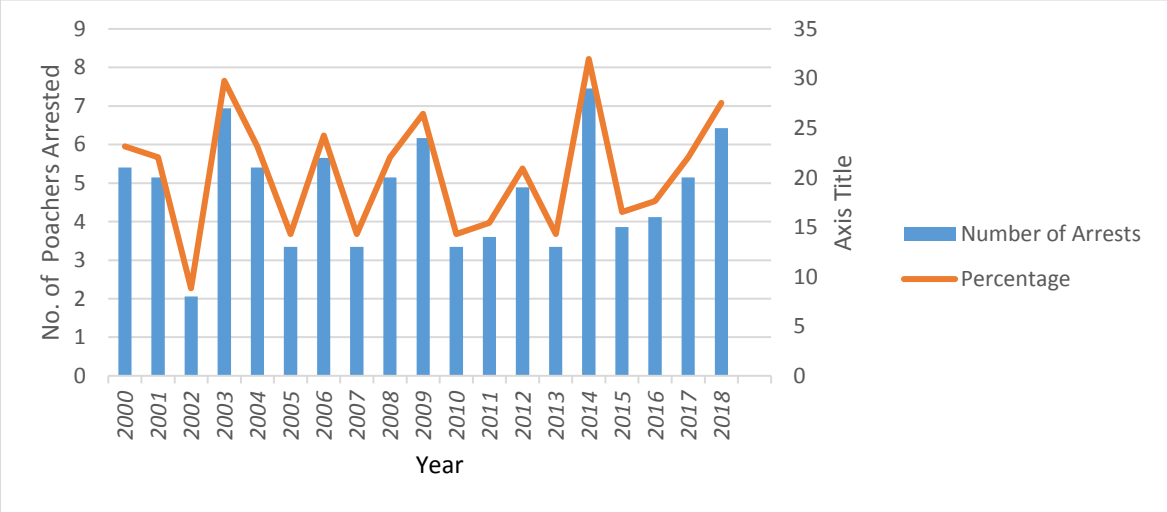

Figure 4: Trend of Arrests in Okomu National Park

Figure 5 indicates that grazing (918) had highest number of poachers arrested between year 2000 - 2018 and this is followed by hunting (515), fishing (402), logging (346) while Non- Timber Forest Products (NTFPs = 8) recorded the lowest during the period under review in Kainji Lake National Park. In Okomu National Park, the findings indicate that out of 347 poachers arrested in various offences, logging (211) had the highest and this is followed by hunting (73) and farming (34) while illegal entry (11) had the lowest occurrence (Figure 6).

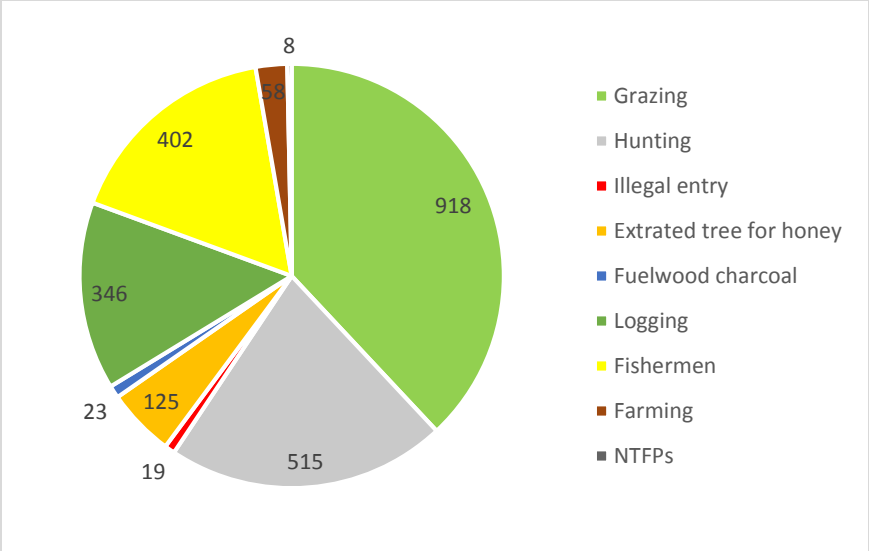

Figure 5: Number of Poachers arrests as indicator of threat factors in KLNP

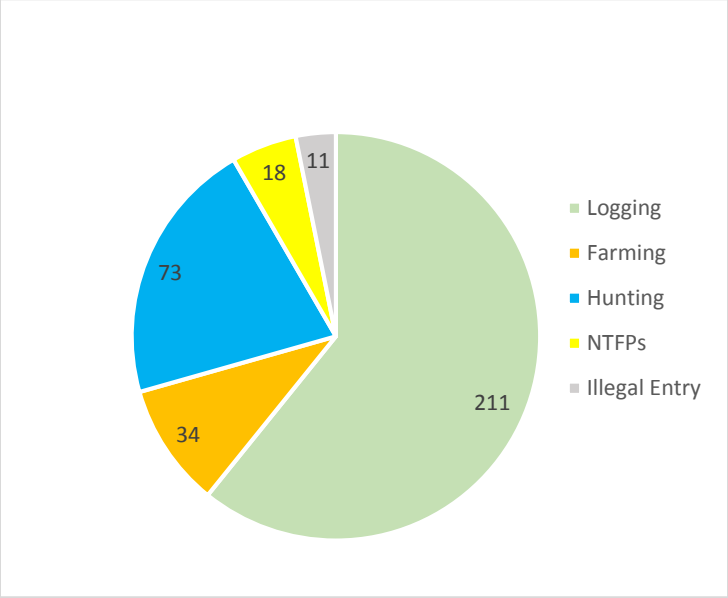

Figure 6: Number of Poachers arrests as indicator of threat factors in ONP

From the threat factors affecting *Syncerus caffer* in Kainji Lake and Okomu National Parks, the poor funding (0.97) scored the highest among 10 given threats. This is closely followed by shortage of manpower (0.95) illegal hunting (0.93) and illegal cutting of tree (0.89) in the Parks while the threat indices of expansion of invasive alien species in the parks had the lowest during the present study (Table 3).

The two Parks were susceptible to most of the threat factors identified in the present study. However, Kainji Lake National Park was most susceptible followed by Okomu National Park having PASI of 10.00 and 0.90 respectively (Table 2). The protected area relative threatened index showed that Kainji Lake National Park (0.88) was most the threatened followed by Okomu National Park (0.80) during the present study. The Kruskal – Wallis test showed that, for both PASI and PARTI, threat scores were higher in both Parks (PASI - r (4) = 0.93, P = 0.0052, PARTI – r = 11.39, P = 0.0021.

Table 3: Mean score and severity index of the threat factors that affect *Syncerus caffer* in Kainji Lake and Okomu National Parks

Threat factors that affect African buffalo population	Mean score of the threat factors	Relative Threat Factor Severity Index
Illegal hunting of African buffalo for bushmeat in the Parks	4.45 ± 0.21	0.93
Illegal cutting of trees for commercial purposes	4. 31 ± 0.19	0.89
Livestock grazing by herdsmen in the Parks	3.87 ± 0.20	0.85
Shortage of manpower	4.57 ± 0.16	0.95
Encroachment of human settlements and agricultural activities expansion in and around the Parks	3.23 ± 0.13	0.79
Poor funding for Parks affects biodiversity conservation	4.69 ± 0.18	0.97
Environmental factors e.g fire, disease and parasite	2.11 ± 0.11	0.39
Climatic factors	2.00 ± 0.10	0.37
Expansion of invasive alien species in the parks	1.09 ± 0.01	0.24
Weak law enforcement	4.19 ± 0.20	0.82
Habitat destruction through deforestation, uses of power saw and heavy truck	4.22 ± 0.19	0.83

Table 4: Total threats recorded in both Parks

National Parks	No. of threats	PASI (rank)	PARTI	Vegetation types	Area of Coverage ($km^{2)}$	Year of Establishment
Kainji Lake	9	0.90 (2)	0.88	Northern Guinea savanna	5,370.82	Decree 36 of 1979
Okomu	10	10.00 (1)	0.80	Lowland Rainforest	202.24	Decree 46 0f 1999

**Decree 36 and 46 is now Cap N65 LFN 2004*

DISCUSSION

In Kainji Lake and Okomu National Parks, various aspects of wildlife utilization have been identified as key factors for population declines of *Syncerus caffer*in their habitats. Findings from the present study on pattern and extent of threats in KLNP and ONP confirmed that the Parks are under intense human influence owing to habitat destruction through logging, hunting and overgrazing by cattle. Signs of human disturbance were observed frequently during the field work, most especially during the dry season in the study areas.

From a total of twenty identified threats, the present study identified the following eleven major threats that affect the population decline of *Syncerus caffer* in Kainji Lake National Park and these include: livestock grazing, honey harvesting, cattle routes, looped trees, snares, gun shots, fishing, human trails, hunter's camp, empty shell of catridges, individual encountered while the main anthropogenic activities encountered in Okomu National Park includes logging, hunting camp, NTPFs, gun shots, hunters footprint, farming during the study period. The result of this study agrees with Aremu *et al.,* (2007) who reported that the activities of cattle grazers have led to the decline of buffalo and other ungulates in KLNP. Demeke and Bekele (2011) also observed similar problems in Nechisar National Park in Ethiopia. Evidence from several other African countries suggest that illegal grazing can have detrimental effects on wildlife populations through direct competition and indirect factors such as habitat fragmentation and modification (Otuoma *et al*., 2009). For example, competitive displacement from illegal grazing in Kenya PAs has led to a decline in over two thirds of wildlife populations and the complete disappearance of buffalo (Ogutu *et al*., 2012; Ogutu *et al*., 2016). Similarly, the persistence of eight endemic native species in Asia has been threatened by increased production and grazing of livestock (primarily goats) due to the economic motivation of the cashmere industry (Berger *et al.,* 2013).

The present study revealed that illegal poaching activities in KLNP and common hunting methods

of killing the animals include: the wire snares and firearms (muzzle loading gun). Similar studies (Felix, 2005) revealed that weapons used for hunting in Tarangire-Lake Manyara Complex, Tanzania include the wire snares, pits of 1-2 m deep and 1-1.5 m wide, simple weapons (clubs, machetes and spears), plaiting nets using ropes, fire, poisoned arrows and muzzle loading guns (Mbano and Nyanchuwa, 1996), but sophisticated automatic firearms are used by the dangerous poachers and in Makao, western corridor of Serengeti National Park (SENAPA) the preferred method of hunting is laying snares around water holes, or a long time worn paths to water holes, or cutting new paths in the bushes and lay snares (Ngowe, 2003; Schmidtz, 2004). This study showed that snare hunting methods were the most commonly employed hunting method in KLNP during typically in the dry season. This may not be unconnected with the fact that the wire snares setting can only be used during the dry season when the soil has low moisture contents. This may be unconnected with the fact that that snares were silent killer, relatively cheap to acquire, easy to use, and stress -free hunting tools because they were constructed by local hunter themselves from steel car springs and were produced in a range of sizes from those large enough to catch buffaloes, to those designed to kill small antelopes. Aberham *et al.,* (2016) also reported that a variety of illegal hunting methods were used in the Chebera Churchura National Park and common hunting methods employed include snare, firearms, poisoning and hunting with dogs. Evidence from this study indicated that the activities of the wire snare hunters can be disastrous due to their mode of operations. Similar studies reported that snare trapping is a particularly undesirable hunting technique, is dreadful and catastrophically wasteful from an ecological perspective, but from a poacher's perspective it is a lot easier than hunting with a bow and arrow or gun (Schmidtz, 2004; Felix, 2005; Masanja, 2014). The relatively more severe activities of muzzle loading gun hunters' (firearm) were observed in the dry compare to wet season in the KLNP. This might be that the hunting season is most commonly practice in the dry season, when farmers must have been less busy with some major farming activities.

The result of this study also showed that only firearm (muzzle loading gun) hunters were in existence in ONP, therefore the findings did not record encounter of the wire snare hunters in the present study. This may not be unconnected with the fact that snaring required loose soil to function properly and ONP being a lowland forest habitat. Snaring is much easier in savanna and majorly in the dry season. The evidence from this study showed that illegal hunting is a major problem confronting wildlife population in the study areas. Other anthropogenic pressure also observed in ONP was cocoa farming plantations. The result also indicated that the farm lands were halted during the present study in ONP. This might be as a result of court verdicts that stopped the farmers to discontinue the farming. Field observation during the study identified that struggled to meet up with the basic needs and scarcity of land is what responsible for encroachment with farming activities in the Park. The study concurs with Atickem *et al.,* (2011), that human population growth around the Park and poverty might be the main causes of clearing of new lands for agriculture which was the most feasible strategy of increasing crop output because they had limited alternative survival strategies which increasingly caused destruction and outright loss of some important habitats in the Park ecosystem.

Field work of the present investigation revealed that Okomu National Park have recorded significant decline of their cover over time mainly due to severe illegal logging activities It was observed during the present study that the loggers usually carried out this heinous act mostly at night and they always armed to the teeth with sophisticated weapons during the operations. The current rate of deforestation and degradation in this important hotspot hints that if the current scenario continues unabated the wildlife populations such as *Syncerus caffer nanus*, forest elephant and the forest guenons utilized the habitats may be force to migrate to another area. Evidence from Aberham *et al*., (2016) and Chowdhury *et al*., (2016) confirmed

this, that logging and deforestation might have a negative impact on wildlife because trees provide a habitat for a wide range of wildlife, and when removed, could lead to local extinctions or minimize the feeding ground and mating site of the wildlife in any conservation areas. Other anthropogenic activities recorded during the present study includes collection of Non- timber forest products, extracted trees for honey harvesting, human trails and human footprints. During field observations, the presence of human footprints which were located within the Park area were for illegal hunters, herders honey collectors and fishermen in KLNP. In ONP, human trails and human footprints encountered belonged to loggers, hunters and Non- timber forest products (NTFPs) collectors.

The findings of the present studies through socio-economic data showed that inadequate funding is one of the major threats affecting those National Parks. Lack of sufficient budget denying Parks opportunity to have enough logistics in carrying out patrol activities as expected and meeting up with the yearning of the support zone communities. Weak law enforcement also rendering both KLNP and ONP ineffective in preventing illegal activities and safeguarding biological resources. This is evident as the number of arrested offenders in the park are lower compared to the high level of illegal activities recorded in this study. The findings agree with the studies of Chowhury *et al*., 2014; and Mengistu *et al.*, 2017) who reported shortage fund and weak enforcement as major factors affecting wildlife population declines in Bangladesh and Ethiopia respectively.

CONCLUSION

The magnitude of threat factors is observed at varying degree in both Kainji Lake and Okomu National Park with high encounter rate, offenders' arrests and high relative threat factor severity index. Livestock grazing was the dominant threat factor in KLNP while severe deforestation through logging ranked the most threat factor in ONP. Shortage of fund, illegal hunting, weak law enforcement, gunshots were associated to the two parks.

The authors hereby recommended that incessant and magnitude illegal logging operation and unsustainable hunting in the study areas needed to be address in order to provide safe haven for the *Syncerus caffer* and other biodiversity resources in the Parks.

REFERENCES

Aberham M, Gurja B., Balakrishnan, M. (2016): Population structure and ecology of the African buffalo (*Syncerus caffer* Sparrman, 1779) in Chebera Churchura National Park. Africa to anthropogenic climate change. *Reg. Environ. Change* **11**: 127–135.

Akinsorotan, O. A., Ogunjemite, B. G. and Afolayan, T. A. (2011). Assessment of the Large Mammals of Arakhuan Range, Okomu National Park, Nigeria. *Ethiopian Journal of EnvironmentalStudies and Management*, 4(3): 25-37.

Amusa T. O., Aridanzi P., Haruna M. (2010). Ethnobotany and Conservation of Plant Resources in the Kainji Lake National Park. Ethnobotany Res. Appl. 8:181-194.

Aremu, O. T., Onadeko, S. A., Ola-Adams, B. A., Inah, E. I., (2007): Population parameters and biomass of African buffalo (*Syncerus caffer*) in Kainji Lake National Park, Nigeria. *J. Appl. Sci.* 7: 1809–1812.

Atickem, A., Loe, L. E., Langangen, O., Rueness, E. K., Bekele, A., Stenseth, N. C. (2011): Estimating population size and habitat suitability for Mountain Nyala in areas with different protection status. *Animal. Conserv*. **14:** 409–418.

Ayeni, J. S. O. (2007): Clinical Methods for the assessment of the effect of environmental stress on fish health United States Fish and Wildlife Service, *Federal Government Series Technical Papers pp: 89.*

Baldus, R. D. (2008): Wildlife: Can it pay its way or must it be subsidized? In: R.D. Baldus, G.R. Damn and K. Wollscheid (eds.) Best practices in sustainable hunting-A guide to best practices from around the world, pp.12-16. Budakeszi, Hungary: International Council for Game and Wildlife Conservation.

Bengtsson, J., Angelstam, P., Elmqvist, T., Emanuelsson, U., Folke, C., Ihse, M., Moberg, F. and Nyström, M. (2003).

Reserves, resilience and dynamic landscapes. *Ambio* 32: 389-396.

Berger, J., Buuveibaatar, B. and Mishra, C., (2013). Globalization of the cashmere market and the decline of large mammals in Central Asia. *Conservation Biology,* 27 (4), 679-689.

Brooks, T. M., Mittemeier, R. A., Mittemeier, C. G., and da Fonseca, G. A. B. (2002): Habitat loss and extinction in the hotspots of biodiversity. Conservation Biology16: 909-923.

Campbell, G., Kuehl, H., Kouamé, P. N., Boesch, C., (2008). Alarming decline of West African chimpanzees in Côte d'Ivoire. *Current Biology,* 18 (19), R903-R904.

Caro, T. and Scholte, P. (2007). When protection falters. Afr. J. Ecol. 45, 233–235.

Chape, S., Spalding, M. and Jenkins, M. D. (2008). *The world's protected areas*. Berkeley, USA: University of California Press.

Chowdhury .S. H. ., N. N, Shigeyuki. I., Nur M.; Masao K. (2016): Patterns and extent of threats to the protected areas of Bangladesh: the need for a relook at conservation strategies. Department of Forest Science, Faculty of Agriculture, Shinshu University, 8304 Minamiminowa-Mura, 399-4598 Nagano-Ken, Japan. 10.2305/IUCN.CH.2014.PARKS-20-1.MSHC.en. Parks Vol 20.1 March 2014.

Collen, B., Ram, M., Dewhurst, N., Clausnitzer, V., Kalkman, V., Cumbartidge, N. and Baillie J. (2009): Broadening the coverage of Biodiversity Assessment In: J-C vie, C Hilton Taylor and S.N Stuart (eds), Wildlife in a changing world: an analysis of the 2008. Review of the IUCN Redlists of Threatened Species, IUCN, Gland, Switzerland, Pp66-72.

Craigie, I. D., Baillie, J. E. M., Balmford, A., Carbone, C., Collen, B., Green, R. E. and Hutton, J. M. (2010): Large mammal population declines in Africa's protected areas. *Biol. Conserv.* 143: 2221–2228.

Demeke Datiko and Afework Bekele (2011). Population status and human impact on the endangered Swayne's hartebeest (*Alcelaphus buselaphus swaynei*) in Nechisar Plains,Nechisar National Park, Ethiopia. *Afr. J. Ecol.* **49:** 311–319.

Edet, D. I., Odunlami, S. S. (2013): Population estimate of forest buffalo (*Syncerus caffer nanus*, 1785) in Okomu National Park, Edo State, Nigeria. African Journal of Agriculture, Technology and Environment Vol. 2(3**):** 74-81December 2013 E-ISSN: 2346-7290. Department of Forestry and Wildlife Technology, Federal University of Technology, Owerri, Nigeria, and[b]Department of Forestry a nd Wildlife Management, University of Port Harcourt, Nigeria.

Ezealor, A. U. (2002): Nigeria. In L.C.D. Fishpool and M.I. Evans (Ed.), *Important Bird Areas in Africa and Associated islands*: *Priority sites for* conservation (pp. 673-692), Pisces Publications and BirdLIfe International, Newbury and Cambridge, UK.

Felix, D. (2005). The effectiveness of anti-poaching activities inside and outside wildlife protected areas in Tanzania: case study of Tarangire-Lake Manyara complex.A special project report submitted to the Sokoine University of Agriculture for the partial fulfillment of the award of degree of Bachelor of Science in Wildlife management, May 2005. Pp1 -72

Heller, R., Brüniche -Olsen, A., and Siegismund, H. R. (2012): Cape buffalo mitogenomics reveals a Holocene shift in the African human-megafauna dynamics. *Mol. Ecol.* 21: 3947–3959.

Henschel, P., Coad, L., Burton, C., Chataigner, B., Dunn, A., MacDonald, D., Saidu, Y. and Hunter, L.T., (2014). The lion in West Africa is critically endangered. *PloS One,* 9 (1), e83500.

Jayeola, O., Onadeko, S., Mafiana, C., Inah, E.; Okeyoyin, O., (2012): Past and present status of kob (*Kobus (Adenota) kob* (Erxleben) in Nigeria. *International Journal of Biodiversity and Conservation*, 4 (5), 197-205.

Kideghesho, J. R. (2009). The potentials of traditional African cultural practices in mitigating overexploitation of wildlife species and habitat loss: experience of

Tanzania. *International Journal of Biodiversity Science & Management* 5: 83-94.

Kiringe and Okello. (2007). Threats and their relative severity to wildlife protected areas of Kenya. *Applied ecology and environmental research*, 5 (2): 49-62.

Leuschner, C., Moser, G., Hertel, D., Erasmi, S., Leitner, D., Culmsee, H., Schuldt, B. and Schwendenmann, L. (2013). Conversion of tropical moist forest into cacao agroforest: consequences for carbon pools and annual C sequestration. *Agroforestry Systems* 87: 1173-1187.

Masanja, F. G. (2014). Human population growth and wildlife extinction in Ugalla Ecosystem, Western Tanzania. *J. Sust. Devel. Stud*. **5:** 192–217..

Mbano, A. S. and Nyanchuwa, J. (1996). Traditional Hunting in Tanzania. In: Leader-Williams, N; Kayera, J.A. and Overton, G.L. (Eds). Community-based conservation in Tanzania. Proceedings of a workshop held in February 1994. IUCN, Gland pp. 41-43.

Mengistu, W., Abeje K., Getachew M., Weldemariam T., Abraham A., (2017). Wildlife Threats and Their Relative Severity of Eastern Ethiopia Protected Areas. *Ecology and Evolutionary Biology*. Vol. 2, No. 4, 2017, pp. 59-67. doi: 10.11648/j.eeb.20170204.12

Michel, S. (2008). Conservation and use of wild Ungulates in central Asia- potentials and challenges. In: R.D. Baldus, G.R. Damn and K. Wollscheid (eds.) *Best practices in sustainable hunting- A guide to best practices from around the world*, pp. 32-40. Budakeszi, Hungary: International Council for Game and Wildlife Conservation.

Ngowe, N. M,. (2003). The role of local community in wildlife management: A case study of the Serengeti Regional Project, Tanzania. MSc. (MNRSA) Dissertation. Sokoine University of Agriculture, Morogoro. 95pp

Ogutu, J.O., Owen-Smith, N., Piepho, H.P., Kuloba, B. and Edebe, J. (2012). Dynamics of ungulates in relation to climatic and land use changes in an insularized African savannah ecosystem. *Biodiver Conserv*. 21: 1033–1053.

Ogutu, J.O., Piepho, H., Said, M.Y., Ojwang, G.O., Njino, L.W., Kifugo, S.C. and Wargute, P.W., (2016). Extreme Wildlife Declines and Concurrent Increase in Livestock Numbers in Kenya: What Are the Causes? *PloS One*, 11 (9), e0163249.

Orhiere, S. S., and Ohenihen. A., (1991). Botanical Garden Conservation News Magazines of the Botanical garden conservation secretariat. Vol 8, pp 48-51

Otuoma, J., Kinyamario, J., Ekaya, W., Kshatriya, M. and Nyabenge, M., 2009. Effects of human–livestock–wildlife interactions on habitat in an eastern Kenya rangeland. *African Journal of Ecology*, 47 (4), 567-573

Plumptre, A.J., Nixon, S., Kujirakwinja, D.K., Vieilledent, G., Critchlow, R., Williamson, E.A., Kirkby, A.E. and Hall, J.S., (2016). Catastrophic Decline of World's Largest Primate: 80% Loss of Grauer's Gorilla (*Gorilla beringei graueri*) Population Justifies Critically Endangered Status. *PloS One*, 11 (10), e0162697.

Ripple, W.J., Abernethy, K., Betts, M.G., Chapron, G., Dirzo, R., Galetti, M., Levi, T., Lindsey, P.A., Macdonald, D.W. and Machovina, B., (2016). Bushmeat hunting and extinction risk to the world's mammals. *Royal Society Open Science*, 3 (10), 160498.

Ripple, W.J., Newsome, T.M., Wolf, C., Dirzo, R., Everatt, K.T., Galetti, M., Hayward, M.W., Kerley, G.I., Levi, T. and Lindsey, P.A., (2015). Collapse of the world's largest herbivores. *Science Advances*, 1 (4), e1400103.

Schmidtz, D. (2004). What it takes to preserve Wilderness. [http://www.abetterearth.org/article.php/612.html] Visited 5th Nov 2004

Smitz, N., Cornélis, D., Chardonnet, P., Caron, A., de Garine-Wichatitsky, M., Jori, F., Mouton A., Latinne, A., Pigneur, L., Melletti, M., Kanapeckas, K.L., Marescaux, J., Pereira, C.L.and Michaux, J. (2014). Genetic structure of fragmented southern populations of African Cape

buffalo (*Syncerus caffer caffer)*. *Evol. Biol*. 14: 203–222.

Tuna Wildlife Consultant Company (1992): Review of Master Plan for the Management of Kainji Lake National Park, Nigeria.

Walsh, P. D., Abernethy, K. A., Bermejo, M., Beyers, R., De Wachter, P., Akou, M. E., Huijbregts, B., Mambounga, D. I., Toham, A. K. and Kilbourn, A. M., (2003). Catastrophic ape decline in western equatorial Africa. *Nature*, 422 (6932), 611-614