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ABUNDANCE AND DISTRIBUTION OF UNGULATES IN THE BUFFER ZONE OF OLD OYO NATIONAL PARK, NIGERIA

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ABSTRACT

The buffer zones of Nigerian protected areas are neglected and under-managed. The study examined the abundance and distribution as well as the population structure of ungulates species in Old Oyo National Park buffer zone. Five 3×2 km transects were laid in the buffer zone of all the ranges (Ogun-Tede, Marguba, Sepeteri, Oyo-Ile, and Yemoso) of the Park. The transects were traversed for a period of 12 months. Observations were based on direct censusing techniques only. The wet season results showed that Marguba range had the highest relative abundance of ungulate species 0.67±0.0057/km^2, while Sepeteri range had the least relative abundance of ungulate species 0.33±0.0023/km^2. Sylvicapra grimmia had the highest number of individuals in a group per square kilometer 0.0043±0.0012, while Kobus kob had the least number of individuals in a group per square kilometer 0.0011±0.0004. Adult males and adult females constituted the highest proportion of ungulate species mean population structure which ranged between 0.75 and 25.0%. In the dry season, however, Ogun-Tede range had the highest relative abundance of ungulate species 1.50±0.0092/km^2, while Yemoso range had the least 0.17±0.0011/km^2. Hippotragus equinus had the highest number of individuals in a group per square kilometer 0.0033±0.0012, while both Potamochoerus porcus and Sylvicapra grimmia had the least number of individuals in a group per square kilometer 0.0017±0.0005. Adult males, adult females and sub-adult males constituted the highest proportion of ungulate species mean population structure which ranged between 0.8 and 22.22%. Based on these findings, a buffer zone of Old Oyo National Park should be given more attention in terms of policing, monitoring and effective protection.

Keywords: Buffer zone, Ungulates, Population, Distribution, National Park

INTRODUCTION

Buffer zones are environmental and ecological management tools, which are used in a variety of ways to surround or shield a particular zone (core area) with the intention of insulating the important or threatened core area from negative external impacts. The definition used by Shafer (1999), includes the effects of invasive plant and animal species, physical damage and soil compaction caused through trampling and harvesting, abiotic habitat alterations and pollution. These are areas outside the boundaries of the core-protected area that are managed sympathetically to minimize the impacts of outside activities. Pressey (1997) stated that while doing all these things, buffer zones increase both the effective size of the protected area and the likelihood that all the life requirements of protected organisms will be provided in this larger area. A buffer zone is essentially a boundary imposed on a specific habitat for a predetermined, specific objective. According to Strayer *et al.,* (2003), ecologists use the term boundary to refer to a wide range of real and conceptual structures and it may be counterproductive to insist that all ecologists agree on a single rigid definition of a boundary. Strayer *et al.*, (2003) states that this is apparent when reading ecological literature those ecologists attach a range of meanings to the term *boundary*, presumably to

accommodate the systems and questions they are studying. Ecological boundaries may differ in their origin and maintenance, their spatial structure, their function, and their temporal dynamics. Therefore, these definitions are important when studying landscape ecology because this science deals with the spatially explicit relationships among patched types in complex mosaics (Turner 1989, Forman 1995, Wiens 1995).

Ideally, the prioritized end-use objective of a buffer zone is protection. Putwain and Pywell (1997) advised that one can protect remaining semi-natural habitats by creating buffer zones between them and an adjacent, potentially damaging land use. They go further to state that part of ecosystem management would be the establishment of buffer zones around protected areas, as Shafer (1999) pointed out, buffer zones can also provide more landscape needed for ecological processes such as fire. Stephens (1998) illustrated that the advantages of buffer zones include increasing the available habitat area, decreasing the potential exposure to adverse impacts and absorbing the severity of impacts. Buffer zones may include areas ranging from almost full protection to areas in the process of rehabilitation, and to those that may include small, low-density urban communities. The characteristics of development (urban edges) along, or in close proximity to sensitive habitats are complex and pose management challenges and the situation is exacerbated when these areas abut protected areas. As has already been stated, the majority of literature and studies on buffer zones related to large conservation areas such as reserves, however Stephens (1998) observed that protected areas have been made available for conservation and must, therefore, coincide with the edges of the pre-existing property. Stephens (1998) further stated that boundaries of natural systems seldom coincide with those of privately-owned property and it is therefore important to find a way of co-managing the urban fringe and natural areas in a way that benefits both the built and natural environment.

Hansen and di Castri (1992) explained that the distinguishing feature of a landscape perspective is not just the recognition that a landscape is composed of elements of different quality, but the emphasis on relationships among patches - what happens between the elements in a mosaic. Differential movements or flows of nutrients, energy, organisms, or disturbances mediate these relationships across a landscape. Once formulated and then implemented, a buffer zone essentially becomes a boundary. Cadenasso *et al.,* (2003) stated that boundaries are the zones of contact that arise whenever areas are partitioned into patches and that the understanding of how boundaries influence the functioning of ecological systems is poorly developed. Cadenasso *et al.,* (2003) further stated that when, where and how boundaries affect ecologically important flows across heterogeneous space are not well known. An area where buffer zones have proven very effective is in the management and protection of biosphere reserves, Birckhead *et al.,* (1997) stated that the biosphere reserve model rests heavily on the concept of buffer zones. Biosphere reserves are models whereby environmentally sound and sustainable development can be promoted in areas adjacent to the more strictly protected areas. Although biosphere reserves are concepts on a larger scale than residential development the principles are the same and the successful creation of biosphere reserves refers back to the mid 60's, and these have included the implementation of buffer zones which provide a transition between areas used primarily for conservation purposes, and areas that are used for purposes not well suited to conservation (Birckhead *et al.,* 1997).

Again, with more specific relevance to national parks and biosphere reserves, Sayer (1991) defined a buffer zone as 'a zone, peripheral to a national park, or equivalent reserve, where restrictions are placed upon resources use or special development measures are undertaken to enhance the conservation value of the area'. What is important to take note of in this definition is that Sayer (1991) recognized that development activities may take place, as long as they are environmentally sustainable and enhance the conservation value of an area. Lucas (1992) stated that the incorporation of human societies, behaviour, and welfare into planning and design of conservation areas is currently lacking, but is destined to become a vital component of conservation management. Considering the aggressive rate of development in Johannesburg and the sociopolitical pressure from government and the private sector to elevate poverty by job creation, the

need to establish cooperation between development and conservation is of utmost importance.

Nigeria has a rich and diverse mammalian faunal resource of about 250 species belonging to 13 orders, 42 families and 133 genera (Happold, 1987). Sixty-five mammalian species which include 21 primates among which are *Erythrocebus patas*, *Papio anubis*, and *Cercopithecus aethiops* are found in Old Oyo National Park (Ayodele, 1989; Afolayan *et al*., 1983). Despite the importance of biodiversity of the ecosystem to man, human being has caused extermination of species through their unfriendly environmental activities which include destruction of wildlife habitats, unsustainable agricultural practices, over-exploitation, industrialization, bush burning, hunting and poaching (Linden, 2000). This destruction remains a serious threat to development and sustainable living. There is a paucity of information or none at all on the abundance and distribution of ungulates in the buffer zones of Nigerian protected areas and much of the data that are available were obtained mainly from mere guesses made by casual observers and visitors. The available information on the buffer zones of other reserves and National Park is inadequate, unreliable, and insufficiently scientific for efficient management of buffer zone of a protected area. This study, therefore, determined the relative abundance and distribution of ungulates in the buffer zone of Old Oyo National Park.

MATERIALS AND METHOD

Study Area

Old Oyo National Park (OONP) derives its name from the ruins of Oyo-Ile, (Old Oyo) the ancient political capital of Yoruba Empire. The abundance of cultural features in and outside the Park with a combination of ecological and biodiversity sites places the Park in a very unique and advantageous position as a potential tourism destination. The Park has a total land mass of 2512 km^2 (making it the fourth largest national park in Nigeria) and is located in the South Western part of Nigeria, specifically Northern part of Oyo State. OONP is geographically located between latitudes $8^o15'$ and $9^o.00'$N of the equator and longitudes $3^o35'$ and $4^o42'$E of the Greenwich meridian. Old Oyo National Park (OONP) is considered as a mixed heritage site with outstanding natural and cultural values that if explored could serve as basis for its enlistment on the UNESCO world heritage list as the first mixed heritage site in Nigeria (Oladeji, 2012).

A 3x2km transect was laid in each of the five-buffer zone ranges in Old Oyo National Park. The total effective study area was 30km^2. Each transect was allowed to rest for 4-5 days after the construction of transects before data collection began to reduce human disturbance and to allow wild animals to return to their initial home range. The five transects were traversed in both dry and wet seasons, from 7.00 am to 1.00 pm and from 4.00 pm to 7.00 pm (local time) with an average walking speed of 2.0 km/hr. Periods of walking were interspersed with periods of 'silent', 'watch' and 'wait' in order to increase the possibility of detecting animals that might hide or flee upon the approach or movement of observers. Each transect was traversed twice in a month for period of 12 months. The counts of individual animals were made conservatively by only including individual seen. Vortex Diamondback Binocular (10x42mm) was used to observe and detect the presence of animals. Animals sighted were identified as outlined and described by Jean and Pierre (1990). Information was collected on groups of animals sighted which included species, sex, sighting distance (m) and population structure such as, adult males, females, sub-adult males, sub-adult females, and juveniles. Five basic assumptions were made as recommended by Burnham, (1980), Seber, (1982) and Dunn, (1993), which were: animals' position directly over the transect line are not missed, animals are seen before they flee, none are counted twice, sighting of each animal or group of animals are done with certainty and all animals are distributed at random with respect to the transects. Relative abundance of individual sighted species was calculated according to (Fernanda *et. al.*, 2001).

$$D = (ns/2LW)/km^2$$

where, D- relative abundance, n- number of groups/animals sighted, s- mean group size, L- area of transect and W- mean perpendicular distance. Body size, shape, presence of horn, female genital organs and udders were used to determine population structure.

RESULTS

Table 1 showed that during wet season at the buffer zone in all the five ranges of Old Oyo National Park,

Marguba had the highest relative abundance of ungulate species 0.67±0.0057/km^2, followed by Ogun-Tede and Yemoso 0.50±0.0034/km^2. Sepeteri range had the least relative abundance of ungulate species 0.33±0.0023/km^2. *Sylvicapra grimmia* had the highest number of individuals in a group per square kilometer 0.0043±0.0012, followed by *Hippotragus equinus* 0.0017±0.0006 while *Kobus kob* had the least number of individuals in a group per square kilometer 0.0011±0.0004. The total number of ungulate species recorded in a wet season was twelve (12) individuals. However, in the dry season, Ogun-Tede had the highest relative abundance of ungulate species 1.50±0.0092/km^2, followed by Marguba and Sepeteri 0.33±0.0024/km^2. Yemoso range had the least relative abundance of ungulate species 0.17±0.0011/km^2. *Hippotragus equinus* had the highest number of individuals in a group per square kilometer 0.0033±0.0012, while both *Potamochoerus porcus* and *Sylvicapra grimmia* had the least number of individuals in a group per square kilometer 0.0017±0.0005. The total number of ungulate species recorded in dry season was fourteen (14) individuals (Table 2).

Table 1: Relative Abundance and Distribution of Ungulates in OONP Buffer zone (Wet season)

Range	**Ungulates species**				**Total**	**Relative Abundance/km^2**
	Sg	**Kk**	**He**	**Pp**		
Ogun-Tede	3	0	0	0	3	0.50±0.0034
Marguba	0	1	3	0	4	0.67±0.0057
Sepeteri	1	0	0	1	2	0.33±0.0023
Yemoso	2	0	0	1	3	0.50±0.0034
Total	**6**	**1**	**3**	**2**	**12**	**2.00±0.0148**
MGS	**2**	**0**	**1**	**1**		
Grp/km^2	**0.0043**	**0.0011**	**0.0017**	**0.0014**		
S.E	**±0.0012**	**±0.0004**	**±0.0006**	**±0.0005**		

Source: Field survey, 2016 and 2017

Sg- Sylvicapra grimmia, Kk- Kobus kob, He- Hippotragus equinus, Pp- Potamochoerus porcus

MGS- Mean Group Size, S.E- Standard Error

Table 2: Relative Abundance and Distribution of Ungulates in OONP Buffer zone (Dry season)

Range	**Ungulates species**					**Total**	**Relative Abundance/km^2**
	Cr	**He**	**Pa**	**Pp**	**Sg**		
Ogun-Tede	2	6	1	0	0	9	1.50±0.0092
Marguba	0	0	1	1	0	2	0.33±0.0024
Sepeteri	1	0	1	0	0	2	0.33±0.0023
Yemoso	0	0	0	0	1	1	0.17±0.0011
Total	**3**	**6**	**3**	**1**	**1**	**14**	**2.33±0.015**
MGS	**1**	**2**	**1**	**0**	**0**		
Grp/km^2	**0.0024**	**0.0033**	**0.0024**	**0.0017**	**0.0017**		
S.E	**±0.0008**	**±0.0012**	**±0.0008**	**±0.0005**	**±0.0005**		

Source: Field survey, 2016 and 2017

Cr- Cephalophus rufilatus, He- Hippotragus equinus, Pa- Phacochoerus aethiopicus, Pp- Potamochoerus porcus, Sg- Sylvicapra grimmia

MGS- Mean Group Size, S.E- Standard Error

Wet season survey in the buffer zone of all the five ranges in Old Oyo National Park revealed that adult males and adult females constituted highest proportion of ungulate species mean population structure which ranged between 0.75 and 25.0%. Sub-adult males, sub-adult females and juveniles all had the least proportion of ungulate species mean population structure which ranged between 0.5 and 16.67%. *Sylvicapra grimmia* had the largest group size (6), while *Kobus kob* had the least (1) (Table 3). Also, the dry season survey in the buffer zone of all the five ranges in Old Oyo National Park showed that adult males, adult females and sub-adult males constituted highest proportion of ungulate species mean population structure which ranged between 0.8 and 22.22%. Sub-adult females and juveniles had the least proportion of ungulate species mean population structure which ranged between 0.6 and 16.67%. *Hippotragus equinus* had the largest group size (6), followed by *Cephalophus rufilatus* (5) while *Sylvicapra grimmia* had the least (1) (Table 4).

Table 3: Mean Population Structure of Ungulates Species in OONP Buffer zone (Wet season)

Ungulates species	Adult males	Adult females	Sub-adult males	Sub-adult females	Juveniles	Number sampled (n)
Sylvicapra grimmia	0	1	1	2	2	6
Kobus kob	1	0	0	0	0	1
Hippotragus equinus	1	2	0	0	0	3
Potamochoerus porcus	1	0	1	0	0	2
Total	**3**	**3**	**2**	**2**	**2**	**12**
Means	**0.75**	**0.75**	**0.5**	**0.5**	**0.5**	
(%)	**25.0**	**25.0**	**16.67**	**16.67**	**16.67**	

Source: Field survey, 2016 and 2017

Table 4: Mean Population Structure of Ungulates Species in OONP Buffer zone (Dry season)

Ungulates species	Adult Males	Adult females	Sub-adult males	Sub-adult females	Juveniles	Number sampled (n)
Cephalophus rufilatus	1	2	1	1	0	5
Hippotragus equinus	1	2	0	1	2	6
Phacochoerus aethiopicus	1	0	1	0	1	3
Potamochoerus porcus	1	0	1	1	0	3
Sylvicapra grimmia	0	0	1	0	0	1
Total	**4**	**4**	**4**	**3**	**3**	**18**
Means	**0.8**	**0.8**	**0.8**	**0.6**	**0.6**	
(%)	**22.22**	**22.22**	**22.22**	**16.67**	**16.67**	

Source: Field survey, 2016 and 2017

DISCUSSIONS

The number of individuals recorded in both wet and dry season was significantly different. This may be due to the fact that ungulates are gregarious in nature and wander more in dry season mainly for food and water. There are usually harvested crops leftover on

the farmland around the buffer zone, which these ungulates come to feed on. This agrees to the view of Newton (1998) and Benton *et al*., (2003) that food abundance influences the distribution and size of wildlife populations. Furthermore, more individuals (14 in dry season and 12 in wet season) as well as more species (5 in dry season and 4 in wet seasons) were recorded in dry season as a result of reduction in the thickness of the forest as well as the dryness of the vegetation which made visibility and sighting of animals easier. The least number of individuals recorded in Sepeteri range in wet season may not be unconnected to the fact that disturbance (in form of ploughing, tilling, farming and other forms of anthropogenic activities) was intense in that range, thus restricting movement of animals in the buffer zone. No ungulate individual was recorded in Oyo-Ile range, and this may not be unconnected with the incessant activities of the buffer zone dwellers (most especially, the Fulani's cattle herders). This is also in agreement with the earlier view of Adedoyin *et al*., (2018) that land adjacent Old Oyo National Park, Nigeria (that is supposed to be mildly protected) is now left unprotected (against every form of anthropogenic activities which include farming, hunting, fire setting and logging) and thus making it a free area. There was a significant difference ($P<0.05$) in the relative abundance of fauna species sighted in each of the ranges in the park. This showed that habitats quality determines distribution and abundance of wildlife species.

There were more adult males and adult females during wet season than other structure members. This may be due to the fact that there were abundance and availability of food. This abundance and availability of food in turn influences breeding. These adult males and adult females could successfully breed to increase the number of individuals in the entire population. This is closely followed by sub-adult males, sub-adult females, and juveniles. This proportion may aid and enhance the sustainability of the population as many reproductive females and males will be recruited into the effective and viable breeding population in the subsequent breeding seasons. This supports the earlier view of Aremu and Emelue (2003). Furthermore, *Sylvicapra grimmia* had the highest number of individuals (6) recorded in wet season and this may be due to the fact that *Sylvicapra grimmia* is a grazer which fed on the abundant grass availability during wet season. On the other hand, *Hippotragus equinus* had the highest number of individuals (6) recorded in dry season. *Hippotragus equinus* is more of a browser than a grazer. Due to the shortage of grass in dry season, many of these ungulates (which are grazers) occasionally behave as browsers.

CONCLUSION

It could be generally concluded that Old Oyo National Park buffer zone harbours some species of ungulates. The findings from this study indicated that buffer zone of Old Oyo National Park should be well monitored, managed and mildly protected against poaching, wildlife habitat destruction, indiscriminate burning of vegetation and grazing. There is also the need to reduce illegal activities in land adjacent Old Oyo National Park, Nigeria.

REFERENCES

Adedoyin SO, Emelue GU, Aremu OT (2018). Effective protection against anthropogenic activities of land adjacent Old Oyo National Park, Nigeria. *Journal of Research in forestry, Wildlife, and Environment, Vol 10(2) June 2018*. ISBN: 2141-1778.

Afolayan TA, Milligan KRN, Salami SO (1983). Abundance and distribution of large mammals, in the Upper Ogun Game Reserve, Oyo State, Nigeria. *International Journal for the Study of Animal Problems*, 4(1), 33-44.

Aremu OT, Emelue GU (2003). Preliminary survey of selected large carnivore population in Kainji Lake National Park, Nigeria. *Nigerian Journal of Forestry* 33(2): 82-87.

Ayodele IA (1989). Impact of socio-economic activities on wildlife resources in *Old Oyo National Park* proceedings of the Bi-annual conference of ecological society of Nigeria 14th-18th August 1989.

Benton TG, Vickery JA, Wilson JD (2003). Farmland biodiversity: is habitat heterogeneity the key? Trends Ecol. Evol. 18:182-188.

Birckhead J, Delacy T, Furze B. (1997). Culture, conservation, and biodiversity: The social dimension of linking local level development

and conservation through protected areas. England, John Wiley & Sons Ltd. Pp 23-29.

Burnham W (1980). Estimate of density line transect sampling of biological population. *Wildlife/Monogr. (71) 202 pp*.

Cadenasso ML, Pickett STA, Weathers KC, Jones CG (2003). A framework for a theory of ecological boundaries. *BioScience,* 53 (8): 45-64.

Dunn A (1993). A manual of census techniques for surveying large mammals in tropical rainforests. Unpublished report to WWF/UK. Pp 49-55.

Fernanda FC, Marques ST, Buckland DF, Camilla ED, David LB, Brenda AM, Andrew JP (2001). Estimating deer abundance from line transect surveys of dung: Sika deer in Southern Scotland. *J. of Appl. Ecology 38:349-363*.

Forman RTT (1995). Land mosaics: The ecology of landscapes and regions. Cambridge University Press, Cambridge, U.K. Pp 58-81.

Hansen AT, di Castri F (Eds.) (1992). Landscape boundaries. Springer-Verlag, New York, USA. Pp 11-19.

Happold DCD (1987). The Mammals of Nigeria. Oxford Publishers: Clarendon Press, 402pp

Jean D, Pierre D (1990). A field guide to the large mammals of Africa. Collins st. James publication, London, 342pp.

Linden E (2000). State of the planet: Condition critical, Time International Mag., special edition, Earth day: how to save the Earth, 19-24pp.

Lucas PHC (1992). Protected landscapes: A guide for policy-makers and planners. Chapman and Hall, London.

Newton I (1998). Population limitation in birds. Academic Press, Oxford, UK.

Oladeji SO, Agbelusi EA, Afolayan R (2012). Anthropogenic activities threatening the management of the ecotourism resources in Old Oyo National Park, Nigeria. *Ethiopian Journal of Environmental Studies and Managemen*t Vol 5. No 1, pp. 100-111.

Pressy RL (1997). Protected areas: where should they be and why should they be ther 68 Spellerberg, I. F., *ed.* Conservation Bi England, Longman Publishers. p. 171-185).

Putwain P, Pywell R (1997). Restoration and conservation gain. *(In* Spellerberg, I. F., *ed.* Conservation Biology, England, Longman Publishers. p. 203-221).

Sayer J (1991). Rainforest buffer zones: Guidelines for protected area managers. Pp 85-91.

Seber GAF (1982). The estimation of animal abundance and relative parameters: *2nd edition. Macmillan New York, 332pp*.

Shafer CL (1999). US National Park buffer zones: Historical, scientific, social and legal aspects. Environmental Management, 23, 49-73.

Stephens A (1998). Co-managing the boundaries between urban and naturat areas: A case study of Scarborough (Cape Peninsula). *South African Geographical Journal,* 80 (2).

Strayer DL, Power ME, Fagan WF, Pickett STA, Telnap J (2003). A Classification of Ecological Boundaries. *BioScience,* 53 (8): 723-729.

Turner MG (1989). Landscape ecology: the effect of pattern on process. *Annual Review of Ecology and Systematics* 20: 171-198.

Wiens JA (1995). Landscape mosaics and ecological theory. Pp. 1-26 (In Hansson L., Fahrig L. and Merriam G. (eds.). Mosaic landscapes and ecological processes. Chapman and Hall, London).