



WELFARE OF ANIMALS IN CAPTIVITY: EXPOSE ON DIVERSITY, ENCLOSURE SIZE AND ENRICHMENT, FOOD AND FEEDING REGIME IN SOME ZOOS IN SOUTH-WEST NIGERIA

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ABSTRACT

This study assessed the diversity of animals with respect to the number and sex, IUCN status, husbandry practices vis a vis enclosure size and enrichment, food and feeding regime in three zoos located in southwest Nigeria, in order to offer an insight into the welfare of animals in captivity in Nigerian Zoos, as well as the practice of captive breeding and/or conservation roles of modern zoos. Two of the five freedoms were focused on namely freedom from hunger and thirst and freedom to express most normal behaviour. It was revealed that a total of thirty-six species of animals (131 individuals) belonging to 25 families, 15 orders, and 3 classes (Aves, Reptiles and Mammals), were presented and displayed in the zoos. These animals largely belong to least concern conservation status of IUCN. Thirty species were without mates and some were housed with members of same sex. Animals' enclosure sizes are designed to accommodate the needs of each species of animal; and enclosure enrichments were largely provided. The sizes of enclosures were however extremely smaller than the standard minimum enclosure requirements of animals in captivity. Feeding and feeding regime was done and appropriated with considerations to what obtains in their wild habitat and the digestive system of the animals. It was concluded that freedom from hunger and thirst was ensured in all the zoos given adequate food and feeding regime but hampered in terms of freedom to express most normal behaviour.

Keywords: Animal welfare, Captive breeding, Conservation, Zoo

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INTRODUCTION

Zoos have evolved over the years, starting in ancient times as an establishment by rulers and lords of kingdoms for sporting activities, while exempting people outside their calibre to becoming ex-situ conservation institutions for aesthetic, recreational, educational and research and breeding purposes (Omonona and Ayodele, 2011; Alarape *et al.*, 2015). Primarily, zoos are

established to bring wild animals close to man (Yager *et al.*, 2015). These animals are constrained to live in captivity, while simulating their environments to be as closely as possible to that which obtains in wild lands. Animal welfare consideration of environmental simulation and species conservation are relatively recent (Knowles 2003, World Association of Zoos and Aquarium {WAZA},

2006) and presents an interesting angle to animal management in captivity since they were formerly constrained to live in menageries where public display and scientific study were the main focus. A modern zoo in addition to research, recreation, education and economic purposes, must be involved in conservation (WAZA, 2006; Baker, 2007; Bowkett, 2009; Adams and Salome, 2014).

Globally, there is a universal practice standard made available to enable zoos by WAZA especially under the animal welfare strategy (WAZA, 2006). The animal welfare strategy projects the five freedoms namely; freedom from discomfort, freedom from hunger and thirst, freedom from fear and distress, freedom from injury pain and disease and freedom to express most normal behaviour. Mellor and Beausileil (2015) noted that these freedoms buttress the significance of health, nutrition, mental state and behaviour of animals. Some nations in addition to this strategy have laws and legislations to ensure animal welfare such as the Animal Welfare Act and Zoo Licensing Act of the United Kingdom; and Guidelines for keeping animals in captivity in India. In Nigeria, there is yet a defined legislation regarding animal welfare especially in captivity (World Animal Protection, 2020) despite the fact that Jos Museum Zoo, the first zoo in Nigeria was established as far back as 1945.

Animals in captivity need environments that have enough motivation and naturalistic content as obtained in the wild (Veasey, 2006). This is hardly the case in some zoos as many enclosures are barren and minimally able to cater for the needs of animals (Hussain *et al.*, 2015). Despite the prevalence of studies in zoos in Nigeria, information on the state of animals in terms of diversity, nutrition, health and husbandry practices that is pertinent to animal welfare remains scarce. Largely studies have been the assessment of recreational/ecotourism potentials of zoos (Ayodele and Alarape, 1998; Adetola *et al.*, 2014; Yager *et al.*, 2015; Adekola, 2015); visitor preferences for wild animal species (Adefalu *et al.*, 2015); impacts of zoological garden in schools (Adams and Salome, 2014) and conservation education (Uloko *et al.*, 2011). Few have focused on the health perspective such as Ajibade *et al.* (2010) and Adeniyi *et al.* (2015) who assessed the cropology and to the prevalence of

gastrointestinal parasites of some animals. The focus of this study was the assessment of the diversity of animals with respect to the number and sex, IUCN status, husbandry practices *vis a vis* enclosure size and enrichment, food and feeding regime and routine cleaning; and veterinary services in three zoos located in southwest Nigeria, in order to offer an insight into the welfare of animals in captivity in Nigerian Zoos, as well as the practice of captive breeding and/or conservation roles of modern zoos.

MATERIALS AND METHODS

Study Area

This study was carried out in three university-based zoological gardens in South West, Nigeria namely Federal University of Abeokuta (FUNAAB) Zoological Park (Ogun State); Obafemi Awolowo Zoological Garden (Osun State) and Federal University of Technology Wildlife Park (Ondo State).

Federal University of Abeokuta Zoological Park (FUNAAB Zoo)

FUNAAB Zoo is located on latitude 7° 13' and longitude 003° 26' in a conserved forest about 200 metres away from the Federal University of Abeokuta main gate. The zoo was established in 2008 for education/research and recreational purposes. The zoo serves as a research resource for students studying Forestry, Wildlife, Zoology, Veterinary and Botanical studies. It also serves the general public as a leisure garden to appreciate nature and see different animals in enclosed environments and also in their natural habitat. Animal enclosures are sparsely round the zoo which enables a circular patterned tour for visitors.

Obafemi Awolowo University Biological Garden (OAU Garden)

Occupying a land area of 13 hectares is the OAU Garden located on at latitude 07° 31' 27.4" N and longitude 004° 31' 26.9" E and close to the Department of Zoology, Faculty of Science within the Obafemi Awolowo University campus. The Garden was established in 1968. It is primarily a facility for biological studies and at the same time for recreation (Omonona and Ayodele, 2011). The garden has two sections namely the botanical garden and the zoological garden, the most popular being the latter and referred to as OAU Zoo. Enclosures of animals are distributed unevenly within the thick forest

of the garden, thus providing nature trail experience as visitors seeks and advance to

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T. A. Afolayan wildlife park (FUTA Park)

T.A Afolayan Wildlife Park was established in 2008 and named after Late Professor T. A. Afolayan, a renowned professor of wildlife. The park is situated in Federal University of Technology Akure, Wildlife Park along Akure – Ilesha road in the North-Western part of the institution between longitude 05° 18' E and latitude 07° 17'N covering a land area of 8.91ha (Olusola and Oyeleke, 2015). The park has two sections; one is the zoological section and the second is the wild land. The enclosures of animals are concentrated within the immediate entry of the park, offering spectacular view of the animal collections.

Experimental Design

Data was primarily collected through the use of direct observation, enclosure size measurement and key informant interviews. Direct observation was done to collate data on wildlife species in the zoos, specifically number, enclosure enrichment, feed and feeding regime. The enclosures of all the animals in the zoos were measured using a meter tape and recorded. This was compared with the minimum enclosure requirements for animals (Appendix) in captivity as recommended by the Central Zoo Authority (2011). Key Informant Interview was used to obtain information from the directors/managers (where available), zoo keepers and curators on feeding regime, veterinary practices and zoo animals' history. This study was carried out between June 2017 and May 2018.

RESULT

Checklist of animals in the study zoos

A total of thirty-six species of animals (131 individuals) belonging to 25 families, 15 orders, and 3 classes (Aves, Reptiles and Mammals), were presented and displayed in the three zoological gardens. FUNAAB Zoo Park had a total of twenty-six species while OAU Bio Garden and FUTA Wildlife Park had thirteen species each (Table 1). Across the zoos, *Balaerica pavonia* (Crowned crane), *Sthrutio camelus* (ostrich), *Cercopithecus mona* (Mona monkey), *Papio Anubis* (olive baboon) and *Chentrochelys sulcata* (African spurred tortoise) were represented. Two out of the three zoological gardens had *Psittacus erithacus* (African grey parrot), *Anas platyrhynchos* (Mallard duck), *Chen caerulescens* (White geese), *Numida meleagris* (Guinea fowl), *Cercocebus torquatus* (collared mangabey), *Osteolaemus tetraspis* (dwarf crocodile), *Crocodylus niloticus* (Nile crocodile) and *Python sebae* (African rock python). The most represented class of animals is the Mammalia with sixteen species. Aves and reptiles had ten species each. Only one (*Panthera leo*) of the big five is represented in one of the zoos (OAU Gardens).

Majority (72%) of the animals belongs to the Least Concern conservation status of IUCN, followed by 19% that are threatened (Endangered (5%), and Vulnerable (14%)). Also, 6% are domesticated and 3% not evaluated (Fig 1).

S/No.	Scientific name	Family	Order	Common name	IUCN Status	FUNAAB Zoo	OAU Bio Garden	FUTA Park
Aves								
1.	<i>Psittacus erithacus</i>	Psittacidae	Psittaciformes	African grey parrot	EN	✓		✓
2.	<i>Psittacula krameri</i>	Psittacidae	Psittaciformes	Rose ringed parakeet	LC	✓		
3.	<i>Anas platyrhynchos</i>	Anatidae	Anseriformes	Mallard duck	LC	✓	✓	
4.	<i>Cairina moschata</i>	Anatidae	Anseriformes	Muscovy duck	LC			✓
5.	<i>Chen caerulescens</i>	Anserinae	Anseriformes	White geese	LC	✓		✓
6.	<i>Milvus aegypticus</i>	Accipitridae	Accipitriformes	Yellow billed kite	LC	✓		
7.	<i>Columba guinea</i>	Columbidae	Columbiformes	Speckled pigeon	LC		✓	
8.	<i>Balaerica pavonia</i>	Gruidae	Gruiformes	Black crowned crane	VU	✓	✓	✓
9.	<i>Numida meleagris</i>	Numididae	Galliformes	Guinea fowl	LC		✓	✓
10.	<i>Struthio camelus</i>	Struthionidae	Struthioniformes	Ostrich	LC	✓	✓	✓
Reptiles								
11.	<i>Osteolaemus tetraspis</i>	Crocodylia	Crocodylidae	Dwarf crocodile	VU	✓	✓	
12.	<i>Crocodylus niloticus</i>	Crocodylia	Crocodylidae	Nile crocodile	LC	✓		✓
13.	<i>Python sebae</i>	Pythonidae	Squamata	African rock python	VU	✓	✓	
14. P	<i>Python regius</i>	Pythonidae	Squamata	Royal python	LC	✓		
15. b	<i>Bitis gabonica</i>	Viperidae	Squamata	Gaboon viper	LC	✓		
16.	<i>Bitis arietans</i>	Viperidae	Squamata	Puff adder	NE	✓		
17.	<i>Veranus niloticus</i>	Veranidae	Squamata	Monitor lizard	LC	✓		
18.	<i>Trionyx triunguis</i>	Trionychidae	Testudines	African soft-shell turtle	EN		✓	
19.	<i>Pelusios castaneus</i>	Pelomedusidae	Testudines	West African mud turtle	LC	✓		
20.	<i>Centrochelys sulcata</i>	Testudinidae	Testudines	African spurred tortoise	VU	✓	✓	✓
Mammals – primates								
21.	<i>Chlorocebus sabaeus</i>	Cercopithecidae	Primates	Green monkey	LC			✓
22.	<i>Cercopithecis mona</i>	Cercopithecidae	Primates	Mona monkey	LC	✓	✓	✓
23.	<i>Erythrocebus patas</i>	Cercopithecidae	Primates	Patas monkey	LC	✓		
24.	<i>Chlorocebus pygerythrus</i>	Cercopithecidae	Primates	Vervet monkey	LC	✓		
25.	<i>Cercocebus torquatus</i>	Cercopithecidae	Primates	Collared or red capped mangabey	VU	✓		✓
26.	<i>Papio Anubis</i>	Cercopithecidae	Primates	Baboon	LC	✓	✓	✓
27.	<i>Equus asinus</i>	Equidae	Perissodactyla	Domesticated donkey	D	✓		
28.	<i>Philantomba maxwelli</i>	Bovidae	Artiodactyla	Maxwell's duiker	LC	✓		
29.	<i>Cephalophus rufilatus</i>	Bovidae	Artiodactyla	Red flanked duiker	LC			✓
Mammals - rodents								
30.	<i>Hystrix cristata</i>	Hystricidae	Rodentia	Crested porcupine	LC	✓		
31.	<i>Cavia porcellus</i>	Caviidae	Rodentia	Guinea pig	D			
Mammals - carnivores								
32.	<i>Civettictis civetta</i>	Viverinidae	Carnivora	African civet cat	LC	✓		
33.	<i>Panthera leo</i>	Felidae	Carnivora	Lion	LC		✓	
34.	<i>Canis aureus</i>	Carnidae	Carnivora	Common jackal	LC	✓		
35.	<i>Crocuta crocuta</i>	Hyaenidae	Carnivora	Spotted hyena	LC		✓	
Total						26	13	13

Note: LC= Least Concern, EN = Endangered, V = Vulnerable, NT = Near Threatened, D= Domesticated, NE = Not Evaluated

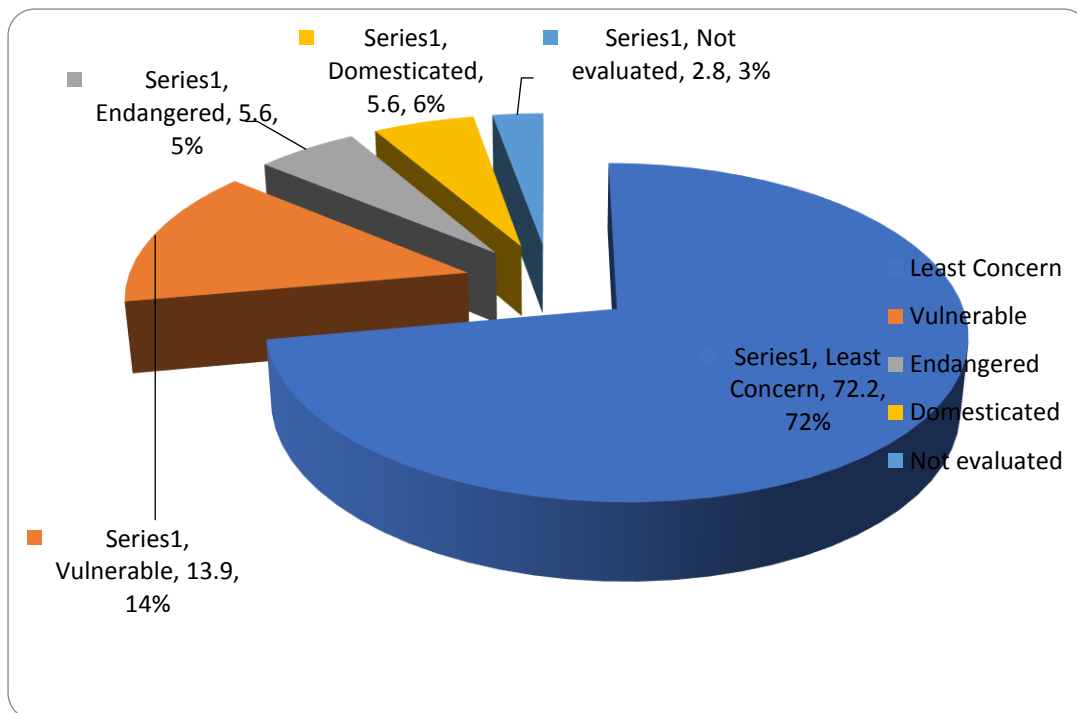


Figure 1: IUCN status of the study zoos species

Animal diversity, Number, Sex, Enclosure size, Cage enrichment, Food and Feeding regime of animals in FUNAAB Zoo

This is outlined on Table 2.

Diversity, Number and Sex: there were twenty-six species of animals in the zoo. They were largely classified (for the purpose of this study) into five sections namely aviary (7 species), primates (7 species), herbivores (2 species), herpes (9 species) and carnivores (2 species). Most species of animals had at least one member of its group. Ten species however had no mate. In total, there were 76 individuals in the zoo. The sexes of the birds were largely undefined in the zoo. There were juvenile records.

Enclosure size and Cage Enrichment: Animals enclosure sizes were with respect to the type and requirements of the animals. It was smaller for the birds (with the exception of the larger birds such as the ostrich) and herpes, and larger for the primates, herbivores and carnivores. Only one species of the animals (*Struthio camelus*), had an appropriate enclosure size. Cage enrichment varies for all the animals; for example, there were inner rooms for all the primates and carnivores; hanging bars for the primates, etc.

Food: Birds were largely fed with grains (groundnut, dried maize and sorghum) with the exception of the carnivorous birds that were fed

with flesh. Some such as the ostrich was also given compounded feed. Primates were fed with fruits (banana, water melon, banana, cucumber, pineapple, cabbage and orange) and supplemented with cooked beans and corn mixture with oil. The carnivores were fed with raw meat (cow). The civets were also given banana. The jackals were fed cooked beans too. The herbivores were fed with grasses. It was supplemented with cooked beans for the porcupine. The herpes especially the snakes were fed with live rabbits and giant rat. The crocodiles were fed with cow meat. The soft shell and hard-shelled turtles were fed with the intestine of slaughtered animals and or soft meat. The tortoises were fed with cooked beans and fruits.

Feeding regime: birds were fed generally once daily. The carnivorous ones were fed once in 2 days. Primates were fed twice daily (fruits in the morning and cooked beans/yam in the afternoon). The herpes especially snakes were fed once in 2 or 3 weeks. The turtles were fed twice/thrice weekly. The tortoises were fed on a daily basis. The captive herbivores were fed once/twice daily. The carnivores were fed twice weekly.

Table 2: Number, Enclosure Size and Cage Enrichment of Animals in FUNAAB Zoo

S/No	Scientific name	Number			Enclosure size (m ²)	Cage enrichment	Food	Feeding regime
		AdM	AdF	Juv				
Birds								
1.	<i>Psittacus erithacus</i>	1	1	-	3.0	Iron bars	Groundnut, dried maize, sorghum	Once daily
2.	<i>Psittacula krameri</i>	1	-	-	3.0	Iron bars	Groundnut, dried maize, sorghum	One daily
3.	<i>Anas platyrhynchos</i>	1	-	-	108.0	Water bath, sparse trees	Groundnut, dried maize, sorghum	Once daily
4.	<i>Balaerica pavonia</i>	1	2	-				
5.	<i>Chen caerulescens</i>	4	2	-		Water bath	Groundnut, dried maize, sorghum	Twice daily
6.	<i>Struthio camelus</i>	1	1	-	544.5*	Trees, shrubs, inner room layed with sandy soil	Compounded feed (growers marsh)	Twice daily
		-	-	1	36.0			
7.	<i>Milvus aegypticus</i>	1	-	-	20.3	Shrubs, Hollow box	Cow meat	Once in 2 days
Herpes								
8.	<i>Osteolaemus tetraspis</i>	1	1	1	7.6	Water bath, dry area, inner room, grassy enclosure	Cow meat	Twice weekly
9.	<i>Crocodylus niloticus</i>	-	1	2	81		Cow meat	Twice weekly
10.	<i>Python sebae</i>	^1	-	-	10.1	Concrete floor, Tree stump, long tree branch, water bath	Giant rat, rabbit	Once in 2/3 weeks
11.	<i>Python regius</i>	^1	-	-	1.5	Gravel floor, tree branch	Giant rat, rabbit	Once in 2/3 weeks
12.	<i>Bitis gabonica</i>	^1	-	-	1.5	Gravel floor, tree branch	Giant rat, rabbit	Once in 2/3 weeks
13.	<i>Bitis arietans</i>	^1	-	-	1.4	Gravel floor, tree branch	Giant rat, rabbit	Once in 2/3 weeks
14.	<i>Veranus niloticus</i>	1	1	-	7.6	Water bath, sandy area	Intestines, liver, kidney	Once in 2/3 weeks
15.	<i>Pelusios castaneus</i>	11*	-	9	7.6	Water bath, sandy area	Intestines, liver, kidney	Twice weekly
16.	<i>Chentorchelys sulcata</i>	1, 1	-	-	324	Trees, shrubs, inner house, grasses	Grasses, grains	Once daily
Primates								
17.	<i>Cercopithecis mona</i>	1	1	2	71.8	Tree twigs and branches, iron bars, inner room, grasses	Cooked beans and corn, banana, water melon	Twice daily
18.	<i>Erythrocebus patas</i>	1	4	-	95.2	Tree twigs and branches, iron bars, inner room, grasses	Cooked beans and corn, banana, water melon	Twice daily
19.	<i>Chlorocebus pygerythrus</i>	1	-	-	108.2	Tree twigs and branches, iron bars, inner room, grasses	Cooked beans and corn, banana, water melon	Twice daily
20.	<i>Cercocebus torquatus</i>	1	-	-	47.6	Tree twigs and branches, iron bars, inner room, grasses	Cooked beans and corn, banana, water melon	Twice daily
21.	<i>Papio Anubis</i>	1,1	1	-	108.2	Tree twigs and branches, iron bars, inner room, grasses	Cooked beans and corn, banana, water melon	Twice daily
Herbivores								
22.	<i>Equus asinus</i>	1	1	1	Free range			-
23.	<i>Philantomba maxwelli</i>	2	-	-	220.0	Shrubs and grasses		Once daily
24.	<i>Hystrix cristata</i>	2	-	-	15.2	Cemented floors, concrete burrows	Cooked beans and corn	Once daily
Carnivores								
25.	<i>Canis aureus</i>	1	-	-	130.7	Trees, shrubs, inner room	Cooked beans, cow meat	Twice weekly
26.	<i>Civettictis civetta</i>	3^	-	-	75.7	Shrubs, forages, inner room	Banana, cow meat	Twice weekly

(Ad M – Adult male; Ad F – Adult female, Juv – Juvenile, ^ = sex undetermined, * = Appropriate enclosure size)

Animal diversity, Number, Sex, Enclosure size, Cage enrichment, Food and Feeding regime of animals in OAU Zoo

Diversity, Number and Sex: there were thirteen species of animals in the garden (Table 3). They were largely classified (for the purpose of this study) into four sections namely aviary (5 species), primates (2 species), herpes (4 species) and carnivores (2 species). Most species of animals (10 of 13) had no mate. In total, there were 26 individuals in the zoo. The sexes of the birds and herpes were largely undefined in the zoo. The zoo generally lacks juvenile animals.

Enclosure size and Cage Enrichment: Animals enclosure sizes were with respect to the type and requirements of the animals. It was smaller for the birds, and larger for the herpes primates, herbivores and carnivores. Only one of the species (*Panthera leo*) had an appropriate enclosure size. Cage enrichment varied for all the animals; for example, there were inner rooms for all the primates and carnivores among others.

Animal diversity, Number, Sex, Enclosure size, Cage enrichment, Food and Feeding regime of animals in FUTA Wildlife Park

Diversity, Number and Sex: there were thirteen species of animals in the Park (Table 4). They were largely classified (for the purpose of this study) into four sections namely aves (6 species), primates (4 species), herpes (2 species) and herbivore (1 species). There was no carnivore in the park. Most species of animals (10 of 13) had no mate. In total, there were 29 individuals in the zoo. The sexes of the animals were largely defined in the zoo. The zoo generally lacked juvenile animals.

Enclosure size and Cage Enrichment: Animals enclosure sizes were with respect to the type and requirements of the animals. It was smaller for the birds and larger for the primates, and herbivores. None of the species had appropriate enclosure size. Cage enrichment varied for all the animals; for example, there were inner rooms for some of the primates e.g. baboon.

Food: Birds were largely fed with corn and cooked beans. The ostriches and pea fowl were also given compounded feed. Primates were fed with fruits (banana, water melon, banana, cucumber, pineapple, cabbage and orange) and supplemented with cooked beans and yam with oil. The tortoise was fed with cooked beans and fruits.

Feeding regime: birds were fed generally once daily. Primates are fed twice daily (fruits in the morning and cooked beans/yam in the afternoon). The tortoise was fed on a daily basis. The crocodiles were fed once weekly/biweekly. The herbivore was fed once daily.

Food: Birds were largely fed with grains (corn, millet and beans). The ostrich was also given compounded feed. Primates were fed with fruits (banana, water melon, banana, cucumber, pineapple, cabbage and orange) and supplemented with cooked beans and corn mixture with oil. The carnivores were fed with raw meat (cow, goat or pig), with special bony parts preference for the hyena. The snake was fed with live rabbits. The crocodile was fed with cow meat. The soft-shell turtles were fed with the intestine of slaughtered animals and or diced meat. The tortoises were fed with cooked beans and fruits.

Feeding regime: birds were fed generally twice daily. Primates are fed twice daily (fruits in the morning and cooked beans/yam in the afternoon). The snake was fed once in 3 weeks. The turtles were fed once in two days. The tortoises were fed on a daily basis. The carnivores were fed twice weekly.

Table 3: Number, Enclosure Size and Cage Enrichment of Animals in OAU Zoo

S/No.	Scientific Name	Number			Enclosure Size (m ²)	Cage enrichment	Food	Feeding regime
		AdM	AdF	Juv				
Birds								
1.	<i>Anas platyrhynchos</i>	-	1	-	12.3	Shrub, water bath, hollow box, twigs and branches	Grains (corn, millet, beans)	Twice daily
2.	<i>Balaerica pavonia</i>	1	-	-	82.1	Same as above	Grains (corn, millet, beans), growers marsh	Twice daily
3.	<i>Columba guinea</i>	1	1	-	11.9	Same as above	Grains	Twice daily
4.	<i>Numida meleagris</i>	1	1	-	14.1	Same as above	Grains	Twice daily
5.	<i>Struthio camelus</i>	1	-	-	441	Shed, grassed enclosure	Grains (corn, millet, beans), growers marsh, water leaf	Twice daily
Herpes								
6.	<i>Osteolaemus tetraspis</i>	1	-	-	66.0	Water bath, Tree, grassed dry area	Slaughtered pig, goat or cow meat	Twice weekly
7.	<i>Python sebae</i>	1	-	-	11.0	Water bath, rocky bed floor	Live rabbit	Once in three weeks
8.	<i>Trionyx triunguis</i>	1	-	-	27.9	Water bath, trees	Liver, meat cut into small pieces	Once in two days
9.	<i>Chentrochelys sulcata</i>	1	-	-	43.2	Inner room, Trees	Cooked beans and corn, ripe banana, pawpaw, carpet grass, edible mushroom	Twice daily
		1	-	-	52.9			
		-	-	4	40.7			
Primates								
10.	<i>Cercopithecis mona</i>	1	1	1, 1	115	Shrubs, inner room	Fruits, cooked beans and corn, cooked yam and cocoyam, cooked groundnut	Twice daily
11.	<i>Papio anubis</i>	1	-	-	115	Rocky outcrop, ball, inner room	Fruits, cooked beans and corn, cooked yam and cocoyam, cooked groundnut	Twice daily
Carnivores								
12.	<i>Panthera leo</i>	1	1	2	1075.6*	Trees, inner room	Slaughtered pig meat, bones with stripped meat from slaughter slab	Twice weekly
13.	<i>Crocota crocuta</i>	1	-	-	128	Trees, inner room	Bony part of slaughtered pig, goat or cow e.g head and leg	Twice weekly

(AdM – Adult male; Ad F – Adult female, Juv – Juvenile, * = Appropriate enclosure size)

Table 4: Number, Enclosure Size and Cage Enrichment of Animals in FUTA Wildlife Park

S/N0	Scientific Name	Number			Enclosure Size (M ²)	Cage Enrichment	Food	Feeding Regime
		Ad M	Ad F	Juv				
Birds								
1.	<i>Psittacus erithacus</i>	1	-	-	0.36	Tree twig, iron bars	Cooked beans, corn	Once daily
2.	<i>Cairina moschata</i>	9	3	-	263	Natural pond,	Cooked beans, corn	Once daily
3.	<i>Chen caerulescens</i>	1	-	-		constructed pond, pen house, trees (guava and palm)	Cooked beans, corn	Once daily
4.	<i>Balaerica pavonia</i>	1	-	-	45	Covered enclosure,	Cooked beans, corn	Once daily
5.	<i>Numida meleagris</i>	1	2	-		rock outcrop	Cooked beans, corn, compounded feed	Once daily
6.	<i>Struthio camelus</i>	2	-	-	225	Shed, One Tree	Cooked beans, corn, compounded feed	Once daily
Herpes								
7.	<i>Crocodylus niloticus</i>	1	1	-	39	Water bath, dry area	Cow meat	Once weekly/biweekly
8.	<i>Chentorchelys sulcata</i>	-	1	-	8.0	Water hole, small house	Cooked beans, yam	Twice daily
Primates								
9.	<i>Cercopithecis mona</i>	1	-	-	9.25	Inner room, iron bar	Cooked beans, yam, mango, banana	Twice daily
10.	<i>Cercocebus torquatus</i>	-	1	-				
11.	<i>Green monkey</i>	1	-	-	18.0	Inner room, iron bar, Concrete floor	Cooked beans, yam, mango, banana	Twice daily
12.	<i>Papio anubis</i>	1	-	-	41.0	Inner room	Cooked beans, yam, mango, banana	Twice daily
		-	1	-				
Herbivore								
13.	<i>Cephalophus rufilatus</i>	-	1	-	108	Bush thicket, shed	Corn	Once daily

(Ad M – Adult male; Ad F – Adult female, Juv – Juvenile)

Adequateness of enclosure sizes of animals

Majority of the animals in the zoos (94.5%) do not have appropriate enclosure sizes that measure up to CZA standard.

Table 5: Adequateness of enclosure sizes of animals in the zoos

Zoo/Park	Adequate		Inadequate	
	Frequency	Percentage	Frequency	Percentage
FUNAAB Zoo	1	3.9	25	96.1
OAU Zoo	1	7.7	12	92.3
FUTA Park	-	-	13	100.0
Total	2	5.6	34	94.5

DISCUSSION

A total of thirty-six species of animals (131 individuals) belonging to 25 families, 15 orders, and 3 classes (Aves, Reptiles and Mammals), were presented and displayed in the three zoos. Across the zoos, *Balaerica pavonia* (Crowned crane), *Struthio camelus* (ostrich), *Cercopithecus mona* (Mona monkey), *Papio anubis* (olive baboon) and *Chentochelys sulcata* (African spurred tortoise) are represented. Two of the three zoos had *Psittacus erithacus* (African grey parrot), *Anas platyrhynchos* (Mallard duck), *Chen caerulescens* (White geese), *Numida meleagris* (Guinea fowl), *Cercocebus torquatus* (collared mangabey), *Osteolaemus tetraspis* (dwarf crocodile), *Crocodylus niloticus* (Nile crocodile) and *Python sebae* (African rock python). These species were mostly birds, primates and reptiles. This may be because of the local abundance of these species, ease of acquisition and maintenance. Also, majority (72%) of the animals belong to the Least Concern conservation status of IUCN, followed 19% that are threatened. In a study, by the Consortium of Charitable Zoos (2007) on the IUCN status of thirteen UK Zoos a similar result was obtained as 62% of the animal species were Least Concern while 24.7% were threatened. This puts the conservation roles that zoos include as one of the core objectives into debate.

FUNAAB Zoo houses twenty-seven species of animals in captivity. Most species of animals had at least one member of its group. Ten species however had no mate. This situation is more devastating in OAU Zoo and FUTA Park where 10 of their 13 species had no mate. The implication is that the reproduction capacity of these animals' *vis a vis*, freedom to express most normal behaviour is incapacitated. In total, there were 76 individuals in the zoo. Another main issue was the pairing of animals of the

same sexes such as two males of *Hystrix cristata* in FUNAAB Zoo, and two males of *Struthio camelus* in FUTA Park. The sexes of some animals were also undefined in the zoos especially the birds and reptiles. In other words, whether or not these animals were male or female were unknown. This is highly unexpected for zoo animals as management in terms of reproduction is hampered. Further, while there were juvenile records in FUNAAB zoo as it was documented that the animals especially the primates and the ostrich have been breeding in captivity, this was not the case in FUTA Park and OAU Zoo. The earlier can be said to be propagating the zoo objective of captive breeding and enabling the functionality of the animals according to Baker (2007) and Bowkett (2009), a conservation characteristic of a modern zoo while the later were not.

Animals' enclosure sizes across the zoos were with respect to the type and requirements of the animals. It was smaller for the birds (with the exception of the larger birds such as the ostrich) and herpetes, and larger for the primates, herbivores and carnivores. Cage enrichment varies for all the animals; for example, there were inner rooms for all the primates and carnivores; hanging bars for the primates, hollow boxes for the birds, dry and wet areas for the crocodile, etc. This is in line with the goal of the modern naturalistic zoo exhibits to improve animal welfare standards through environmental enrichment and naturalistic features in order to reduce their behavioural and physiological problems, like stereotypic behaviours or obesity and nutrient deficiencies (Anderson *et al.*, 2008; Carr and Cohen, 2011). Enclosures of majority of the animals (94.5%) in the zoos were extremely smaller than the recommendations of the Central Zoo Authority (2011). Similarly, Hussain *et al.* (2015) in a study of Lahore Zoo documented that over half

(55%) of animals in the zoo had inappropriate enclosure sizes. By and large, the provision of large enclosures for animals in captivity is usually hard; given animals usually have large range and territories in the wild (Rees, 2011).

Birds were largely fed with grains once daily with the exception of the carnivorous birds that were fed with flesh once in 2 days. Some, such as the ostrich was also given compounded feed. Primates were fed with fruits in the morning and supplemented with cooked beans and corn mixture with oil in the afternoon. The carnivores were largely fed with raw meat (cow) twice weekly. The jackals in FUNAAB Zoo were fed cooked beans too. The herbivores were fed with grasses once/twice daily, while those on free range has unlimited access to grasses. It was supplemented with cooked beans for the porcupine. The herpes especially the snakes were fed with live rabbits and giant rat once in 2 or 3 weeks. The crocodiles were fed with cow/goat/sheep meat. The soft turtles were fed with the intestine of slaughtered animals and or soft meat twice/thrice weekly. The tortoises were fed with cooked beans and fruits on a daily basis. The various food given to the animals were with respect to the food the animals consume in their natural habitat. This is in accordance with EAZA (2014) and Omonona and Ayodele (2011). Feeding of animals with natural foods enhances nutrition as obtained in the natural habitat of the animals, which enhances the freedom of animals from hunger and thirst, freedom to express most normal behaviour and freedom from pain and distress. It was however observed that some animals such as primates, birds and jackals were fed with cooked food especially beans and yam. This has been a substantiated practice over the years in the zoos, with little or no complications to the animals. This however needs to be checked and reviewed. Essentially, animals should be fed their food in raw states as obtained in the wild. A notion supported by Omonona and Ayodele (2011).

Also, the feeding regime of the animals is designed to accommodate the specific natures of each animal. For example, carnivores are fed twice or thrice weekly, so as to enable adequate feeding and digestion process of the animals.

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Snakes are feed between once to twice in a month depending on the size of food given. Granivorous birds with quicker digestion process are fed twice daily, and most times there are excess in the feeding troughs so they can feed as deemed fit throughout the day. Water is also provided for the animals as appropriate. It can be said that to a large extent, animals in these zoos had adequate welfare with respect to freedom from hunger and thirst.

CONCLUSION

A total of thirty-six species of animals (131 individuals) belonging to 25 families, 15 orders, and 3 classes (Aves, Reptiles and Mammals), were presented and displayed in the three zoos. The species numbers in individual zoo were 26, 13 and 13 in FUNAAB Zoo Park, OAU Zoo and and FUTA Park respectively. Across the zoos, the most represented species were birds and primates. Majority of the animals in the zoos belong to the Least Concern conservation status of IUCN. Animal welfare in terms of freedom to express most normal behaviour was to an extent hampered in the zoos. While simulation of environments to reflect natural environments was largely done, and enclosure enrichments ensured where possible, animals were largely without mates especially in FUTA Park and OAU Zoo and enclosures were extremely smaller than standard minimum enclosure sizes. Freedom from hunger and thirst was ensured in all the zoos given adequate food and feeding regime vis a vis their natural requirements and digestion patterns. Captive breeding as a role of modern zoo was hardly practiced as most animals have not been reproducing.

Recommendation

It is important that the management of animals especially as regards animal welfare in these zoos be revised. The lack of mates for animals and confinement within unusually small enclosures are critical issues that should be looked into, as this inhibits the *ex-situ* conservation status of the zoos. Further studies, especially as regards behavior of animals in captivity and health should be carried out so as to further explore the animal welfare strategies in Nigerian zoos.

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APPENDIX

Table 1: Minimum Enclosure Size for animals in captivity

Species	Minimum size of outdoor enclosure (m ²)	Number of animals (Male: Female)	Minimum extra area per added species	AZA
Flightless birds e.g. Ostrich	500	1:1		
Pheasants	80	1:3		
Pea fowl	160	1:3		
Flying birds (single species)	80	2:2		
Flying and water birds (mixed species)	300			
Parrots, Macaws and Cockatoos	80	2:2		
Baboon and other monkeys	500	1:1	100	
Buffalo, Wild ass, Wild sheep	1500	1:1	200	
Chimpanzees, orangutans and gorilla	1000	1:1		
Deer	1000	2:3	100	
African elephant	5000	1:1		
Giraffe	1500	1:1		
Jaguar	500	1:1		
African lion	1000	1:1		
Small cats, Civets, Jackal, wild dog	400	1:1	100	
Crocodiles/Alligators	500	1:1		
Python	80			
Cobra, rat snake, vipers, sand boas	40			
Monitor lizards	80			
Water monitor lizards	80			
Chameleon and small lizards	40			
Tortoises	40	1:1		
Turtles	80	1:1		
Small aviary birds such as love birds, sparrows, budgerigar parrots	15	2:3		

Adapted from CZA, 2011