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Species Diversity Associated with Salt Lick Utilization in Borgu sector of Kainji Lake National Park, Nigeria

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ABSTRACT

Salt licks play an important role in the health of wildlife by supplying the essential minerals required especially for herbivores. This study assessed nine mineral salt lick sites, fauna utilization and tree species diversity in response to threats encountered at the site. Systematic random sampling, quadrat sampling, and transect survey were used as the methodological indices to carry out the research. The dominant tree species is *Anogeissus leiocarpus* while recessive species was *Vitellaria paradoxa*. Fauna distribution and abundance within and across mineral salt lick sites were observed. Kobs (*Kobus kob*) were the highest while Tantalus monkey (*Chlorocebus tantalus*) and Warthog (*Phacochoerus aethiopicus*) had the least encounter rate. Park management should implement conservation education, stringent policies against wildlife offences and constant surveillance to conserve biodiversity in protected ecological site. The overall benefits derived from salt licks for wildlife health, majorly through herbivores, are crucial in maintaining a healthy wildlife community for their reproduction and survival.

***Key words*:** Conservation, Biodiversity Management, Ecotourism potential, Management tool, Eco-destination, Mineral utilization, Specie Composition, Kainji Lake National Park

1. INTRODUTION

Salt licks are key places and locations for the ecological dynamics of wildlife communities in protected areas. Wildlife salt licks are generally found in large, relatively undisturbed forested areas. It provides many species of wildlife, especially herbivores beneficial health minerals for food digestion, assimilation and other body metabolisms. Salt licks occur naturally in certain locations in the forest where mineral salts are found on the

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ground surface (Lameed and Adetola, 2012). It refers to any mineral spring or ground containing salt or any other mineral of which the consumption is conducive to the health or well-being of wildlife (Wildlife Conservation Act, 2010). In simple terms, a salt lick is a natural mineral deposit area where animals visit periodically for mineral uptake; it is a mineral rich site frequently and actively visited by animals for the purpose of consuming minerals deposited through licking or geophagy. Salt licks are well-defined landscape elements present in both temperate and tropical ecosystems where species with diets based on plant materials, particularly birds and mammals, exhibit geophagical behaviours (Blake *et al*., 2010). Geophagy, consumption of soil, is a behavior common among ruminants and appears to be a strategy to address mineral deficiencies and possibly even self-medicate (Stephenson *et al*., 2011). Many animals visit salt licks to engage in geophagy, which may serve to supplement mineral intake, ease gastrointestinal issues or buffer the effects of dietary toxins. This behavior varies with the soil type of the area, seasons and among groups of animal species (Blake *et al*., 2010). Unlike carnivores that gain sodium from their prey, the intrinsically low sodium in plant tissue means phytophagous species must seek this vital nutrient elsewhere (Dudley *et al.*, 2012). As such, sodium deprivation is often considered a key driver of natural lick visitation (Bravo *et al.*, 2012), but other elements such as calcium and magnesium may also constitute visitation factors. Potentially toxic elements exist, side by side, along with essential ones in the bedrock or soils, and these toxic elements may become a direct risk for human and animal health if present in low quantities or excessive quantities in the diet (Selinus *et al.*, 2010). Although toxicities are less likely to occur than mineral deficiencies, hidden or direct effects may occur due to accumulation of toxic elements in the body organs, especially in the liver and bones following soil ingestion by animals, and through consumption of animal products, such as meat and milk by man (Crawford *et al.*, 2012). Tooth wear (Miller *et al.*, 1978), erosion of intestine lining (Miller *et al.*, 1977) and fungus containing antibiotics killing useful intestinal flora (Brewer *et al.*, 1971) are some ill effects of soil ingestion. Silica and sodium carbonate lead to kidney stones (Wheeler *et al.*, 1980). The ingestion sometimes creates mineral imbalances and toxicity (Miller *et al.*, 1978). High sodium chloride increases thirst and reduces food intake (Croom *et al.*, 1982). The seasonal incidence of lick use primarily occurs at the beginning of the rainy season, corresponding with the green flush and dietary change and the second period observed during the transition to the dry season (Henshaw and Ayeni, 1971). National parks, game reserves and other protected areas of natural habitat have been a major component of wildlife conservation with a visible network of protected areas in the continent of Africa. One of such places in Africa, where natural minerals are located within protected area, is Kainji Lake National Park, (KLNP) located in the western middle belt of Nigeria. Kainji Lake National Park is an area of high biodiversity value and includes a number of saltlick sites frequently used by different herbivores and carnivores. These sites play a critical role in the ecology and diversity of organisms utilizing them.

2. EXPERIMENTAL

2. 1. Description of study area

Kanji Lake National Park was established in 1979 by the merging of two former non-contiguous game reserves (Borgu and Zuguruma) into one entity (under decrees 46 of 29th July, 1979), later act 46 of 1999 and now CAP 65 LFN 2004.

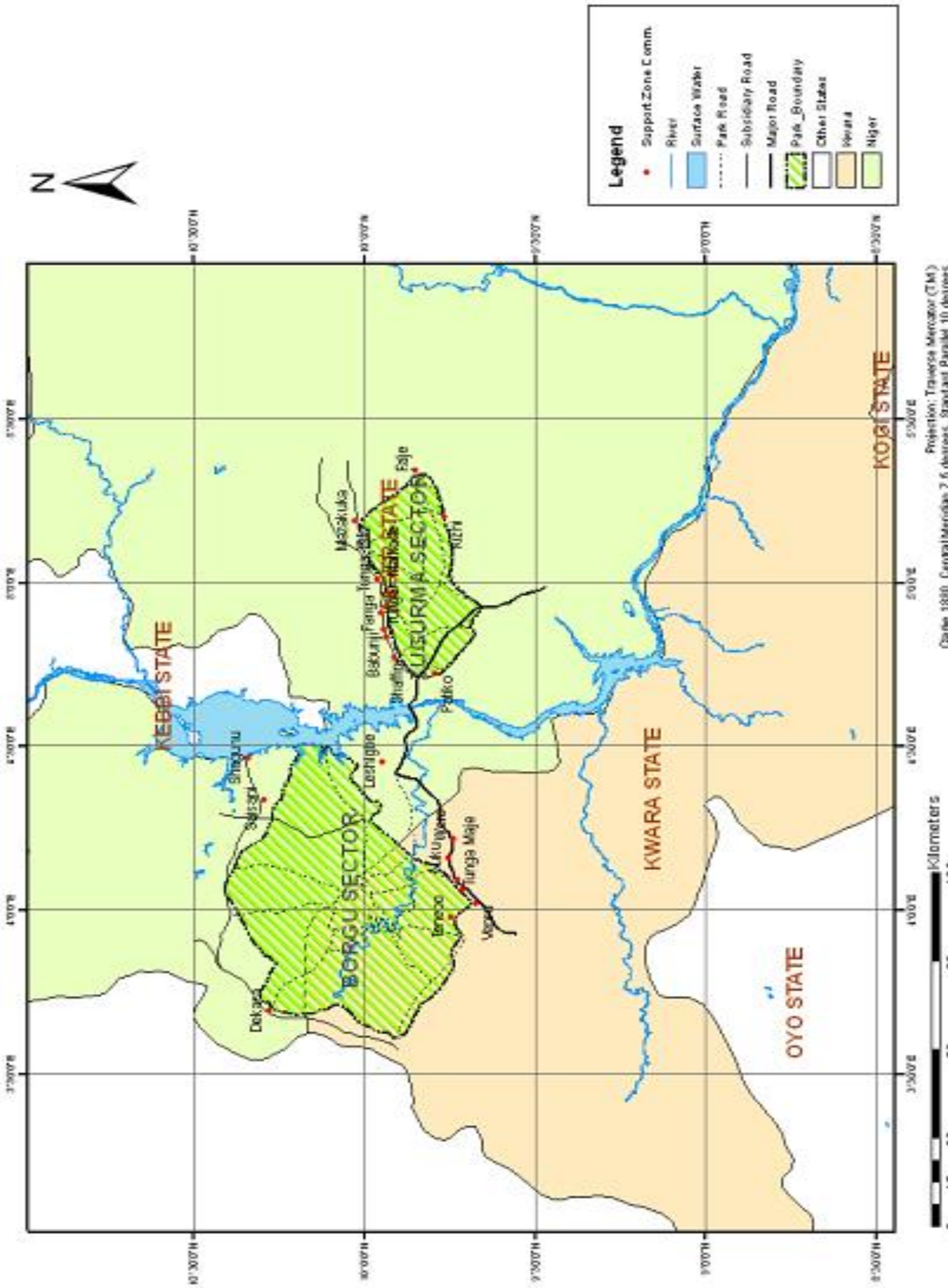

Figure 1. Map of Kainji Lake National Park showing Borgu and Zugurma Sectors

The Park is located between latitudes 09º45'N - 10º23'N and longitudes 03º40'E – 5º47'E. It covers a total area of 5,340.82 km^2 (**Figure 1**). It is made up of two non-contiguous sectors: (Borgu and Zugurma) situated in Borgu and Kaiama/Baruten Local Government areas of Niger and Kwara states, respectively. The Borgu sector covers an area of 3,970.83 km^2 (74.3%) while the Zugurma sector covers an area of 1,370 km^2 (25.7%).

Kanji Lake National Park is one of the most important National parks in Africa, with highly endowed flora and fauna resources. The objectives are to promote biodiversity conservation for sustainable development, research/scientific, cultural and historical development of the people within the support zone and the development of ecological tourism as means of recreation for mankind.

3. METHOD OF DATA COLLECTION

3. 1. Data sampling and collection

The study was undertaken in the Borgu sector of Kainji Lake National Park with a reconnaissance survey. Nine salt lick sites out of the total twenty five salt lick points within the sector were monitored for the study. The saltlick sites were selected using a systematic random sampling method at marked intervals. The sampled sites lie in five different tracks of Oli range. The vegetation assessment was carried out using 25 m × 20 m dimension for 500 m^2 areas for the tree survey. Faunas and threats posed to the sites were assessed using three predetermined transect lines (towards the North, South and West of each salt lick site). A Line transect of 1 km was established along the animal trails for direct and indirect observation.

3. 2. Data Analysis for Biodiversity Indices

Data collected from the study sites were subjected to descriptive statistics and diversity t – test. The Paleontological Statistics Software (PAST) was used to calculate the biodiversity indices. The diversity index was used to determine the richness of various species and to compare their occurrence in the study areas. Encounter was calculated for fauna species and identified threat variables in the study area. This was calculated by dividing the total number of sightings (across all sites) by the total number of kilometers walked.

Table 1. Tree species composition summary and diversity indices for the sampled sites

S/N	Species	FREQ	ABS F	RF	RD	Tot BA	RDO	IVI	P*i*
1	*Acacia brownie* (Poir.) Steud.	1	11.11	0.31	0.31	0.60	0.96	1.58	0.00
2	*Acacia gourmaensis* A Chev.	65	722.22	20.19	20.19	7.79	12.47	52.84	0.20
3	*Acacia seyal* DC	7	77.78	2.17	2.17	0.80	1.28	5.63	0.02
4	*Anogeissus leiocarpus* (DC.) Guill. & Perr.	88	977.78	27.33	27.33	19.61	31.39	86.04	0.27

5	*Bombax constatum* Pellegr. &Vuillet	1	11.11	0.31	0.31	0.47	0.76	1.38	0.00
6	*Bridelia micrantha* (Hochst.) Baill.	2	22.22	0.62	0.62	0.06	0.09	1.33	0.01
7	*Burkea africana* Hook.	2	22.22	0.62	0.62	0.29	0.47	1.71	0.01
8	*Cassia sieberiana* DC.	1	11.11	0.31	0.31	0.22	0.35	0.97	0.00
9	*Combretum fragrans* F. Hoffm.	22	244.44	6.83	6.83	4.22	6.75	20.42	0.07
10	*Combretum molle* R. Br. ex G. Don	1	11.11	0.31	0.31	0.04	0.07	0.69	0.00
11	*Combretum nigricans* Lepr. ex. Guill. & Perr.	29	322.22	9.01	9.01	2.64	4.22	22.23	0.09
12	*Crossopteryx febrifuga* (Afzel. ex G. Don) Benth.	13	144.44	4.04	4.04	3.59	5.75	13.83	0.04
13	*Daniella oliverli* (Rolfe) Hutch. Et Dalz.	1	11.11	0.31	0.31	1.79	2.86	3.48	0.00
14	*Diospyros mespilformes* Hochst. ex A. DC	26	288.89	8.07	8.07	5.18	8.30	24.45	0.08
15	*Hymenocardia acida*Tul.	1	11.11	0.31	0.31	0.17	0.28	0.90	0.00
16	*Kigelia africana* (Lam.) Benth.	1	11.11	0.31	0.31	0.43	0.70	1.32	0.00
17	*Lannea acida* A. Rich	2	22.22	0.62	0.62	0.53	0.85	2.09	0.01
18	*Maytenus senegalensis* (Lam.) Exell	8	88.89	2.48	2.48	0.51	0.82	5.79	0.02
19	*Mitragynai nermis* (Willd). Kuntze	4	44.44	1.24	1.24	1.20	1.92	4.41	0.01
20	*Pseudocedrela kotschyi* (Schweinf) Harms.	5	55.56	1.55	1.55	0.99	1.59	4.69	0.02
21	*Pterocarpus erinaceous* Poir.	2	22.22	0.62	0.62	1.00	1.60	2.84	0.01
22	*Stereospermum kunthianum* Cham.	2	22.22	0.62	0.62	0.52	0.83	2.07	0.01
23	*Tamarindus indica* L.	28	311.11	8.70	8.70	9.00	14.41	31.80	0.09
24	*Terminalia albida* Scott-Elliot	2	22.22	0.62	0.62	0.18	0.29	1.54	0.01
25	*Terminalia glaucescens* Planch. Ex Benth.	1	11.11	0.31	0.31	0.03	0.05	0.67	0.00
26	*Vitellaria paradoxa* C.F. Gaertn.	7	77.78	2.17	2.17	0.60	0.96	5.30	0.02
	Total	322	3577.78	100.00	100.00	62.47	100.00	300.00	1.00

Table 2. Observation of fauna diversity across all sampled sites

S/N	Common Names	Scientific Names	Direct Observation	Indirect Observation	Index of observation
1	Buffalo	*Syncerus caffer*	-	+	Sight/ faecal dropping/ footprint
2	Bush Buck	*Tragelaphus scriptus*	+	-	Sight
3	Guinea fowl	*Numida meleagris*	-	+	Feathers
4	Hippopotamus	*Hippopotamus amphibious*	-	+	Faecal dropping
5	Kob	*Kobus kob*	+	+	Sight/faecal dropping/ footprint
6	Lion	*Panthera leo*	-	+	Remnant
7	Maxwell duiker	*Philantomba maxwelli*	+	-	Faecal dropping
8	Red flanked duiker	*Cephalophus rufilatus*	+	-	Footprint
9	Roan Antelope	*Hippotragnus equines*	+	-	Sight
10	Stone partridge	*Ptilopachus petrosus*	+	-	Sight
11	Tantalus Monkey	*Chlorocebus tantalus*	+	-	Sight
12	Warthog	*Phacochoerus aethiopicus*	+	-	Sight
13	Western Hartebeest	*Alcelaphus buselaphus*	+	-	Sight

Table 3. Summary of fauna species composition across all sampled salt licks sites

S/N	Common Name	Scientific Name	Families	No of sightings	% of sightings	Encounter rate
1	Western Hartebeest	*Alcelaphus buselaphus*	Bovidae	35	8.73	0.32
2	Roan Antelope	*Hippotragus equinus*	Bovidae	64	15.96	0.59
3	Bush Buck	*Tragelaphus scriptus*	Bovidae	22	5.49	0.2
4	Kob	*Kobuskob*	Bovidae	162	40.4	1.5

5	Warthog	*Phacochoerus africanus*	Suidae	8	2	0.07
6	Tantalus Monkey	*Chlorocebus tantalus*	Cercopithecidae	1	0.25	0.009
7	Baboon	*Papio Anubis*	Cercopithecidae	72	17.96	0.67
8	Red flanked duiker	*Cephalophus rufilatus*	Bovidae	37	9.23	0.34

3. RESULT

The study composition of the flora species shows that *Anogeissus leiocarpus* (88%) has the highest frequency, followed by *Acacia gourmaensis* (65%), while others are equally represented (**Table 1**). Observation of fauna composition across the sampled site revealed abundance of the fauna diversities within the park and index of their observation shows that Buffalo *Syncerus caffer and Kobus kob* are majorly has pronounce observation index while others are equally represented **Table 2**. The encounter rate, number of sightings and percentage of sightings of fauna species across all sampled salt lick sites is as equally in **Table 3**.

4. DISCUSSION

The sampled sites fall within five different tracks with varying distances to jeep track and river Oli, as presented in Table 1. A total of count of three hundred and twenty-two species (322) were identified during the period of study across all sites. The highest relative density was also calculated for *Anogeissus leiocarpus*, while the least is *Acacia brownie*, *Combretum nigricans, Cassia siberiana, Terminalia glaucescens, Bombax constatum. Anogeissus leiocarpus* and was observed to be the most abundant across all saltlick sites with its frequency, absolute frequency, relative dominance, relative frequency, total basal area, important value index and relative abundance outrageously greater than every other species, as presented in Table 1. The observation of fauna species across the sampled site is summarized in Table 2. The indices of observation recorded include footprint, carcass (Lion’s remnant), faecal droppings, feathers and direct sightings.

The encounter rate, number of sightings and percentage of sightings of fauna species across all sampled salt lick sites are, as presented in Table 3. Kob (*Kobuskob*) has the highest number of sightings (162) with an encounter rate of 1.5, which implies that 1.5 individuals of Kob would be sighted at every kilometer walked in each salt lick site. Tantalus monkey (*Chlorocebus tantalus*) has the lowest number of sighting (1) with an encounter rate of 0.09, implying that 0.09 individual of Tantalus monkey would be sighted at every kilometer walked in each salt lick site. It can be summarized that Kobs would be sighted at each salt lick sites, while Tantalus monkey may not be encountered at all. Animal census and monitoring of species diversity in the park reported that Kobs are abundant and this evidence is provided with the calculated encounter rate. It was found that the salt lick utilization by Kobs signifies nutritional supplement and as well promotes game viewing of the species for its eco-touristic values. Warthogs and Tantalus species of monkey are usually preyed upon in the park during the study, this driver of illegal warthog hunting accounts for the low rate of encounter across the salt lick sites. The identified types of threat across all saltlick sites and the rate of encounter were observed. SN (Snares), SC (Spent Catridges), (Carnivores remnant), HF (Hunters footprints), IH (Individual hunters) were encountered. The highest level of encounter was recorded for spent cartridges implying high rate of poaching activities at the salt lick sites. The use of snares in hunting for animals by poachers is recorded high, due to their knowledge of these locations of convergence by animals which they strategically use in hunting a variety of them while carnivores' remnant presented the lowest encounter rate. The potential of saltlick sites is, however, at its brim due to uncontrolled anthropogenic activities rendering these ecologically important locations denatured.

5. CONCLUSIONS

Biodiversity has an impact on human survival, economic well-being and its ecosystem functional stability. As a part of effort to have sustainable management strategies instituted successfully, it is vital to know, understand the structure and composition of ecologically important habitats. The study has highlights with a high encounter rate of illegal variables on fauna compares to flora findings. The infiltration of anthropogenic activities has restricted the utilization of the saltlicks by a wide range of species, due to hunting exhibition of poachers. The frequency and pattern of usage by a variety of Endangered and Vulnerable species, regardless of the prospective dangers associated with its utilization, demonstrates the significance of the saltlicks and highlights the need to focus conservation efforts on their protection.

Recommendations

Summarily, one of the main objectives for the establishment of National parks is to conserve biodiversity. The areas sampled provided a baseline data indicating that the sector of the park is still behind the satisfactory level in terms of protection. Based on the findings of the study, following recommendations are made:

A) There is need for effective and holistic conservation and management policy enforcement to prevent habitat destruction through anthropogenic activities.

B) Illegal burning should be discouraged and controlled burning promoted to increase palatability of fresh grasses for the herbivores utilizing the salt licks in the park.

C) Managers of parks pay special attention to saltlick sites to promote ecotourism and species diversity.

D) Accessibility to tracks leading to saltlick sites should be reconstructed for further enhancement of ecotourism values of the park.

E) There is need to increase legal protection by the park management through a well-designed management practices for conservation development of the biodiversity resources.

F) Awareness through conservation education should be encouraged among local people on biodiversity management to reduce conflict between park management and host community.

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