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Research Article

Assessment of Ecological and Conservation Impacts of Wildlife Exploitations as Bushmeat in Lokoja Forest Area, Kogi State, Nigeria

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Abstract

Background and Objective: More recently, wildlife exploitation as bushmeat and other by-products have been recognized as having serious impacts in the ecosystem with the impact more pronounced in the Savannah biomes. This high exploitation of wildlife resources is done without considering their conservation and as such leads to extinction of these animals in the wild. This study was carried out to determine the level of exploitation of wildlife as bushmeat and how this could be a threat to the ecosystem of the area.

Materials and Methods: A survey of wildlife use as bushmeat in Lokoja Government Area of Kogi state was carried. The study was aimed at documenting the species of wildlife exploited for bushmeat and the danger to conservation. Visits were made to local markets, villages, roadsides and bushmeat traders within Lokoja Local Government. Data was collected through visual observation and identification of encountered species, questionnaires and oral interviews with 60 respondents. **Results:** The result showed 19 animal species being exploited for bushmeat. The most exploited species were *Hippopotamus* with 103 individuals followed by giant snails with the total of 95 individuals and *Civettictis civetta* was the lowest with 7 individuals. The month of April had the highest exploitation rate with 357 individuals, while May had the least exploitation rate with 158 individuals. Shannon-Wiener diversity index for the month of March was the highest ($H' = 1.1626$) followed by April with $H' = 1.116$. **Conclusion:** The study observed high rate of exploitation of wild animals for bushmeat in the area which is a threat to conservation if actions are not put in place to reduce the exploitation.

Key words: Bushmeat, exploitation, conservation, tradition, hunter, lokoja

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Bushmeat is one of the most valuable tropical forest products after timber. It is widely consumed in both urban and rural areas as it is an important source of protein¹ and also sold commercially. Animal parts are used in traditional medicine, which form an important component of healthcare delivery programmes². It has been opined that with increase in human population, extraction of bushmeat directly increase due to increase demand². More recently, wildlife exploitation as bushmeat and other by-products have been recognized as having serious impacts in the Savannah biomes³. Illegal hunting is typically conducted by young men using one or a combination of snares, traps, various types of firearms, dogs and bush burning to obtain meat for consumption or sale^{4,5}. Illegal hunting is conducted on a continuum from that done merely to generate meat for subsistence and for local trade, that done for trade to urban centers and in some cases for trade to international cities³. There is a high exploitation of wildlife resources without considering their conservation and as such leads to extinction of these animals in the wild^{6,7}. The loss of wildlife threaten the livelihood and food security of those who depend on it as a staple or supplement to their diet⁸ and has also pose a significant threat to sciences as they are unique to sciences. It has been opined that we are approaching a period of mass extinctions and man is gravely responsible². This is due to the level of extraction, industrialization and the quest for survival. 'Empty Savannah syndrome' is becoming a reality, with the rise of commercial bushmeat trade from Savannah habitats in Africa². In most areas, bushmeat consumption exceeds the recommended value of 22 kg per capita by the Food and Agriculture Organization⁹. In Nigeria, the consumption of bushmeat is fast becoming an inseparable delicacy from the diet of all classes of people¹⁰, thereby causing rapid depletion of wildlife population. If this trend keeps rising, the wildlife soon loses its value in the place of tourism, education and cultural heritage. It has also been observed that majority of people are more interested in what to consume than what to conserve, with pressure on bushmeat, while the situation is worsen by poverty due to the present economic condition in most developing countries¹⁰. As a result of the present economic meltdown and socio-inequality experience in our society today, bushmeat is now the last resort to the common man in rural areas and a dynamic source of protein for individuals in the urban areas. Creating alternative livelihood options and exploring options for producing alternative sources of protein have potential to reduce reliance of local people on exploiting wildlife populations to survive and could help to improve standards of living¹¹.

Bushmeat may have some 'magic' connotations, at least in remote villages. For instance, in the villages of Boje and Nsadop (northern Cross River state, Nigeria) the palm Civet (*Nandinia binotata*) is consumed as a ju-ju food before fights or local wars because it is considered to favour good luck during combats¹². Although, bushmeat undoubtedly retains a deep cultural relevance for local communities in many areas of west Africa, its cultural importance is been nowadays decreasing substantially in the economically wealthier and more developed areas. Restoration of such cultural beliefs will save the remnants to some extent.

The commercial trade of bushmeat is not in itself bad but, it become an issue for concern when it is been over exploited without considering its later effect which when not address could drive wildlife into extinction¹³. Each animal in a habitat has a specific role it plays and the extinction of a particular species can have immediate or future consequence on the natural characteristics of an area². The ecosystem imbalance is one of the consequences of uncontrolled hunting of animal for bushmeat. Animals form important component of the ecosystem chain, each animal has its ecological niche, an injury or accident to one component translates to disruption of the whole ecological functions. Bushmeat carcass supply is nothing, but removing critical component of nature, a lot of scientific discovery have been made studying the animal in their habitat. Bushmeat carcass supply could exterminate the wildlife, this mean whatever man stand to learn from the animal is lost for life. The consequence of this action is retardation of some scientific discovery. It has been reported that most people involved in the bushmeat trade are either ignorant or less informed about matters related to biodiversity loss and endangered species².

Although, data exists on wildlife exploitation in some parts of the country, such information is a gap in Kogi state. This research will not only show the rate of exploitation of the wildlife resources, but also provide a preliminary checklist of the animal species composition remaining in the area. The outcome of this work may trigger conservation strategy that will shift from quantifying the problems to constructing and installing solutions. This study, therefore, aimed at assessing the wildlife species exploited as bushmeat in Lokoja Local Government Area, Kogi state, Nigeria.

MATERIALS AND METHODS

Study site: The study was conducted in Lokoja Local Government Area of Kogi state. Lokoja lies at 07.8023°N of the equator and 06.7333° E of the Meridian between March-May,

2018. The town is situated in tropical wet and dry Savanna climate zone of Nigeria and the temperature remains hot all year round.

Sample collection

Determination of species diversity and abundance: Species composition and abundance were determined according to the methods used by Tanko *et al.*². Two methods were used to collect data; primary source and the secondary source. The primary source involved visits to areas where bushmeat are processed and sold. Areas such as; Bushmeat markets, general markets, roadsides and hunter's houses were selected and visited twice a month for 3 months (March-May, 2018). Visual observations of processed animals on display, animals waste, remains, feathers, hooves and horns were done at the site. Photographs of sighted samples were taken with the aid of digital Sony Camera model Wx9, 516079. During these visits, animals displayed were observed to identify them to species level. Parts such as; the head, horns, legs/feet, skins and faeces were used to identify the animals already skinned or processed for bushmeat. Those animals which could not be identified in the field were photograph for further authentication of the identification.

The secondary source of data by involved the use of oral interview with stakeholders using a pre-planned questionnaire. On each visit, 10 respondents were randomly chosen making a total of 60 respondents.

Hunters were also interviewed to know the hunting gadgets used. Houses of hunters were visited to survey animals which they normally keep as records of their successes and trophies.

Assessments of traditional beliefs associated with wildlife: A designed questionnaire was used to obtain information from hunters and other people on the traditional beliefs attached to certain species that could encourage or deter the exploitation of the species. This was to assess the role traditional beliefs could play in wildlife conservation.

Statistical analysis: Diversity indices were analyzed by using Shannon wiener diversity index and evenness of distribution. Shannon-Wiener diversity index was computed using the formula:

$$H' = -\sum p_i \ln p_i$$

Where:

H' = Shannon wiener index

Pi = Number of individuals species divided by the total number of species encountered

Ln = Natural Log of Pi

The evenness of species was determined by using the formula:

$$E_H = H'/\ln S$$

Where:

H = Shannon-Wiener index

LnS = Natural log of number of species encountered

RESULTS

Wildlife species composition and abundance: Table 1 is a checklist of animal species composition exploited as bushmeat in Lokoja. There were 19 animal species from 18 families. Roan Antelope with 103 encountered rates were the most exploited followed by giant snail with 95 individuals encountered during the 3 months study. The least exploited was African Civet Cat. Comparing the encountered rate between the three months, April had the highest total individuals (375) followed by March (275), while May with 158 individuals was the least. Roan Antelope, Grass cutter, Porcupine, Nile Monitor Lizard, Helmeted Guinea Fowl, African Giant Rat, Warthog, Tantalus Monkey, Double-Spurred Francolin, Rock Python and Bat were more exploited in April than in March and May. On the other hand African Savanna Hare, Squirrel and African Civet Cat were more exploited in March. Table 1 also showed the comparative diversity indices of the animal species composition and diversity.

Species richness were highest in March and May with 19 species each. Shannon-Wiener diversity index and equitability had their highest values in March (1.1626 and 0.90913, respectively) followed by April (1.1161 and 0.88913, respectively), while May had the least (1.0597 and 0.82871, respectively). Figure 1-4 is pictorial display of some species of animals being exploited in Lokoja as observed during the survey.

Demographic information from the secondary data: Out of the 60 respondents, 27 were hunters, 25 were marketers and 8 roadside traders and elderly people. The hunters were all males of different ages and status. Five out of the 27 hunters



Fig. 1(a-b): Processed meat of (a) Grasscutter and monitor lizard and (b) Guinea fowl along Karara road side

Table1: A checklist of wildlife species composition exploited as bushmeat in Lokoja and the monthly exploitation rate during the study

Family	Common names	Scientific names	March	April	May	Total
Bovidae	Roan antelope	<i>Hippo tragus equinus</i>	37	46	20	103
Thryonomyidae	Grasscutter	<i>Thryonomys swinderianus</i>	28	40	15	83
Histricidae	Porcupine	<i>Histrix cristata</i>	16	18	6	40
Varanidae	Nile Monitor Lizard	<i>Varanus niloticus</i>	32	33	20	85
Canidae	Fox	<i>Vulpes pallidoharteri</i>	7	2	1	10
Erinaceidae	Hedgehog	<i>Atelerix albiventrix</i>	2	4	2	8
Phasiadidae	Helmeted-guinea Fowl	<i>Numidia meleagris</i>	10	38	5	53
Phasianidae	Doubled-spurred Francolin	<i>Francolinus bicalcaratus</i>	3	15	1	19
Nesomyidae	Giant African Rat	<i>Cricetomys gambianus</i>	15	33	5	53
Suidae	Warthog	<i>Phacochoerus africanus</i>	22	38	8	68
Cercopithecidae	Tantalus Monkey	<i>Cercopithecus tantalus</i>	20	21	10	51
Leporidae	African Savana Hare	<i>Lepus microtis</i>	5	1	3	9
Manidae	Long-tailed Pangolin	<i>Manis tricuspis</i>	8	10	3	21
Boidae	Rock Python	<i>Python sabae</i>	8	9	1	18
Helicidae	Giant Snail	<i>Helix aspersa</i>	30	25	40	95
Viverridae	African Civet Cat	<i>Civettictis civetta</i>	5	1	1	7
Crocodylidae	Crocodile	<i>Crocodilus niloticus</i>	2	3	3	8
Sciuridae	Squirrel	<i>Sciurus carolinensis</i>	10	0	4	14
Molossidae	Bat	<i>Chaerephon nigeriae</i>	15	20	10	45
Total =18		19				
Species richness (S)			19	18	19	
Shannon-wiener index (H')			1.162	1.116	1.059	
Equitability			0.909	0.889	0.828	

were having a tertiary school certificates. On the marketers, 15 were wholesalers who purchased the animals directly from the hunters, 5 were retailers who buy in small quantity for their use as pepper soup business, while 3 were buying for their consumption and 2 were buying for medicinal purposes.

Traditional beliefs and wildlife exploitation: Traditional beliefs were found to play a significance role in wildlife exploitation. Some animals like monkey, bush pig and monitor

lizard are strongly discouraged by some communities within the local government, because of the general beliefs that they are unclean animals. Women in some of the communities were said to have been forbidden from eating certain animals like; reptiles and monkeys. The royal python was said to be respected by certain communities and they would not killed it if seen. The Nile monitor lizard, some aquatic reptiles and the catfish were believed to be responsible for retention of water in some pools/streams that holds water year round for the use



Fig. 2(a-d): Species of, (a) Grasscutter, (b) Civet cat, (c) Nile monitor lizard and (d) Log-tailed pangolin



Fig. 3(a-b): (a) Tantalus monkey and (b) Roan antelope at international market, Lokoja



Fig. 4: Royal python at International market, Lokoja

of the community and so the community will not allowed hunting of such animals in the pools.

Assessment of hunting gadgets: The hunting gadgets used by hunter's ranges from baits, traps, snares, cutlasses, ground digging, to sophisticated guns and trained dogs.

DISCUSSION

The level of exploitation in the area was rated to be very high. Clear evidence and wide spread scientific census indicated that the impact of bushmeat hunting in Africa have accelerated over the last few decades¹⁴. If conservation strategies are not put in place this will pose a threat in the nearby future². Highly hunted species have been reported to be depleting greatly in terms of population². Hunting and trading of bushmeat in the Local Government Area may be attributed to lack of alternative means of livelihood as opined¹⁵.

Although, bushmeat plays a very important role in the life of individuals, if it is not done with conservation consciousness may lead to local extinction of some species. The study discovered over exploitation of some species such as; *Hippo tragus equinus*, *Thryonomys swinderanus* and *Phacochoerus africanus*. The over exploitation may lead these species into local extinction/extirpation in no distant time. Tanko *et al.*² made a similar observation on *H. cristata*, *P. porcus* and *T. Swinderianus* at Chikun Local Government Area of Kaduna state. The findings of this research supported the previous works about bushmeat extraction in eastern Nigeria¹⁶. Killing of young animals and pregnant females as observed in this study is a clear indication that most of the hunters do not know the impact this could pose to their hunting business in the future. This was similar to the findings of Tanko *et al.*². The need for enforcement of conservation laws and public enlightenment cannot be over emphasized. It has been observed² that the meat of these species has short shelf life and hunters may end up discarding the product as a result of spoilage if not utilized within few days. Sensitization of the hunters was recommended as the best way to reduce the rate of exploitation in the area².

Most of the hunters engaged in hunting probably due to lack of alternative means of livelihood. Fa *et al.*¹⁴ attributed the high exploitation of bushmeat as direct and indirect consequences of human population growth. There should be more job creation for this youths alongside training and engagements in modern agricultural practices of the current administration. This will not only be a detractor, but will reduce the poverty rate in the area. Antelopes were highly exploited in the area probably because of their availability in the area. This is contrary to the findings at Cross-Sunaga rivers region in Nigeria where brush-tailed porcupine was the most exploited species¹⁶. This is an indication that antelopes are still available in the region. Fa *et al.*¹⁶ advanced same reason for the high exploitation of the brush-tailed porcupine at Cross-Sunaga rivers region.

Traditional beliefs were identified as a major tool that could be used to reduce the over-exploitation of wildlife in the area if properly enforce. Although, traditional beliefs play a pivotal role most especially in Africa where it is highly respected, today, traditional beliefs are gradually losing their value. With beliefs attached to certain animals in the region the exploitation of these species should have reduced. However, they are still being hunted and sold in the open markets without the traditional consequences on violators being enforced. Some of the customers who were interviewed attested that some of the animals they eat are traditionally not allowed in their home town, but they eat them in the city. Also, wildlife like snakes, tortoise and birds are secretly use for traditional medicine which invariably heightens their exploitation. Restoration of these traditional beliefs and the enforcement of consequences of violation on violators could play a vital role in reducing the rate of exploitation.

The progressive sharp decreased in diversity indices from the month of March through May was probably associated with the period of peak of dry season activities in March which is a period that most farmers depend solely on hunting as the means of livelihood since most are wet season farmers. Also, in March most hunters used bush burning to flush out games and enhance visibility. The month of April had a greater number of encountered rate than March and May. This may be due to low patronage by customers in the month of March which led to the accumulation of the products in April. Catchability dropped in May probably due to commencement of the raining season. This makes the animals to spread out because of increase in resources. Spreading out reduced the chances of being met in a group which will exposed the animals to the hunter. Also, at this period most of the part-time hunters most have gone back to farms.

CONCLUSION

It can be concluded that loss of species or even loss of genetic diversity within a species, is the loss forever of a potential opportunity to improve human welfare. At the present rate of uncontrolled exploitation of wild animal for bushmeat, it is unarguable that in no distant time uncommon species of wildlife in Lokoja Local Government Area will become extinct locally. To prevent this avoidable environmental catastrophe it is recommended that animals classified as vulnerable, critically endangered and highly threatened by International Union of Conservation of Nature (IUCN) should be made known to the hunters through enlightenment campaign and the consequences of killing any of the animal in that category.

SIGNIFICANCE STATEMENT

The study discovered the wildlife species diversity exploited for bushmeat in the area. The study also identified some religious and traditional belief associated with wild animals in the region. Hunting gadgets, sex and age group of individuals involved in the exploitation were also identified. This information can be beneficial in designing any conservation and management plan by the government and environmental conservation organizations. This study has helped the researchers to uncover the critical areas of bushmeat exploitation in Lokoja that many researchers were not able to explore. Thus, a new conservation approach involving the restoration of traditional and religious beliefs in the area may design to reduce the exploitation rate in the area.

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