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Evaluation of Factors Predisposing Primates to conflict in Kainji Lake National Park, Nigeria

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Abstract

The study evaluated the causes of human-primate conflicts in Kainji Lake National park, Nigeria. Information on the causes of human-primate conflicts was obtained with the use of a structured questionnaire. Measurement of distances and size of farmlands (maximum of 16) at 8 locations closest to the park boundary and enumeration of the number of crop damage constituted the direct method of data collection. Descriptive statistics and Chi-square test analyses were adopted to reveal the opinions of respondents for significant differences in causes of human-primate conflict. The Completely Randomised Design (CRD) was further used in comparing factors that predisposed primates to crop damage. The results revealed 63.7% of farmlands were within 500m of the park boundaries and 15.2% were located within less than 1km of the park boundaries. The causes of crop damage include the proximity of farmlands to the park (47.5%), availability of preferred food (34.0%), and the number of standing crops (17.8%). Chi-square tests revealed that the opinions of respondents $P < 0.05$. The vulnerability factor of the proximity of farmlands to park boundaries was significantly ($P<0.05$) higher than other factors, with the Ibbi range having the least distance (18.5 ± 6.5m). Crop damage was significantly ($P<0.05$) higher (4000 ± 1000) in Kali than in any other range. The study established the proximity of farmlands to the park cutlines and the number of standing crops as the major causes of human-primate species conflict in the study area. The park management should articulate programs that could persuade the farmers to relocate their farms to distances that cannot be reached by primate species, at least more than 1km from the park boundaries.

Keywords: Primates, predisposing factors, human-primate conflicts, crop damage

Introduction

Habitat domination by humans and the concomitant compression, fragmentation, and conversion of primate habitats are the major driving forces behind human-primate conflict and one of the greatest threats to primate survival (Strum, 2010, Wahab *et al.,* 2021). Resolving the human-great-ape conflict is a conservation imperative because these species are amongst the most threatened on earth. They can cause substantial economic loss to farmers through crop raiding. Their high visibility in farms may distort the perceived damage caused. These attributes cause people to be fearful of them. They are killed by farmers in retribution for crop raiding (Reynolds, 2006). Their varied diet makes it difficult for farmers to protect crops with a single strategy and their advanced intelligence means that they can quickly learn how to circumvent mitigation strategies (Campbell-Smith *et al.,* 2012). The most significant contributing factor to the development of raiding is the dramatic reduction in natural food available to wildlife because of agricultural settlement. Farmers planting and growing patterns subsequently make food available to wildlife, especially during times of natural food scarcity (Lee and Priston, 2005). Crop raiding certainly intensifies when natural forage is limited (Lemessa *et al.,* 2013) and raiding intensity has also been linked to peaks in crop production, occasionally despite natural food availability (Campbell-Smith *et al.,* 2010). Crop raiding is therefore an adaptation by wildlife to both natural habitat loss and increased availability of alternative food resources (Hockings *et al.,* 2009). Natural food availability and peaks in crop production, and several other factors affect the frequency. These include the species involved (Nijman and Nekaris, 2010), farm location and size, crop type, number of neighboring farms, surrounding land use, and mitigation methods employed by the farmers (Lee and Priston, 2005).

The Study Area

Location of the Study area

Kainji Lake National Park (KLNP) is geographically located between Latitudes 9º 40'and 10º 20' N, and Longitude 3º 40' and 5º10'E. The study area (KLNP) which has a savannah climate has a total area of 5,340.82 sq km and is located in the North West central part of Nigeria between Niger and Kwara States. The area has two distinctive sectors known as the Borgu and Zugurma Sectors (Marguba, 2002). Kainji Lake National Park was established as Premier Park in Nigeria on 29th July 1979 by the amalgamation of the two existing Game Reserves, Borgu and Zugurma sectors under decree 46 of 1976 replaced by decree 36 of 1991. Zugurma Sector covers an area of

1370.89km2 and it is situated in Mashegu Local Government Area of Niger State while the Borgu sector is located in Borgu Local Government Area of Niger State in Kaiama and Barutten Local Government Areas of Kwara state. It covers an area of 3970.02sqkm. Both sectors (Zugurma and Borgu) are separated by the Kainji Lake, a lake impounded on the river Niger for hydroelectric power generation (Eleazor, 2002).

Sampling and Data Collection

Sampling Technique

A purposive sampling technique was used in data collection. This involved the selection of communities with a serious presence of human-primate conflict in the study area. A total of ten communities having serious human-primate conflict were identified and selected. The communities included Mazakuaka, Felegi, Patiko, Woko, Worumakoto, Kemanji, Luma, Kulho, Ibbi, and Dekara. A simple random sampling technique was then applied to select respondents from each community. The respondents included farmers, civil servants, traders, students, pastoralists, and hunters. The number of respondents selected in each community shown in (Table 1) was determined using the probability proportional formula as adopted by Amaja *et al.*, (2016). The formula is stated as follows;

$$n = \frac{Z^2 PQ / d^2}{1 + \frac{1}{N}\left[\frac{Z\frac{\alpha^2}{2}PQ}{d^2} - 1\right]}$$

Where:

n = desired sample size when population is less than 10000

Z =standard normal deviation (1.96 for 95% confidence level)

P = 0.1 (proportion of population to be included in sample, that is, 10%)

Q = is 1-P, that is, (0.9)

N= is the total number of the population and

d = is a degree of accuracy desired (0.05)

Distances and size of farmlands (maximum of 16) at 8 (ranges/areas) locations closest to the park boundary at both sectors of the park were measured and the number of crop damage and the number of standing crops were enumerated and their relationship to crop damage intensity was determined.

Table 1: Number of Respondents randomly selected from each community

Community	Population	Number of respondents sampled
Mazakuka	150	15
Feleji	200	20
Patiko	149	15
Woko	150	15
Worumakoto	200	20
Kemanji	499	50
Luma	500	50
Kulho	350	35
Ibbi	530	53
Dekara	300	30
Total	3028	303

Source: KLNP office (2019)

Data analysis

Questionnaires data were analyzed using SPSS version 20 software and MS Excel; Accordingly, descriptive statistics in form of frequency analysis, cross-tabulation, and percentages were used for the analysis of the vulnerable factors that increase conflict and crop losses associated with primate crop damage. A Chi-square test analysis was adopted to reveal the opinions of respondents for significant differences. The one-way classification analysis or Completely Randomised Design (CRD) was adopted to compare the variation in crop damage intensity among some indicators of the vulnerability of primates to crop damage.

Results

Table 2 presents the distances of farmlands to the park boundaries. About 63.7% of farmlands were within 500m of the park boundaries with another 21.1% within 1 km of the park boundaries. About 15.2% of the farmlands were located within less than 1km of the park boundaries.

Table 2. Distances between the park boundary and farms in the study area

Distance	Frequency	Percentage (%)	P
<500 m	193	63.7	0.00
1 km	64	21.1	
> 1 km	46	15.2	
Total	303	100	

α = 005

Source: Field survey (2019)

Table 3 presents some of the factors pre-disposing primates to conflicts and crop damage. About 47.5% of the farmers indicated that the proximity of the farmlands to the park is one of the key factors responsible for the crop losses as a result of primate invasions. About 34.0% were of the opinion that the availability of preferred food attracts primates to the farms, while 17.8% attributed vulnerability to the conflict to the number of standing crops. About 0.7% indicated that farm size caused primate vulnerability to crop damage. Chi-square tests revealed that the opinions of respondents $P < 0.05$.

Table 3 Factors of vulnerability to primate species attacks

Factors	**Frequency**	**Percentage (%)**	**P**
Proximity to park	144	47.5	0.00
Availability of preferred food	103	34.0	
Number of standing crop	54	17.8	
Farm size	2	0.7	
Total	303	100	

α = 005

Source: Field survey (2019)

The results of mean separations for the ANOVA concerning farm distance to park boundaries showed that all ranges were significantly different ($P < 0.05$) from one another with Kali Range being the farthest to the farmlands in all its boundaries (5340 ± 500 m). The most vulnerable area is the Ibbi Range with a mean distance of 18.5 ± 6.5 m between farmlands and park boundaries. The number of standing crops damaged was more in the Kali range with a mean of 4000 ±s 1000, and least in Doro Range with a mean of 57.5 ± 7.5. Doro, Ibbi, Kuble, and Kulho Ranges were not significantly different ($P < 0.05$) in terms of the number of standing crops damaged on farmlands. They were however significantly different ($P < 0.05$) with Kali, Kemanji, and Worumakoto Ranges. Kali, Kemanji, and Worumakoto were however significantly different from one another in terms of the number of standing crops damaged. Details of the mean separation (LSD) results are shown in Table 4.

Table 4. LSD results for predisposing factors assessment

Range	Farm distance to park (m)	Farm size (acre)	Number of standing Crops damaged	Number of Standing crops
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
Doro	1280 ± 90^{a}	2.5 ± 0.5^{a}	57.5 ± 7.5^{a}	14000 ± 4000^{ab}
Ibbi	18.5 ± 6.5^{b}	3.0 ± 2.0^{a}	100 ± 50^{a}	2750 ± 2250^{a}
Kali	5340 ± 500^{c}	5.5 ± 0.5^{a}	4000 ± 1000^{b}	40000 ± 10000^{b}
Kemanji	1503.3 ± 622.9^{d}	2.833 ± 2.75^{a}	1200 ± 984^{c}	26433 ± 30190^{ab}
Kuble	3585 ± 85^{e}	2.0 ± 0.0^{a}	175 ± 75^{a}	8750 ± 1250^{a}
Kulho	1665 ± 5^{e}	2.0 ± 0.0^{a}	225 ± 25^{a}	1750 ± 250^{a}
Worumakoto	129.5 ± 106.5^{f}	4.5 ± 1.5^{a}	1150 ± 350^{c}	30000 ± 10000^{b}

Source: Field survey (2019)

N.B. Means with the same alphabets as superscripts in each column are not significantly different

Discussion

The study showed that many factors predisposed primates to conflicts and crop damage in the study area. The majority of the respondents (47.5%) indicated that the proximity of the farmlands to the park is one of the key factors responsible for the crop losses as a result of primate invasions. This opinion agrees with Wallace and Hill's (2012) report that the distance of farmland from the forest edge is directly related to human-wildlife conflict. In addition, Datiko and Bekele (2013) reported that people who live close to or near the park area generally faced more problems of human-primate conflict than those living far from the park. Other causes of crop raiding as indicated by the respondents (34.0%) include the availability of preferred food close to the cutline of the park while 17.8% of the respondents believed that standing crops were another factor that causes vulnerability to conflict. The synchronicity in planting and ripening of maize, millet, and sorghum results in peaks in the availability of preferred food. The primates responded similarly to these peaks by leaving forests to raid field crops such as maize. Noughton-Travse (1998) reported that the abundance of forest fruits did not diminish the primate appetite for maize. Furthermore, Conover (1994) observed that wildlife raids crops whenever preferred crops are available because they are more palatable and nutritious than wild foods. Primates' preference for maize may be due

to its elevated protein content (dry matter of cob = 12% protein) as reported by Osborn (1993). He further observed that primates exhibit similar patterns in foraging on highly seasonal grain crops such as millet. In respect of standing cropsNijman and Nekaris (2010) reported that farm location and size and the number of standing crops, affect the frequency, duration, and type of crop raids, and therefore the extent of damage sustained. Although primate crop-raiding behavior is often considered context-dependent, it is unlikely that vulnerability indicators contribute equally to crop loss during a raid. Three parameters: (i) Farm distance to the park, (ii) Farm size, and (iii) the number of standing crops damaged were further investigated as causes of crop raiding. Analysis of variance was used to compare the extent to which the vulnerability Indicators (farms' distance to the park, farm size, and the number of standing crops) contributed to crop losses among the ranges. The result showed that shorter distances from farms to parks contributed significantly higher ($P>0.05$) to crop loss in all the ranges than any other vulnerability indicator. The incidence of crop damage was highest in the Ibbi range, in which the mean distance value of farmlands to park boundaries was 18.5±6.5m. However, there was no significant difference ($P<0.05$) in the contribution of farm sizes to crop raiding among the ranges. The contribution of standing crops to crop loss was also significant ($P>0.05$). The statistical analysis confirms that farm distance and the number of standing crops irrespective of farm size were the major vulnerability factors that influence crop raiding. This agrees with the report of Hassen (2003) and Priston*et al.,* (2012) that primates predominantly raided crops within 10 meters of farm-forest edges. The minimum farmers' farmland distances from the park during their study was 12 meters. This suggests that distances traveled by farms and hence minimum buffer widths to deter travel are site-specific, as particularly observed by Warren (2009) in olive baboons. Planting a crop relatively far from the forest is often considered an option to minimize the likelihood of the crop being raided by wildlife (Webber, 2006).

In conclusion, the study established from a statistical comparison of vulnerability indicators for crop damage revealed that the number of standing crops and the proximity of farmlands to the park were the major factors responsible for crop raiding. The most vulnerable area is the Ibbi Range with a minimum distance between farmlands and park boundaries. The number of standing crops damaged was more in Kali Range and least in Doro Range. Doro, Ibbi, Kuble, and Kulho Ranges were not significantly different in terms of the number of standing crops damaged on farmlands. It is recommended that the local farmers should be encouraged to cultivate crops that are not

palatable to the primate species and the park management should articulate programs that could persuade the farmers to relocate their farms to distances that cannot be reached by primate species, at least more than 1km from the park boundaries.

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