



Dynamics and Socioeconomic Drivers of Illegal Hunting of Wildlife Animal for Consumption in Oba Hills Forest Reserve in Southwest Nigeria

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ABSTRACT: This study investigated the dynamics and socioeconomic drivers of illegal hunting of wildlife animal commonly called bushmeat in Oba Hills Forest Reserve (OHFR) in Southwest Nigeria. Two hundred and thirty-four households in 8 host communities were subjected to direct household survey using a multi-stage sampling technique. The results revealed that mainly young and middle-aged men engaged in group and seasonal bushmeat hunting, mostly during the dry season. Also, the scale of daily illegal bushmeat hunting is high in the protected area. Non-selective hunting has increased over the last five years with traditional means of hunting still prominent during the hunting expedition. Thus, the socioeconomic drivers (age, ethnicity and household size) had a strong relationship with illegal bushmeat hunting, and their odds ratio ranged between 2.11 and 3.73. Failure to provide stakes for the host communities' inhabitants and weak penal system influenced illegal bushmeat hunting in OHFR. We conclude that the aforementioned factors need to be addressed for illegal bushmeat hunting to be tackled effectively. However, in the absence of political and economic stability, controlling illegal bushmeat hunting will remain extremely difficult and the future of wildlife conservation will remain bleak.

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Bush meat hunting is becoming a major concern and driver of many wildlife population decline at the local and regional level (Wittemyer *et al.*, 2014). Local people in the tropical forest of Africa depends heavily on bushmeat as a cultural, economic and nutritional component of their livelihood (Nasi *et al.*, 2011). However, the extraction of these wild animal species is unsustainable and leads wildlife populations to local extinctions (Bennett, 2011; Wilkie *et al.*, 2011; FAO, 2018). The need for more money (cash economies) increased access to remote and conservation areas for natural resource extraction. Expansion of logging and mechanized transport provides easy access to most remote parts of the forest (Chaber *et al.*, 2010; UNEP, 2016). Similarly, the widespread use of guns have transformed traditional hunting behavior and increased dependency on the sale of bushmeat to meet urban demands (UNEP, 2016). In Nigeria, the trade in bushmeat is growing at an alarming rate with an estimated volume of 900, 000 kilogram of bushmeat sold annually (Fa *et al.*, 2006; Eniang *et al.*, 2008; Petrozzi *et al.*, 2018). Large profit margins create incentives for the bushmeat trade across all levels of the commodity and supply chain biased towards larger and rare species, allowing bushmeat to reach national and international markets (Coad *et al.*, 2010; Petrozzi *et al.*, 2018). In the Ivory Coast, for example, the bushmeat trade is valued at 150 million USD (Friant *et al.*, 2015). An estimated five tons of bushmeat are smuggled from Africa to Europe per week (Friant *et*

al., 2015). Worldwide, wildlife is second only to narcotics among black market trades (McMurray, 2008). Illegal hunting is detrimental to the existence of large-bodied mammals as they are the most commonly hunted species. Many species have been extirpated from their natural habitats and those still found have their population declining (Usman and Adefalu, 2010; Jayeola *et al.*, 2012; Henschel *et al.*, 2014). For instance, large and medium-size herbivores and apex predators are restricted to few protected areas with an indication of decline in their number owing to unsustainable extraction through illegal hunting (Henschel *et al.*, 2014, Luiselli *et al.*, 2015). Past study revealed that the population of duikers are severely depleted while rock hyrax (*Procavia capensis*) were not sighted in Tanzania (Nielsen, 2006). Across the central African region between 2002 -2011, over a 60% decline in forest elephants was recorded with no sign of a fall in the rate of poaching (Maisels *et al.*, 2013). In addition, ungulates in Ivory Coast suffered a decline of over 60% over 20 years, with poaching through hunting probably the only plausible explanation for the decline (Fisher and Linsenmair, 2001). In addition, Oba Hills Forest Reserve (OHFR) was listed among sites of significance for primate conservation due to past report on the existence of Nigerian-Cameroon Chimpanzee (*Pan troglodytes ellioti*). However, recent field survey by Nigeria Conservation Foundation confirms that the species might have been extirpated from the forest reserve.

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Data collection: The primary sample unit in this study is the household heads (HH) of the host communities in and around the OHFR. Eight host communities within 5 km radius to the OHFR boundary were purposively sampled during the 2018 illegal hunting survey. Using cluster sampling, a total of 234 HH were randomly selected from the eight villages - Akinleye (6), Owu-Ile (27), Ife-Odan (104), Isero (9), Ikonifin (53), Olori (21), Familopa (8) and Togunde (6). Due to lack of village register, it was impossible to use a computer-based randomization method or random table to select the HHs. Therefore, a systematic random sampling that entails the selection of every other HH was employed. HHs interviewed during the survey was from 18 years of age and above. In the absent of the HH (i.e. if the HH is a man), the wife or any adult (above 18 years of age) in the family were included in the survey. The questionnaire was completed by the researcher and an assistant in order to avoid non-response to some questions and mistakes by the respondents (HH). Visitation to village heads preceded the interviews to request permission for research activities. After the first visit, each village was visited at least twice and a minimum of 15 minutes was used to survey one person. Oral consent was sought from each HH prior to the commencement of the survey with options to opt out at any stage of the survey. Primary data were collected using a structured questionnaire (direct questioning) with closed-ended questions in binary and Likert scale formats. These were designed, piloted and administered in the face to face survey of household heads. The household survey was conducted in Yoruba language and an assistance of a bi-lingual indigene that is proficient in speaking Yoruba, Hausa/Fulani language and pidgin (a language spoken as lingua franca across Nigeria) was part of the research team.

Data analysis: The data collected were computer coded and transformed to describe the community's perception of illegal hunting, the preferred methods of hunting and attitude to wildlife conservation. Microsoft Excel and Statistical Package for Social Science (SPSS version 22) were employed in all the statistical analysis. A descriptive analysis was done and the results were presented in percentages and charts. Binary logistic regression was used to

determine the local people's socio-demographic factors presumed to influence their participation in the illegal hunting of large mammal. It was performed to identify the predictors of illegal hunting activities and/or behaviour by using the formulae in equation 1 and 2. The independent variables set as dummy variables are age (above 50 years); education (have formal education); ethnicity (non-indiegene/immigrant); income (high income); household size (2-5); occupation (other artisans); attitude (favourable attitude)

RESULTS AND DISCUSSION

The sample comprised 76.5% men (n=179) and 23.1% women (n=54). The age group with the highest frequency was 31 – 40 (42.7%) followed by 41-50 years (34.6%), 21-30years (12.4%) and above 50years (10.3%). The majority (69.7%) of the respondents were married. Furthermore, a large percentage (68.4%) was from the Yoruba ethnic group with most respondents comparatively Christians (47.9%). More than one third (38.5%) of the respondents have primary education. Primary occupation is predominantly crop farming (67%) without secondary occupation. The majority (42.3%) of the respondents reported having an annual income of below N300, 000 (less than \$2 per day).

Local community's perception of illegal bushmeat hunting in OHFR: More than two-thirds (83.3%) of the respondents were of the opinion that neighbours enter the reserve to hunt. Also, more than half (58.1%) of the respondents reported group hunting as a common practice during hunting expedition. Despite this opinion, 62.4% of the villagers frequently engaged in individual hunting. The result further indicates that hunting expedition was perceived to be conducted mostly (50.9%) during the dry season. Combination of Dane gun, snares and capture by gripping were commonly used (59%) during hunting expedition. One third (30.8%) of the villagers perceived that illegal bushmeat hunting occurs in the reserve every day. The majority (77.8%) of the respondents reported that some species of animals are no longer found in the reserve (Table 2).

$$\ln = \beta_0 + \beta_1A + \beta_2E + \beta_3ET + \beta_4I + \beta_5O + \beta_6A + \beta_7H + \text{Error} \dots (1)$$

$$Pr(P) = \frac{\exp(\beta_0 + \beta_1A)}{1 + \exp(\beta_0 + \beta_1A)} \dots \dots \dots (2)$$

Where: ln= the logit function, Pr= is the probability of event, P= is the response variable (Bushmeat hunting) β_0 = is the intercept, $\beta_1, \beta_2, \dots, \beta_7$ = is the regression coefficients, A (age), E (education), ET (Ethnicity), I (Income), O (Occupation), A (Attitude), H (Household size) = set of predictors (independent variables)

The trend of illegal hunting in OHFR: Figures 2 a, b and c showed that most (73.5%) of the respondents reported that illegal hunting practice has been since the inception of OHFR. More than two-thirds (65.8%) of the villagers affirmed that hunting has increased over the last five years. In addition, 62% reported the type

of animal killed during hunting as non-selective i.e. any animal seen is hunted during hunting expenditure.

Attitude towards bushmeat hunting and wildlife conservation: Local people attitude towards hunting and wildlife conservation in OHFR is presented in Table 1. Overall, respondents had an unfavourable attitude towards bushmeat hunting and wildlife conservation. Nevertheless, attitudes differed with specific statements. The statements for which villagers showed positive attitudes were: ‘Presence of animal is a sign of a healthy environment’ [63.25% agree; mean (SD) =3.56 (1.44)]; ‘These days I think killing any species of animals inside the forest reserve is wrong’ [41.45% agree; mean (SD) = 2.97(1.57)].

Local people perception of bushmeat trade and consumption: Table 2 showed the local people perception on bushmeat trade and consumption. The majority (79.1%) of the respondents were of the opinion that bushmeat hunting is mostly for consumption, and had been a tradition since the inception (64.1%) of the reserve. Food vendors are the major targets (54.7%) for the bushmeat trade. Whole meat (carcasses) are frequently sold (45.3%) as regards the animal part usually sold. Both young and middle-aged men were indicated as those engaged in bushmeat

hunting and trade in OHFR by 26.5% of the respondents. 50.9% of the respondents indicated to join the community of hunters/hunters group in the locality.

Factors influencing illegal bushmeat hunting in OHFR: Socioeconomic drivers of illegal bushmeat hunting in OHFR are presented in Table 3. 3 socioeconomic predictors highly influence the illegal bushmeat hunting ($P \leq 0.01$) - Age (31-40years), ethnicity (Yoruba) and household size (Above 9). Also, 3 socioeconomic predictors moderately influence the illegal bushmeat hunting ($P \leq 0.05$) - Age (21-30years), Education (do not have a formal education) and Primary occupation (crop farming). However, 5 socioeconomic predictors had no significant influence on the illegal bushmeat hunting – Age (41-50years), Primary occupation (livestock farming), low income, Attitude towards wildlife (not favourable), and Household size (6-9). Thus, the age, ethnicity and household size had a strong relationship with illegal bushmeat hunting, and their odds ratio ranged between 2.11 and 3.73. Cox and Snell, and Nagelkerke R squared estimates specify that the whole model explained between 66% and 93% of the variance that can be predicted from the socioeconomic predictors.

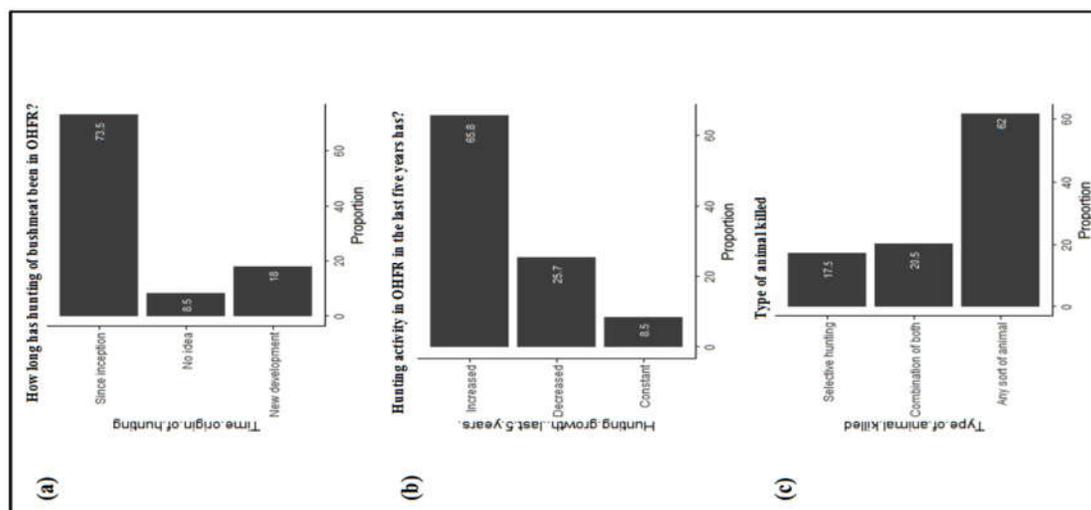


Fig 2: The trend of illegal bushmeat hunting in OHFR

Table 1: Local people attitude towards hunting and wildlife conservation in OHFR

Item	Variable (N=234)	Agree	Unsure	Disagree	NO	Mean (SD)
1	The existence of wildlife will persist forever	207(88.46)	21(8.97)	6(2.56)	-	1.58(.78)
2	There are so many animals left not hunted in the reserve	184(78.63)	25(10.68)	24(10.26)	1(.43)	1.88(.98)
3	Hunting is a danger to the continued existence of wildlife	110(47.01)	58(24.79)	50(21.37)	16(2.56)	3.27 (1.45)
4	Wild animal should be protected	106(45.30)	38(6.24)	70(29.92)	10(4.27)	3.16 (1.41)
5	Presence of animal is a sign of a healthy environment	148(63.25)	35(14.96)	36(15.39)	15(6.4)	3.56 (1.44)
6	I think we should be allowed to kill any species of animals inside the forest reserve	133(56.84)	20(8.55)	64(27.35)	17(7.26)	2.73(1.22)
7	I think I should be allowed to kill any species of animal outside the forest reserve	151(64.53)	16(2.56)	59(25.21)	8(3.42)	2.38(1.62)
8	I think I should be allowed to trap or kill any wild animal that are found in the field damaging crops or attacking livestock	149(63.68)	9(3.85)	71(30.34)	5(2.14)	2.35(1.45)
9	These days I think killing any species of animals inside the forest reserve is wrong	97(41.45)	42(17.95)	85(36.32)	10(4.27)	2.97 (1.57)
10	These days I think I should not be allowed to trap or kill any wild animal that are found in the fields damaging crops or attacking livestock	78(33.33)	14(5.98)	122(52.14)	20(8.55)	2.49(1.54)
11	Wildlife protection should involve restrictions against hunting in the reserve	109(46.58)	21(8.97)	81(34.62)	23(9.83)	2.41(1.32)

Means were rated as unfavourable =0-2.5; somewhat favourable = 2.51-3.5; favourable = 3.51 and above NO= No Opinion; N= sample size, cell value = frequency (%), SD=standard deviation.

Table 2: Local people perception of bushmeat hunting and trade in OHFR

Variables (N=234)	Frequency	Percentage
Is bushmeat hunting for consumption?		
Yes	185	79.1
No	49	20.9
If yes, How long have this bushmeat trade been?		
Since inception of the reserve	150	64.1
A new development	48	20.5
A decade ago or more	36	15.4
Does the bushmeat trade involve selective trade of animal parts or whole meat sales?		
Selective trade in animals parts	57	24.4
Whole meat sales	106	45.3
Combination of both	71	30.3
What are the major targets for bushmeat trade?		
Food vendors	128	54.7
Herb practitioners	29	12.4
Both	66	28.2
Others	11	4.7
Would you like to join the community of hunters in your locality?		
Yes	119	50.9
No	115	49.1
Who are the people involved in bushmeat hunting and trade in the community?		
Young	41	17.5
Middle aged	32	13.7
Aged	41	17.5
Combination of all	58	24.8
Young and middle aged	62	26.5

N= sample size

The surveys conducted in the villages neighbouring OHFR revealed that over 77.6% of household heads resident in study area are men of working age that can engage in any economic activity. In accordance with past studies adult male are presume to have inclination and opportunity to hunt (Kumpel et al., 2010; Lindsey et al., 2013). Personal characteristics of illegal hunters are local, financially poor, food – insecure young men (Lindsey et al., 2011). In south-eastern Zimbabwe, most men between the ages of 21 to 50 years were reported to be involved in illegal hunting (Gandiwa et al., 2014). Most of them are classed as poor, as the majority fall into the low-income group. Poor people in remote, marginal or forested areas are believed to have limited livelihood opportunities and so depend on the natural resources for food and other essentials (Roe

and Elliot, 2006; Eli et al., 2017). The livelihood strategies of local residents in this study mirror those obtained in past studies as respondents are mostly crop farmers with no secondary occupation nor educational level (Abernethy et al., 2013; Duffy et al., 2016). For example, the majority of rural people in eastern Madagascar were found to be farmers (Jenkins et al., 2011). It is interesting to note that those whose occupation is farming are probably involved in hunting (hunter – farmer), by investing the income from agriculture in increased bushmeat consumption and newer hunting equipment (Duffy et al., 2016). This characteristic made the villagers vulnerable and increased their chances of being involved in illegal activities (Gandiwa, 2011) inside the park since there is a need for them to meet resource demand for their

household. Further analyses of the data will be undertaken to examine if this is indeed the case. The survey indicates that the community had some level of involvement in illegal hunting. A large proportion (83.3%) of the respondents agreed that people entered the park to hunt animals. One possible explanation for the reason why a larger number of informants agreed to neighbours illicit behaviour could be the indirect way of asking a sensitive question, as people may prefer to report neighbours undesirable behaviour. The result of this present study

corroborates with the assertion from past authors that indirect questioning in survey evokes higher responses of socially undesirable behaviour. Moreover, group hunting as the common practice and the use of a gun during hunting expedition is detrimental to the population of wild animals in the study. This indiscriminate and unsustainable method of extracting wild animals could have resulted in the disappearance of some species of animals as reported by the respondents.

Table 3: Socioeconomic drivers of illegal bushmeat hunting in OHFR

Independent variables	B	Standard error	Sig.	Exp(B) odds
Age (Above 50years as reference category)				
Age (21-30years)	1.43	0.69	0.05*	1.54
Age (31-40years)	1.01	0.59	0.03**	3.73
Age (41-50years)	0.99	0.59	0.10	2.68
Ethnicity (immigrant as reference category)				
Ethnicity (Yoruba)	1.29	0.37	0.02**	1.75
Education (have formal education as reference category)				
Education (do not have a formal education)	1.32	0.11	0.04*	1.38
Primary occupation (other artisans as reference category)				
Primary occupation (crop farming)	2.38	0.37	0.04*	1.33
Primary occupation (livestock farming as reference category)	-0.38	0.25	0.31	0.69
Income (high income as reference category)				
Income (low)	0.51	0.31	0.10	0.60
Attitude (favorable attitude as reference category)				
Attitude towards wildlife (not favorable)	0.50	0.33	0.13	1.65
Household size (household size 2-5 as reference category)				
Household size (6-9)	0.50	0.40	0.27	1.55
Household size (Above 9)	3.12	1.21	0.00**	2.11
Model χ^2	853.01			

B = estimated coefficient, Standard error, P = level of statistical significance and Exp (B) = odds ratio. (*Sig at 5% level or $P \leq 0.05$; **sig at 1% level or $P \leq 0.01$)

The rather high level of awareness of hunting season can partially be linked to community involvement in the illegal hunting activity. The findings in this study mirror those of previous studies where about 50% of the informants admitted illegal hunting activities and the existence of hunting seasons in their communities (Gandiwa, 2011; Bitanyi et al., 2012; Nachihangu et al., 2018) that have examined wildlife resource use. Therefore, it is reasonable to assume that the scale of illegal hunting of wild animals is still considerable in this forest reserve. However, wild animals in their natural home are severely depleted and at risk of extirpation from illegal hunting for both subsistence and commercial purposes (Ripple et al., 2016; Benitez-Lopez et al., 2017). The findings from this study indicate that hunting practices have been from the inception of the reserve and the trend has increased with all sort of animals targeted and killed resulting in large mammal species population depletion. This general perceived decline in large mammal abundance supports the higher proportion of the local people reporting the reduction in the number of animal species seen in this study. Although respondents were not asked for lists the species not seen over the years that were once present. A possible explanation for this result may be that large mammal species with either low or high population trends have been negatively affected by illegal hunting. As a result of the depleted

status of wildlife population, there is an indication that bushmeat will contribute little to hunters' livelihood in a long-term food security option. People in the neighbouring community to the reserve had negative attitudes towards hunting/wildlife. This figure is high, despite the expected restrictions on natural resource use in the reserve. Unsustainable exploitation of natural resources through the displacement of people from their traditional lands (Muhumuza and Balkwill, 2013; Olaniyi et al., 2019) could explain this negative attitude and non-acceptance of conservation policy. The age was observed to be as one of the factors that significantly associate with illegal hunting in OHFR. The likelihood of an individual engaging in hunting of wild animals increases with ages under 30 years and between 31-40 years respectively. This present result further established past findings that identified age as an important factor influencing those that engaged in illegal hunting in other African countries (Loibooki et al., 2002; Gandiwa et al., 2014). For example, in south-eastern Zimbabwe, most men between the ages of 21 to 50 years were reported to be involved in illegal hunting (Gandiwa et al., 2014). Similarly, most men involved in bushmeat hunting in Botswana are young adults (Lindsey, 2016). Therefore people who tend to hunt bushmeat in OHFR are young adult males of between 21 years of age to 40 years. This will probably have a negative influence on the biodiversity in the

OHFR as these men can engage in any economic activity to provide food security for their family especially during the dry season.

Various studies have found that ethnicity can significantly increase the rate of illegal hunting among the residents of protected areas (de Merode and Cowlshaw, 2006; Jambiya et al., 2007; Duffy et al., 2016). In accordance with past research, our findings showed that the indigenous residents (Yoruba's) are more likely to hunt wild animals than the immigrants. A similar study in Tanzania revealed that indigenous populations use their traditional sources of wealth and means to obtain bushmeat for consumption (Mgawe et al., 2012). The findings of the current study corroborate with the ideas of Naughton-Naughton-Treves, (2002) and Shenck et al., (2006) who suggested that people whose rural tradition and /or religion do not include bushmeat consumption are less likely to it eat because individuals often express negative feelings towards unfamiliar food. However, limitations on natural resource use may be seen as a denial of traditional rights especially among indigenous people that are culturally inclined to bushmeat consumption. The effect can cause a negative attitude towards conservation (Arjunan *et al.*, 2006; Tomicevic et al., 2010). Therefore, the ethnicity of the residents in this study appeared not to favour sustainable hunting of wild animals. However, an effective strategy that provides indigenous people with a strong attachment to wildlife should be educated, encouraged, trained and supported in the domestication of some of the wild animal species preferred by the group. Also, the current study found a significant influence of education on the likelihood of individuals who had no formal education belongs to be engaged in bushmeat hunting. Most individuals are not educated and those educated only completed the primary education which may prevent them to earn a higher and stable income.

A higher education enabled better and stable paid job while a low and/or no formal education will have less opportunity to have a stable income and hence depend on the wildlife resources for survival. This further support the findings that educated households have higher income and do not engage in illegal hunting in Tanzania (Wilfred and MacColl, 2010; Moro et al., 2013). Nevertheless, poor rural people are more prone to livelihood hardship and therefore, will engage in any economic activities to get stable income and sustenance (Lindsey et al., 2011, Nielsen and Meilby, 2015). On the contrary, other researchers have found that both poor and wealthier households involved in illegal hunting (Brashares et al., 2011). This conflicting idea depends on what motivates those involved in illegal hunting. Depending on the economic factor, some may hunt for the table while other may hunt for commercial gain (Mancini et al., 2011; Bi et al., 2016).

The respondent's livelihood strategies are majorly crop farming with no alternative source of income during the lean season. Research has demonstrated that farming as an occupation can influence those practising it to engage in bushmeat hunting (Fusari and Carpaneto, 2006; Duffy et al., 2016; Lindsey et al., 2016). It is interesting to note that those whose occupation is farming are probably involved in hunting too (hunter – farmer). They invested the income from agriculture in increased bushmeat consumption and new hunting equipment (Duffy et al., 2016). This characteristic made the villagers vulnerable and increased their chances of being involved in illegal bushmeat hunting (Gandiwa, 2011). About 90% of household production sold at market in Democratic Republic of Congo is derived from wildlife, compared to 25% for agricultural production (de Merode et al., 2003). It is evident that the market sale and not consumption of bushmeat is most important to poor households and a major driver of commercial bushmeat hunting. This in turn, is potentially a bigger conservation threat than subsistence hunting (Duffy et al., 2016).

Furthermore, the likelihood of engaging in bushmeat hunting is significantly influenced by the household size (large/increase). This result contradicts past research that found a strong relationship with household size (smaller/decrease) and bushmeat consumption in Gabon, as household size increased, consumption of bushmeat decreased (Foerster et al., 2012). One possible explanation for bushmeat hunting to increase with an increase in household size (above 9) could be attributed to the poverty level of local people neighbouring protected areas that could influence individual into the illicit act in other to provide food for his family. In addition, bushmeat is the cheapest and easily affordable and accessible source of animal protein to local people, hence will flout any laws to sustain and improve their family nutritional level. Other potential drivers and explanation for bushmeat hunting activities and/or behaviour considered in this study are: income and attitude but their effects do not statistically influence the individual's likelihood to be engaged in bushmeat hunting.

Conclusion: Communities in OHFR are involved in illegal hunting not because they lack knowledge of the reasons and importance of conservation of wildlife species. Their involvements were due to unemployment, a lack of alternative livelihood, and sources of animal protein. In addition, the wildlife policy does not promote peoples involvement in wildlife conservation, and the local residents were in no way benefiting from the direct use of wildlife resources. These findings may help us to understand the need for diversifying sources of income and for the adoption of poverty reduction policies that are

conservation-friendly to help provide sustainable livelihood opportunities in local communities.

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