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LOCAL PERSPECTIVES ON FACTORS INFLUENCING THE EXTENT OF WILDLIFE POACHING FOR BUSHMEAT IN A GAME RESERVE, WESTERN TANZANIA

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Abstract

Illegal exploitation of wildlife for bushmeat is a widespread problem affecting many ecosystems especially in the Tropics. Understanding the factors associated with such exploitation may help in the management of the problem by conservationists. Although there is a substantial problem of wildlife poaching in east Africa, the factors that affect its occurrence at a local level are still poorly explored. We interviewed heads of households in 19 villages near a game reserve in western Tanzania–from March to October, 2009–to obtain data on wildlife exploitation. Proximity to the reserve encouraged both wildlife poaching and bushmeat consumption on the northern side of the reserve. Conversely, consumption increased with distance on the eastern side. Communities with higher fish consumption rates had fewer incidents of poaching. Most poaching activities were carried out in the rainy seasons. Both large- and medium-sized wild ungulates especially impala, dik-dik and common duiker were favoured bushmeat species. Problems related to anti-poaching efforts particularly during the rainy seasons should be taken more seriously. Future research and conservation should consider addressing bushmeat poaching with respect to distances from human settlements to the nearest Ugalla Game Reserve boundary.

Keywords: *Wildlife poaching; Ugalla Game Reserve; Bushmeat species; Local poaching drivers*.

Introduction

It is generally accepted that human pressure on wildlife protected areas is increasing [1-4]. One of the critical challenges has been bushmeat hunting through wildlife poaching [5-8]. Bushmeat can be defined as 'any non-domesticated terrestrial mammals, birds, reptiles and amphibians harvested for food' [9]. Some other definitions pay special attention to Africa where bushmeat hunting is believed to be problematic. For example, bushmeat has also been defined as 'an African term that includes all wildlife species used for food, from cane rats to elephants' [10]. Bushmeat hunting is often referred to as wildlife poaching because it is pervasively carried out regardless of whether wildlife laws permit it. Poaching is a problem especially in Africa where bushmeat hunting is valued both as a source of income and a source of protein [10-12].

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Since poaching is deeply blended with other livelihood activities into the socio-economic fabric of people's lives, attempts to control it should explore other related livelihood-based factors.

A number of factors influencing bushmeat poaching have been highlighted in the conservation literature. For example, preference as reported in northern Cameroon by Njiforti [13] where most people prefer north African porcupine *Hystrix cristata* and guineafowl, as a consequence these species are heavily exploited. In some areas of the Serengeti ecosystem, species such as buffalo, eland and topi are consumed by a large proportion of the local communities [14]. Agricultural production (crop farming and livestock keeping) as a source of rural livelihoods can influence poaching [15-18], given its ample potential to ensure food security [8, 19, 20]. Studies also suggest that the annual cycle of agricultural activities in rural areas determines the intensity of bushmeat exploitation. For example, Brashares et al. [21] argued that in 'rural Africa' the intensity of hunting is usually inversely related to time spent on farming activities. Alternative sources of protein can help to lessen demand for bushmeat [5, 22]. The widely documented (and seemingly viable) alternatives to game meat are livestock and fish [11, 14, 23, 24]. In Serengeti, for example, both fish [25] and livestock [26] are crucial in tackling illegal hunting. Coad [7] reported the potential of livestock as an alternative to bushmeat hunting in Gabon.

Illegal wildlife use is as well related to distances from human settlements to protected areas. In Serengeti, both bushmeat poaching and consumption rates are quite high among the villages near protected areas [5, 25]. Bushmeat consumption decreases as village location distances from hunting areas increase in some Central African ecosystems [e.g. 27]. Consequently, the presence and importance of factors behind wildlife exploitation may differ from place to place, and the treatment of one place is not necessarily as effective as in another place.

Although Tanzania is among the countries experiencing bushmeat hunting challenges in East Africa [28, 29], studies have paid little attention to the western part of the country particularly in the Ugalla ecosystem where wildlife poaching is problematic [30]. This is regrettable because in order to address poaching across the country, we need to understand ecosystem-specific drivers of the problem. One of the principal priorities of the Wildlife Division of Tanzania is to deal comprehensively with poaching activities across game reserves in the country. The present paper seeks to underscore factors influencing wildlife poaching for bushmeat among local communities around Ugalla Game Reserve in western Tanzania (an integral component of the Ugalla ecosystem), at the village level, thus contributing to the existing body of knowledge on tackling the bushmeat crisis in Tanzania and Africa as a whole.

Materials and Methods

The Study Area

The study was conducted among communities near Ugalla Game Reserve (5,000 km^2) in western Tanzania. At the time of the study, the reserve had 2 tourist hunting blocks: Ugalla east (approximately 2000 km^2) and Ugalla west (3000 km^2). Tourist hunting was the only legal form of wildlife utilisation, carried out in the hunting blocks to ensure that it is well harmonized with wildlife populations [31]. The reserve is found between Katavi and Tabora regions in western Tanzania (Fig. 1). This study was carried out in Sikonge and Urambo districts in Tabora Region, where a considerable portion of the reserve is found [31]. The region is located at 4°-7°S and 31°-34°E. The climate is defined by a dry season (June – November) and a wet season (December – May), and annual rainfall ranges between 700 – 1000 mm. The period of rain spans between the months from November – May with an extension of occasional showers of varying magnitudes until mid-June. The climate seasons in this study are presented according to the distinction given by the Ugalla Game Reserve office in line with what is accepted by local people, so may not necessarily tally with the amount of rainfall. The maximum and minimum

temperatures lie between 28 – 30 ^{0}C and 15 – 21 ^{0}C respectively. The main livelihood activity in the region is subsistence farming of both food crops (for example, maize, rice, groundnut, cassava and potato) and cash crops (tobacco). Small-scale income generating activities are also present as supplementary sources of livelihoods. The area has a diverse range of natural resources such as fish, wildlife, forests, and wetlands. Thus, natural resources based livelihood activities including fishing, hunting, lumbering, beekeeping/honey gathering are widespread.

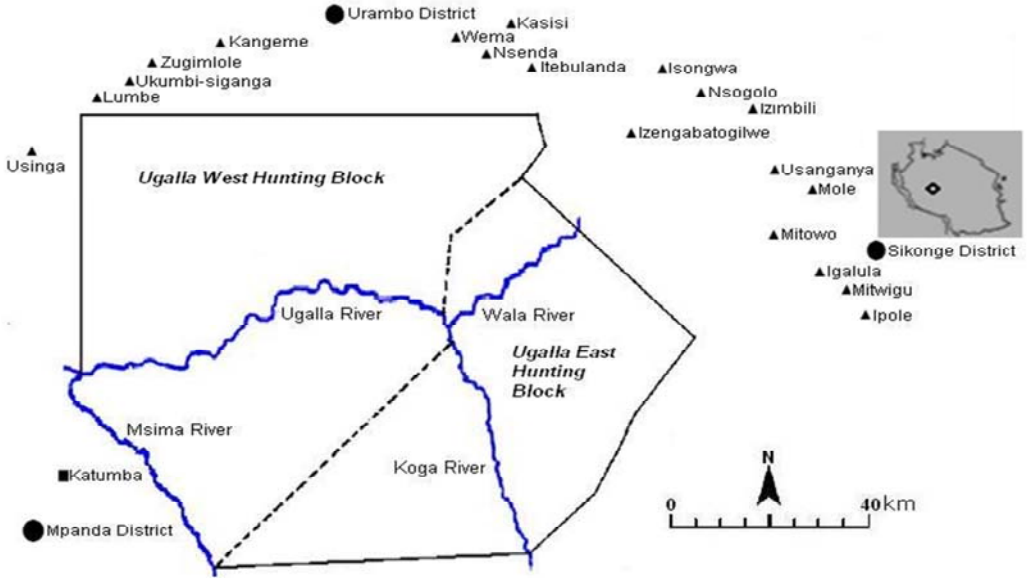

Fig. 1. Ugalla Game Reserve (UGR). Thick line denotes the boundary. Dashed line demarcates the hunting blocks. Triangles represent the study villages. Mpanda, Sikonge and Urambo are districts surrounding the reserve. Meanders of lines show the main rivers. Insert shows the location of UGR in Tanzania.

Data Collection

A questionnaire survey (with heads of households) was conducted in the period from March – October, 2009 in the villages neighboring Ugalla Game Reserve. Firstly, a sample of 19 study villages was randomly selected from a total of 122 villages from both Sikonge and Urambo districts representing a sampling intensity of 15%. Since Urambo borders Ugalla west hunting block and Sikonge Ugalla east hunting block, study villages were thus adjacent to either of the two hunting blocks (Fig. 1). Villages bordering Ugalla west hunting block were north of the reserve. At least 5% of the households from each study village were randomly selected from the village register. Accordingly, we surveyed 573 households (out of about 11,000 households in all the study villages), 319 (56%) near Ugalla west hunting block and 254 (44%) near Ugalla east hunting block. Questionnaires containing both open- and close- ended questions were administered in Swahili (a language familiar to villagers) in order to accommodate a wide range of responses about wildlife exploitation. Questions were asked in order of their sensitivity, beginning with respondents' characteristics and continuing up to bushmeat consumption. The interview started by asking questions about respondents' age and level of education, and number of livestock owned and crop yield in kgs from the preceding harvest season. Then recall of dietary protein intake followed later, and was done separately for different sources of protein in different stages of the interview to avoid any potential bias in the responses. Villagers mentioned the number of times they ate livestock meat and/or fish in the previous week/month/6 months (whichever was easier for them to remember). Additionally, they were asked to state whether poaching incidents had occurred in their villages in the previous 6 months, and bushmeat species hunted by poachers. This was considered as an indication of

poaching frequency in a study village. In the same vein, they were asked to mention months they thought most poaching activities took place. For the purpose of the present analysis, responses to this question were considered to be 'monthly poaching frequency'. Direct questions about involvement in poaching were avoided because such questions normally receive considerably less cooperation from respondents [32]. Finally, villagers were asked whether they had consumed bushmeat in the last 6 months prior to survey. During the fieldwork it was established that asking about bushmeat consumption in this way was not only a proper approach in the study villages, but also helped interviewers to win respondents' confidence and cooperation.

In order to minimize challenges associated with the bushmeat survey (for example, respondents not saying the truth) arising from the illegal nature of wildlife poaching [14, 32], questions were preceded by a brief introduction about the purpose of the survey and the fate of the information gathered as well as requesting the respondent's participation. Furthermore, on arriving at the study village, the research team spent the first few days establishing rapport with villagers and their leaders prior to embarking on the survey. Personal observations [33] were carried out at each village to verify the responses. In this case, the survey team monitored closely people's daily activities along with collecting anecdotal information about bushmeat.

Distance from the centre of the village (as agreed with the village chairman) to a closest point on the Ugalla Game Reserve boundary was estimated using a handheld global positioning system unit (Garmin GPSMAP® 60Cx). Rainfall data, recorded in different months, for 8 years (2001 – 2008) were obtained from Tabora Metrological Station.

Statistical Analysis

All statistical analyses were performed in GenStat (release 10, VSN International Ltd., Hemel Hempstead, UK). The analysis was based on comparing study villages near Ugalla west to the ones near Ugalla east in order to systematically and comprehensively explore the factors determining poaching in the Ugalla ecosystem. Descriptive statistics (mean, range and percentage) were used to describe sample characteristics. Generalised linear models (GLM) with a binomial error structure and a logit link function were used to analyse the following data: firstly, the frequency with which species were mentioned as being hunted by poachers. The response variable 'species poaching frequency' took a value of 1 if a species was illegally hunted and 0 if was not. Species was used as a predictor variable. Secondly, separate models were used to identify the best predictors of the frequency of poaching incidents and the frequency of bushmeat consumption in the study villages where distance from the village to the reserve boundary, hunting block (study villages near Ugalla east hunting block 'East' and near Ugalla west hunting block 'West'), fish consumption (number of times respondents ate fish prior to the dates of the interview), retained crop yield–amount of food crops in kgs. (maize, beans, groundnut, sunflower, cassava, potato, rice, sorghum, sesame etc.) kept during the survey period, retained livestock–number of livestock kept during the survey (cattle, goat, sheep, chicken), and livestock consumption (number of times respondents ate livestock meat) were included in each of the models as fixed effects. Thirdly, the identification of the best predictors of monthly poaching frequency in which rainfall (mean rainfall [mm] per month), season (dry and wet seasons) and month (January – December) were used as fixed effects. Information on daily agricultural activities gleaned through participant observation was presented as a pattern of the annual cycle of agricultural activities to help illustrate the trend of monthly poaching frequency. For each GLM, significance of fixed effects was determined by sequentially dropping each effect from the full model and comparing the change in deviance to a Chi-square distribution with the appropriate degrees of freedom. A GLM with normal errors was used to examine variation in rainfall. The fixed model here included the effects season and month.

Results and Discussion

Illegally Hunted Wildlife Species

Respondents mentioned a total of 25 bushmeat species targeted by poachers. Different primate species were pooled under a single name "primates" as they had very small frequencies (Table 1). The frequency with which species were mentioned as being poached varied significantly across species (deviance $\chi^2_{24} = 18.12$, $p<0.001$), the most mentioned species was impala, followed by dik-dik and common duiker, whereas primates were seldom mentioned (Table 1). The first ten most hunted species were the ones also commonly hunted for bushmeat elsewhere in Tanzania. For example, impala is commonly hunted in the Serengeti ecosystem [34]. Caro [35] mentioned species favoured by poachers in the Katavi-Rukwa ecosystem, among them were: buffalo, warthog, hippopotamus and bushpig. In the areas around Urumwa Forest Reserve in western Tanzania, common duiker and dik-dik are the primary species hunted for bushmeat [36]. The large number of bushmeat species mentioned as being illegally hunted is an indication that wildlife is among the primary sources of animal protein in the Ugalla ecosystem.

Table 1. Frequency of bushmeat species mentioned by villagers as being poached. Species are listed in descending mean frequency.

Species	Local name	Mean frequency ± s.e.
Impala (*Aepyceros melampus*) Lichtenstein, 1812	Swalapala	5.84 ± 0.71
Dik-dik (*Madoqua kirkii*) Ogilby, 1837	Digidigi	4.53± 0.45
Common Duiker (*Sylvicapra grimmia*) Linnaeus, 1758	Nsya	3.79 ± 0.50
Buffalo (*Syncerus caffer*) Sparrman, 1779	Nyati	3.63 ± 0.54
Kongoni (*Alcelaphus buselaphus cokii*) Günther, 1884	Kongoni	3.21 ± 0.66
Topi (*Damaliscus korrigum*) Ogilby, 1837	Nyamera	2.90 ± 0.54
Warthog (*Phacochoerus aethiopicus*) Pallas, 1766	Ngiri	2.16 ± 0.50
Hippopotamus (*Hippopotamus amphibius*) Linnaeus, 1758	Kiboko	2.00 ± 0.44
Sable antelope (*Hippotragus niger*) Harris, 1838	Palahala	1.84 ± 0.47
Bushpig (*Potamochoerus porcus*) Linnaeus, 1758	Nguruwe	1.58 ± 0.33
Roan antelope (*Hippotragus equinus*) Desmarest, 1804	Korongo	1.58 ± 0.43
Reedbuck (*Redunca redunca*) Pallas, 1767	Tohe	1.53 ± 0.46
Bushbuck (*Tragelaphus scriptus*) Pallas, 1766	Pongo	1.21 ± 0.22
Greater kudu (*Tragelaphus strepsiceros*) Pallas, 1766	Tandala Mkubwa	1.11 ± 0.23
African elephant (*Loxodonta africana*) Blumenbach, 1797	Tembo	1.00 ± 0.28
Oribi (*Ourebia ourebi*) Zimmermann, 1782	Taya	0.84 ± 0.25
Helmeted guineafowl (*Numida meleagris*) Linnaeus, 1758	Kanga	0.79 ± 0.24
Giraffe (*Giraffa camelopardalis*) Linnaeus, 1758	Twiga	0.68 ± 0.20
African hare (*Lepus capensis*) Linnaeus, 1758	Sungura	0.63 ± 0.22
Ducks & gees (*Anatidae*) Vigors, 1825	Mabata	0.58 ± 0.21
Eland (*Taurotragus oryx*) Pallas, 1766	Pofu	0.53 ± 0.20
Crested porcupine (Hystrix cristata) Linnaeus, 1758	Nungunungu	0.53 ± 0.14
Francolins (*Francolinus*) Stephens, 1819	Kwale	0.47 ± 0.14
Waterbuck (*Kobus ellipsiprymnus*) Ogilby, 1833	Kuro	0.47 ± 0.18
Primates [Olive baboon *(Papio anubis)* Gray, 1821 & Vervet monkey (*Chlorocebus pygerythrus*) F. Cuvier, 1821]	Nyani & Ngedere	0.37 ± 0.16

Factors behind Wildlife Poaching

More than half of the respondents (63%) admitted that there had been poaching incidents in their villages. Thirty eight percent of these were from villages adjacent to Ugalla west, and 24% were adjacent to Ugalla east. Factors influencing poaching in the study area are presented here below:

Distance from the reserve boundary

We found that wildlife poaching was strongly linked to the village distance from the Ugalla Game Reserve boundary. The mean village distance from the reserve boundary was 16.89 ± 2.33 km (range 2.5 – 35 km). Poaching frequency decreased significantly with village

location distance from the reserve boundary (Table 2). The frequency was higher among local communities near Ugalla west than Ugalla east, but it declined more rapidly with distance from Ugalla in the former than the latter (Table 2). The relationship between wildlife use and distance from protected areas has also been reported by other bushmeat studies [5, 8, 25, 37, 38]. The results of this study suggest that poaching frequency near Ugalla west hunting block is higher than Ugalla east because villagers are closer to the reserve boundary. About half of the study villages adjacent to Ugalla west were within 5 km of the reserve boundary. Average distances between study villages and the reserve boundary near Ugalla east and Ugalla west were 24.11 ± 2.0 km (range 16 – 35 km) and 10.4 ± 2.3 km (2.5 – 21 km) respectively. Being closer to the reserve might be advantageous because of easy or cost effective access to wildlife resources. Elsewhere, the extent of poaching is a trade-off between the cost involved in hunting (often time and financial resources) and proximity to a hunting area (for example, 7, 34].

Rainfall

Monthly poaching frequency increased with amount of rainfall (χ^2_{11} = 16.25, p<0.001). The amount of rainfall varied significantly between dry and wet seasons ($F_{1,11}$ = 14.87, p = 0.002), and between months ($F_{11,107}$ = 47.14, p<0.001). Poaching frequency was higher in wet season than dry season (χ^2_1 = 11.31, p = 0.001, Fig. 2). The effect of month on poaching frequency was only marginally non-significant (χ^2_{11} = 1.83, p = 0.058).

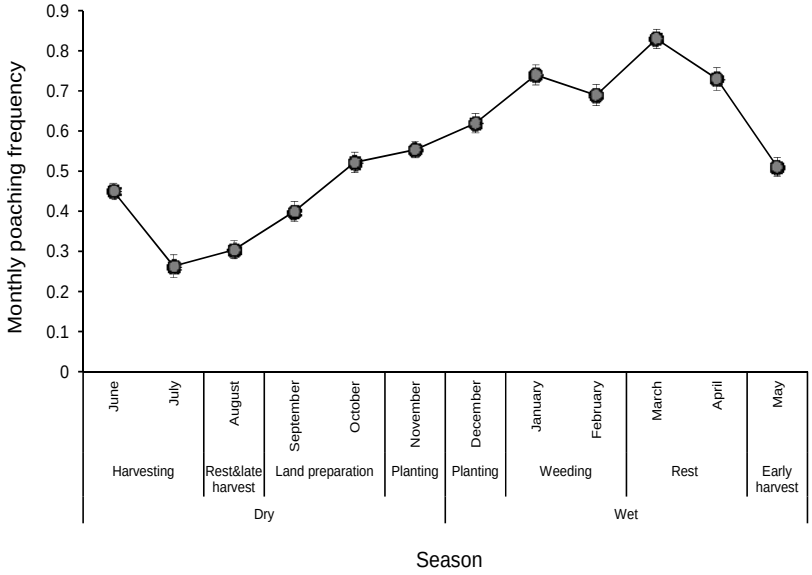

Fig. 2. Poaching frequency between dry and wet seasons. Months and agricultural seasons are included for illustration purposes. Error bars are the standard error of the mean.

Rainfall determines poaching activities in various ways. In rural areas, for instance, rainfall influences agricultural production [39], which in turn acts as a source of household income and food security [40] that are related to wildlife poaching [30]. A close relationship between rainfall, agriculture and poaching is well reported in Serengeti [15]. The annual pattern of farming activities–as presented in Fig. 2–indicates that poaching is least common at harvest time, when villagers are busier and food is most abundant, and most common immediately before harvest when villagers have little to do and food is scarce. During periods of rain, villagers depend predominantly on food stocks accumulated in preceding cropping seasons. Owing to the fact that a rainy season may last for 5 – 6 months, food stocks are always inadequate or quickly depleted resulting in villagers' increased dependence on wildlife

resources [41]. In addition, rainfall seasons can pose major setbacks to anti-poaching efforts. In India, it is said to help poachers avoid detection by rangers and the species they target by walking slowly and quietly on the wetter surfaces [42]. In the Mara-Serengeti region, most of the patrol roads become hardly passable during the rain seasons, hence hampering anti-poaching patrols [43]. In Ugalla Game Reserve, the wet season is the most difficult time of the year for game rangers to access the reserve as many roads become muddy and impassable [44]. It is this time of the year when poachers devastate wildlife populations, taking advantage of the patrol teams' infrequent visits and poor coverage of their operations within the reserve [45].

Fish consumption, livestock and food crops

Fifty four percent (mean frequency = 2.46 ± 0.17 month^{-1}) of the respondents consumed fish and 76% (2.78 ± 0.03 month^{-1}) consumed livestock meat. Nonetheless, only fish consumption had a negative association with poaching frequency, meaning that villages with high fish consumption rates had low poaching frequency. This observation corroborates previous findings that increase in fish supply reduces the frequency of bushmeat hunting [11]. But, Rowcliffe et al. [24] argued that if the fish stock is considerably reduced, fish may not provide a viable alternative to bushmeat. Elements like availability, preference, and price make the relationship between fish and bushmeat further complicated [21, 46]. We acknowledge the fact that our study did not explore these elements, but it does provide an important highlight about the level of bushmeat poaching with respect to fish consumption that would create awareness and stimulate further research into protein alternatives to illegal bushmeat in Ugalla and similar ecosystems. Likewise, study villages with higher mean amount of retained food crops tended to have lower poaching frequency, although this was not statistically significant (Table 2).

Table 2. Factors associated with wildlife poaching frequency among villages around Ugalla Game Reserve. Parameter estimates are given for significant effects only. df = 1.

Fixed effect	Deviance χ^2	P	Estimate ± s.e.
Village distance	32.10	<0.001	2.00 ± 0.90
Hunting block	5.23	0.022	
West			1.70 ± 0.82
East			1.30 ± 0.90
Fish consumption	4.88	0.027	-0.23 ± 0.10
Village distance x Hunting block	6.53	0.011	
West x Village distance			-0.08 ± 0.03
East x Village distance			-0.06 ± 0.02
Retained crop yield	3.03	0.082	-0.01 ± 0.01
Retained livestock	0.91	0.339	-
Livestock consumption	0.23	0.632	-

Bushmeat Consumption

Forty six percent of the respondents had consumed bushmeat within six months prior to the survey. Generally, villages close to Ugalla Game Reserve had a high bushmeat consumption frequency; there was considerable variation in the frequency of bushmeat consumption between villages at different location distances from Ugalla east and west hunting blocks, however. Bushmeat consumption near Ugalla west hunting block (about 60% of all bushmeat consumers) was higher than Ugalla east (40%). However, consumption increased with distance among communities near Ugalla east while the opposite pattern was observed in the villages adjacent to Ugalla west (Table 3). Variations in bushmeat consumption among local communities utilising the same conservation area are also reported elsewhere in another ecosystem in western Tanzania [47].

Table 3. Results from general linear model showing the influence of different predictors on the mean village bushmeat consumption. Parameter estimates are given for significant effects only. Df = 1.

Fixed effect	Deviance χ^2	P	Estimate ± s.e.
Hunting block	15.50	<0.001	
West			2.33 ± 0.53
East			1.54 ± 0.49
Village distance	2.14	0.256	0.05 ± 0.02
Village distance x Hunting block	20.68	<0.001	
West x Village distance			-0.11 ± 0.03
East x Village distance			0.18 ± 0.05
Fish consumption	0.46	0.385	-
Retained crop yield	0.11	0.640	-
Retained livestock	0.06	0.682	-
Livestock consumption	0.04	0.750	-

Reasons for bushmeat consumption in villages close to the reserve boundary, as pointed out by one of our key informers (K. Twaha) through personal communication, included villagers being given bushmeat by game scouts and other workers from some tourist hunting companies when they visited villages around Ugalla for official or private reasons. Another source of meat was from villagers who hunted in areas immediately outside the reserve, particularly farm lands. Indeed, Ugalla has a long history of ungulates going out of the reserve in search of palatable grazing during the rainy season when the reserve floods and for a short period afterwards [48], where they come across village farms and hunters take advantage of the situation under the umbrella of protecting their crops (K. Twaha, pers. comm.). Caro [49] noted that this could be one of the reasons for low densities of species outside protected areas in the Katavi-Rukwa ecosystem. Protected area edges close to human settlements are often subjected to severe hunting pressures [8].

The results in this study indicate the presence of additional factors that drive the heterogeneous variation in bushmeat consumption especially in villages far from the reserve. For example, bushmeat black markets [12, 14, 25, 32] that involve supply chains [29] can encourage consumption in areas far from protected areas. Olupot et al. [50] reported a good example of secretive networks of the bushmeat trade in Uganda, which included poachers, middlemen/dealers and consumers. Rise in people's living standards or wealth heightens bushmeat consumption [51]. Abundance of bushmeat species and heterogeneity of the spatial distribution of anti-poaching efforts can bring about varied bushmeat poaching and consumption [52, 53]. Perhaps future studies in the Ugalla ecosystem should consider exploring drivers of bushmeat consumption and wildlife poaching at the village and household levels while controlling for distances from human settlements to the nearest Ugalla Game Reserve boundary.

Conclusions

This article has revealed some important factors when seeking ways to strengthen the conservation of Ugalla Game Reserve. The Results indicate that wildlife poaching activities are largely carried out by villagers closer to the reserve.

Rainfall seasons in conjunction with agricultural cycle influenced poaching activities. Ineffectiveness of anti-poaching operations in wet seasons is a serious matter in the conservation of Ugalla. Accessibility to the reserve should be enhanced through shortening of the distance to the reserve and improving access road conditions to cope with wet seasons. The reserve management team has done its best to construct and maintain three active game posts, namely Ipole, Ussoke and Lumbe. Strengthening these game posts and ensuring adequate means of transport would boost anti-poaching activities in the ecosystem. There is a Wildlife Division's anti-poaching unit in Tabora (popularly known as KDU-Tabora – a Swahili abbreviation for Kikosi Dhidi Ujangili-Tabora) which oversees all anti-poaching activities in

western Tanzania. We think that KDU-Tabora is already weighed down as it currently covers a large area (western Tanzania and nearby areas) with few staff. In fact, extensive and thorough assessment of the effectiveness of anti-poaching activities in the Ugalla ecosystem needs to be carried out, and practical recommendations developed and implemented.

Fish provided the best alternative to bushmeat at the village level. In order to ensure sustainability of fisheries resources in the area, aquaculture production should be promoted. Mwangi [54] defined aquaculture as 'the growing (farming) of fish and other aquatic organisms in controlled environments'. The author argued further that aquaculture is a great replacement of wild fish stocks during times of fish scarcity. Plans to ensure sustainable food security, in the periods of low food crop harvests, for villagers around Ugalla are also of supreme importance.

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