



## **Assessment of Wildlife Poaching in Ugalla Game Reserve, Western Tanzania: Preferred Animal Species and Products**

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### **Abstract**

*Illegal hunting of wildlife for subsistence (poaching) is a significant threat to conservation areas in Africa. As law enforcement is the main method used to deter poaching within protected areas, an understanding of the items confiscated from poachers upon arrest can provide an insight into the pressure suffered by different wildlife species, and improve law enforcement efforts accordingly. In this paper, long-term ranger-collected data was used to determine hunting gear and wildlife products seized from poachers in the Ugalla Game Reserve of western Tanzania. Overall, 27 wildlife species were established as having been killed by poachers, with common duiker (*Sylvicapra grimmia*), hippopotamus (*Hippopotamus amphibius*), African elephant (*Loxodonta africana*), and impala (*Aepyceros melampus*) found to be the most commonly poached species. Over 70% of the species were hunted for bushmeat. Some of these species seemed to be more preferred and more abundant. Other confiscated wildlife products included animal teeth, tails, skins, skulls, and horns; suggesting that uses of wildlife in Ugalla are more diverse. Three hundred and twenty-four poachers were arrested, with more than 18 arrests recorded in 7 out of the 11 years for which there was data. The majority of the arrested poachers used muzzleloader rifles. This paper presents possible implications of these findings for wildlife conservation in Ugalla.*

**Keywords:** *poaching; hunting gear; confiscations; wildlife species; Ugalla Game Reserve*

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## **1 Introduction**

Wildlife poaching – illegal hunting of wildlife for food and other purposes – is a common problem in Africa (Davies & Brown, 2007; Ripple et al., 2016) and conservation scientists have identified many factors that drive poaching (e.g. Lindsey et al., 2013), including poor agricultural productivity in rural areas (Agrawal & Redford, 2006; Brockington & Wilkie, 2015), rural poverty and limited livelihood alternatives to subsistence hunting (Coad, 2007; Harrison et al., 2015). For most rural dwellers in Africa, subsistence agriculture is the primary livelihood (Davis et al., 2017), thus low agricultural productivity impacts household food security, and may ultimately lead to dependence on natural resources (for example, Cawthorn & Hoffman, 2015). The ongoing growth in human populations near conservation areas, alongside the rise in living standards, are said to intensify pressure on wildlife, mainly through poaching and habitat degradation (Caro & Davenport, 2016). Preference for bushmeat because of its taste, affordability, and availability has made it more popular than most other sources of animal protein, such as livestock and fish (Ndibalema & Songorwa, 2007; Ordaz-Németh et al., 2017).

Poaching negatively affects wildlife and habitat in different ways (Wilfred, 2012). Unlike other forms of hunting (e.g. trophy hunting), poaching involves the use of both selective and non-selective methods like guns, wire snares, pitfalls, dogs, and fire (Mfunda & Røskaft, 2010; Lindsey et al., 2013), resulting in the mortality of target and non-target species (Coad, 2007; Lindsey et al., 2013). This can drive wildlife population declines and extinctions (Ginsberg & Milner-Gulland, 1994; Coad, 2007; Caro, 2008). In addition, sex ratios in exploited wildlife can become extremely

skewed towards females (Milner-Gulland et al., 2003; Setsaas et al., 2007; Marealle et al., 2010), which can lead to reduced fecundity and limited population growth (Gordon et al., 2004). In the critically endangered saiga antelope (*Saiga tatarica tatarica*), for instance, the highly female-biased sex ratio is believed to have caused reproductive collapse (Milner-Gulland et al., 2003). Poaching of species such as elephants may affect their movement patterns and home ranges (Goldenberg et al., 2018), which in turn may affect plant species composition, and diversity, specifically because elephants play an important role in the seed dispersal of many plants (e.g. Campos-Arceiz & Blake, 2011).

There is increasing pressure for conservationists in Africa and around the world to find smart, sustainable methods that can help address the root causes and challenges of poaching while still meeting conservation objectives (Wilfred, 2012; Brockington & Wilkie, 2015). Such methods include integrated conservation and development (ICD) projects aimed at striking a balance between conservation and poverty reduction (Harrison et al., 2015); participatory conservation, where local people are considered as key stakeholders in conservation initiatives where their interests may be directly or indirectly affected (Paudel et al., 2007); protein alternatives to bushmeat, usually fish and livestock (Brashares et al., 2004; Rowcliffe et al., 2005; Ndibalema & Songorwa, 2007); and law enforcement. Law enforcement is the predominant method used to ensure adherence to conservation norms (Critchlow et al., 2016). In protected or conservation areas, law enforcement is conducted using ranger patrols on a daily, monthly, weekly, or ad-hoc basis, to deter and apprehend poachers, and confiscate their belongings and poached wildlife products (Jachman, 2008; Critchlow et al., 2016). An

understanding of hunting gear and wildlife products confiscated from poachers, and species the products are obtained from can inform law enforcement efforts by serving as an indicator of pressures facing individual wildlife species.

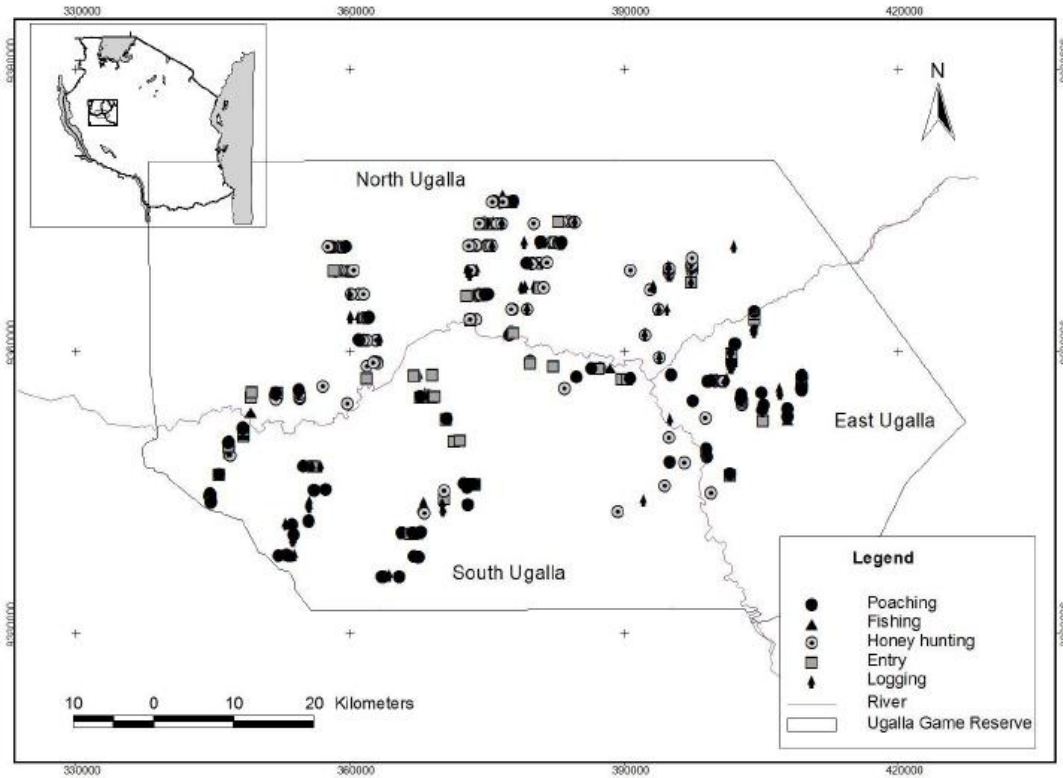
Just like many other protected areas in the country, and indeed elsewhere in Africa, Ugalla Game Reserve (hereafter Ugalla) is experiencing a high level of poaching (Wilfred et al., 2017). Tanzania Wildlife Management Authority (TAWA) rangers carry out patrolling inside the reserve to deter offenders from poaching; however, controlling the problem remains an uphill struggle. To inform anti-poaching efforts and other conservation actions, I used long-term data (2007 to 2017) on illegal activity from the reserve to determine the number of arrests of poachers during the wet and dry seasons each year; the poaching gear commonly used in Ugalla; the species poached, the wildlife products harvested by poachers; and the relationships between offtake and animal density (individuals/km<sup>2</sup>), and offtake and species preferred by poachers (as identified by local people).

## 2. Materials and Methods

### 2.1 Description of study area

Ugalla, western Tanzania, is situated at 5°–6° South, 31°–32° East, and covers approximately 5000 km<sup>2</sup> (Fig. 1). The area was gazetted as a game reserve in 1965 to

reduce pressure on natural resources. Ugalla experiences a tropical climate defined by wet season (January to June) and dry season (July to December). The reserve consists of miombo woodland characterised by species such as *Brachystegia speciformis*, *B. microphylla*, *B. bussei*, and *Isoberlinia globiflora*. The area is home to an array of wildlife, including mammals – African elephant, impala, hartebeest, Kirk’s dik-dik, lion, hippopotamus, and the endangered African wild dog; and birds – helmeted guineafowl, ostrich, shoebill, wattled crane, southern red bishop, hamerkop, and miombo wren-warbler (UGR, 2006). The main legal activity in the reserve is tourist/trophy hunting performed in three hunting blocks, namely East Ugalla, North Ugalla, and South Ugalla. The hunting blocks are leased by foreign investors (trophy hunting operators), who pay considerable fees to TAWA for hunting licenses (e.g. game fees and hunting permits). Although Ugalla is administered and patrolled by TAWA, trophy hunting operators occasionally support anti-poaching activities financially or through hiring temporary patrollers (trained local citizens) as game scouts to work alongside TAWA rangers as part of their contribution to conservation. Anti-poaching patrols are conducted both on foot and in vehicles in most sections of the reserve, but poaching remains a problem (UGR, 2006; Wilfred et al., 2017).



**Figure 1:** Ugalla Game Reserve showing locations of poaching and other types of illegal activity as reported by Wilfred (2015). Names show approximate locations of trophy hunting blocks. Inset shows the location of the reserve in Tanzania

## 2.2 Poaching Data

Secondary data were used in assessing poaching in the study area. The data were obtained as part of a study of the factors affecting ranger patrols in Ugalla, which had approval from the Wildlife Division of Tanzania. These data were extracted from Ugalla’s database on registered wildlife cases from 2007 to 2017. The database contained information about the start and finish dates for a completed patrol (patrol dates), number of rangers per patrol, patrolled areas within Ugalla, poachers (names and places of residence), animals killed in each poaching incidence, the items confiscated from poachers (e.g. rifles, bicycles) and poached wildlife products (e.g. skin, horns, bushmeat). Unfortunately, the dataset lacked some GPS locations of arrests, especially for patrols conducted

from 2007 to 2015, and it was therefore not possible to estimate patrol effort using distance covered and areas visited, as is commonly done (e.g. Hötte *et al.*, 2016). Alternatively, following Nahonyo (2005), the number of patrol days was used as a measure of patrol effort. Animal density estimates were obtained from Wilfred & MacColl (2016), except for four species – common duiker, kirk’s dik-dik, eland, and greater kudu – that had no density estimates. The densities of these species were obtained from the Katavi-Rukwa ecosystem (Caro, 1999), also in western Tanzania, with wildlife habitat similar to Ugalla. Information on species preferred by poachers was gathered from five hundred seventy-three household interviews conducted in 19 randomly selected villages near Ugalla as part of a large-scale study of

conservation effectiveness (*see* Wilfred & MacColl, 2015).

### 2.3 Data Analysis

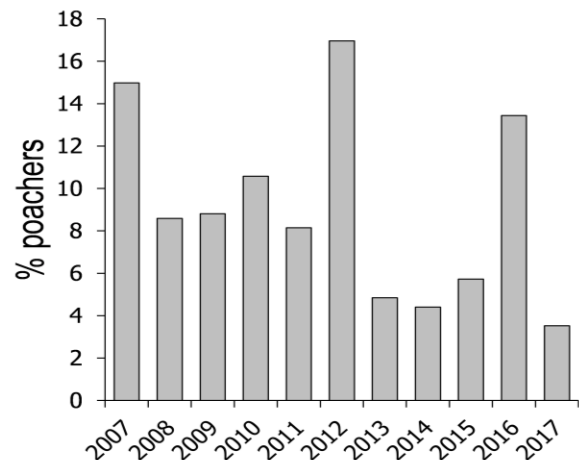
Information on poaching gear, arrests made, animals killed, and wildlife products was summarised to get frequency counts and percentages for simple comparisons and clearer understanding of the aspects of interest. Since rainfall affects the accessibility and coverage of patrols in remote areas of Ugalla (*P.W.'s unpublished data*), the number of poachers arrested during the wet and dry seasons were taken into consideration. Seasonal difference in the number of arrests was examined using a Mann-Whitney-Wilcoxon test. The variations in the number of arrests across years, and animals killed across species were analysed using the Kruskal-Wallis test. The relationships between offtake and density, and offtake and number of times a species was mentioned by villagers as favoured by poachers were analysed with Pearson's correlations. All statistical tests were performed in *R* v. 3.2.2 (R Development Core Team, 2015), and the significance level was set to 0.05.

### 3. Results

Although patrol days ranged from 5 to 24, there was no considerable variation in the number of days across patrols. On average there were 14 patrol days per patrol trip. Patrols arrested 113 groups of poachers and a total of 324 poachers, which is an average of 2.9 poachers per group, and 32.4 poachers per year between 2007 to 2017. The number of arrests varied significantly across years (Kruskal-Wallis chi-squared = 26.946, *df* = 10, *p*-value = 0.0027; Fig. 2) but did not differ significantly between the dry and wet seasons (*W* = 1590.5, *p*-value = 0.9815). In total, patrols confiscated 80 homemade muzzleloader rifles, 30 modern firearms, and 384 wire snares. Forty-seven poaching groups (41.6%) used muzzleloaders only, 14

(12.4%) modern firearms, 10 (8.8%) wire snares, 6 (5.3%) muzzleloaders and firearms, 3 (2.7) muzzleloaders and snares, and 33 (29.2%) had no poaching gear.

There were 159 confiscations of illegal wildlife products from which approximately 27 species were identified as having been killed (Table 1). A total of 164 animals were removed from Ugalla by poachers in the period 2007 to 2017. The number of animals killed varied across species (Kruskal-Wallis chi-squared = 47.624, *df* = 26, *p*-value = 0.0059, Table 1). The species with the highest number of animals hunted was common duiker, followed by hippopotamus, African elephant, and impala. Additionally, the majority of the confiscated animal products came from the same species. Bushmeat was the most commonly encountered wildlife product, followed by teeth and skin (Fig. 3). About 70% of the species affected by poaching were hunted primarily for bushmeat (Table 1).



**Figure 2:** People arrested for illegal hunting by the law enforcement patrols of the Ugalla Game Reserve between 2007 and 2017, *N* = 324 poachers

The frequency with which a species was mentioned as being targeted by poachers was significantly positively correlated with illegal offtake ( $r = 0.58$ ,  $df = 25$ ,  $P = 0.0016$ ; Fig. 4). Species with less than 4% of illegally removed individuals were rarely mentioned as targeted by poachers (all mentioned fewer than 2 times). Such species

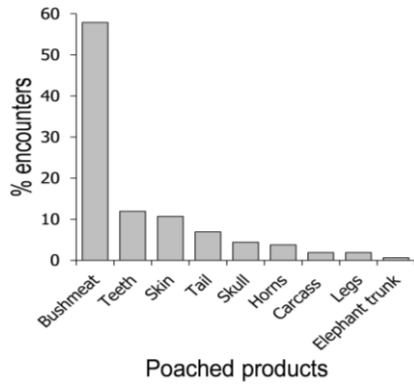
included dik-dik, sable antelope, lion, greater kudu, and crocodile (Table 1). Offtake was also positively correlated with animal density for selected species ( $r = 0.63$ ,  $df = 25$ ,  $P = 0.0211$ ; Fig. 5), which means that abundant species were hunted more frequently than less abundant ones.

**TABLE 1: Wildlife species and their products illegally removed from Ugalla Game Reserve, western Tanzania, in 2007–2017 (N = 164 animals)**

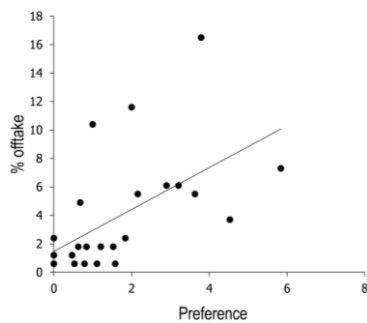
Species	% confiscated offtake	Global conservation status <sup>‡</sup>	Poached product (encounters*)
Common duiker ( <i>Sylvicapra grimmia</i> )	6.5	least concern (LC)	horns (1), meat (15)
Hippopotamus ( <i>Hippopotamus amphibius</i> )	1.6	vulnerable (VU)	legs (1), meat (12), skull (1), teeth (5)
African elephant ( <i>Loxodonta africana</i> )	0.4	vulnerable (VU)	meat (3), tail (6), trunk (1), teeth (12)
Impala ( <i>Aepyceros melampus</i> )	.3	least concern (LC)	horns (2), skin (3), skull (3), meat (6)
Lichtenstein's hartebeest ( <i>Alcelaphus buselaphus lichtensteinii</i> )	.1	least concern (LC)	meat (9), tail (1)
Topi ( <i>Damaliscus korrigum</i> )	.1	vulnerable (VU)	meat (8), skin (2)
African buffalo ( <i>Syncerus caffer</i> )	.5	least concern (LC)	meat (8), skull (1)
Common warthog ( <i>Phacochoerus africanus</i> )	.5	least concern (LC)	meat (5), skull (2), tail (1), teeth (1)
Giraffe ( <i>Giraffa camelopardalis</i> )	.9	vulnerable (VU)	meat (5), tail (3)
Kirk's dik-dik ( <i>Madoqua kirkii</i> )	.7	least concern (LC)	meat (6)
Leopard ( <i>Panthera pardus</i> )	.4	vulnerable (VU)	skin (4)
Lion ( <i>Panthera leo</i> )	.4	vulnerable (VU)	carcass (1), skin (2), teeth (1)
Sable antelope ( <i>Hippotragus niger</i> )	.4	least concern (LC)	horns (1), meat (3)
Bushbuck ( <i>Tragelaphus scriptus</i> )	.8	least concern (LC)	horns (1), meat (1), skin (1)
African savanna hare ( <i>Lepus microtis</i> )	.8	least concern (LC)	legs (1), meat (1)
Oribi ( <i>Ourebia ourebi</i> )	.8	least concern (LC)	meat (2), skin (1)
Bohor reedbuck ( <i>Redunca redunca</i> )	.8	least concern (LC)	meat (3)
African civet ( <i>Civettictis civetta</i> )	.2	least concern (LC)	meat (1), skin (1)
African wildcat ( <i>Felis lybica</i> )	.2	least concern (LC)	skin (2)
Waterbuck ( <i>Kobus defassa</i> )	.2	least concern (LC)	horns (1), skin (1)
Bushpig ( <i>Potamochoerus porcus</i> )	.6	least concern (LC)	meat (1)
Nile crocodile ( <i>Crocodylus niloticus</i> )	.6	least concern (LC)	carcass (1)
Eland ( <i>Turotragus oryx</i> )	.6	least concern (LC)	meat (1)
Honey badger ( <i>Mellivora capensis</i> )	.6	least concern (LC)	carcass (1)
Helmeted guineafowl ( <i>Numida meleagris</i> )	.6	least concern (LC)	meat (1)
Greater kudu ( <i>Strepsiceros strepsiceros</i> )	.6	least concern (LC)	meat (1)
Porcupine ( <i>Hystrix galeata</i> )	.6	least concern (LC)	legs (1)

<sup>‡</sup> Least concern (LC): a species which is considered not critically endangered, endangered, vulnerable or near threatened by the International Union for Conservation of Nature (IUCN). Most widespread and abundant taxa fall under this category (IUCN, 2012). Vulnerable (VU): 'a species which is considered to be facing a high risk of extinction in the wild' by the IUCN unless its conservation is improved (IUCN, 2012).

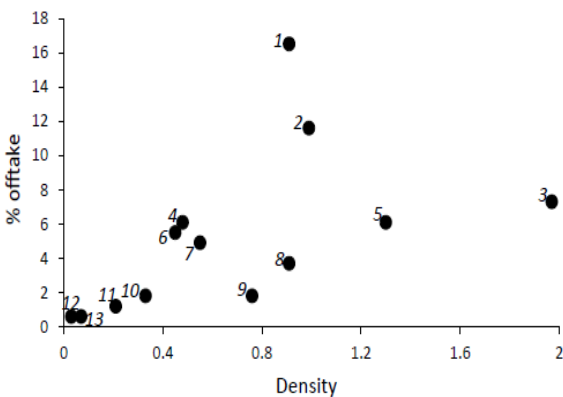
\*Number of times a product was encountered



**Figure 3:** Wildlife products confiscated by law enforcement patrols in Ugalla Game Reserve between 2007 and 2017, N = 159 confiscations



**Figure 4:** Relationship between frequency with which species were mentioned in interviews with local communities as being preferred by poachers and illegal offtake



**Figure 5:** Relationship between density (individuals km<sup>-2</sup>) of selected species and illegal offtake. 1 = common duiker, 2 = hippopotamus, 3 = impala, 4 = lichtenstein's hartebeest, 5 = topi, 6 = common warthog, 7 = giraffe, 8 = kirk's dik-dik, 9 = oribi, 10 = bohor reedbeek, 11 = waterbuck, 12 = eland, 13 = greater kudu.

#### 4. Discussion

Although the use of only secondary data sources in conservation research is potentially subject to bias, the long-term secondary data used in the present manuscript can guarantee a more objective reporting on aspects of law enforcement interests. This study found evidence that 27 species were poached in Ugalla. Six of the species – hippopotamus, African elephant, topi, giraffe, leopard, and lion – were globally-vulnerable species recognised by the International Union for Conservation of Nature (IUCN). The correlation between higher offtake observed in some species and both hunter preference and species density suggests that these factors are drivers of hunting choices, but further information is needed to ascertain whether hunter effort is one of the factors leading to increased offtake.

Over 50% of the arrested poachers hunted bushmeat. This is not surprising as bushmeat has long been a common source of protein in natural-resource dependent communities, especially in Africa (Davies & Brown, 2007). Bennett et al. (2006) defined bushmeat as ‘an African term that includes all wildlife species used for food, from cane rats to elephants’. In central and west Africa, for example, the problem has already reached a significantly high level of intensity (Blom et al., 2005; Waite, 2007) as wildlife populations there may not support further sustained offtake (Milner-Gulland et al., 2003; Wright & Priston, 2010). Bushmeat hunting has also been reported in other East African countries such as Uganda (e.g. Harrison et al. (2015), and Kenya (Wato et al., 2006).

Animal teeth were the second most frequently confiscated wildlife product. Most of the poached teeth belonged to hippopotamus and elephants. Other conservation literature suggests that elephants are poached for both their tusks (extended front teeth/incisors) and bushmeat (Blake et al., 2007; Stiles, 2011). In Tanzania, poaching is the root cause of the

decline of the elephant population (Kideghesho, 2016). The exploitation of elephants for ivory in Ugalla dates back to the 1800s during the famous “caravan” trade when people resorted to the lucrative ivory trade at the expense of the survival of the species (Roberts, 1968). In the case of hippos, a recent study on ‘the trade of hippo ivory’ suggests that Tanzania is one of the main sources of poached hippopotamus teeth (Andersson & Gibson, 2018). Ripple et al. (2015) argued that hippopotamus face increased pressure from hunting for their ivory teeth. Like other species, bushmeat is another reason why poachers favour hippopotamus. In the Katavi-Rukwa ecosystem, for example, hippopotamus is among the top bushmeat species favoured by poachers (Caro, 2008). Elsewhere in Uganda, hippopotamus is a common species on bushmeat menus (BEAN, 2009; Olupot et al., 2009).

The confiscation of other wildlife products like horns, skin, tails, and skulls, suggests that non-meat wildlife products may be favoured by poachers as well. This fits with a study in Nepal, which examined a 10-year dataset of records on poacher arrests (Dangol, 2015). The author found a range of confiscated wildlife products/parts, including horns, tusks, meat, and skins. Another study by Ocholla et al. (2016) indicates that all non-meat wildlife products are important in the livelihoods of local people; for example, the authors found that in the Samburu communities in Kenya, skins, tails, horns and feathers derived from lion, giraffe, greater kudu, and Somali ostrich, (*Struthio camelus*), respectively, are used for cultural beliefs and practices, and medicinal purposes. Vats & Thomas (2015) argued that wildlife parts like warthog tusks/teeth, skin from African elephant, and blood from hippopotamus are used as animal-based traditional medicines by Sukuma communities in Tanzania. Although the use of wildlife products other than bushmeat could not be established with the findings in this study, a

possible explanation is that such products are being sold or considerably relied upon for a range of other essential needs by the local communities in Ugalla. Therefore, future research should determine the use and use values of wildlife products derived from each of the exploited species in the area, preferably from the local communities’ viewpoint.

Law enforcement patrols arrested an average of 11.3 poaching groups per year, which is about half the annual average of Ruaha National Park, 22.4, Nahonyo (2005). This difference could possibly be because the latter included different types of illegal activity, ranging from poaching, logging, and fishing to livestock grazing and human encroachment into protected area. There was no consistently discernable trend across years over poachers arrested. This could be due to varying levels of anti-poaching effort, and ‘competing dynamics’ between rule breakers and wildlife law enforcement. For example, studies indicate that anti-poaching effort is a trade-off between poaching and the incentives not to engage in poaching (e.g. Bulte & Van Kooten, 1999; Duffy & St John, 2013). This means that the success of law enforcement patrols can be influenced by a number of factors; for instance, offenders can react to patrolling effort by altering their behaviour so as to circumvent anti-poaching patrols (Ford, 2005; Keane et al., 2008); and experienced poachers can avoid detection by patrollers (Forsyth, 2008). Other incentives to poach may also come into play primarily due to poverty (Duffy & St John, 2013; Challender & MacMillan, 2014), and the tendency of poaching offences to receive relatively lenient penalties (Salum et al., 2017). Since law enforcement patrols are particularly important for their deterrence effects on poaching (Ford, 2005; Critchlow, et al., 2016), more study would be required to monitor both the annual variation in the success of ranger patrols, especially in terms of the number of poachers arrested per unit effort, and the poacher



behaviour, and provide practical recommendations for achieving consistently effective enforcement in Ugalla.

The hunting methods used in Ugalla are not uncommon in conservation areas (Hofer et al., 1996; Knapp et al. 2017). Most of the modern guns used for illegal hunting in the area may have originated from Katumba refugee camp located near the reserve (e.g. Wilfred, 2012). Jambiya et al. (2007) noted that refugee camps near protected areas are the main source of illegal guns used by poachers. The high number of poaching groups using muzzleloaders probably reflects that a muzzleloader is the most readily available hunting gear to poachers entering Ugalla. Similarly, previous studies show that muzzleloader hunting is common in western Tanzania (Carpaneto & Fusari, 2000). Compared with other studies that have assessed poaching in Tanzania (Holmern et al., 2007; Knapp et al., 2017), the findings here indicate a somewhat different pattern as regards illegal hunting methods. For example, the main bushmeat hunting gear in the Serengeti ecosystem is “wire snares” (Hofer et al., 1996; Kaltenborn et al., 2005). Nearly 30% of the arrested poaching groups were without a poaching gear, which suggests that a significant proportion of poaching groups may serve as porters on hunts. Alternatively, hunting gear may have been hidden within the protected area for use later.

This paper has presented two examples of factors influencing illegal offtake or poaching, namely preference for bushmeat and population densities of exploited species. The data have shown that species with higher offtake rate are more preferred and more abundant. This relationship has been shown in other ecosystem by the studies of bushmeat hunting (e.g. Ndibalema & Songorwa, 2007; Gandiwa, 2011). The direct relationship between offtake and density is problematic because its persistence may cause population

declines. There is increasing evidence that the targeting, by poachers, of medium and large-sized mammals that were once abundant has had significant impacts on densities of the species in question, precisely because of sustained preference for areas with greater prey densities (e.g. Milner-Gulland et al., 2003; Caro, 2008; Ripple et al., 2016). Studies suggest that poachers can increase their effort in response to changes in species densities in order to ‘maximise returns’ (Coad, 2007). For example, in the Tsavo ecosystem of south-eastern Kenya, Maingi et al. (2012) noted that elephant poachers concentrated their efforts in areas with relatively large and high-density elephant populations to guarantee returns.

## **5. Conclusion**

These findings indicate that poachers in Ugalla target many different species and wildlife products. In the wider context, it looks like there is evidence here that hunters are driven by different factors. Ivory hunting, for example, is commercial and lucrative, whereas bushmeat is often connected with subsistence needs (although definitely not always). Since the majority of the poachers come from the villages surrounding the reserve (see Wilfred et al., 2017), conservation efforts to address the drivers of poaching may need to be targeted specifically toward these areas. For instance, regular operations to confiscate muzzleloaders and other poaching weapons among the local communities may reduce the intensity of poaching. Protein alternatives to bushmeat should be made available to locals to reduce demand for bushmeat. Examples of such alternatives include fish, cattle, chicken, and other types of livestock (Wilfred, 2012). Alternatives to bushmeat hunting such as agricultural production (e.g. livestock and fish-farming) can also act as income generating activities (see for example Wilkie et al., 2016). Improving the efficiency and effectiveness of ranger patrols should be an overarching objective of Ugalla’s law

enforcement strategy (P.W.'s unpublished data). Other conservation approaches, including participatory conservation and community outreach to raise conservation awareness, which are also used elsewhere in western Tanzania (Borgerhoff Mulder et al., 2007) should be implemented. These approaches can help conservationists tackle demand for bushmeat, as demonstrated by Veríssimo et al. (2018) in northern Tanzania. The present study aimed at shedding some light on poached wildlife products in Ugalla. It is important to be explicit here that there are many other types of illegal activities in the reserve, like logging and fishing, which are worth looking at in the future; and that the correlations in this study do not necessarily imply causation, but provoke further work on the impacts of consumptive use of wildlife in Ugalla ecosystem

## 6 Acknowledgments

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