



Socioeconomic drivers of illegal bushmeat hunting in a Southern African Savanna

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ABSTRACT

Illegal bushmeat hunting of economically and ecologically valuable wildlife populations is emerging as a threat across African savannas. Due to the cryptic nature of illegal hunting, little information exists on the drivers of the bushmeat industry. Here we report on the socioeconomic drivers identified in a broader investigation into illegal bushmeat hunting in rural villages around a southern African savanna ecosystem, the Okavango Delta, Botswana. We conducted interviews with bushmeat hunters and heads of rural households about hunting activities, rural livelihoods, attitudes towards wildlife, and market characteristics of illegal bushmeat. Using generalized linear models, we identified and investigated a set of independent variables that characterize illegal-hunter households. Results revealed that compared to non-hunter households, illegal hunter households ($n = 119$, 25% of the sample) lived in closer proximity to wildlife, were more likely to farm crops, and more often received income from formal employment by at least one household member. Bushmeat hunting was positively correlated with livestock wealth but not associated with household income. Only 11.4% ($n = 44$) of non-hunter households reported purchasing bushmeat. Most households (84%) reported incurring costs associated with living near wildlife (e.g., damages to crops or livestock), with no difference between hunter and non-hunter households. Hunters were more likely to say they valued wildlife. We conclude that bushmeat hunting in Botswana is generally supplemental to household core income sources rather than essential for subsistence. We propose two interventions to counter the negative impacts of illegal hunting on the region's lucrative wildlife-based economy: 1) more effective law enforcement that imposes costs for hunting illegally, and 2) development of alternative wildlife-based revenue streams that motivate communities to conserve wildlife.

1. Introduction

Bushmeat hunting has driven many species and ecosystems to the brink of extinction or collapse (Galetti and Dirzo, 2013; Ripple et al., 2016). Bushmeat hunting, or the hunting of wild animals for the primary purpose of consuming the meat or selling the meat for consumption, has long been a focus of socioecological research in the forests of Central and West Africa (Fa et al., 2002; Fa and Brown, 2009; Abernethy et al., 2013). More recently, bushmeat hunting has emerged as a severe threat to wildlife in the savannas of East and Southern Africa (Lindsey et al., 2013; van Velden et al., 2018). Wildlife are declining as a result (Hilborn et al., 2006; Hayward, 2009; Lindsey et al., 2011a; Lindsey et al., 2015; Rogan et al., 2017). Amidst growing concern for the conservation implications of bushmeat hunting, our understanding

of the drivers and socioeconomic implications of bushmeat hunting in savannas remains limited, particularly across Southern African ecosystems.

Findings from the few savanna ecosystems that have been studied are generally complex and contradictory (van Velden et al., 2018). Further, we cannot assume that the lessons learned from studying bushmeat hunting in the forest biome will hold true for savanna systems. Large vertebrate communities are more productive in mesic savannas than forests, increasing potential bushmeat harvests (Robinson and Bennett, 2004), while the prevalence of pastoral communities expands the scope for human-wildlife conflict in savannas. Wildlife-based industries such as trophy hunting and photographic tourism are also more prominent in savannas. These industries contribute billions of dollars to regional economies (Makochehanwa, 2013) and depend on

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effective strategies to control illegal and unsustainable bushmeat hunting.

Most bushmeat hunting in savannas is illegal (Lindsey et al., 2013). This complicates research. Data collection on illegal activities is challenging and underreporting is common (Knapp et al., 2010). Yet two general perceptions emerge from the literature: illegal hunting is 1) a subsistence activity practiced primarily by poor households for consumption, or 2) a commercial practice done for financial gain (Duffy and St. John, 2013). The truth is more complex (Duffy et al., 2016). The relationships between illegal bushmeat hunting and poverty or wealth vary, both within and among communities, in response to diverse regulatory and socioeconomic conditions (Brashares et al., 2011; van Velden et al., 2018).

In the simplest terms, consuming bushmeat and selling it for cash are the two most direct benefits hunters derive (Muth and Bowe Jr., 1998; Nielsen et al., 2017). Most bushmeat hunting globally is for home consumption (Nielsen et al., 2017). However, some hunters earn substantial income from selling bushmeat (Loibooki et al., 2002; Damania et al., 2005; Kümpel et al., 2010; Lindsey et al., 2011b; Rentsch and Damon, 2013; Nielsen and Meilby, 2015).

Bushmeat hunting is frequently presumed to stem from community-level poverty (Adams et al., 2004). Hunters are often unemployed (Knapp, 2007; Lindsey et al., 2011b) and, in some areas, own fewer livestock than non-hunters (Loibooki et al., 2002). Hunting is sometimes associated with responses to human-wildlife conflict (Alexander et al., 2014; Kahler et al., 2013). Bushmeat is typically an inexpensive alternative protein source in rural areas where it originates (Ndibalema and Songorwa, 2008; Rentsch and Damon, 2013; Lindsey et al., 2011b), but in some contexts the poorest households may lack the resources required for hunting (Coad et al., 2010) even in the face of food insecurity (Brashares et al., 2011). In these cases, rural households that hunt are wealthy relative to their communities (Coad et al., 2010; Mgawe et al., 2012). Wealthier urban households create commercial demand and intercontinental markets (Chaber et al., 2010) underpinned by premium prices (Bennett, 2002; van Vliet and Mbazza, 2011).

Social issues also motivate bushmeat hunting. Empirical studies have found that local hunting rates in Africa vary with ethnic group (Ceppi and Nielsen, 2014). Elevated social status obtained through hunting is a key motivator (Brown and Marks, 2007; Lindsey et al., 2013). People seek bushmeat because they prefer the taste or wish to add variety to their diet (Wilkie et al., 2005; Lindsey et al., 2011b). Some perceive bushmeat as healthier than meat from livestock (van Vliet and Mbazza, 2011). Where it is illegal, hunting can be an expression of personal or traditional rights, or an act of defiance against the state or landowner (Muth and Bowe Jr., 1998; Harrison et al., 2015). Illegal hunting is not purely a product of circumstance. Individual attitude, behavior, and decision-making are critical motivators (Duffy et al., 2016).

We explored the motivations for illegal bushmeat hunting in the Okavango Delta of Botswana, a World Heritage site renowned for its rich wildlife community. The Delta is the cornerstone of Botswana's lucrative wildlife tourism industry, which contributed 11% of national GDP in 2016 (WTTC, 2017). The economic benefits deriving from the tourism sector are vital to the region but are unevenly distributed geographically (Mbaiwa, 2005). In 2009–2010, 28% and 47% of residents in the Ngamiland East and Ngamiland West census districts lived below the poverty line (Statistics Botswana, 2014).

Botswana traditionally permitted limited bushmeat and trophy hunting on designated public lands. In January, 2014, the government stopped issuing permits to hunt mammals due to concerns about declines in wildlife populations (Mbaiwa, 2017a). All subsequent bushmeat hunting has been illegal with the exception of regulated hunting of game birds. Illegal bushmeat hunting is pervasive in and around the Delta, although illegal hunting has generally been overlooked as a critical conservation issue (Rogan et al., 2015). Rogan et al. (2017)

estimated that nearly 2000 illegal hunters operate in the Delta, extracting > 500,000 kg of meat per annum. The scale and intensity of illegal hunting is likely unsustainable, reducing the capacity of the Delta to support large carnivore populations and compromising the growing wildlife-tourism industry (Rogan et al., 2017). Due to the severity of these threats, mitigating illegal bushmeat hunting is one of the most critical conservation challenges in northern Botswana.

We interviewed bushmeat hunters and heads of households in 13 villages in the region; we used these data to compare the socioeconomic characteristics of hunter households to non-hunter households and to describe patterns in livelihoods, bushmeat hunting and consumption, and attitudes towards wildlife. We investigated several hypotheses: that most bushmeat hunters would 1) lack formal employment (Lindsey et al., 2011b), 2) identify with certain ethnic groups (Ceppi and Nielsen, 2014; Kiffner et al., 2015), and 3) have direct access to protected areas where wildlife was accessible (Brashares et al., 2011; Ceppi and Nielsen, 2014). We aim to provide conservationists and policy makers with insights into illegal hunting in African savannas. We further offer recommendations for policy interventions tailored to the Delta but relevant across savanna ecosystems.

2. Methods

2.1. Study area

The Okavango Delta is a ~20,000 km² inland freshwater delta, savanna, and woodland ecosystem in northern Botswana that hosts a rich community of large vertebrates (McNutt, 1996). The Delta's network of protected areas consists of the Moremi Game Reserve (MGR) surrounded by 18 Wildlife Management Areas (WMAs), land concessions that the government leases to private companies or community trusts for the purpose of wildlife-based tourism (Fig. 1). Boundaries between WMAs and areas designated primarily for human land use (hereafter “residential concessions”) are delineated by semi-permeable veterinary fences designed to inhibit the spread of disease from wildlife to livestock. Although they are intended to separate livestock and wildlife to prevent disease transmission, animals routinely cross the fence lines, with cattle entering protected areas (Rich et al., 2016) and wildlife widely distributed on community grazing lands (EWB 2010).

Enforcement of wildlife laws varies among concessions in the Delta. All concession lease holders are required to conduct monitoring as part of their management agreements, but they are not obligated to conduct anti-poaching. Some WMA leaseholders employ private anti-poaching teams, and the Department of Wildlife and National Parks and the Botswana Defence Force conduct anti-poaching patrols throughout the region, with an emphasis on high-value poaching for ivory and rhinoceros horn. Wildlife crimes are investigated by the Botswana Police Service.

We surveyed households in 13 villages in the Okavango Delta. All were located within 35 km of WMAs, a reasonable distance for hunters travelling on horseback or spending multiple nights on hunting expeditions (Loibooki et al., 2002). Villages were geographically, economically, and ethnically diverse (see Rogan et al., 2017 for a more detailed description of study villages). Eleven study villages consisted of a core residential area surrounded by cattle posts, semi-permanent outposts used primarily for accessing remote crop fields or grazing livestock. Two of the villages consisted entirely of cattle posts. We concentrated efforts to interview bushmeat hunters in six villages along the western edge of the Delta's protected areas. We selected this region because bushmeat hunting was well-documented and because these villages exhibited variation in village economies and land use policies which were representative of the Delta as a whole.

2.2. Interviews

Semi-structured interviews with heads of households and bushmeat

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