Illegal Bushmeat Hunting in the Okavango Delta, Botswana

Drivers, Impacts and Potential Solutions
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Recommended citation:

ISBN: 978-0-620-68693-8 (print)
ILLEGAL BUSHMEAT HUNTING IN THE OKAVANGO DELTA, BOTSWANA

DRIVERS, IMPACTS AND POTENTIAL SOLUTIONS

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Technical Cooperation Programme Project (TCP/BOT/3501)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Zimbabwe 2015

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ACKNOWLEDGEMENTS

The work presented in this report was done thanks to the technical and financial support of the Food and Agriculture Organization of the United Nations (FAO) Technical Cooperation Programme Facility TCP/BOT/3501 to the Government of Botswana. Panthera and the Botswana Predator Conservation Trust provided their technical and financial contributions as implementing partners.

The support and assistance of the Botswana Ministry of Environment, Wildlife and Tourism and the Department of Wildlife and National Parks is gratefully acknowledged. The project research assistants – Kentse Madise, Ernest Tjihumino, Ikatametseng Pro Seboifeng, Keone Samxhose and Anna Shaw – were integral to the research and the project would not have been accomplished without them.

The Botswana Police Service, Magistrate Courts of Ngamiland, Bushcraft APU and the 911 Anti-poaching Operations Centre are also gratefully acknowledged for their cooperation and willingness to provide valuable records. The contribution of the following research partners is recognized – Elephants Without Borders, Wilderness Safaris, Craig Tambling and researchers from the Botswana Predator Conservation Trust. Their collaboration was invaluable.

Above all, the research team salutes the research participants and their organizations for their contributions and the trust they placed in the project, particularly the hunters who were interviewed or participated in focus groups.
FOREWOR

The Food and Agriculture Organization (FAO) Subregional Office for Southern Africa is pleased to publish and disseminate this technical paper, titled “Illegal Bushmeat Hunting in the Okavango Delta, Botswana: Drivers, Impacts and Potential Solutions”, as the third publication in an open series of FAO papers on illegal hunting and bushmeat trade.

The paper reveals the findings of a study implemented in the framework of the FAO Technical Cooperation Programme TCP/BOT/3501 “Investigating the status, scale and main drivers of illegal hunting and bushmeat trade in Northern Botswana and assessment of impact on long-term food security and livelihoods options”. The project was implemented at the request of the Government of Botswana as a follow-up to a regional initiative that has been supported by FAO and the SADC Secretariat since 2012, in close collaboration with the Department of Wildlife and National Parks under the Ministry of Environment, Wildlife and Tourism, Panthera and the Botswana Predator Conservation Trust.

The results of the study were presented and discussed in depth with the Minister of Environment, Wildlife and Tourism and his team from the Ministry and the Department of Wildlife and National Parks. FAO is currently supporting the Government of Botswana in formulating a project which would allow the development and testing of some of the solutions proposed in the paper.

I believe that the information contained in this report will be very useful, not only to the stakeholders in Botswana, but would also inform policy-makers and wildlife practitioners in other countries in the region on issues related to illegal hunting and bushmeat trade and challenges that derive from the Botswana case study.

In fact, this sharing of knowledge and experiences responds directly to the request of the African Forestry and Wildlife Commission encouraging FAO to partner with other specialized organizations to support the member countries in their efforts to manage wildlife sustainably and to derive sustainable benefits from wildlife-based economies to support rural livelihoods and contribute to food security.

Dr Chimimba David Phiri
FAO Representative for Botswana &
FAO Subregional Coordinator for Southern Africa
# ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>APU</td>
<td>anti-poaching unit</td>
</tr>
<tr>
<td>BDF</td>
<td>Botswana Defence Force</td>
</tr>
<tr>
<td>BPCT</td>
<td>Botswana Predator Conservation Trust</td>
</tr>
<tr>
<td>BWP</td>
<td>Botswana Pula</td>
</tr>
<tr>
<td>DWNP</td>
<td>Department of Wildlife and National Parks</td>
</tr>
<tr>
<td>EWB</td>
<td>Elephants Without Borders</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<tr>
<td>FMD</td>
<td>foot-and-mouth disease</td>
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<tr>
<td>GDP</td>
<td>gross domestic product</td>
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<tr>
<td>GIS</td>
<td>geographic information system</td>
</tr>
<tr>
<td>GLM</td>
<td>generalized linear model</td>
</tr>
<tr>
<td>OCT</td>
<td>Okavango Community Trust</td>
</tr>
<tr>
<td>SADC</td>
<td>Southern African Development Community</td>
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<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
</tr>
<tr>
<td>WMA</td>
<td>wildlife management area</td>
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Executive Summary

Illegal hunting is a widespread but poorly understood problem in African savannahs. With financial and technical support from the United Nations Food and Agriculture Organization’s Technical Cooperation Programme, the research team investigated illegal bushmeat hunting around the Okavango Delta, Botswana. Data were collected through interviews with hunters, randomly selected heads of households, wildlife experts, land concession managers and anti-poaching personnel. Records of wildlife-related crimes and census data for delta wildlife populations were obtained from all available sources.

The study found that illegal hunting is a widespread practice throughout the Okavango Delta, particularly in the western region. Three approaches were applied to estimate the number of hunters. Results suggest that 1,500 to 2,000 illegal hunters currently operate in and around the delta, with a best estimate of 1,775. Hunters’ reports indicate that approximately 244,500 to 470,000 kilograms of bushmeat are harvested annually. The average hunter harvests illegal bushmeat worth 3,260 to 4,720 BWP (USD326–472) a year.

Hunters most commonly hunt with firearms. They frequently reported hunting with dogs or on horseback, using a variety of weapons. The use of snares for hunting is relatively uncommon.

Illegal hunters kill small game such as francolins, hares and small carnivores more frequently than large herbivores (i.e. those weighing more than 25 kg). Among medium to large herbivores, impala and greater kudu are most affected. These findings contrast with official records, which suggest that large species such as buffalo and giraffe account for the largest proportion of offtake.

Data on illegal hunting indicate that wildlife managers and law enforcement officials do not detect the harvest of small species effectively. Even as a proportion of the total species populations, illegal hunters kill greater kudu, wildebeest and sable antelope more intensively than buffalo or giraffe. The findings of this study suggest that the proportion of greater kudu killed illegally each year is approximately equivalent to the species’ intrinsic growth rate. Interviewed hunters also reported killing large carnivores, especially lions. Whereas they reported targeting small carnivores specifically for bushmeat, they primarily killed large carnivores to pre-empt, or in retaliation for, livestock killings. Some hunters, however, acknowledge that they will eat meat from large carnivores when it is available.

Most illegal hunting occurs in areas adjacent to, but outside of, protected areas. One in five interviewed hunters acknowledged hunting inside protected areas. Although a majority of interviewed hunters cited wildlife availability as a major factor in choosing hunting grounds, three-fifths cited the risk of capture as an important consideration. Perceptions of risk vary regionally. Illegal hunters in the western delta perceive hunting to be a high-risk activity more frequently than illegal hunters from other parts of the delta. Riskiness also depends on the size of hunted game. While 70 percent of big-game hunters believe their activities are risky, small-game hunters are equally likely to perceive hunting as a high- or low-risk activity.

Illegal hunters’ households exhibited greater livestock wealth, lived closer to wildlife and were more likely to be employed than non-hunter households were. Generalized linear models revealed that every kilometre of distance between a household and wildlife populations was associated with an 11 percent decrease in the likelihood of that household hunting illegally. For every 100,000 BWP of livestock wealth (approximately 50 cattle) that a household had accumulated, the likelihood of that household hunting illegally increased 49 percent. Illegal hunters were typically young men of between 20 and 35 years old, who have been hunting for five years or less.

Household surveys revealed that secretive bushmeat markets exist in some villages. No clear pattern explains why sales of bushmeat were reported in some villages during the surveys but not others. Models suggest that the proximity of wildlife to a village may play a role, but the results were inconclusive. Alternatively, it is possible that some communities were more willing to acknowledge the bushmeat trade than other villages, and that the trade is more consistent across the study area than surveys suggest.
Although some respondents preferred the taste of bushmeat to meat from livestock (18 percent of interviewed heads of households) or said that bushmeat is more accessible in their village than meat from livestock (16 percent), the decision to hunt or consume bushmeat illegally is largely economic. Illegal hunters enjoy access to a public resource at little to no cost and limited risk and with no production costs. Even when hunters encounter law enforcement, they rarely face any penalty and when they do, the fines imposed are typically less than the value of the harvested bushmeat. Many interviewed hunters cited the unaffordability of meat or a need to feed their households as their primary reasons for hunting illegally. However, even among these individuals, livestock wealth was greater than among other members of their communities. This pattern suggests that illegal hunters avoid consuming their livestock by consuming free bushmeat instead. In other words, illegal hunting is typically a livelihood activity and not a subsistence activity; it increases a household’s purchasing power but is not essential to most households’ self-sufficiency.

Some hunters reported earning significant income from the illegal bushmeat trade. Thirty percent of interviewed hunters reported selling bushmeat and other products illegally, but these commercial hunters accounted for a disproportionate amount of bushmeat offtake. Three hunters interviewed, classified as “syndicate-level” hunters, reported an individual offtake of more than 1 000 kilograms in the previous twelve months, approximately five times more than the average bushmeat hunter. With the exception of the three syndicate-level hunters, commercial hunters reported earning less than 40 percent of their household income from selling bushmeat and other wildlife products illegally. On average, commercial hunters earned 6 043 BWP (604 USD) from illegal bushmeat sales in the previous year. This income is marginally less than the annual income from a minimum-wage job in the agricultural sector. While commercial hunting is significant, hunting is more often a small-scale or infrequent activity for home consumption. More than one-third of hunters who were interviewed reported collecting less than 50 kilograms of bushmeat in the previous twelve months.

A vast majority of interview respondents, regardless of whether their household hunts, reported suffering costs from living with wildlife, usually through the loss of crops and livestock to wild animals. This conflict drives negative attitudes towards wildlife and instigates retaliatory killings. Additionally, less than one-quarter of respondents believed their community benefits from wildlife other than through hunting. Study-area residents typically held negative views towards wildlife, and human-wildlife conflict is a likely driver of those attitudes. Whereas less than half of non-hunters said wildlife is important, 96 percent of hunters said it is.

Illegal bushmeat hunting constitutes a resource rent and is a highly inefficient use of wildlife resources. Comparing the community benefits from illegal hunting to the benefits from community-based photographic tourism operations in the northern delta demonstrates that this form of tourism can provide benefits to local communities an order of magnitude greater than bushmeat hunting.

Furthermore, illegal hunting threatens delta wildlife populations and the lucrative tourism industry dependent on wildlife. Hunters may kill four percent or more of many species’ populations annually. For greater kudu, ostrich, sable antelope and wildebeest, the annual harvest is likely greater than ten percent of the population, and an even greater proportion in the peripheral areas where poaching occurs. More than half of interviewed hunters believe that one or more wildlife species is in decline, though not necessarily because of hunting. To quantify the effects of observed hunting rates on wildlife populations, large herbivore biomass offtake was modelled in relation to available populations. The model indicates that when biomass offtake from hunting compounds the offtake from predators, large herbivore populations are susceptible to declines in wildlife management areas outside the delta core, particularly in the western delta where hunting pressure is greatest. Illegal hunting removes more large-herbivore biomass from the ecosystem than any predator except for lions. In addition to potentially causing declines in herbivore populations, illegal hunting also threatens large carnivores by increasing competition for a limited prey base.

Human-wildlife conflict, economic and financial benefits from illegal hunting, few direct benefits from legal wildlife ventures, ineffective law enforcement and constant opportunity are major factors underpinning illegal hunting in the Okavango Delta. Illegal hunters suffer costs from wildlife but rarely derive legal benefits from it. They benefit from hunting, but do not suffer costs for hunting illegally. To limit illegal hunting, these underlying dynamics must change.
A holistic approach is necessary to address illegal bushmeat hunting in the Okavango Delta and improve wildlife management. This report outlines strategies for expanding legal community benefits from wildlife, reforming wildlife management policies, improving enforcement and raising public awareness about wildlife issues.

**Key recommendations include:**

1) Educating communities about the value of wildlife, the threat illegal hunting poses to an important public resource, and the importance of only consuming legal game meat, and not illegal bushmeat.
2) Building tourism camps/lodges in peripheral areas of the delta that host dense wildlife populations and experience high levels of hunting.
3) Developing legislative frameworks that enable communities to engage in wildlife-based land uses in the areas neighbouring the delta, so that legal and sustainable game meat supplies can be generated, in addition to benefits such as income from tourism (and trophy hunting if permitted).
4) Developing a wildlife-guardians programme that pays former hunters to monitor wildlife, prevents livestock incursions into wildlife areas and reduces human-wildlife conflict.
5) Coordinating a lobbying effort to encourage Parliament to adopt proposed legislation for reforming laws governing wildlife crimes. Penalties for illegal hunting should foster significant risk.
6) Improving anti-poaching patrols by increasing inter-agency coordination and focusing patrols more effectively, for example by prioritizing foot patrols of open boundary areas.
7) Expanding private anti-poaching operations in hunting hotspots.

**Major factors underpinning illegal hunting in the Okavango Delta are human-wildlife conflict, economic and financial benefits from illegal hunting, few direct benefits from legal wildlife ventures, ineffective law enforcement and constant opportunity.**
INTRODUCTION

While numerous studies have examined the scale and impacts of bushmeat industries in central African forests, experts are comparatively ill-informed about the hunting and trade of meat in savannahs (Lindsey et al., 2013). Human hunting of large herbivores has driven declines in large mammals for millennia; it continues to pose the greatest threat to large herbivore populations around the world (Ripple et al., 2015).

To understand better the impacts of bushmeat hunting on wildlife in African savannahs, a brainstorming workshop was organized by Panthera, the Zoological Society of London and the Wildlife Conservation Society in Johannesburg, South Africa in May 2012. The participants presented available data and came to a consensus on steps necessary to address the problem (Lindsey et al., 2013). Later that year, those findings were disseminated at a second meeting involving the Southern African Development Community (SADC) Secretariat and top officials from SADC state wildlife agencies. Government attendees at the second meeting requested more evidence of the impacts of bushmeat hunting to demonstrate the severity of the issue to their superiors. This study arose from that request.

Studies have shown that hunting can drive declines in wildlife and initiate trophic cascades (Wright et al., 2000; Sinclair et al., 2010; Galetti and Dirzo, 2013; Ripple et al., 2015). In Botswana, one threat that concerns policymakers and wildlife managers is the possibility that hunting could undermine the tourism industry. Tourism drives growth in the service industry and bolsters job creation. In 2014, the nationwide total contribution of tourism to Botswana’s economy was 15.8 billion BWP (1.58 billion USD) or 8.5 percent of GDP, and 10.1 percent of employment. Its contribution to GDP is expected to rise by more than five percent per year over the next decade (World Travel and Tourism Council, 2015).

The Okavango Delta, an inland freshwater delta, savannah and mopane-woodland ecosystem in northern Botswana (McNutt, 1996), is central to the country’s tourism industry. It hosts large wildlife populations and has more accommodation and tourism facilities than any other district in Botswana. Community-based tourism is a major source of employment in rural villages around the delta. The economic contribution of tourism is particularly important in the greater delta region where approximately 50 to 60 percent of residents live below the poverty line (Mbaiwa, 2011).

A recent aerial survey of wildlife populations indicated that 12 out of 14 populations of large herbivore species declined in Ngamiland District, in which the delta is the major ecological feature (Chase, 2011). Amidst growing concern over the instability of Okavango wildlife populations, some stakeholders hypothesized that unregulated and illegal hunting and consumption of mammals was a contributing factor to declines in wildlife (J.W. McNutt, personal communication, June 2014; M.A.P. Ives, personal communication, July 2014). Exacerbating the confusion concerning the causes of wildlife population declines in the delta, local wildlife managers have access to minimal scientific information about the bushmeat industry in the area, particularly following the recent ban on trophy hunting, which dramatically altered the management of large portions of the delta ecosystem.

Recognizing the need for reliable information about the bushmeat industry and its effects on wildlife populations, the Botswana Predator Conservation Trust and Panthera, two conservation-oriented non-governmental organizations, launched a collaborative research project, with support from the United Nations Food and Agriculture Organization (FAO), to study the bushmeat industry in the delta. For the purposes of this report, bushmeat hunting is defined as the illegal killing of terrestrial animals for consumption or sale of the meat from harvested animals. Since the Botswana government instituted a ban on trophy hunting on public land in 2014, with the exception of licences for hunting game birds, all hunting on public land in Botswana is illegal. The bushmeat trade is defined as the exchange of meat from illegally killed animals for financial or material gain.

The research project was designed to identify the drivers and assess the impacts of the trade, and to suggest the solutions most likely to be effective in addressing the issue. This report describes the research activities and summarizes the findings. Within the context of broader wildlife management and socio-economic patterns in the Okavango Delta, it describes a holistic strategy intended to address the negative impacts of bushmeat hunting and improve wildlife management. The report also provides recommendations for engaging local communities in the sustainable use of wildlife resources.
METHODS

Study area

The study area encompassed the Okavango Delta and the surrounding communities. The ecosystem encompasses a mosaic of permanently dry savannah and Mopane woodland, seasonally flooded plains and permanent swamp (McNutt, 1996). In 2014, UNESCO designated 20,236 km² of the Okavango as a world heritage site (UNESCO, 2014). The Moremi Game Reserve (MGR), a 4,610 km² protected area, forms the core of the delta (Mbaiwa, 2005). Surrounding the game reserve are wildlife management areas (WMAs), land concessions that the government leases to private entities or to community-based trusts under a policy framework to give communities stakes in tourism ventures. Although several small human settlements are located inside WMAs, the vast majority of land is designated for wildlife-based uses only; most livestock are prohibited inside WMAs. Adjacent to WMAs are mixed-use concessions (hereafter designated “residential areas”) that include residential communities, small-scale crop and livestock farming, and some ecotourism enterprises.

Study sites consisted of twelve study villages in residential concessions (Figure 1) and their surrounding cattle posts. All study villages were located within 35 km of WMAs in the delta. Villages in the study area for which population data were available were qualitatively evaluated to determine which villages best capture geographic and other types of variation in the study area, while also maximizing the amount of information that could be collected about bushmeat hunting in the limited timeframe of the study. Just over half of the villages meeting the criteria were included in the study.

Study villages are ethnically varied. Some study villages are part of community-based natural resource management projects and other villages are not. Study village economies range from being almost entirely pastoral to depending predominantly on crop farming.

Owing to the challenges of convincing people to acknowledge and discuss illegal activities, efforts to identify and interview active hunters were concentrated in six villages in the western delta based on reports that bushmeat hunting was especially prevalent in that area (911 Anti-poaching Operations Centre, unpublished data). Interviews with western-delta hunters were supplemented with opportunistic interviews with hunters in the northern and southern portions of the delta.

WMAs adjacent to the focal study villages in the western delta encompass a variety of habitat types – from permanent swamp to permanently dry woodland and bushland. They also exhibit a variety of management scenarios, ranging from minimal management with no permanent tourism presence and rare anti-poaching patrols (NG 24) to areas with constant tourism activities and intensive private anti-poaching operations (NG 26). The Botswana government, intending to control the spread of foot-and-mouth disease (FMD), erected fences between villages and WMAs in order to separate wildlife and livestock. However, large portions of the fences are in disrepair.

Interviews

This research project proceeded under the auspices of research permit EWT 8/36/4 xxvii (25) from the Botswana Ministry of Environment, Wildlife, and Tourism. Structured and semi-structured interviews were the primary means of data collection (Appendices A-E). Between August 2014 and March 2015, project staff conducted interviews with diverse stakeholder groups to provide a comprehensive understanding of the hunting and trade of bushmeat (Table 1). Additionally, the project staff attempted to identify and interview bushmeat traders – individuals who buy and sell bushmeat – but they were unable to identify any individuals meeting the criteria. All interviews were conducted between August 2014 and March 2015.

Interview questionnaires for heads of households, bushmeat hunters, concession managers and anti-poaching personnel were adapted from Lindsey et al., 2011 (a–b) to address local conditions. Research assistants conducted household and hunter interviews in Setswana, Herero, Mbanderu, Hambukushu and Seyei, depending on the language preference of the respondent. M. Rogan conducted interviews with wildlife experts and stakeholders, concession managers and anti-poaching personnel in English, in which all respondents were fluent. The project granted anonymity to all research participants.

3 Cattle posts are single households or clusters of households located outside the village proper for the purposes of managing free-ranging herds of livestock and accessing remote crop fields.
Research assistants were hired based on their familiarity with communities in the study area and knowledge of hunting activities. The research assistants spent time networking in study villages to identify hunters and build trust with community members. In villages where research assistants had few personal ties, the research team worked with community liaison officers and village headmen to help research assistants contact illegal hunters. They also identified hunters at households that acknowledged sourcing bushmeat themselves during household interviews. The research team attempted to interview every hunter it identified.

Research staff sampled village households based on randomly distributed points within each village. Polygons were manually drawn around each village using satellite imagery (Google Earth, 2014); and constructed sets of randomly distributed points within the village polygons using ArcGIS 10.2 (ESRI 2014). At least 75 metres separated each point. Research assistants travelled to each point and interviewed the head of the nearest household. Because this sampling approach excluded households situated outside the village proper (as defined by manually drawn polygons), additional interviews were conducted with heads of households based at cattle posts. The non-random cattle post component was critical to capturing the variation within delta communities. In each village, researchers conducted 30 to 56 interviews, with a minimum of 30 randomly sampled households.

Table 1: Bushmeat project surveys and researchers

<table>
<thead>
<tr>
<th>Interview Type</th>
<th>Sample Method</th>
<th>Quantity</th>
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</tr>
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<tbody>
<tr>
<td>Bushmeat hunters</td>
<td>Non-random</td>
<td>91</td>
<td>E. Tjihumino, I.P. Seboifeng, K. Madise, M. Rogan</td>
</tr>
<tr>
<td>Wildlife experts and stakeholders</td>
<td>Non-random</td>
<td>58</td>
<td>M. Rogan</td>
</tr>
<tr>
<td>Concession managers</td>
<td>Non-random</td>
<td>17</td>
<td>M. Rogan</td>
</tr>
<tr>
<td>Anti-poaching personnel</td>
<td>Non-random</td>
<td>17</td>
<td>M. Rogan</td>
</tr>
</tbody>
</table>

Past research has demonstrated that self-reporting of bushmeat hunting tends to underestimate hunting intensity because hunters under-report their offtake (Knapp et al., 2010). Where suitable data are available, records from anti-poaching patrols are a better indicator of hunting intensity than self-reporting is. After evaluating anti-poaching records, however, it was concluded that the sampling effort of patrols varied too greatly across the study area and that records were insufficient to form the basis for estimating hunting levels in the delta. Instead, hunters’ self-reporting and household consumption estimates were relied upon, with the known caveat that these methods provide conservative estimates of actual hunting intensity and offtake.
Figure 1. Map of the Okavango Delta and study villages. In focal villages (blue), research assistants worked intensively to identify and interview illegal bushmeat hunters. In non-focal villages (purple), research assistants interviewed hunters opportunistically.
Wildlife experts and stakeholders were defined as anyone who demonstrated detailed knowledge of wildlife, wildlife-based land uses (e.g. photographic tourism), hunting, law enforcement, or ecosystem management. As many wildlife experts and stakeholders as possible were interviewed within the timeframe of the study. Although the sample was not exhaustive, expert/stakeholder interviews continued beyond response saturation, suggesting the sample was sufficiently representative (Guest et al., 2006). Concession managers were defined as any individuals tasked with managing a concession lease (e.g. managers of community trusts), managing tourism activities on a concession, managing law enforcement operations (governmental and private), or implementing environmental management plans for specific concessions in the Okavango Delta. Because some concession managers are responsible for more than one concession in the Okavango Delta, the sample included at least one manager for the 18 concessions in the Okavango Delta designated for wildlife-based land uses (i.e. WMAs and game reserves in the delta). Some concession managers interviewed, particularly Department of Wildlife and National Parks (DWNP) subregional Wildlife Officers, were also responsible for managing residential concessions adjacent to the Okavango Delta WMAs. All concession managers also participated in the wildlife expert and stakeholder survey. The latter survey asked respondents about wildlife and hunting trends across the entire study area, whereas questions in the concession manager survey were specific to each manager’s jurisdiction.

Anti-poaching personnel were defined as individuals who conduct anti-poaching patrols, or individuals responsible for arresting or detaining suspected hunters on behalf of governmental or private agencies. Because all anti-poaching personnel operate in teams, no more than two individuals from a single team were interviewed. Interviews were conducted with representatives of every agency that gave permission for the research team to interview their team members. The research team did not receive permission to conduct interviews with some important agencies, such as the Botswana Defence Force (BDF).
Records of hunting incidents

Available records of species-specific hunting incidents were collected for the years 2009–2014 from governmental authorities, non-governmental monitoring organizations and private anti-poaching units. Sources of records of hunting incidents include Ngamiland Magistrate Courts, the Botswana Police Service, DWNP, Bushcraft APU, and the 911 Anti-poaching Operations Centre. The latter two organizations also provided GPS coordinates of some hunting incidents; however, these data were too few and too spatially biased to allow for meaningful analysis.

Focus groups

Three focus groups were held with a total of 26 current and former hunters from four villages in the western delta. E. Tjihumino facilitated the focus groups, I.P. Seboifeng translated from Setswana to English and M. Rogan recorded responses. Audio recordings of the focus group discussions were not collected on account of the illicit nature of the hunting activities discussed during focus groups. As a result, hunters’ responses are discussed where appropriate in this report, but they were not incorporated into any systematic analyses.

Aerial survey data

Elephants Without Borders (EWB) provided aerial transect routes and GIS coordinates of large mammal observations in the Okavango Delta and surrounding wildlife management concessions from a 2014 dry-season aerial survey (Chase, in preparation). A description of EWB survey protocols is available from Chase, 2011.

Carnivore data

The Botswana Predator Conservation Trust (BPCT) provided estimates of the densities of lions, spotted hyaenas, leopards, cheetahs and wild dogs from radio telemetry data of average home range size and audio-visual sampling methods (Golabek et al., in preparation; Cozzi et al., 2013). BPCT and Okavango Wilderness Safaris provided opportunistic data on the large carnivore guild’s prey selection (Golabek et al., in preparation; K. Collins, unpublished data).

Focus group with bushmeat hunters (faces were darkened to protect anonymity)

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4 A private anti-poaching operator.
5 A community-run neighbourhood watch organization that gathers information about illegal hunting and notifies law enforcement authorities.
Human population data

Village-specific results of the 2011 national census were obtained from Wilderness Safaris (K. Collins, unpublished data).

Analyses

Statistical analyses were performed using R i386 3.1.2 (R Core Development Team, 2014). Spatial analyses were performed using ArcGIS 10.2 (ESRI, 2014).

Estimating the number of hunters

Three methods were applied to estimate the number of illegal hunters in communities around the Okavango Delta:

1) The first method used random sampling from the household survey. This sampling provided estimates of the proportion of houses that hunt, with 95 percent confidence intervals based on asymptotic approximation of a binomial distribution. Recognizing that hunting dynamics vary between very small rural villages and larger population centres, separate hunting rates were estimated for small villages with fewer than 2 000 residents and larger villages with more than 2 000 residents. The random sample captures hunting activity within households, not among individual hunters. Based on information from hunters about hunting partners and the transfer of hunting skills and weapons within family, hunting households were assumed to hold an average of 1.5 hunters. The population of Maun was excluded from the population estimates because no reliable data on hunting rates among Maun residents were available, and because anecdotal evidence suggests that Maun hunters typically access bushmeat through their households’ rural cattle posts. Non-local hunters were also excluded from the estimate because interviewed hunters reported only rare encounters with non-local hunters hunting bushmeat. Their contribution was deemed insignificant.

2) Because of concerns that randomly sampled households might under-report illegal activities in interviews (Knapp et al., 2010), the random-sample estimate was revised. In addition to the random sample, the revised estimate incorporated interviewed hunters’ estimates regarding the number of other hunters they know in their villages, hunting rates at cattle posts excluded from the random sample, and hunters’ estimates of the proportion of households involved in hunting as discussed in the focus groups. In the case of villages where no additional information was available, the proportion from the random sample was retained.

3) The third method of estimating the number of hunters in the Okavango Delta was based on records of local residents convicted of wildlife crimes. Ngamiland court records identify 67 convictions for wildlife-related crimes between 2009 and 2014. Among the 91 interviewed hunters, two acknowledged being convicted of illegal activities relating to hunting. By identifying a maximum potential conviction rate for illegal hunters over the five-year period, it was possible to determine the minimum number of hunters necessary to result in 67 convictions. Using the pool of interviewed hunters, a bootstrapping simulation was performed by sampling with replacement over 10 000 replications. The minimum number of hunters necessary to produce 67 wildlife crime convictions was identified based on the 95th percentile conviction rate in the bootstrap simulation.
Socio-economic characteristics of bushmeat hunters and consumers

Characteristics of hunter households were compared with those of non-hunter households, and households that acknowledged eating bushmeat to households that said they never eat bushmeat, using generalized linear models (GLMs) with a binomial distribution and a logit function (McCullagh and Nelder, 1989). Predictor variables were selected for inclusion in GLMs through a thorough exploratory data analysis using Spearman’s rank correlations, analysis of variance (ANOVA), and comparisons of means and standard deviations to examine relationships between predictor and response variables. Saturated GLM models were constructed with all selected variables. Dredging (R package “MuMIn” v. 1.15.1; Bartoń, 2015) was performed to identify models that provided the greatest insight into factors relating to illegal hunting. Pairwise models were compared using AICc, relative operating characteristic (ROC; R package “ROCR” v. 1.0-7; Sing et al., 2015) and analysis of variance with a Chi-squared test. Jackknifing of variable importance was also performed: for each predictor variable, a GLM with only that variable and a GLM excluding only that variable were tested. This jackknifing process measures the individual explanatory power of each variable and its unique information – how much explanatory power is lost when that variable is absent from the model. Explanatory power is defined as one minus the ratio of deviance in the fitted model to deviance in the null model. Where appropriate, Kolmogorov-Smirnov tests and bootstrapping were used to compare means between sub-samples of the interview pool. All bootstrapping was performed by sampling with replacement 10,000 times.

Data from all study villages were aggregated into unified samples for three reasons: 1) the Botswana government manages poaching at the district level; 2) court records indicate that poaching parties often include participants from multiple villages; and 3) cattle posts may be extensions of more than one village and may belong to families that keep a primary residence in a different village.

Estimating bushmeat offtake

Interviewed hunters reported the number of each species that they killed in the previous 12 months. To measure the amount of meat produced, average dressed weight estimates (Bothma, 2002) were incorporated into the calculations. The total amount of bushmeat that each hunter reported harvesting was divided by the number of people in his typical hunting party, in order to determine his individual share of the bushmeat offtake. Due to a skewed distribution of individual offtake, the true mean was estimated by bootstrapping. A 95 percent confidence interval for the true mean was defined as the interval from the 2.5th and 97.5th percentile outcomes. As hunters are prone to “substantial under-reporting” of their offtake, this estimate is highly conservative (Knapp et al., 2010).

Commercial bushmeat hunters most commonly reported selling bushmeat for 20 BWP (2.00 USD) per kilogram, although some commercial hunters reported selling at higher prices. The cost of meat from livestock was tracked and 20 BWP per kilogram represented the replacement cost of substituting an illegal kilogram of bushmeat with a legal kilogram of ration beef. For the purposes of this report, a value of 20 BWP per kilogram was adopted as a consistent, conservative estimate of bushmeat value.

Estimating herbivore biomass offtake

The total offtake of large-herbivore biomass from hunting was estimated and incorporated into a model examining the effects of hunting on population dynamics of medium to large herbivores (Lindsey et al., 2014). The approximate number of large herbivores that illegal hunters kill each year was calculated from hunters’ average reported offtake of each species. Field reports of non-butchered carcasses exhibiting gunshot wounds suggest that in addition to animals that hunters kill outright, some wounded animals also die from hunting (Bushcraft APU, unpublished data). One-half of animals that hunters reported wounding were assumed to die prematurely from their wounds. This additional offtake from wounding was included in the estimate of total offtake from hunting.

Commercial bushmeat hunters most commonly reported selling bushmeat for 20 BWP (2.00 USD) per kilogram, although some commercial hunters reported selling at higher prices.
METHODS

The study area was divided into four subregions: western delta, southern delta, northern delta and the delta core (Figure 3). The biomass offtake of each region was based on the revised estimate of the number of hunters (1,775) distributed proportionally across the western, northern and southern regions. The model assumes that hunting within the delta core is insignificant. Total hunting offtake was calculated as the product of the number of hunters in each region, the average number of each species killed by each hunter and the species’ average body mass (Coe et al., 1976).

The resulting estimates of biomass offtake from hunting were integrated with estimates of biomass consumption among the large carnivore guild, intrinsic herbivore growth rates derived from a species body mass index (Bothma, 2002) and depredation by the large carnivore guild (Golabek et al., in preparation; K. Collins, unpublished data). Rather than apportion carnivore consumption to specific species, the model aggregates carnivore consumption and assumes that herbivore species maintain a constant relative abundance regardless of changes in herbivore biomass. Herbivore population dynamics were modelled with and without hunting in the western delta, the delta core and the three outer regions collectively.

Figure 3. Okavango Delta subregions for analysing the effects of bushmeat hunting on large herbivore population dynamics. Transect routes determine region boundaries as some transects cover more than one WMA.
RESULTS

Number of hunters

Random sampling produced an estimate of between 548 and 1,839 bushmeat hunters around the Okavango Delta (Figure 4). In small villages, 13.7 percent of households (n=248) acknowledged hunting. In large villages, 7.6 percent of households (n=119) did. Bootstrapped simulations of wildlife crime convictions resulted in a 95th percentile conviction rate of 4.4 percent. To produce 67 convictions with a 4.4 percent conviction rate, there would need to be a minimum of 1,523 illegal hunters in villages adjacent to the delta. The median bootstrapped conviction rate, 2.2 percent, produced an estimate of 3,045 total hunters. The estimate of the minimum conviction rate was too low to produce a meaningful maximum estimate of bushmeat hunters using this bootstrapping method (i.e. the maximum estimate goes to infinity).

The revised estimate from random sampling produced an estimate of 1,775 bushmeat hunters around the Okavango Delta. Because the revised estimate incorporates all available information and is consistent with the results of the other two approaches, it was selected as the best estimate and applied to all subsequent calculations.

<table>
<thead>
<tr>
<th>Conviction rates estimate</th>
<th>3,045</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random sample maximum</td>
<td>1,839</td>
</tr>
<tr>
<td>Revised sampling estimate</td>
<td>1,775</td>
</tr>
<tr>
<td>Conviction rate minimum</td>
<td>1,523</td>
</tr>
<tr>
<td>Random sample estimate</td>
<td>1,198</td>
</tr>
<tr>
<td>Random sample minimum</td>
<td>548</td>
</tr>
</tbody>
</table>

Figure 4. Estimates of bushmeat hunters in the Okavango Delta based on three methods. Researchers selected the revised estimate, which combines random sampling estimates with additional information that hunters provided in interviews and focus groups, as the representative estimate.

Socio-economic characteristics of hunting and bushmeat consumption

Exploratory data analysis investigated 16 potential predictor variables potentially relating to whether a household consumes bushmeat, and 15 predictor variables potentially relating to whether a household hunts illegally. Respondents’ home village was excluded from the latter analysis because of unequal sampling effort in the various study villages.

Seven predictor variables were selected for inclusion in the saturated GLM to predict whether a non-hunter household consumes bushmeat: home village, ethnicity, distance from home to wildlife, whether the household farmed crops, livestock wealth, the number of meals skipped in the previous year owing to poverty, and the harvest value. Although a model that included home village and distance to wildlife performed best in terms of AICc, area under the ROC curve, and explanatory power, a model that included home village as the only predictor variable was the most parsimonious (Burnham et al., 2011). Differences between the model were insignificant (ANOVA, p=0.075). Furthermore, home village and distance from households to wildlife were not independent variables (ANOVA, F=17.72, df=11, p<0.001). Because of the strong relationship between the two variables, the model including home village by itself was deemed the

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6 This and all subsequent estimates apply only to bushmeat hunting and do not necessarily reflect the situation for ivory and rhino horn hunting.
most appropriate. A large portion of respondents in four out of 12 study villages acknowledged consuming bushmeat, suggesting that these four villages have active – but secretive – bushmeat black markets. The relationship between village and distance to wildlife populations is one possible explanation for why bushmeat consumption is more common in some communities than in others. It is by no means conclusive.

It was noted that many household interviews contained inconsistencies (e.g. respondents saying they have never eaten bushmeat but specifying a preference for certain types of bushmeat). These inconsistencies, coupled with an unexpectedly low rate of respondents refusing to participate in interviews considering the illicit content of the interview questions (<3%), may indicate that some respondents were untruthful. Thus while it is possible that some communities have developed a bushmeat market and others have not, it is also possible that some communities were more comfortable acknowledging a bushmeat trade than other communities.

Seven variables were included in the saturated generalized linear model to predict whether a household is involved in hunting: livestock wealth, distance to wildlife, ethnicity, total annual household income, meals skipped due to poverty, and level of employment (Table 2). The best performing model included six predictor variables but excluded the number of meals a household skipped due to poverty. The top model explained approximately 17.7 percent of the variance in whether a household participates in hunting (p<0.001).

The results of the generalized linear model suggest that the tendency among households to hunt relates strongly to having above-average livestock wealth, living close to wildlife, farming crops and having formal employment. No ethnic group exhibited a proclivity for hunting. However, some ethnic groups, namely those not prevalent in Ngamiland (Ethnicity 0), exhibited a tendency not to hunt. In other words, people who do not originally come from Ngamiland are somewhat less likely to hunt than are residents from ethnic groups from the district. Hunter households exhibited a median livestock wealth more than four times greater than non-hunter households did (Kolmogorov-Smirnov test, p<0.001). The coefficient for livestock wealth suggests that for every 100 000 BWP worth of livestock a household owns, the predicted likelihood of that household hunting increases 0.485. Each additional kilometre between a household and its nearest wildlife populations decreases the predicted likelihood 0.107.

It is important to note that because the model explains a relatively small portion of the variation between hunter and non-hunter households, the predicted likelihoods are not entirely representative of whether a household hunts. Nevertheless, these results provide a clear indication that poaching strongly relates to households of rural farmers that are financially stable (i.e. have employment and considerable livestock wealth). The distribution of hunter and non-hunter households in relation to the six variables indicates that nearly all hunter households share certain characteristics but that not all households exhibiting these characteristics hunt. Based on reports

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient Estimate</th>
<th>Z-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept (Ethnicity 0)</td>
<td>-1.115</td>
<td>-1.94</td>
<td>0.053</td>
</tr>
<tr>
<td>Livestock</td>
<td>0.00000485</td>
<td>3.651</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Distance to wildlife</td>
<td>-0.107</td>
<td>-3.622</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ethnicity 1 (as factor)</td>
<td>-1.128</td>
<td>-1.802</td>
<td>0.072</td>
</tr>
<tr>
<td>Ethnicity 2 (as factor)</td>
<td>-0.632</td>
<td>-0.995</td>
<td>0.320</td>
</tr>
<tr>
<td>Ethnicity 3 (as factor)</td>
<td>0.135</td>
<td>0.218</td>
<td>0.828</td>
</tr>
<tr>
<td>Ethnicity 4 (as factor)</td>
<td>-0.096</td>
<td>-0.171</td>
<td>0.864</td>
</tr>
<tr>
<td>Crop farming (as factor)</td>
<td>0.7574</td>
<td>2.873</td>
<td>0.004</td>
</tr>
<tr>
<td>Annual household income</td>
<td>-0.0000160</td>
<td>-1.862</td>
<td>0.063</td>
</tr>
<tr>
<td>Employment level</td>
<td>0.857</td>
<td>2.836</td>
<td>0.005</td>
</tr>
</tbody>
</table>
from hunters and focus-group discussions, some of the other factors that may account for the unexplained variation include whether a family has a tradition of hunting; whether households have access to guns, horses, or trained hunting dogs; and psychological factors such as individuals’ aversion to risk.

Jack-knifing of variable importance revealed that livestock wealth is the factor that most strongly relates to whether or not a household is involved in hunting (Figure 5). Livestock wealth had the greatest explanatory power of any predictor variable and captured the most unique information. Distance to wildlife contains as much unique information as livestock wealth, and ethnicity has as much explanatory power as livestock. Farming crops, employment level and household income were comparatively less important variables. It is somewhat surprising that hunting correlated positively with employment level, but not income. A household’s level of employment was classified as being regularly employed, intermittently employed (e.g. piece-jobs, small-scale craft making, temporary government work schemes), or unemployed. Hunter households exhibited higher rates of both regular and intermittent employment than non-hunter households.

A close look at household income among hunting and non-hunting households illustrates the full importance of livestock wealth. Median income among hunter households is higher than among non-hunter households. Greater income from livestock explains the difference entirely. In fact, hunter households on average earn slightly less from formal employment (despite being better employed overall, hunter households seem to not have the highest-paying jobs, mainly government positions) and crop farming, but income from livestock more than makes up the difference for most hunter households (Figure 6).

Average income from hunting, through bushmeat consumption and sales, accounted for approximately one-sixth of the average hunter’s household income. This measure skews heavily toward a few hunters who account for a disproportionately high amount of the bushmeat production (see below).

Only 10 percent of hunters identified bushmeat as their most important source of protein; 50 percent listed it among their three most important protein sources. When asked why they hunt, 36 percent of hunters described themselves as unable to afford to buy meat or in need of bushmeat to have sufficient food (Figure 7). However, those households also exhibited high livestock wealth consistent with hunter households in general (KS test, p=0.61). Other commonly cited reasons for hunting included a desire for free meat, additional income and a preference for the taste of bushmeat. These results indicate that bushmeat is not essential to most households’ food security.


diagram

Figure 5. Spatial jackknifing of variable importance for GLM predicting whether a household participates in hunting. It illustrates the explanatory power of GLMs with each variable as the only predictor variable in a model and each variable as the only excluded predictor variable in the model.
RESULTS

Commercial bushmeat

Thirty percent (n=91) of interviewed hunters acknowledged selling bushmeat. On average, these commercial hunters earned 6 043 BWP (604 USD) from bushmeat sales in the previous 12 months. As a point of comparison, the minimum wage for workers in Botswana’s agricultural sector is 550 BWP per month, or 6 500 BWP per year (MLHA, 2014). For three-quarters of the commercial hunters, income from selling bushmeat accounted for less than 40 percent of total household income (Figure 8). The few who relied on bushmeat for a greater share of household income are considered to engage in ‘syndicate-level’ hunting (see below).

Figure 6. Average income from seven sources among hunter and non-hunter households.

Figure 7. Percentage of bushmeat hunters citing seven respondent-generated reasons for hunting.
Estimated bushmeat offtake

Hunter surveys revealed that, on average, individual hunters harvested 163 to 235 kilograms of bushmeat (i.e. dressed weight) in the 12 months prior to being interviewed. At a rate of 20 BWP per kilogram, hunters harvested bushmeat worth, on average, between 3 260 BWP and 4 720 BWP (326 – 472 USD) per year.

As previously mentioned, hunters’ individual offtake was not distributed normally. Also, it varied widely. An *a posteriori* classification was applied based on an evaluation of the histogram of hunters’ reported individual offtake (Figure 9). More than half of the hunters (n=90) reported an individual offtake of less than 100 kg in the previous year. Most of these hunters only harvested small game such as game birds, hares and springhares. Others may have killed larger game such as impala, but infrequently. At the other end of the spectrum are three hunters who acknowledged that their individual share of harvested bushmeat amounted to more than 1 000 kilograms in the previous 12 months. This level of hunting suggests a systematic, intense effort that necessitates large hunting parties in order to transport and distribute the meat of large target species such as buffalo and giraffe. This level of offtake is therefore classified as a ‘syndicate.’ It is impossible to know whether these syndicates exhibit the same level of sophistication as those involved in hunting high-value wildlife products in Africa (Hauck and Sweijd, 1999).

![Figure 8](image8.png)

**Figure 8.** Proportion of household income from selling bushmeat among 27 commercial bushmeat hunters.

![Figure 9](image9.png)

**Figure 9.** Histogram of the cumulative dressed weight of all animals that each interviewed hunter reported killing in the previous 12 months, divided by the number of people in that hunter’s typical hunting party.

7 One hunter’s reported offtake was excluded from the analysis because he reported his harvest over the previous five years, rather than the previous twelve months.
RESULTS

Hunting methods

Most bushmeat hunters reported using firearms to hunt. Hunters who used firearms or air guns experienced a higher hunting success rate than those using other methods. Hunting from horseback produced success rates nearly equivalent to firearms (Figure 10). Dogs were the second most common hunting method, although hunters typically employed them only for hunting medium and small game. Hunters used a variety of weapons to kill prey when hunting with dogs or when hunting from horseback; clubs and axes were most common. One of the most striking characteristics of hunters’ hunting methods is how few hunters reported using snares. Whereas snares are often the most common bushmeat hunting method elsewhere in Africa (Noss, 2000, Homern et al., 2006, Becker et al., 2013), among delta hunters only 12 percent of hunters reported setting snares. The low rate of snare use makes sense in the context of snaring’s low success rate. Though unusual for snaring to be so uncommon, these results are consistent with research from Damania et al., 2005 that also found firearms to be more efficient than snaring.

Figure 10. Commonality and effectiveness of bushmeat hunting methods as reported by 91 bushmeat hunters.

The median age of hunters was 32 years and 60 percent were younger than 35 years. More than half of the interviewed hunters reported five or fewer years of hunting experience; three-quarters reported fewer than ten (Figure 11). Few cases were uncovered in which hunting is an activity that older men practice as a way of life. In most cases, men hunt during their youth. There seem to be relatively few cases where hunters continue hunting beyond the age of forty. Of the 91 interviewed hunters, one was female. She reported using snares to catch small game around her crop fields. All other evidence suggests that hunters are overwhelmingly male.

Figure 11. Histogram of the number of years of bushmeat hunting experience among 91 interviewed hunters.
Approximately 10 percent of hunters (n=91) reported hunting inside WMAs (Figure 12). Most hunters reported being able to kill game in areas between the veterinary fence and rivers that run between human communities and the adjacent WMAs (Figure 13). Both hunters and heads of non-hunting households reported that game is common outside of buffalo fences and that in most cases, one need not assume the risk of entering a protected area in order to harvest bushmeat.

Many hunters fear capture. Although wildlife availability was the most common reason that hunters cited for choosing hunting grounds, more than 40 percent (n=91) cited the risk of capture as a major factor as well (Figure 14). A closer look, however, reveals that hunters’ perceptions of risk vary regionally.

![Chart of Interviewed Hunters](chart.png)

**Figure 12.** Proportion of interviewed hunters (n=91) that reported hunting in four areas as defined by local geographic features.

![Map of Hunting Areas](map.png)

**Figure 13.** An example of typical geographic features that characterize hunting areas around the Okavango Delta.
Hunters in the western delta were more likely to perceive hunting as a high-risk activity than hunters elsewhere in the delta (Figure 15). Some hunters in the southern delta, for example, reported that they hunt inside WMAs because the risk of capture in those areas is very low; the swampy terrain inhibits anti-poaching patrols. Hunters were also less likely to perceive hunting as high risk if they only target small game.

Perhaps because of the risks that many hunters associate with illegal hunting, more than 80 percent of interviewed hunters reported that hunting is decreasing in their communities. This contrasts with wildlife experts and concession managers, who mostly perceive hunting activity to be increasing or remaining steady over the previous few years (Figure 16). Although it is difficult to quantify the change in the amount of hunting from year to year, one potential explanation for the difference between hunters’ perceptions and expert opinion is that the latter group focuses its attention on hunting in WMAs, whereas this research suggests that the majority of illegal hunters operate outside those areas. Thus, it is conceivable that hunting is decreasing overall but remaining steady or increasing inside wildlife areas.
Anti-poaching, law enforcement and wildlife management

Anti-poaching operations vary widely across the Okavango Delta. At one extreme is NG24, which has no camps or lodges inside the WMA and no systematic monitoring. Government authorities such as the DWNP Anti-poaching Unit (APU) or other units may conduct patrols in the concession occasionally, but there is no regular law enforcement presence. At the other extreme are concessions NG26, NG27B, NG 29 and NG30 where private anti-poaching outfits operate continuously. These private entities are well funded, employ scouts who are skilled at operating in the bush, and in some cases, have proven highly effective at capturing illegal hunters and increasing perceptions of risk. Those four WMAs, in addition to Chief’s Island in Moremi Game Reserve, are the only parts of the delta with a constant anti-poaching presence. Elsewhere, anti-poaching patrols are irregular at best and non-existent at worst. In the case of the southern delta, even the presence of a BDF facility for conducting anti-poaching operations does not deter illegal hunters. Interviews with hunters corroborate scouts’ perceptions that foot patrols are more effective than vehicle patrols. Twenty-three hunters reported 29 cumulative encounters with law enforcement or private anti-poaching units. Those 29 encounters resulted in two convictions (a 500 BWP fine and suspended prison sentence, and a two-month stint in prison). On 14 occasions, the hunters evaded the patrols, often because they heard vehicles approaching. In the remaining instances, hunters were able to make excuses, received verbal warnings, or were released because of insufficient evidence to prosecute them. Among the most commonly used excuses is that hunters are searching for cattle that have crossed degraded veterinary fences into wildlife areas. Anti-poaching personnel acknowledged the difficulties of patrolling outside protected areas where people have the right to carry rifles or other hunting weapons.

Scouts and anti-poaching managers reported numerous challenges to conducting effective anti-poaching operations. Scouts cited shortages of transport, human and other resources, as well as an ineffective legal system, a need for new tactics (e.g. improved use of informants, deploying listening and observation posts) and difficult terrain. The challenges that managers reported facing varied more widely. Several mentioned the difficult terrain and inaccessibility of the areas they manage. Others cited an ineffective legal system or an attitude...
RESULTS

Among government officials and the general populace that hunting is not an important issue. Most of the scouts and concession managers who voiced concerns about the legal system referred specifically to the inadequacy of investigations or the difficulty of properly investigating illegal hunting crimes. Others voiced concerns about lenient sentencing guidelines.

Among the 58 wildlife experts and stakeholders interviewed, 45 (78 percent) believe illegal hunting is a serious issue for wildlife, but only 31 (53 percent) cited it as a driver of population trends for one or more species. Thirty-six (62 percent) estimated that commercial hunting accounts for at least half of all bushmeat. Fifteen (76 percent) scouts said the same.

Species offtake

Hunters reported killing 37 species of mammals and birds in the previous 12 months. Francolins were the most commonly hunted species by far (Figure 17). Hunters commonly killed other small game, including hares, duikers and small carnivores such as jackals and wild cats; many hunters target bushmeat from small carnivores as much as bushmeat from herbivores.

Impala and greater kudu were the only medium to large game (i.e. species weighing more than 25 kilograms) that hunters reported killing as often as small game (Figure 18). It is unsurprising that hunters kill impala more often than other large game species since impala are the most common large mammal in the Delta (Chase, 2011). Similarly, hunters reported killing large numbers of buffalo, another of the most common large herbivores.

On the other hand, few incidents of red lechwe hunting were detected. This may partially reflect red lechwe's prevalence in inaccessible habitat. However, it may also reflect the fact that many of the interviewed hunters live in dry parts of the delta ecosystem where red lechwe are uncommon. Thus, it is possible that the low levels of red lechwe offtake reflect a detection bias rather than true red lechwe harvest rates.

![Camera-trap photo of a hunter carrying a game bird carcass in a wildlife management area](image)

**Figure 17.** Interviewed hunters’ reported offtake of small game in the previous twelve months. Species are grouped into categories because hunters’ ability to identify small species properly was unreliable.
Comparing governmental and private anti-poaching records of hunted species with hunters’ reports of what they kill reveals notable discrepancies. Anti-poaching operators recorded illegal hunting incidents involving buffalo and giraffe more than other species, despite these two large herbivores being less prominent in hunters’ reports. Given the size of buffalo and giraffe, it is more common for hunters to leave behind identifiable parts of their carcasses than for smaller species, which partly explains why these larger species account for such a high percentage of records. However, this discrepancy also suggests that anti-poaching operators are unsuccessful at detecting hunting of smaller species, particularly those species that are available outside of protected areas where baseline monitoring is less pervasive. Hunters frequently noted that impala, greater kudu, zebra and even buffalo are available outside of protected areas where the anti-poaching presence is less intense.

Although this research focused on hunting primarily for the harvest of meat, it also detected significant rates of retaliatory or pre-emptive killing of large carnivores, for which meat was not the primary goal. Interviewed hunters acknowledged killing lions more frequently than other large carnivores (Table 3). Focus group participants, when discussing this trend, described a tendency among lions to remain near villages after killing livestock, as opposed to hyaenas, which leave the area. Although hunters do not target large carnivores for meat, a few interviewed hunters admitted that they eat, and enjoy, the meat from large carnivores.

Table 3: Hunters’ (n=90) self-reported offtake of large carnivores in the previous 12 months

<table>
<thead>
<tr>
<th>Species</th>
<th>Killed</th>
<th>Wounded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lion</td>
<td>21</td>
<td>3</td>
</tr>
<tr>
<td>Spotted Hyaena</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Leopard</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Cheetah</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Wild Dog</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 18. Reported hunting of selected large mammals. Official records include any available records since 2009. Hunters’ reports refer to the 12 months prior to the interview.
Total estimated offtake

Using the revised estimate (1 775) of the total number of illegal hunters in the Okavango Delta, the total annual offtake was projected for selected species and compared with population estimates for large herbivores. Although buffalo and giraffe garner the most concern from wildlife managers and anti-poaching operations, relative offtake of those species was lower than for many other herbivore species (Table 4). Greater kudu were the most heavily hunted species of large herbivore relative to their estimated population size.

The herbivore biomass model projects that in the absence of illegal bushmeat hunting, western-delta large-herbivore biomass would remain stable, assuming no migration in and out of the region (Table 5). When accounting for the removal of biomass from bushmeat hunting in addition to predation, however, the model suggests that herbivore biomass would decline substantially without immigration from the delta core or other areas. For the western, southern and northern delta collectively, the model predicts biomass would increase slowly in the absence of hunting. If current hunting rates are included in the model, however, then herbivore biomass is predicted to decline.

The model lacks the precision to measure accurately the exact size of the effect illegal hunting has on population trends, but it broadly illustrates a compelling pattern whereby the delta core subsidizes wildlife populations in WMAs on the periphery. Furthermore, the model suggests that large carnivore densities are near their carrying capacity in the outer regions of the delta. As a result, there is strong indication that bushmeat hunters compete with large carnivores for the limited prey base. At current rates, hunters remove more herbivore biomass than all the large carnivores except for lions (Figure 19). As these predators form the foundation for wildlife-based tourism (Ray et al., 2005), this competition poses a threat to a long-term driver of economic growth in Ngamiland. Finally, this model demonstrates the importance of evaluating the impacts of hunting in the context of other factors. Surveys with wildlife stakeholders suggest that many wildlife managers perceive bushmeat hunting to comprise a minor offtake of herbivore populations. However, in the context of predator consumption and the economic importance of high carnivore densities, even minor offtake from bushmeat hunting can have major ramifications.


<table>
<thead>
<tr>
<th>Selected species</th>
<th>Estimated annual offtake from hunting</th>
<th>Hunting offtake as a proportion of total estimated population*</th>
<th>Species’ intrinsic growth rate ±</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buffalo</td>
<td>472</td>
<td>0.025†</td>
<td>0.166</td>
</tr>
<tr>
<td>Giraffe</td>
<td>98</td>
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<td>1 317</td>
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<td>Greater Kudu</td>
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<td>0.256</td>
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<td>226</td>
<td>0.083</td>
<td>0.381</td>
</tr>
<tr>
<td>Wildebeest</td>
<td>169</td>
<td>0.108</td>
<td>0.265</td>
</tr>
</tbody>
</table>

Figure 19. Proportion of herbivore biomass consumption by species in the western delta.
Among non-hunter interview respondents, only 42 percent said that they consider wildlife to be important (Table 5). In contrast, 96 percent of hunters value wildlife ($\chi^2=115.47$, df=1, p<0.001). The vast majority of interview respondents, regardless of whether or not their household is involved in hunting, suffer costs from living with wildlife. In most cases, these costs stem from herbivores eating or destroying crops, or predators killing livestock. Some respondents reported that wildlife also damages fences and boreholes. Less than a quarter of all respondents agreed that their community benefits from wildlife other than through hunting, but half of respondents agreed that their community benefits from tourism. These perceptions were independent of whether or not the respondent was a hunter ($\chi^2=0.653$, df=1, p=0.419 and $\chi^2=0.392$, df=1, p=0.822, respectively). In other words, large portions of these communities recognize neither a direct link between tourism and wildlife nor an indirect link between tourism revenues and the ability of government to spend money on infrastructure and development projects.

Respondents, regardless of whether or not they consume bushmeat, also believe wildlife populations are growing. Equal proportions of hunters (62 percent) and randomly sampled respondents (64 percent) said that general wildlife populations (i.e. all species collectively) are increasing around their village. However, hunters were twice as likely as heads of households to believe that wildlife populations are declining in general (23 percent and 11 percent respectively), and far less likely to say they do not know ($\chi^2=34.579$, df=3, p<0.001). Most of the hunters (71 percent, n=21) believe hunting causes or contributes to general declines in wildlife populations.

Fifty-three percent of interviewed hunters identified one or more species as declining (Table 6). Wildebeest and sable antelope were the species that hunters cited most frequently as decreasing; two species that results suggest hunters kill intensively relative to the size of their populations. Only one hunter identified greater kudu as declining from hunting, however, in contrast to the high proportion of the population killed annually.

### Table 5: Herbivore biomass model parameters and results.

Periphery includes the western, northern and southern regions. All biomass estimates exclude biomass from elephants.

<table>
<thead>
<tr>
<th></th>
<th>West</th>
<th>Periphery</th>
<th>Core</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass available (Kg)</td>
<td>6 961 285</td>
<td>20 239 289</td>
<td>10 370 875</td>
<td>30 610 164</td>
</tr>
<tr>
<td>Hunter offtake (Kg)</td>
<td>391 545</td>
<td>656 542</td>
<td>0</td>
<td>656 542</td>
</tr>
<tr>
<td>Lion consumption (Kg)</td>
<td>527 768</td>
<td>1 411 827</td>
<td>571 590</td>
<td>1 983 417</td>
</tr>
<tr>
<td>Leopard consumption (Kg)</td>
<td>303 534</td>
<td>900 484</td>
<td>329 551</td>
<td>1 230 035</td>
</tr>
<tr>
<td>Cheetah consumption (Kg)</td>
<td>22 765</td>
<td>68 295</td>
<td>24 835</td>
<td>93 130</td>
</tr>
<tr>
<td>Wild dog consumption (Kg)</td>
<td>82 782</td>
<td>244 897</td>
<td>89 681</td>
<td>334 577</td>
</tr>
<tr>
<td>Hyaena consumption (Kg)</td>
<td>429 415</td>
<td>1 249 548</td>
<td>465 616</td>
<td>1 715 164</td>
</tr>
<tr>
<td>Total consumption (Kg)</td>
<td>1 757 810</td>
<td>4 531 594</td>
<td>1 481 272</td>
<td>6 012 866</td>
</tr>
<tr>
<td>Total consumption (%)</td>
<td>25.25%</td>
<td>22.39%</td>
<td>14.28%</td>
<td>19.64%</td>
</tr>
<tr>
<td>Biomass growth (%)</td>
<td>19.83%</td>
<td>20.27%</td>
<td>22.14%</td>
<td>20.90%</td>
</tr>
<tr>
<td>Change (%)</td>
<td>-5.42%</td>
<td>-2.12%</td>
<td>7.85%</td>
<td>1.26%</td>
</tr>
<tr>
<td>Outcome</td>
<td>DECLINE</td>
<td>DECLINE</td>
<td>GROWTH</td>
<td>GROWTH</td>
</tr>
<tr>
<td>Consumption (No hunting)</td>
<td>19.64%</td>
<td>19.15%</td>
<td>14.28%</td>
<td>17.50%</td>
</tr>
<tr>
<td>Change (No hunting)</td>
<td>0.19%</td>
<td>1.12%</td>
<td>7.86%</td>
<td>3.40%</td>
</tr>
<tr>
<td>Outcome (No hunting)</td>
<td>STABLE</td>
<td>GROWTH</td>
<td>GROWTH</td>
<td>GROWTH</td>
</tr>
</tbody>
</table>
RESULTS

Table 6: Proportion of interview respondents agreeing with each statement

<table>
<thead>
<tr>
<th>Statement</th>
<th>Hunters (n=137)</th>
<th>Non-hunters (n=386)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildlife is important</td>
<td>96%</td>
<td>42%</td>
</tr>
<tr>
<td>My household suffers costs from living with wildlife</td>
<td>88%</td>
<td>83%</td>
</tr>
<tr>
<td>My community benefits from wildlife (ex. hunting)</td>
<td>21%</td>
<td>25%</td>
</tr>
<tr>
<td>My community benefits from tourism (ex. hunting)</td>
<td>52%</td>
<td>53%</td>
</tr>
</tbody>
</table>

Table 7: Species that interviewed hunters (n=91) identified as declining in local areas

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of interviewed hunters perceiving a decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildebeest</td>
<td>12</td>
</tr>
<tr>
<td>Sable</td>
<td>7</td>
</tr>
<tr>
<td>Guinea Fowl</td>
<td>5</td>
</tr>
<tr>
<td>Red Lechwe</td>
<td>4</td>
</tr>
<tr>
<td>Giraffe</td>
<td>3</td>
</tr>
<tr>
<td>Honey Badger</td>
<td>3</td>
</tr>
<tr>
<td>Rhinoceros</td>
<td>3</td>
</tr>
<tr>
<td>Serval</td>
<td>3</td>
</tr>
<tr>
<td>Baboons</td>
<td>3</td>
</tr>
<tr>
<td>Buffalo</td>
<td>2</td>
</tr>
<tr>
<td>Steenbok</td>
<td>2</td>
</tr>
<tr>
<td>Eland</td>
<td>2</td>
</tr>
<tr>
<td>Sitatunga</td>
<td>2</td>
</tr>
<tr>
<td>Buffalo</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>9</td>
</tr>
</tbody>
</table>

It is important to contextualize the benefits from hunting by also examining benefits from legal wildlife-based land uses. Non-commercial illegal hunters on average earn approximately 60 percent of the minimum wage for agricultural workers. Findings from Snyman (2012, 2014) were used to compare the community benefits from the Okavango Community Trust (OCT) to the comparative benefits from bushmeat hunting. OCT subleases two concessions in the northern delta to tourism operators and mandates certain levels of local employment in the lodges. For the purposes of a direct comparison, it was assumed that hunters distribute their gains from bushmeat to dependents at rates equivalent to those of OCT employees. If illegal hunters earned as much as the average OCT staff, the bushmeat industry would support fewer than 250 hunters. In the five OCT communities, the benefits from wildlife-based tourism are worth nearly an entire order of magnitude more than the comparative benefits from hunting (Table 7), and yet the latter jeopardize the former.

Table 8: Community benefits from the Okavango Community Trust (Snyman, 2012, 2014) and comparative estimates of benefits from bushmeat hunting in the same communities

<table>
<thead>
<tr>
<th>Benefit to Community</th>
<th>Okavango Community Trust Lodge Staff</th>
<th>Bushmeat Hunters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average monthly income for industry staff/participants</td>
<td>2 191 BWP</td>
<td>301 BWP</td>
</tr>
<tr>
<td>Average monthly benefit for dependents</td>
<td>46.4 BWP</td>
<td>6.4 BWP</td>
</tr>
<tr>
<td>Total annual benefit for OCT communities</td>
<td>~1.5 million BWP</td>
<td>~265 000 BWP</td>
</tr>
</tbody>
</table>
Hunting and tourism

Peripheral areas of the delta were evaluated for relationships between wildlife populations, tourism lodges and hunting intensity. Half (n=10) of the WMAs that share a boundary with residential concessions host tourism camps or lodges within 15 kilometres of the boundary. Although data are unquantifiable, among WMA areas within 15 kilometres of community land, evidence from the surveys and expert opinion both suggest that poaching is less common where permanent safari camps and lodges exist (Figure 20).

Figure 20. Areas on the periphery of the Okavango Delta. Areas encompassed by red polygons host dense herbivore populations, experience high hunting rates and lack permanent tourism camps and lodges.
DISCUSSION

Illegal bushmeat hunting is widespread and persistent across the Okavango Delta. More than 1,000 hunters hunt primarily or entirely for home consumption. Syndicate-level hunting does occur and accounts for a large portion of the bushmeat offtake, especially from buffalo and giraffe. Bushmeat hunting, however, is more commonly an irregular or infrequent activity that targets small to medium-sized species. Bushmeat hunting, in conjunction with retaliatory or pre-emptive killings of large carnivores, results in wildlife offtake at a scale that likely affects ecosystem dynamics in large portions of the Okavango Delta. Current management of the delta does not mitigate the environmental impacts and socioeconomic consequences of this hunting adequately.

Drivers of bushmeat hunting

Three drivers of bushmeat hunting emerged from this study: 1) economic opportunity, 2) a lack of disincentives to hunt, and 3) negative attitudes towards wildlife. Causal relationships are difficult to detect and numerous factors influence decisions to hunt and to trade bushmeat. Nevertheless, the findings suggest a number of conclusions about the drivers of hunting.

Primarily, hunting is an economic opportunity. For syndicate hunters, who harvest meat worth 20,000 BWP (2,000 USD) or more, hunting is lucrative. For others, hunting represents a source of free protein and an opportunity to save household resources for other needs.

The strong correlation between hunting and livestock wealth does not prove (nor necessarily even imply) causation. Nevertheless, it is hypothesized that hunting enables households to grow livestock herds by providing an alternative source of food and income. Although regulations for foot-and-mouth disease prevention suppress livestock markets, cattle and goats are a tradable commodity. Less than half of respondents in the household survey reported some form of formal employment. Such low employment rates mean that most households in the study area are looking for alternative ways to increase their purchasing power even if they have sufficient livestock and crop production to provide enough food for the household. Consuming bushmeat and conserving livestock is one way to increase purchasing power and meet basic needs simultaneously by exploiting a public resource that has minimal production costs.

The proximity of most hunters to wildlife populations indicates that hunters are seizing a local advantage and that resource availability plays a major role. Because bushmeat hunting is effectively an open-access public resource, it lends itself to a tragedy-of-the-commons model of overexploitation (Pires and Moreto, 2011). These findings suggest that maintaining distance between wildlife and people can have benefits for conservation.

A factor that contributes to illegal hunting is the widespread misconception among hunters and bushmeat consumers that hunting does not affect wildlife populations. The inconsistency with which hunters identified declining species demonstrates the poor ability of hunters to detect changes in populations, but perceptions of wildlife as an inexhaustible resource facilitate widespread consumption.

Furthermore, it was concluded that the low costs of hunting also act as a driver. Firearms are common in rural communities and in focus groups hunters discussed the opportunity to use relatives’ firearms for hunting when they themselves do not own one. Even though many hunters perceive hunting as a risky activity, that risk is insufficient to deter them. Hunters’ success avoiding prosecution, either by eluding patrols or not leaving enough evidence for a trial, certainly plays a role, but the low penalties for hunting are a likely factor as well. Court records reveal that nearly all convictions for bushmeat hunting result in a fine of 1,000 to 2,000 BWP (100–200 USD) and a suspended jail sentence. In relative terms, those fines are equivalent to the value of hunting one greater kudu. Some convicted bushmeat hunters did not pay any fine or face any prison sentence as long as they did not repeat the offence. Repeat convictions are extremely rare. Therefore, while anti-poaching pressure does influence hunting behaviour, for example by determining where some hunters hunt, the legal system does not impose sufficient costs on hunters to create financial disincentives to hunt. Further, production costs associated with hunting wildlife illegally are zero (other than the ‘harvesting’ costs) and thus the activity is an attractive one.

Lastly, attitudes towards wildlife are a clear factor in people deciding to hunt, although it is difficult to measure their effect. First, study area residents generally perceive wildlife as a financial burden that produces few or no benefits for local communities. Even if these perceptions are misguided, they still matter. Research from Caprivi, Namibia, an area close to and similar to the Okavango Delta, shows that hunting events are spatially correlated with areas where residents perceive the costs of living with wildlife to be high (Kahler et al., 2013). Communities do not want wildlife near their crop fields or pastures.
In focus groups, hunters consistently articulated a sense that local communities in the western delta do not have access to, or benefit from, local wildlife populations to which they have a right. Some hunters in the focus groups stated that they would prefer to stop hunting if they had alternative means of benefiting from wildlife. Because focus groups were conducted only with hunters from western villages, it is unclear whether these sentiments are common in the northern or eastern portions of the delta where communities benefit from wildlife through wildlife trusts. These attitudes suggest a need for more opportunities for local residents to become stakeholders in wildlife-based enterprises.

**Subsistence hunting**

Many stakeholders, including government officials, land managers and hunters themselves, believe that hunting is predominantly a subsistence activity. Often, “subsistence hunting” refers to hunting for home consumption rather than for selling (as in Balakrishnan and Ndhlovu, 1992). However, such a broad definition fails to capture the nuances of bushmeat hunting. Muth and Bowe Jr. (1997) identified 10 motivations for hunting in North America, only one of which was for commercial gain. Interviewed hunters cited several motivations that Muth and Bowe Jr. enumerate: “commercial gain, household consumption, recreational satisfaction, protection of self and property, hunting as a traditional right”. Other motivations apply also.

The single motivation of household consumption, however, does not necessarily imply subsistence. This distinction is critical to addressing hunting properly: just because people eat bushmeat does not mean they need bushmeat to eat. The higher levels of employment and greater livestock wealth of hunters compared with other members of their communities indicate that most hunting is not a subsistence activity; it is a livelihood activity. Whether hunting is a subsistence activity depends on too many factors to measure precisely with the available data. For example, it is possible that households with intermittent or seasonal income (e.g. irregular livestock sales due to small herds or employment only during peak tourism season) rely on hunting to supplement their normal diet during periods of low income, which would qualify as subsistence. However, no clear indication that this is common was found in the data.

Wildlife managers and government authorities should recognize the distinction between hunting for livelihoods and hunting for subsistence and acknowledge illegal hunting for what it is: a resource rent.

**The impact of hunting on wildlife populations and tourism**

Wildlife is the foundation of tourism in Northern Botswana. The discrepancy between the proportion of interview respondents who believe tourism benefits their community and the proportion believing the same of wildlife suggests that many Ngamiland residents do not draw a direct link between wildlife and tourism. Furthermore, many may not recognize that wildlife is an exhaustible resource.

Wildlife, however, is exhaustible. Several studies have found that hunting can cause declines and, ultimately, the collapse of wildlife populations, as has been observed in many other protected areas in Africa (Fischer and Linsenmair, 2001, Bouche et al., 2010, Henschel et al., 2014). Numerous findings from this study indicate that hunting negatively affects wildlife populations in the Okavango Delta. These findings include reports from wildlife managers, researchers and hunters themselves; high hunting rates of some species such as greater kudu, sable antelope and wildebeest; and a herbivore-predator biomass model that suggests insufficient prey resources to support current predator populations and current hunting intensity in some parts of the delta.

The observed levels of offtake are consistent with studies from elsewhere in Africa. In the Katavi-Rukwa savannah ecosystem of Tanzania, for example, Martin and Caro, 2012 detected similar or higher rates of offtake from bushmeat hunting relative to aerial census data of wildlife populations. These hunting rates coincided with steep declines in some species in Katavi-Rukwa. As with sable antelope, wildebeest and other uncommon species in the Okavango Delta, Martin et al., 2013 found disproportionately high offtake of rare species.

Ecosystem dynamics complicate the picture. The potential for the delta core (i.e. Moremi Game Reserve, NG 17, 27a&b and 31) to subsidize herbivore populations on the edge of the delta may mask the effects of hunting in the delta periphery. Many delta experts also highlight the role of changing flood patterns as an underlying driver of wildlife population dynamics. If high flood levels persist, critical dry-season pastures in the delta core may become permanently inundated or transition to less palatable sedges (R. Fynn, personal communication, July 2014). Such changes could diminish herbivore biomass production in the delta core, making it less able to subsidize offtakes at the delta periphery.
DISCUSSION

The complexity of the relationship between hunting, wildlife population dynamics and other factors means that wildlife managers cannot wait until the evidence is conclusive before acting to address illegal hunting. By the time data conclusively prove that hunting is causing wildlife populations to decline, the damage is done already. It is reasonable to conclude that bushmeat hunting at present threatens the delta ecosystem and its wildlife. Wildlife managers should take the precautionary approach, and act to address the issue now.

The biomass model illustrates that the effects of illegal hunting are not limited to the herbivores and small carnivores that people eat; hunting indirectly affects the predators that depend on those prey species. The model suggests that predator-prey dynamics are balanced more finely and precariously than many wildlife managers may realize. Hunters and predators compete directly for prey. Incremental increases in the offtake of herbivores from hunting can cause total offtake to reach a tipping point, at which the loss of herbivores becomes unsustainable.

Reaching such a tipping point would have implications beyond the herbivore guild. As previously described, hunters kill many large carnivores. Additionally, hunting has the potential to reduce the number of large predators that the ecosystem can support (Ripple et al., 2014). More research is necessary to examine in detail how strong this effect is, and whether it may contribute to measured declines in the delta’s lion population (Bauer et al., 2015).

Strategies to reduce illegal hunting

Declines in herbivore and predator populations have the potential to undermine the tourism industry in Ngamiland. Authorities should treat bushmeat, therefore, as not only a wildlife management issue but also as an economic issue. Hunters exploit a public resource, but they achieve a value for bushmeat well below its intrinsic value to the region and to the nation as a whole. The 20 BWP/kilogram price that most hunters achieve, whether selling the bushmeat or avoiding purchasing livestock meat, is markedly less than the value of a live animal as a component of the lucrative wildlife tourism industry (Barnes and De Jager, 1996; Chardonnet et al., 2002; Smyman, 2012). Contrasting the communal benefits from hunting with the benefits from a community trust venture demonstrates that when hunting reduces wildlife populations in an area, particularly areas near human communities, the phenomenon imposes significant opportunity costs on those communities in terms of lost potential benefits from tourism (in addition to risking the economic benefits from tourism for the country as a whole). Similarly, Lindsey et al., 2015 have shown that bushmeat hunting in southern Africa creates very modest, unsustainable livelihoods, imperils existing wildlife-based employment and worsens food security.

While illegal hunting poses serious challenges to wildlife management and tourism in Ngamiland, it also presents opportunities. Illegal hunters overwhelmingly value wildlife in contrast to most members of their communities. They have wilderness skills and knowledge. They are enterprising risk-takers. In focus groups, hunters were eager to assume more responsibility for managing and conserving wildlife, and for establishing non-consumptive value streams.

These factors suggest that illegal hunters can and should be part of the solution. Furthermore, through conversations with anti-poaching scouts and managers, it is clear that wildlife managers and law enforcement lack the resources and expertise to address bushmeat hunting purely through enforcement. Strategies to reduce illegal hunting and mitigate its effects on wildlife must begin with creating incentives for communities to conserve and protect wildlife rather than relying entirely on creating disincentives to hunt (Pires and Moreto, 2011).

However, enforcement does matter. The difference between how hunters in the western delta perceive risk and hunters elsewhere perceive risk suggests that effective enforcement strategies can influence hunters as part of a broader trade-off between risk and reward. To be effective, however, that risk of capture must coincide with risk of penalties severe enough to impose costs for hunting illegally.

The rewards from wildlife are complex and vary widely among and within villages. Many of the study villages experience minimal tourism presence or employment in tourism lodges. However, everyone benefits from wildlife. Wildlife and tourism industry revenues fuel social welfare programmes in Botswana, ranging from free education and healthcare to poverty eradication and government work programmes. While indirect benefits from wildlife may not convince people of the need to conserve wildlife, it is important that Ngamiland residents recognize how closely interlinked their welfare is with the district’s wildlife resources. Further exacerbating this dynamic is the fact that illegal hunting benefits a small cadre of wildlife managers and work programmes in Botswana, ranging from free education and healthcare to poverty eradication and government work programmes. While indirect benefits from wildlife may not convince people of the need to conserve wildlife, it is important that Ngamiland residents recognize how closely interlinked their welfare is with the district’s wildlife resources. Further exacerbating this dynamic is the fact that illegal hunting benefits a small cadre of individuals, while a community trust has the potential to spread benefits to a larger swathe of the community (Mbaiwa and Stronza, 2011).

This study proposes a holistic strategy of interventions designed to address illegal bushmeat hunting by creating incentives to conserve, creating disincentives for illegal
hunting, reducing the costs associated with living with wildlife and raising public awareness (Figure 21). Holding together these three pillars is a sensible policy climate that empowers communities and local wildlife managers to work together.

![Four pillars of a holistic approach to addressing bushmeat hunting in the Okavango Delta.](image)

**Figure 21.** Four pillars of a holistic approach to addressing bushmeat hunting in the Okavango Delta.

**Empower communities to benefit through legal wildlife use**

The strategy revolves around empowering communities to benefit from legal wildlife use. Policy should facilitate opportunities for communities to maximize benefits from legal wildlife use while simultaneously creating disincentives for illegal wildlife use through strict laws and effective enforcement.

Two approaches are recommended:

1) expanding tourism with strong community linkages, especially in the western delta; and

2) developing a legislative framework that allows for wildlife-based land uses owned by and implicitly involving communities. Generating legal benefits from wildlife given the current ban on trophy hunting may be challenging. The government of Botswana may wish to reconsider that decision, or alternatively to look seriously at alternative options for communities to benefit from conserving wildlife, such as through payments for environmental services (Dickman et al., 2011).

Increasing legal benefits from wildlife begins with expanding and investing in community-based tourism ventures, or tourism which implicitly involves and benefits communities. Currently, community trust ventures are prominent in the northern, eastern and southern portions of the delta. Existing lease agreements prevent the Tawana Land Board (the entity responsible for administering land rights in Ngamiland) from bestowing western WMAs on community trusts (I. Khama, personal communication, May 2015). Additionally, the western delta experiences high hunting pressure because of its large human populations, its predominantly pastoral economy and its wildlife populations in community areas. As a result, western-delta stakeholders should pursue further community-based tourism programmes outside existing WMAs.

Expanding alternative wildlife-based land uses in the western delta through community projects is further advocated. The most recent Ngamiland Integrated Land Use Plan (Tawana Land Board, 2008) recommended community-owned game ranches adjacent to the veterinary fence in the western delta. The study recommends that stakeholders explore a pilot project to test whether a community-owned game ranch between villages and the veterinary fence can be a productive land use that contributes to conservation.

Game ranching can boost employment, create economic output comparable to livestock farming, produce large quantities of legal and sustainable game meat and lead to an increase in wildlife populations. It could meet some of the demand for bushmeat in Ngamiland and generate more value per kilogram of game meat than hunting, especially if DWNP reconsidered allowing trophy hunting within the ranch (Lindsey, 2011). Well-managed game ranches would allow wildlife populations to recover, which can increase sustainable yields. Selective harvesting of only adult male animals – in contrast to illegal hunting which research has shown disproportionately removes sub-adult animals (Holmern et al., 2006) – improves the long-term productivity of game-ranch populations.

Furthermore, to avoid facilitating sales of illegal bushmeat under the guise of legitimate game meat, game ranch operators would have to implement some form of certification system with distributors to ensure that only legal game meat is available to the public.

The obstacles to community-owned game ranching are formidable in the current policy and legislative environment, but with inclusive planning and clear goals, a community-owned game ranch can effectively engage communities in wildlife management and conservation while creating jobs and improving food security. Communities lack expertise and capital to manage and market a game ranch properly (Mbaiwa, 2004). Therefore, it is advisable that the game ranches
DISCUSSION

are established as joint ventures between the community and either a private operator or a non-profit organization with expertise in wildlife management. With investment in training and capacity building, over time community members could develop the skills necessary for them to manage a game ranch independently.

The current policy climate for game ranching fosters uncertainty and hinders long-term planning. To operate effectively, the government should consider relaxing certain regulations, such as fencing requirements and permits for selling bushmeat. In general, there is a need for a more coherent and supportive policy framework for game ranching throughout Botswana.

There is also a need for expanding the photographic tourism footprint in the delta to increase the community benefits arising from wildlife. Three areas with dense wildlife populations, high hunting intensity and no permanent tourism camp or lodge were identified (Figure 20). It is believed that these three areas are viable for more prominent tourism activities and that expanding tourism in these areas could reduce hunting by providing a presence. Current environmental management plans may prevent leaseholders in these concessions from adding lodge capacity. Therefore, it is recommended that the Botswana Tourism Board issue special waivers for NG26, NG29 and NG30 that permit additional lodge capacity (lodge construction in eastern NG32 is already underway).

**Strengthen laws on hunting and improve law enforcement**

Expanding wildlife-based land uses to the western delta will reduce bushmeat hunting only if communities benefit adequately and at the same time, face consequences for illegally exploiting wildlife. First, there is a need for reform of the laws governing wildlife crimes. Currently, penalties for illegal bushmeat hunting are far less severe than penalties for livestock theft, even though wild animals are more valuable than livestock. In fact, a hunter convicted of a first-time offence pays less in penalties than he earns from hunting a large herbivore. DWNP currently endorses proposals for more stringent sentencing guidelines for wildlife crimes. A coordinated lobbying effort could provide valuable support to DWNP and encourage Parliament and the Ministry of Justice and Security to adopt DWNP’s recommendations.

The study recognizes a need for law enforcement agencies to coordinate anti-poaching operations more effectively. Certain programmes, such as the 911 Anti-poaching Operations Centre, demonstrate that agencies can share information effectively when given a proper forum. Agencies should develop regional integrated task forces that not only review ongoing investigations but also coordinate patrol operations.

Government agencies do not have the resources or capacity to prevent hunting by themselves. Currently, the responsibility for anti-poaching patrols primarily falls on DWNP subdistrict offices, DWNP APU and the BDF. Entities that benefit the most from wildlife resources (e.g. tourism operators) should assume more of the burden for protecting those resources. Arrest records and focus groups with hunters reveal that private anti-poaching units can be highly effective in the delta. Their presence should expand into additional areas. The burden for funding private anti-poaching, however, should not fall solely on concession leaseholders on the periphery of the delta.

Tourism operators in Moremi Game Reserve and other parts of the delta core also benefit from an intact ecosystem. Furthermore, it may be unclear how much responsibility leaseholders have for conducting anti-poaching operations. Currently, leaseholders are required to monitor hunting events, but they are not required to conduct patrols intended to prevent or capture illegal hunters. Therefore, it is recommended that stakeholders and government authorities consider revising future lease agreements to define explicitly each party’s contribution to anti-poaching. This does not imply that leaseholders should necessarily employ private anti-poaching teams. Instead, leaseholders could be responsible for supporting DWNP patrols within their concessions or providing other equipment and resources that anti-poaching teams lack.

Finally, interviews with hunters reveal that they routinely elude patrols. Too often law enforcement employs costly vehicle patrols that rarely catch illegal hunters and fail to deter illegal hunting. Foot patrols in targeted areas are more cost effective. Prioritizing boundary monitoring, where cut-lines expose incursions, and a greater reliance on tracking, could produce better outcomes for anti-poaching operations.

**Reduce human-wildlife conflict and address negative attitudes towards wildlife**

In the western delta, gaps in the veterinary fence allow livestock to stray into WMAs in violation of veterinary policy (C. Whitesell, personal communication, April 2015). These incursions increase the spread of foot-and-mouth disease, increase the chances that predators will eat the livestock and provide a cover story for hunters illegally entering WMAs. The high levels of livestock
Husbands and reduce livestock depredation. Additionally, organizations should develop programmes to improve anti-predator strategies. Guardians and conservation would decline significantly if farmers employed improved proportion of livestock that farmers lose to carnivores (C. Whitesell, personal communication, April 2015). The Livestock husbandry is poor in the western delta capacity and identify new activities for wildlife guardians. A wildlife guardian programme should seek to grow Conservation organizations that sponsor and manage a wildlife guardian programme inspired by ongoing conservation projects such as the Lion Guardians programme in Kenya and the Long Shields programme in Zimbabwe is recommended. These projects demonstrate that human-lion conflict can be reduced radically through the combined efforts of communities and wildlife experts (Hazzah et al., 2014; Panthera, 2014). Furthermore, such a programme could provide alternative livelihoods for poachers if they were targeted for employment.

Hunters often have considerable knowledge of the wildlife and landscapes where they hunt. They are competent trackers. They work hard on foot in remote areas and difficult terrain. They value wildlife. They want responsibility for managing wildlife and legitimate avenues to benefit from local wildlife resources. It is believed that these hunters can form the backbone of a wildlife guardian programme in the western delta.

Guardians should work with WMA managers to identify livestock incursions into WMAs and to herd livestock back into community areas. The cut-lines along veterinary fences create a focal point for monitoring incursions by illegal hunters and livestock, or movements of wildlife into community areas. By patrolling this boundary, ideally in communication with government authorities and private anti-poaching units, wildlife guardians can efficiently identify circumstances requiring their intervention. In collaboration with researchers and conservationists, they should monitor large carnivores that may disturb livestock and chase those predators towards wildlife-designated areas. They could also deter elephants and other herbivores from raiding crop fields and encourage better livestock husbandry.

Conservation organizations that sponsor and manage a wildlife guardian programme should seek to grow capacity and identify new activities for wildlife guardians. Livestock husbandry is poor in the western delta (C. Whitesell, personal communication, April 2015). The proportion of livestock that farmers lose to carnivores would decline significantly if farmers employed improved anti-predator strategies. Guardians and conservation organizations should develop programmes to improve husbandry and reduce livestock depredation. Additionally, conservation partners should pursue long-term goals to train hunters and wildlife guardians to become anti-poaching managers and ecotourism guides.

A wildlife guardian programme can be a cost-effective means for directly incentivising hunters to conserve wildlife. These young men and women can become role models for children and improve community attitudes towards wildlife.

**Improve environmental education and outreach**

The proposed strategies will not succeed amidst public indifference and misinformation. The low proportion of the public that values wildlife and believes their community benefits from wildlife is concerning. It is recommended that stakeholders launch a public relations campaign that raises awareness about the importance of wildlife in funding social services, supporting local economies and generating livelihoods. Many Ngamiland residents believe that wildlife is inexhaustible and that hunting does no harm. Stakeholders should act to dispel this misconception.

Additionally, the tourism industry must address public perceptions of exclusion and corruption. Concession managers should engage with communities directly through community meetings, even when those concessions are not leased to community trusts. In focus groups, hunters articulated widespread beliefs that anti-poaching operators engage in illegal activities. While these beliefs may be unfounded, the perceptions matter. Stakeholders should act to correct them. Finally, a public information campaign is necessary to inform the public about differentiating between legal and illegal sources of bushmeat. Consumers should be aware that legal game meat creates jobs and that bushmeat exploits a public good.

**Long-term prospects for the Okavango Delta**

Despite the numerous problems that illegal bushmeat hunting poses and the challenges that wildlife managers face, the current situation yields enormous opportunity. The Okavango Delta's status as a world-renowned tourism attraction will continue. Integrating communities into its management could increase its appeal and diversify tourism attractions in the long term. Most importantly, however, communities need time to grow into their roles. A persistent effort to include youth and village leaders in wildlife management could yield innovative approaches to improving wildlife management and developing new wildlife-based revenue streams.
REFERENCES


REFERENCES


REFERENCES


APPENDIX A: QUESTIONNAIRE SURVEY FOR HUNTERS

Hello, my name is __________ and I am a researcher with the Botswana Predator Conservation Trust. I am here today because I would like to interview you as part of a project to understand the social and economic roles that hunting and wild meat consumption play in local communities. We would also like to ask questions about hunting so that we can better understand the practice. The survey is voluntary, and if you agree to participate, you may decline to answer any questions or end the interview at any time. All responses will be kept strictly confidential and all interviewees will be anonymous. Information will not be used against you in any way, including regarding illegal activities. We are here merely so that we can understand the community’s perspective on the hunting tradition and how important it is to your livelihood.

The interview will take approximately 45 minutes.

Are you willing to participate in this research? __________

Evaluator name __________
Date of survey __________
Village __________ Cattle post: __________
GPS coordinates S: __________ E: __________
Language of interview __________
Respondent ID __________

(Village Codes: Habu=01, Nokaneng=02, Gumare=03, Tubu=04, Etsha 6=05, Etsha 13=06, Boro = 07, Gunotsoga=08, Beetsha=09, Eretsha=10, Gudigwa=11, Toteng=12)

BACKGROUND

1) How old are you?
2) Gender: Male Female
3) What is your ethnicity?
4) Where is your home village?
   A) [If different from current village] How long have you lived in your current village?
5) What is your position within the community?
6) What is your highest level of education?
7) How many adults are in your household? How many children?
8) How many children are going to school?
9) Are you or anyone else in your household employed?
   • No [SKIP TO QUESTION 10]
   • Permanent position, as
   • Part-time position, as
   • Seasonal work as during the months of
   • Self-employed, as
   A) If yes, how much income does your household get from employment per month?
10) Does your household receive any income from farming crops? Yes No
   A) Which months does your household harvest its crops?
   B) If you sold your entire harvest, how much income would you receive?
### APPENDIX A: QUESTIONNAIRE SURVEY FOR HUNTERS

#### BACKGROUND

11) How many livestock does your household own? None [SKIP TO QUESTION 12]

<table>
<thead>
<tr>
<th>Cows:</th>
<th>Goats/Sheep:</th>
<th>Horses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donkeys:</td>
<td>Chickens:</td>
<td>Other:</td>
</tr>
</tbody>
</table>

A) How much income did your household earn from livestock in the last year?

12) Does your household receive any government assistance? Yes [SKIP TO QUESTION 13] No

|---------------|--------------|----------|

13) Does your household receive income from any source other than direct employment, crops, livestock or government assistance?

| Yes, specify | No | How much per year? |

14) Which months do you receive the most income?

15) Which months do you receive the least income?

#### FOOD SECURITY

16) In the last 12 months, did you or anyone else in your household ever cut the size of your meals or skip meals because there wasn’t enough money for food?

| Yes | No | Don’t know |

A) [IF YES] How often did this happen?

| Almost every month | Some months but not every month | Only 1 or 2 months | Don’t know |

B) [IF YES] Which months of the year does someone skip meals/reduce meal size most often?

#### PROTEIN CONSUMPTION

17) Which types of protein do you eat most often, and why?

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<thead>
<tr>
<th>Type 1:</th>
<th>because</th>
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<tbody>
<tr>
<td>Type 2:</td>
<td>because</td>
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<tr>
<td>Type 3:</td>
<td>because</td>
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</tbody>
</table>

18) How far from your home is the nearest butchery that sells meat every day?

19) Of the three types of protein you buy most frequently, how much do you typically buy, and how much do you typically pay?

<table>
<thead>
<tr>
<th>Type 1:</th>
<th>Amount:</th>
<th>Cost:</th>
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</thead>
<tbody>
<tr>
<td>Type 2:</td>
<td>Amount:</td>
<td>Cost:</td>
</tr>
<tr>
<td>Type 3:</td>
<td>Amount:</td>
<td>Cost:</td>
</tr>
</tbody>
</table>

20) Do you prefer red meat or white meat?

| Red meat | White Meat | No Preference |

A) Why?

21) Do you prefer bushmeat or meat from livestock?

| Bushmeat | Livestock | No Preference |

A) Why?
APPENDIX A: QUESTIONNAIRE SURVEY FOR HUNTERS

PROTEIN CONSUMPTION
22) For each of the following protein sources, how often do you eat it and where did you get it from?

<table>
<thead>
<tr>
<th>Protein Type</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Rarely</th>
<th>Never</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>Beef</td>
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<td>Sheep and Goats</td>
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<td>Chicken</td>
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<td>Fish</td>
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<td>Eggs</td>
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<td>Milk</td>
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<td>Bushmeat</td>
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<td>Beans</td>
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<tr>
<td>Other, please specify</td>
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</tbody>
</table>

BUSHMEAT HUNTING
23) How often do you hunt?
24) Why do you hunt?
25) For how many years have you been hunting?
26) Which species do you target when you hunt?

1 2 3
27) Which species do you catch most often?

1 2 3
28) When you go hunting, do you think the chances of being caught are high, medium or low?

High       Medium       Low       Don’t know
29) Have the risks of being caught increased, decreased or stayed the same over the last five years?

Increased   Stayed the same   Decreased   Don’t know
30) Have you ever been caught?

Yes        No [IF NO, SKIP TO QUESTION 29]
A) How many times?
B) Who caught you each time?
C) What were the consequences of being caught each time (i.e. did you receive punishment and if so, what)?

31) Have you ever received assistance with hunting from game scouts or other staff working in the Wildlife Management concessions?

Yes        No
A) [IF YES] How and how often?

32) Have you ever encountered, or are you aware of, any hunters in this region who are not from local villages?

Yes        No
A) [IF YES] Explain how often, where and where they came from:
### BUSHMEAT HUNTING

33) Where do you typically go hunting [USE MAP]?

   A) Why do you hunt in these areas?

34) What hunting methods do you use?

<table>
<thead>
<tr>
<th>Hunting method</th>
<th>Firearms</th>
<th>Snares</th>
<th>Gin traps</th>
<th>Dogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunting from horseback with:</td>
<td>Guns</td>
<td>Spear/Machete</td>
<td></td>
<td></td>
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<tr>
<td>A combination of methods:</td>
<td>Other:</td>
<td></td>
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</tbody>
</table>

35) Why do you use those methods?

36) [IF THEY USE MORE THAN ONE]:

   A) When do you use each method?

   B) Is there a difference in the risk of being caught associated with each method?  
      [IF YES] What?

37) [IF MULTIPLE METHODS] Does the hunting method vary with season, moon phase or other factor?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Doesn't vary</th>
<th>Season</th>
<th>Moon phase</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) [IF VARES] How?</td>
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</table>

38) Does the frequency with which you hunt vary with the season, moon phase or any other factor?

<table>
<thead>
<tr>
<th>Factor</th>
<th>Doesn't vary</th>
<th>Season</th>
<th>Moon phase</th>
<th>Other</th>
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</thead>
<tbody>
<tr>
<td>A) [IF VARES] How?</td>
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</tbody>
</table>

39) How many hunting trips do you make per year?

40) How long (time period) is your typical hunting trip?

   A) Maximum time?

41) What is the typical distance that you travel when you hunt?

   A) Maximum distance?

42) At what time of the day do you hunt?

   A) Do you ever hunt at night?

43) How many other people do you typically hunt with?

44) How do you transport meat?

<table>
<thead>
<tr>
<th>Method</th>
<th>Horse/Donkey</th>
<th>Makoro</th>
<th>Vehicle</th>
<th>Other</th>
</tr>
</thead>
</table>

45) Do you think that over the last five years the number of hunters and the amount of hunting has:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Increased</th>
<th>Decreased</th>
<th>Stayed the same</th>
<th>Don't know</th>
</tr>
</thead>
</table>

46) Approximately how many hunters are there in your village?

47) Approximately how many hunters were there before the hunting ban?

48) Under what circumstances would you no longer hunt?
### WILDLIFE IMPACTS

49) Do you think wildlife populations are increasing, decreasing or staying the same?

<table>
<thead>
<tr>
<th></th>
<th>Increasing</th>
<th>Decreasing</th>
<th>Staying the same</th>
<th>Don't know</th>
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<tr>
<td>A) If declining, what do you think is causing the decline?</td>
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</table>

50) Are there any species that have experienced drastic declines?

- A) If yes, what species?
- B) What do you think has caused the decline?

51) Do you think that bushmeat hunting should:

<table>
<thead>
<tr>
<th></th>
<th>Be legal without any limitations</th>
<th>Be illegal</th>
<th>Be legal but with certain rules and limitations</th>
<th>No opinion</th>
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<td>Why?</td>
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52) In the last 12 months, how many animals have you killed and wounded? (SPECIFY THE NUMBER FOR EACH SPECIES, ✓ = KILLED, X = WOUNDED)?

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<tr>
<th>Species</th>
<th>1</th>
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<th>16-20</th>
<th>20-50</th>
<th>51-100</th>
<th>&gt;100 estimate:</th>
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<td>Honey Badger</td>
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<tr>
<td>Sitatunga</td>
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<td></td>
<td>✓</td>
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</tbody>
</table>
52) In the last 12 months, how many animals have you killed and wounded? [SPECIFY THE NUMBER FOR EACH SPECIES, ✓ = KILLED, X= WOUNDED]?

<table>
<thead>
<tr>
<th>Species</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>10-15</th>
<th>16-20</th>
<th>20-50</th>
<th>51-100</th>
<th>&gt;100 estimate:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steenbok</td>
<td>✓</td>
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<tr>
<td>Tsessebe</td>
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<td>Warthog</td>
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<tr>
<td>Waterbuck</td>
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<tr>
<td>Wild Cat</td>
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<tr>
<td>Wild Dog</td>
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</tr>
<tr>
<td>Wildebeest</td>
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<tr>
<td>Zebra</td>
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<tr>
<td>Other spp?</td>
<td>✓</td>
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</tbody>
</table>

**SELLING MEAT**

What proportion of the meat that you catch do you sell?

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) What do you do with the remainder?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B) Do you ever give meat away to people who are not in your household? [IF SELL 0%, SKIP TO NEXT SECTION]</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C) Does this amount vary seasonally?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D) If yes, how?</td>
<td></td>
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</tr>
</tbody>
</table>

54) How much money do you earn per month from hunting?

55) When selling game meat, do you:

- Always sell for cash
- Sometimes sell for cash, sometimes barter for goods (if so, what goods do you trade for meat?)
- Always barter for goods (if so, what goods do you trade for meat?)

56) When you sell game meat, what price do you get per kg?

57) Do you vary the price depending on the species you are selling? [IF YES] Which species are most expensive? Least expensive?

58) What species do buyers prefer? 1 2 3

59) Are there species that some people won’t buy?

A) If yes, what?
B) Why?

60) Do you ever lie about the type of meat you are selling? Yes No

61) What proportion of meat do you sell as dry? % dry

62) Where do you sell meat that you hunt?

63) Where are most of the people who buy meat from?
### SELLING MEAT

64) Who (e.g. ages, professions, sexes) do you sell to?

65) Do the people who buy your meat consume it themselves or sell it to other people?

<table>
<thead>
<tr>
<th>Eat themselves</th>
<th>Sell to other people</th>
<th>Mix</th>
<th>Don't know</th>
</tr>
</thead>
</table>

A) If sold on, do they sell locally or transport it elsewhere?

<table>
<thead>
<tr>
<th>Sell locally</th>
<th>Transport elsewhere</th>
<th>Mix</th>
<th>Don't know</th>
</tr>
</thead>
</table>

B) If transported, to where?

### METHOD-SPECIFIC QUESTIONS

#### FIREARMS

What type and calibre of firearm do you use?

Where do/did you get the firearm?

How much did the firearm cost?

How much does ammunition cost per bullet/round?

In what habitat do you use firearms?

Which species do you target with firearms?

How high are the risks of being caught when using firearms?

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
</table>

A) Why?

B) Are you worried about someone hearing the shot? Yes No

C) [IF NO] Why not?

What proportion of hunting trips with firearms is successful?

| 25% | 50% | 75% | 100% |

#### SNARES

What type of snare do you use?

Where do you get the material?

How much does the material cost?

How many snares do you use on each hunting trip?

In what habitat do you use snares?

Which species do you target with snares?

How high are the risks of being caught when hunting with snares?

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
</table>

A) Why?

What proportion of hunting trips with snares is successful?

| 25% | 50% | 75% | 100% |
## METHOD-SPECIFIC QUESTIONS

### GIN TRAPS
- What size trap do you use?
- Where do you get the trap?
- How much does the trap cost?
- How many traps do you use on each hunting trip?
- In what habitat do you use gin traps?
- Which species do you target with gin traps?
- How high are the risks of getting caught when using traps?
  - High
  - Medium
  - Low
  - A) Why?
- What proportion of hunting trips with traps is successful?
  - 25%
  - 50%
  - 75%
  - 100%

### DOGS
- How many dogs do you hunt with on each hunting trip?
- Do the dogs kill the animals or do the hunters?
  - Dogs
  - Hunters
  - Mix
  - A) [IF HUNTERS OR MIX] How do the hunters kill the animals?
- In what habitat do you hunt with dogs?
- Which species do you target with dogs?
- How high are the risks of being caught when hunting with dogs?
  - High
  - Medium
  - Low
  - A) Why?
- What proportion of hunting trips with dogs is successful?
  - 25%
  - 50%
  - 75%
  - 100%

### HUNTING FROM HORSEBACK
- How many horses do you hunt with on each hunting trip?
- In what habitat do you hunt on horseback?
- Which species do you target on horseback?
- How high are the risks of getting caught when hunting from horseback?
  - High
  - Medium
  - Low
  - A) Why?
- What proportion of hunting trips on horseback is successful?
  - 25%
  - 50%
  - 75%
  - 100%
### APPENDIX A: QUESTIONNAIRE SURVEY FOR HUNTERS

#### WILDLIFE

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>66) Is wildlife important to you and your community?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A) Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67) How far is your cattle post [IF HE HAS ONE] from a wildlife management concession?</td>
<td></td>
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</tr>
<tr>
<td>68) Where in the area of your village are the nearest populations of wildlife?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A) How far are they from your home or cattle post (whichever is closer)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69) Do you bear any costs associated with living close to wildlife?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70) Does your household derive any benefits from wildlife (other than through hunting)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71) Does your household derive any benefits from tourism?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72) Do you think that your community derives any benefits from wildlife (other than from hunting)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>73) Does your community gain any benefits from tourism?</td>
<td></td>
<td></td>
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<tr>
<td>[IF YES] What?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>74) Did your community gain any benefits from trophy hunting?</td>
<td></td>
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<tr>
<td>[IF YES] What?</td>
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</tr>
<tr>
<td>75) Do you have any other relevant comments?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### ADDITIONAL NOTES:

<table>
<thead>
<tr>
<th>This person seemed:</th>
<th>Very truthful</th>
<th>Somewhat truthful</th>
<th>Not very truthful</th>
</tr>
</thead>
</table>
APPENDIX B: QUESTIONNAIRE SURVEY FOR HEADS OF HOUSEHOLDS

Hello, my name is ____________________________

and I am a researcher with the Botswana Predator Conservation Trust. I am here today because I would like to interview you as part of a project to understand the social and economic roles that hunting and wild meat consumption play in local communities. We would also like to ask questions about hunting so that we can better understand the practice. The survey is voluntary, and if you agree to participate, you may decline to answer any questions or end the interview at any time. All responses will be kept strictly confidential and all interviewees will be anonymous. Information will not be used against you in any way, including regarding illegal activities. We are here merely so that we can understand the community’s perspective on the hunting tradition and how important it is to your livelihood. The interview will take approximately 45 minutes.

Are you willing to participate in this research?

Evaluator name
Date of survey
Village Cattle post:
GPS coordinates S: E:
Language of interview
Respondent ID

(Village Codes: Habu=01, Nokaneng=02, Gumare=03, Tubu=04, Etsha 6=05, Etsha 13=06, Boro = 07, Gunotsoga=08, Beetsa=09, Eretsha=10, Gudigwa=11, Toteng=12)

BACKGROUND

1) How old are you? 2) Gender: Male Female
3) What is your ethnicity?
4) Where is your home village?
   A) [If different from current village] How long have you lived in your current village?
5) What is your position within the community?
6) What is your highest level of education?
7) How many adults are in your household? How many children?
8) How many children are going to school?
9) Are you or anyone else in your household employed?
   • No [SKIP TO QUESTION 10]
   • Permanent position, as
   • Part-time position, as
   • Seasonal work as during the months of
   • Self-employed, as
   A) If yes, how much income does your household get from employment per month?
10) Does your household receive any income from farming crops? Yes No
A) Which months does your household harvest its crops?
B) If you sold your entire harvest, how much income would you receive?
**BACKGROUND**

11) How many livestock does your household own? None [SKIP TO QUESTION 12]

<table>
<thead>
<tr>
<th>Cows:</th>
<th>Goats/Sheep:</th>
<th>Horses:</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Donkeys: Chickens: Other:

A) How much income did your household earn from livestock in the last year?

12) Does your household receive any government assistance? Yes | No [SKIP TO QUESTION 13]


13) Does your household receive income from any source other than direct employment, crops, livestock or government assistance? Yes, specify | No | How much per year?

14) Which months do you receive the most income?

15) Which months do you receive the least income?

**FOOD SECURITY**

16) In the last 12 months, did you or anyone else in your household ever cut the size of your meals or skip meals because there wasn’t enough money for food?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Don’t know</th>
</tr>
</thead>
</table>

A) [IF YES] how often did this happen?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- Don’t know

B) [IF YES] Which months of the year does someone skip meals/reduce meal size most often?

**PROTEIN CONSUMPTION**

17) Which types of protein do you eat most often, and why?

<table>
<thead>
<tr>
<th>Type 1:</th>
<th>because</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2:</td>
<td>because</td>
</tr>
<tr>
<td>Type 3:</td>
<td>because</td>
</tr>
</tbody>
</table>

18) How far from your home is the nearest butchery that sells meat every day?

19) Of the three types of protein you buy most frequently, how much do you typically buy, and how much do you typically pay?

<table>
<thead>
<tr>
<th>Type 1: Amount:</th>
<th>Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2: Amount:</td>
<td>Cost:</td>
</tr>
<tr>
<td>Type 3: Amount:</td>
<td>Cost:</td>
</tr>
</tbody>
</table>

20) Do you prefer red meat or white meat?

- Red meat
- White Meat
- No Preference

A) Why?

21) Do you prefer bushmeat or meat from livestock?

- Bushmeat
- Livestock
- No Preference

A) Why?
APPENDIX B: QUESTIONNAIRE SURVEY FOR HEADS OF HOUSEHOLDS

### PROTEIN CONSUMPTION

22) For each of the following protein sources, how often do you eat it and where did you get it from?

<table>
<thead>
<tr>
<th>Protein Type</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Rarely</th>
<th>Never</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
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<tr>
<td>Sheep and Goats</td>
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<tr>
<td>Chicken</td>
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<tr>
<td>Fish</td>
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<tr>
<td>Eggs</td>
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<tr>
<td>Milk</td>
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<td></td>
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<tr>
<td>Bushmeat</td>
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<td></td>
</tr>
<tr>
<td>Beans</td>
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<tr>
<td>Other, please specify</td>
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</tbody>
</table>

### BUSHMEAT HUNTING

23) During the last five years, has the amount of bushmeat being sold in your village:

- Increased
- Stayed the same
- Decreased
- Not sure

A) [IF INCREASING/DECREASING] What do you think has caused this trend?

B) [IF NOT SURE]: Are you aware of bushmeat ever being sold in the village?

- Yes
- No

24) How often do you or anyone in your household eat bushmeat currently?

- Never
- Daily
- Weekly
- Monthly
- Other

25) How often did you or anyone in your household eat bushmeat before the hunting ban?

- Never
- Daily
- Weekly
- Monthly
- Other

[IF NEVER, ASK QUESTIONS IN BOLD THEN SKIP TO WILDLIFE SECTION]

26) How often do your neighbours or other people in your village eat bushmeat currently?

- Never
- Daily
- Weekly
- Monthly
- Other

27) Where (e.g. village or cattle post) do you, or other people in your village, get bushmeat?

### WILDLIFE SECTION

28) Are you aware of people not from your village ever selling or buying meat in the village?

- Yes
- No

A) [IF YES] Do you know where (e.g. village or general area of cattle post) they come from?

29) If you or someone from your household buys bushmeat, do you buy it directly from the hunter?

- Yes
- No
- Sometimes

A) [IF NO] Who do you buy it from (names not required) and where do they get it?
BUSHMEAT HUNTING

30) How many kilograms of bushmeat does your household typically buy per month?

31) When buying game meat, does your household:
   - Always pay with cash
   - Sometimes pay with cash, sometimes barter with goods (if so, what do you barter with?)
   - Always barter with goods (if so, what do you barter with?)

32) [IF THEY BUY WITH CASH] How much do you pay per kg?

33) Is there variation in price among species being sold?
   - A) If yes, which species are most expensive?
   - B) Least expensive?

34) Does your household ever source the bushmeat yourselves?
   - [IF YES] How often?

35) What species of game meat do you prefer? 1 2 3

36) Are there any species that you would not eat?
   - [IF YES] Please list and say why

37) When hunters bring game meat for you to buy, how do you identify the species?

38) How often is bushmeat sold in your village?

39) What species of bushmeat are sold most often?

40) During which months is bushmeat most available?

41) Does the price of bushmeat vary during the year?
   - If yes, in which months is meat most expensive?
   - Least expensive?

42) When hunters sell meat, is it generally sold as wet meat or dried meat?
   - Always wet
   - Mostly wet
   - Mostly dry
   - Always dry

43) Do you prefer fresh or dried meat?
   - Why?

44) Do you or anyone in your household ever buy wildlife products (e.g. skins, horns, tail, fat) other than meat for any reason?
   - A) [IF YES] Please list examples and why

45) Is bushmeat sold openly or secretly?
   - Openly
   - Secretly

46) If you were seen by the authorities buying bushmeat, what would the consequences be?

47) How many people do you know that hunt currently?

48) How many people do you know that hunted prior to the hunting ban?

49) How many people do you know who sell bushmeat currently?

50) How many people did you know who sold bushmeat before the hunting ban?
**APPENDIX B: QUESTIONNAIRE SURVEY FOR HEADS OF HOUSEHOLDS**

**WILDLIFE**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>51) Is wildlife important to you?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A) If yes, why</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52) How far is your cattle post from a wildlife management area?</td>
<td></td>
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<tr>
<td>53) Where in the area of your village are the nearest populations of wildlife? How far are they from your home or cattle post (whichever is closer)?</td>
<td></td>
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</tr>
<tr>
<td>54) Does your household bear any costs associated with living near wildlife?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>A) [IF YES] What costs?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55) Does your household derive any benefits from wildlife (other than through hunting)?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56) Does your household derive benefits from tourism?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57) Do you think that your community derives any benefits from wildlife (other than through hunting)?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>If yes, specify</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58) Does your community derive any benefits from tourism?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>[IF YES] What?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59) Did your community gain any benefits from trophy hunting?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>[IF YES] What?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60) Do you think that wildlife populations in the Okavango Delta are:</td>
<td></td>
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<tr>
<td>Decreasing</td>
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</tr>
<tr>
<td>Staying the same</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not sure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A) [IF DECREASING] What do you think is causing this trend?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61) Do you think that bushmeat hunting should:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Be legal without any limitations</td>
<td>Be illegal</td>
<td></td>
</tr>
<tr>
<td>Be legal but with certain rules and limitations</td>
<td>No opinion</td>
<td></td>
</tr>
<tr>
<td>Why?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[IF THEY SUPPORT RULES AND LIMITATIONS] What limitations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62) Do you have anything to add about any of the subjects we have discussed today?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ADDITIONAL NOTES:**

This person seemed: Very truthful | Somewhat truthful | Not very truthful
APPENDIX C: QUESTIONNAIRE SURVEY FOR CONCESSION MANAGERS

Introduction

The goal of this research is to investigate the social and economic drivers of the bushmeat trade in the Okavango Delta and how bushmeat hunting relates to law enforcement and land management. Staff members of the Botswana Predator Conservation Trust are conducting this research with funding from the Food and Agriculture Organization of the United Nations.

I am interviewing you to learn more about bushmeat hunting and land management practices on your concession. It is our hope that the findings of this research will empower you to implement more informed management decisions. Additionally, we will use our findings to develop strategies for reducing or mitigating the impacts of bushmeat hunting on the surrounding landscape.

All of your responses will be kept anonymous. I will be the only person who knows the origins of any responses. You may stop the interview at any time or decline to answer any questions. The interview will last approximately one hour. Do you have any questions before we begin?

<table>
<thead>
<tr>
<th>Interviewee ID</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concession ID</td>
<td></td>
</tr>
<tr>
<td>Management tenure (yrs)</td>
<td></td>
</tr>
<tr>
<td>Experience (yrs)</td>
<td></td>
</tr>
<tr>
<td>Land use</td>
<td></td>
</tr>
</tbody>
</table>

1. On a scale of 0 to 5 (0 meaning no impact to 5 meaning a devastating impact), please rate the degree of threat bushmeat hunting poses to the viability of wildlife populations on this concession:

   0 1 2 3 4 5

2. Do you think that, over the last five years, bushmeat hunting on the concession is:

   Getting worse  Getting better  Staying the same  Not sure

   Why?

3. How many animals did you record as having been poached last year?

4. What proportion of the total that were killed by poachers would you estimate that number comprises?

5. Which three species are most heavily affected by poaching?

   A)  B)  C)

6. Do you think bushmeat hunting has caused any species’ population to decline over the last three years?

   Yes
   No
   Not sure

   If yes, which species?

7. What are the three most common hunting methods used by poachers, in order?

   A)  B)  C)
8. What are the most common indicators of bushmeat hunting on your concession (e.g. carcasses, tracks, drying racks, poachers themselves, snares, poachers’ spoor, etc.)

9. How do poachers transport meat out of the concession?

<table>
<thead>
<tr>
<th>Horse/Donkey</th>
<th>Makoro</th>
<th>Other:</th>
<th>Not sure</th>
</tr>
</thead>
</table>

10. Can you describe which portions of your concession experience the highest and lowest levels of bushmeat hunting? (use map)

11. Have you noticed any seasonal patterns in the amount of bushmeat hunting?

12. During which months is poaching worst on your concession?

13. Do you think annual rainfall or flood levels affect poaching levels or methods?
   If yes, how?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
</table>

14. Do you think moon cycles affect poaching levels or methods?
   If yes, how?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
</table>

15. Does the time of day affect poaching levels or methods?
   If yes, how?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Not sure</th>
</tr>
</thead>
</table>

16. Where do you think most of the poachers who operate on your concession come from?

17. Where do you think that most of the bushmeat from your concession is sold?

18. Do you have formal anti-poaching efforts on your concession?
   If yes, who does the anti-poaching?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

19. What do you think the standard of anti-poaching is on most other concessions?

20. How much do you typically spend per month on anti-poaching?

21. How many game scouts and scout teams do you have?

22. How much are game scouts paid per month?

23. Are the scouts fed rations?
   If yes, what and how often?

| Yes | No |
### APPENDIX C: QUESTIONNAIRE SURVEY FOR CONCESSION MANAGERS

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>24. What proportion of your scouts are honorary wardens?</td>
<td></td>
</tr>
<tr>
<td>25. On each patrol, how many scouts carry weapons? What type?</td>
<td></td>
</tr>
<tr>
<td>26. Do you provide your scout teams with radios?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>27. Do your scouts wear uniforms?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>28. How long are patrols and how far do they typically travel?</td>
<td></td>
</tr>
<tr>
<td>29. What methods of patrol do you employ (e.g. foot, vehicle)?</td>
<td></td>
</tr>
<tr>
<td>30. How many scout bases/camps are there and where are they located (use map)?</td>
<td></td>
</tr>
<tr>
<td>31. Please describe any formal training you provide for your scouts:</td>
<td></td>
</tr>
<tr>
<td>32. Please describe how you, or other supervisors, manage the scout teams. Do you, or other supervisors, ever work in the field with the scouts?</td>
<td></td>
</tr>
<tr>
<td>33. Describe your scouts’ protocol if they encounter poachers in person:</td>
<td></td>
</tr>
<tr>
<td>34. Have your scouts ever been shot at by poachers? If yes, when was the last time?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>35. Where do most of the scouts that you employ come from?</td>
<td></td>
</tr>
<tr>
<td>36. Are any of your scouts known to be former poachers? If yes, approximately what proportion?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>37. Have you ever had problems with anti-poaching staff being involved in poaching or cooperating with poachers?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>38. Do you have any informers in the local community? If yes, how many?</td>
<td>Yes</td>
</tr>
<tr>
<td>If yes, how do you recruit informers?</td>
<td>No</td>
</tr>
<tr>
<td>39. Do you coordinate anti-poaching efforts with any neighbouring land managers? If yes, how?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>40. Do you keep records of poaching incidents?</td>
<td>Yes</td>
</tr>
<tr>
<td>If yes, do these records include GPS locations?</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
</tr>
<tr>
<td>41. Where do most of the anti-poaching staff come from?</td>
<td></td>
</tr>
<tr>
<td>42. Do you have any anti-poaching operations in place?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>43. What type of anti-poaching operations do you have in place?</td>
<td></td>
</tr>
<tr>
<td>44. Do you work with any other organizations in anti-poaching efforts?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>45. Which organizations do you work with?</td>
<td></td>
</tr>
<tr>
<td>46. Do you have any success stories to share?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>47. If yes, please describe.</td>
<td></td>
</tr>
<tr>
<td>48. Do you have any plans to improve anti-poaching efforts?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>49. If yes, what are your plans?</td>
<td></td>
</tr>
<tr>
<td>50. Have you ever had problems with law enforcement agencies being involved in poaching or cooperating with poachers?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>51. Describe any conflicts or issues you have had with law enforcement agencies.</td>
<td></td>
</tr>
<tr>
<td>52. Do you have any plans to work with law enforcement agencies in the future?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>53. If yes, what are your plans?</td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX C: QUESTIONNAIRE SURVEY FOR CONCESSION MANAGERS

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>41. When a poacher is caught on your concession, do you track the legal process?</td>
<td>Yes, No, Sometimes</td>
</tr>
<tr>
<td>If yes, what proportion of cases result in a penalty (fine or jail time)?</td>
<td></td>
</tr>
<tr>
<td>If yes, what is the typical penalty imposed for illegal bushmeat hunting?</td>
<td></td>
</tr>
<tr>
<td>42. Do you think the legal framework that governs poaching in Botswana is effective?</td>
<td>Yes, No, Sometimes</td>
</tr>
<tr>
<td>43. How do you think the legal framework could be improved?</td>
<td></td>
</tr>
<tr>
<td>44. Please describe any way in which the government assists with anti-poaching on your concession:</td>
<td></td>
</tr>
<tr>
<td>What government agencies are involved in anti-poaching and please rate them on a scale of 0 to 5 (where 0 means no help and 5 means everything in their power):</td>
<td></td>
</tr>
<tr>
<td>DWNP: 0 1 2 3 4 5 Police: 0 1 2 3 4 5 Magistrates: 0 1 2 3 4 5 BDF: 0 1 2 3 4 5 Other: 0 1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>45. How many times have BDF or DWNP officials come to your concession to assist with anti-poaching in the last twelve months?</td>
<td></td>
</tr>
<tr>
<td>BDF:</td>
<td></td>
</tr>
<tr>
<td>DWNP:</td>
<td></td>
</tr>
<tr>
<td>46. Do you think there are ways in which government authorities could better assist with anti-poaching efforts?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>If yes, how?</td>
<td></td>
</tr>
<tr>
<td>47. Do you have formal programmes to develop positive relationships with local communities around your concession?</td>
<td>Yes, No</td>
</tr>
<tr>
<td>If yes, please describe:</td>
<td></td>
</tr>
<tr>
<td>If yes, how much money is injected into these programmes each year?</td>
<td></td>
</tr>
<tr>
<td>48. As a land manager, what are the biggest challenges and constraints to preventing bushmeat hunting on your concession?</td>
<td></td>
</tr>
<tr>
<td>49. Are there strategies that you would recommend for land managers, government officials or non-profit organizations to reduce bushmeat hunting levels in your district?</td>
<td></td>
</tr>
<tr>
<td>50. Are there other aspects of bushmeat hunting or anti-poaching that you think are relevant?</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D: QUESTIONNAIRE SURVEY FOR WILDLIFE EXPERTS AND STAKEHOLDERS

1. What is the nature of your work in the delta?
2. How long have you worked in the delta?
3. Which concessions in the delta are you most familiar with?
4. Have you perceived a general increase or decrease in wildlife populations in the delta over the last five years?
5. Are there any species in the delta that you think have shown especially significant increases or decreases?
6. Are there specific concessions that have seen especially significant increases or declines in wildlife (show map)?
7. In your opinion, what has caused these trends in wildlife populations?
8. Do you think illegal hunting is a serious issue for wildlife conservation in the delta? Yes  
   No
9. Do you think illegal hunting affects wildlife population dynamics significantly? Yes  
   No
10. Has it always been a problem, or only became a problem recently? Always  
    Recently
11. Has it become more of a problem or less of a problem over the last five years? More  
    Less  
    Same  
    Don't know
12. If yes, which species are most affected?
13. Where do you think poaching is worst?
14. Do you think poaching is mainly subsistence or commercial? Subsistence  
    Commercial  
    Both
15. How would you profile poachers?
16. Do you think the hunting ban has had, or will have an impact on wildlife populations? Yes  
    No
17. If yes, how?
18. Do you think the hunting ban has had, or will have an impact on bushmeat poaching levels? Yes  
    No
19. If yes, how and why?
20. Who else do you recommend I talk to?
APPENDIX E: QUESTIONNAIRE SURVEY FOR ANTI-POACHING PERSONNEL

Introduction

The goal of this research is to learn about the social and economic drivers of the bushmeat trade in the Okavango Delta and how bushmeat hunting relates to law enforcement and land management. Staff members of the Botswana Predator Conservation Trust are conducting this research with funding from the Food and Agriculture Organization of the United Nations.

I am interviewing you to learn more about bushmeat hunting and anti-poaching practices. It is our hope that the information you provide will help us develop strategies for reducing or mitigating the impacts of bushmeat hunting on wildlife management concessions.

All of your responses will be kept confidential and I will be the only person who knows the origins of your responses. You may stop the interview at any time or decline to answer any questions. The interview will last approximately 40 minutes. Do you have any questions before we begin?

<table>
<thead>
<tr>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewee ID</td>
</tr>
<tr>
<td>Signature</td>
</tr>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Organization</td>
</tr>
<tr>
<td>Area of patrol</td>
</tr>
<tr>
<td>Land use(s)</td>
</tr>
</tbody>
</table>

1. Where is your home village?
2. Where do you currently live?
3. What is your position?
4. How many years have you been employed in this position?
5. How many years of anti-poaching experience do you have?
6. Why did you choose to become a game scout?
7. How much do you earn per month?
8. Are you an honorary warden?  Yes
                                No
9. Are you permitted to carry a weapon?  Yes
                                            No
    If yes, what type?
    If yes, on what proportion of patrols are you armed?
10. Do you, or someone else in your team, carry a radio when patrolling? | Yes
No

11. Please describe any formal training you have had:

12. Is there additional training that you would like to have?
   If yes, what training? | Yes
No

13. Do your family and friends believe working as a game scout is a respected profession?
   Why (not)? | Yes
No

14. How many times per month do you go on patrol?

15. How long are patrols and how far do you typically travel?

16. If patrolling for more than a day, where do you typically sleep?

17. What type of patrols do you go on (e.g. foot, vehicle, mix)?

18. What method and length of patrol do you think is most effective in deterring poachers?

19. On what proportion of patrols, or how many times per patrol, do you typically find evidence of poaching?

20. Do you think that poaching on the concession is:
   Getting worse | Getting better | Staying the same | Not sure
   Why?

21. How many poaching incidents (i.e. encountering a poacher or finding evidence of a poaching event) have you encountered on patrols in the last month?

22. Which three species are most heavily poached on this concession?
   A) B) C)

23. Can you describe which portions of this concession experience the highest and lowest levels of poaching (show map)?

24. How often do you or your team find the following indicators of poaching:
   Spoor (poachers or livestock)? Carcasses?
   See poachers? Traps or snares?
   Drying racks? Other?

25. What are the three most common hunting methods used by poachers, in order (most commonly used first):
   A) B) C)
### APPENDIX E: QUESTIONNAIRE SURVEY FOR ANTI-POACHING PERSONNEL

26. How do poachers typically transport meat off the concession?
   - Horse/Donkey
   - Makoro
   - Other:

27. Have you noticed any seasonal or other patterns in the amount of poaching on this concession? If yes, what and how?
   - Yes
   - No

28. During which months is poaching worst on this concession?

29. Where do you think most of the poachers who operate on this concession come from?

30. Do you use informants from villages to assist with anti-poaching?
   - Yes
   - No

31. Do you think most poaching is for subsistence or commercial purposes?
   - Subsistence
   - Commercial

32. Where do you think that most of the bushmeat from this concession is sold?

33. Describe the protocol if you encounter poachers in person:

34. How many poachers have you or your team caught in the last twelve months?
   - Yes
   - No

35. Have you or your team ever been shot at by poachers?
   - Yes
   - No

36. Are there things your managers could do to improve anti-poaching efforts? If yes, what?
   - Yes
   - No

37. What could the government do to reduce poaching?

38. Have you ever hunted for bushmeat? If yes, when was the most recent occurrence?
   - Yes
   - No

39. Do you know family or friends who hunt for bushmeat?
   - Yes
   - No

40. Among your family and friends, how many times per month do they eat bushmeat?

41. Are you aware of any other anti-poaching personnel on this concession hunting illegally? If yes, how many?
   - Yes
   - No

42. Are you aware of anti-poaching personnel hunting illegally on other concessions?
   - Yes
   - No

43. What government agencies are involved in anti-poaching and please rate them on a scale of 0 to 5 (where 0 means no help and 5 means everything in their power):
   - DWNP:
     - 0
     - 1
     - 2
     - 3
     - 4
     - 5
   - Police:
     - 0
     - 1
     - 2
     - 3
     - 4
     - 5
   - Magistrates:
     - 0
     - 1
     - 2
     - 3
     - 4
     - 5
   - BDF:
     - 0
     - 1
     - 2
     - 3
     - 4
     - 5
   - Other:
     - 0
     - 1
     - 2
     - 3
     - 4
     - 5

44. What factors prevent scouts from being more effective at controlling poaching in the concession?

45. Are there other aspects of bushmeat hunting or anti-poaching that you think are relevant?

### ADDITIONAL NOTES:
This publication was produced by the FAO. It provides an overview of illegal bushmeat hunting in the Okavango Delta in Botswana. It also offers insights into the drivers, impacts and potential solutions to illegal bushmeat hunting in this inland freshwater delta, which is central to the country’s tourism industry.

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ISBN: 978-0-620-68693-8 (print)