ILLEGAL HUNTING AND THE BUSHMEAT TRADE IN CENTRAL MOZAMBIQUE:

A CASE-STUDY FROM COUTADA 9, MANICA PROVINCE

PETER LINDSEY AND CARLOS BENTO

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Front cover photograph: Illegal hunter transporting a cane rat and a tortoise.

Photograph credit: P. Lindsey.

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Credit: Mokore Safaris

Buffalo captured and killed in a gin trap set by illegal hunters in Coutada 9, Mozambique

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Please note that the views expressed in this report are those of the authors and do not represent the views of TRAFFIC or BMZ.

ACRONYMS

AP	Agricultural Police
BMZ	*Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung* (Federal Ministry for Economic Co-operation and Development (Germany))
DRC	Democratic Republic of Congo
FRELIMO	*Frente de Libertação de Moçambique* (Front for Liberation of Mozambique)
RENAMO	*Resistência Nacional Moçambicana* (Mozambique Resistance Movement)
SVC	Savé Valley Conservancy
USD	United States dollars
WBLU	Wildlife-based land use(s)

EXECUTIVE SUMMARY

This project is part of the BMZ-funded programme with TRAFFIC, "Vulnerable People, Diminishing Wildlife: Addressing priority bushmeat trade, livelihood and food security issues in Africa".

The illegal trade in bushmeat represents a severe conservation threat in several African countries. Using the Coutada 9 safari hunting area as a case-study, this report attempts to assess the drivers, scale and impacts of the bushmeat trade in Central Mozambique and to determine the extent to which illegal hunting is limiting the development of sustainable wildlife-based tourism. Structured questionnaire surveys were designed for stakeholders involved in anti-poaching, illegal hunting and the sale of bushmeat, and illegal hunting statistics were collected from game scout report forms.

Results

Illegal hunting and the bushmeat trade have resulted in a major decline in wildlife populations in Coutada 9, resulting in significantly reduced potential earnings from safari hunting, and reductions in the potential for wild meat production. Wildlife populations are currently <10% what they could be and earnings from safari hunting are at least 96% lower than what they could be if wildlife populations were allowed to recover. Several species (e.g. rhinoceroses) have been extirpated due to illegal hunting, and several others (e.g. Waterbuck *Kobus ellipsiprymnus* and Plains Zebra *Equus quagga*) have been reduced to population sizes that are probably not viable.

Historical and present-day illegal hunting imposes estimated opportunity costs of USD1.62 million per year in foregone potential safari hunting revenues and imposes additional costs in the region of USD60 000/year through the need for anti-poaching security. Communities incur opportunity costs of ~USD308 000/year as a result of historical and present-day illegal hunting. Historical and illegal hunting also impose opportunity costs in terms of foregone food security benefits: 86 t more meat than currently produced could potentially be generated from safari hunting and harvesting of Impala *Aepyceros melampus* and Greater Kudu *Tragelaphus strepsiceros* in Coutada 9 if illegal hunting were controlled and wildlife populations allowed to recover.

Illegal hunting is most commonly practised with the use of gin traps, dogs, and muzzle-loaders. Illegal hunters are typically local poor, food-insecure men in their 30s and 40s. Though some bushmeat is consumed by hunters, most is sold in villages or along roads within 50 km of the *coutada*. Some meat is sold to middlemen, who transport it to more distant urban centres. Buyers of bushmeat are typically those with a cash income, such as businesspeople or teachers. However, government officials and police are known to purchase bushmeat despite the clear illegality of the source, creating a conflict of interest which may discourage effective policing of illegal hunting.

Anti-poaching efforts by the management of Coutada 9 appear to be reducing the flow of bushmeat from the area, increasing the price of gin traps (due to extraction of large numbers from circulation and consequent reduction in supply) and allowing wildlife populations to recover in some areas. However, effective anti-poaching effort is hampered by the low returns from safari hunting which limit available resources, the large size of Coutadas 9 and 13, the weak penal structure providing no

deterrent to illegal hunters, and failure of the Ministry of Agriculture or the police to enforce fines imposed on illegal hunters.

Recommendations

Recommendations for the management of hunting *coutadas* in Mozambique to maximize returns from wildlife-based land use (WBLU) and to minimize illegal hunting are summarized below:

- A review of Mozambique's hunting *coutadas* to assess: the status of wildlife populations; the presence/absence of key wildlife species; the state of wildlife habitats; the degree of human settlement; the potential viability of WBLU; and the steps required to rehabilitate the areas.
- Following the review process, the *coutada* hunting areas should be zoned, following a similar model to that employed in Coutada 9, to provide a template for community involvement in, and benefit from, WBLU.
- Following the zoning process, consideration should be given to constructing partial game fencing (using wire mesh that cannot readily be made into snares) around *coutada* hunting areas, to minimize human–wildlife conflict. Such fencing should only be considered if there is a plan to maintain the fencing in the long term (e.g. via agreements with operators and/or communities).
- Efforts should be made to limit supplies of wire that could be used to make snares.
- Efforts should be made to attract donor funding to assist in the rehabilitation and development of *coutada* hunting areas.
- The structure of leases for *coutada* hunting areas should be designed such that hunting operators are provided with sufficient time to invest in anti-poaching and infrastructure development and to ensure that potential medium- to long-term returns are attractive.
- The involvement of hunting operators in management should be an enforced lease condition.
- A plan should be developed for reintroducing key wildlife species into *coutada* hunting areas.
- Where hunting operators wish to reintroduce wildlife, government should provide a clear and simple process for applying for permission and should actively facilitate their efforts, e.g. by providing founder animals from protected areas and/or negotiating with parks agencies from neighbouring countries for founder animals for reintroductions, providing veterinary assistance where necessary.
- Following the recovery of wildlife populations in the *coutadas*, hunting operators should be required to provide a sustainable legal supply of affordable game meat to communities, as an alternative to illegally sourced supply, which is often acquired in wasteful and inhumane ways.
- Hunting operators in *coutadas* should be encouraged to invest in the development of sustainable and mutually profitable projects involving communities, to provide alternative livelihood options for illegal hunters. Support for the development of such projects should be provided by government and/or non-governmental organizations.
- A revision of the penal system governing crimes relating to wildlife is required to provide genuine deterrents to illegal hunting. Punishments should include mandatory gaol terms and compensation, the severity of which should increase for repeat offenders.
- Police and government officials should be educated about the negative impacts of illegal hunting; purchasing illegally sourced bushmeat should merit dismissal and prosecution.

INTRODUCTION

The bushmeat trade

Hunting and the sale of bushmeat[1] represent an important survival strategy for significant numbers of people in rural forest areas of West and Central Africa (Bowen-Jones *et al.,* 2003). In some places, bushmeat is a relatively high-value luxury commodity which flows primarily from rural sources to urban areas (Bowen-Jones and Pendry, 1999; Fa *et al.,* 2000). In rural areas, bushmeat is often an important alternative protein source to meat from livestock, particularly where tsetse flies *Glossina* spp. are prevalent (Barnett, 1998).

The scale of the bushmeat trade in some Central and West African nations is such that it contributes measurably to Gross Domestic Product (Bowen-Jones *et al.,* 2003). However, the bushmeat trade is commonly unsustainable, as reflected by declining prevalence of large species in markets and increasing reliance on r-selected species (Fa *et al.,* 2000). Rates of off-take are such that widespread local extinctions of forest species are likely (Wilkie and Carpenter, 1999). Finding solutions with which to reduce reliance on this unsustainable harvest is thus important from both wildlife conservation and human needs perspectives.

The majority of work on bushmeat in Africa has focussed on the forest regions of West and Central Africa (Noss, 1998; Wilkie *et al.,* 1998; Bowen-Jones and Pendry, 1999; Barnes, 2002; Fa *et al.,* 2002; Robinson and Bennett, 2002; Bennett *et al.,* 2007). Outside those areas, research on bushmeat has been limited largely to isolated studies in East Africa (notably around the Serengeti [Loibooki *et al.,* 2002; Ndibalema and Songorwa, 2007] and in parts of Kenya [Fitzgibbon *et al.,* 1995; Okello, 2004; Wato *et al.,* 2006]).

TRAFFIC conducted a broad review of the bushmeat trade in southern Africa in the late 1990s (Barnett, 1998), and some work has been done on the topic in Mozambique (e.g. Fusari & Carpaneto 2006), Namibia (e.g. Vaughn and Long, 2007), South Africa (e.g. Hayward 2009), Zambia (e.g. Lewis, 2007), and Zimbabwe (e.g. Lindsey 2009; Gandiwa 2011). Otherwise, there has been little attention to the issue in southern Africa, perhaps owing to a misconception that bushmeat hunting is a sustainable, subsistence phenomenon in the region (Barnett, 1998). There are indications that the bushmeat trade represents a serious conservation threat in parts of southern Africa (Lewis and Phiri, 1998; du Toit, 2004). Commercialized trade involving meat sourced from protected areas occurs in at least five southern African nations (Barnett, 1998). To address this informational shortage, TRAFFIC developed a series of case-studies on illegal hunting and the trade in bushmeat in southern Africa, covering Zimbabwe, Namibia and, in the present study, Mozambique.

The prevalence and impacts of the bushmeat trade appear to be exacerbated under conditions of economic and political instability (de Merode and Cowlishaw, 2006). For example, the recent TRAFFIC study in Zimbabwe indicated that levels of illegal hunting had surged during the political instability experienced there in recent years (Lindsey *et al.,* 2009). In Tanzania, a significant illegal trade in bushmeat arose as a result of the influx of refugees from neighbouring Burundi, the

[1] "Bushmeat", also known as "wild meat", refers to meat from terrestrial wild animals killed for food.

Democratic Republic of the Congo (DRC) and Rwanda (Jambiya *et al.,* 2007). In DRC, the prevalence of protected species in urban markets increased during civil war (de Merode and Cowlishaw, 2006). In Mozambique, the civil war (which occurred 1977–1992) resulted in unregulated illegal hunting and steep declines in wildlife populations (Hatton, 2001). Though the political instability in Mozambique has ceased, large proportions of the human population continue to rely directly on the exploitation of natural resources for survival, including bushmeat (Hatton, 2001). Such reliance, and its manifestation through illegal hunting and the trade in bushmeat have potential to severely limit recovery in wildlife populations in Mozambique, and to stifle the development of wildlife-based tourism (Ministry of Tourism, 2004).

Using the Coutada 9 safari hunting area in as a case-study, an attempt is made to assess the drivers, scale and impacts of the bushmeat trade in Central Mozambique and to determine the extent to which illegal hunting is limiting the development of sustainable wildlife-based tourism. Wildlife-based land uses (WBLU) including safari hunting have potential to contribute significantly to rural development, local and national economies. However, such land uses are dependent on the retention of sufficient wildlife-resources. Such retention is currently threatened by illegal bush meat hunting.

This project forms a component of the BMZ-funded programme with TRAFFIC entitled "Vulnerable People, Diminishing Wildlife: Addressing priority bushmeat trade, livelihood and food security issues in Africa".

Protected areas in Mozambique

There are several categories of protected area in Mozambique, the most important being national parks, game reserves, vigilance areas, *coutadas* (safari hunting areas) and forest reserves (**Table 1**). The Mozambican civil war (1977–1992) had severe impacts on biodiversity conservation in Mozambique—an excellent overview of which is provided by Hatton *et al.* (2001), which is summarized in the next two paragraphs. Impacts were particularly severe in areas where troops were stationed for protracted periods, such as in Gorongosa National Park and the Zambezi Delta. Both RENAMO (Mozambique Resistance Movement) and FRELIMO (Front for Liberation of Mozambique) troops were stationed in wilderness areas and they hunted wildlife for sustenance and for trophies. In addition, there are reports that the Zimbabwean and South African armies (supporting FRELIMO and RENAMO respectively) hunted large quantities of wildlife in Gorongosa National Park. Wildlife was also hunted to a significant degree by people living adjacent to protected areas. Furthermore during and immediately after the civil war, large numbers of people moved into protected areas in Mozambique, providing open access to wildlife resources. Following cessation of the conflict, hunting continued on a large scale in most protected areas, to supply thriving markets in bushmeat. The bushmeat trade was also facilitated by improvements in security, and in road and rail networks which improved connectivity between source-areas and commercial markets (Barnett, 1998). For example, an estimated 30–60 t of meat were being extracted per month from the abandoned Gorongosa during mid-1994. Demand for bushmeat was particularly high in urban areas owing to a shortage of meat from livestock, which had mostly been eaten or stolen during the conflict. Illegal extraction of wildlife for meat immediately after the conflict was exacerbated by the lack of

effective enforcement by government or traditional authorities, which effectively led to wildlife being used as an open-access resource (Barnett, 1998).

As a result of excessive off-takes of wildlife during and immediately after the war, wildlife populations in most protected areas were severely depleted, with the effect that a major recovery operation is required for most areas before they can be used for productive WBLU. For example, the African Elephant *Loxodonta africana* population in Gorongosa declined from 2200 in 1968 to four individuals in 1993, the African Buffalo *Syncerus caffer* population from 14 000 to zero in the same period (**Table 2**). Similarly, in the Marromeu complex, African Buffalo numbers declined from an estimated 45 000 in 1977 to 2346 in 1994, African Elephants declined from 331 to zero in the same period, and Waterbuck *Kobus ellipsiprymnus* from 36 380 to 142 (Hatton, 2001).

Table 1

Protected areas in Mozambique (from Hatton *et al.,* 2001)

Protected area	Size km^2	Province	Year gazetted
Coutada 8	310	Sofala	1969
Coutada 14	1350	Sofala	1969
Coutada 11	1930	Sofala	1969
Coutada 10	2000	Sofala	1961
Coutada 15	2300	Sofala	1969
Coutada 12	2960	Sofala	1969
Coutada 9	4450	Manica	1969
Coutada 6	4560	Sofala	1960
Coutada 7	5450	Manica	1969
Coutada 13	5680	Manica	1960
Coutada 5	6860	Sofala	1972
Coutada 4	8900	Manica	1969
Coutada 16—now Limpopo National Park	10 000	Gaza	1969
Boboli Forest Reserve	13	Maputo	1961
Zomba Forest Reserve	31	Manica	1950
Likwait Forest Reserve	33	Maputo	1943
Matibane Forest Reserve	42	Nampula	1950
Mpalwe Forest Reserve	51	Nampula	1950
Ribawe Forest Reserve	52	Nampula	1950
Moribane Forest Reserve	53	Manica	1950
Maronga Forest Reserve	83	Manica	1950
Mucheve Forest Reserve	90	Sofala	1950
Nhapakwe Forest Reserve	170	Sofala	1953
Baixo Pinda Forest Reserve	196	Nampula	1950
Nhamitanga Forest Reserve	1067	Sofala	1943
Derre Forest Reserve	1700	Zambezia	1950
Mecuburi Forest Reserve	1954	Nampula	1950
Chirindzene Forest Reserve	?	Gaza	1974
Gile Game Reserve	2100	Zambezia	1960
Niassa Game Reserve	24 400	Niassa	1969
Pomene Game Reserve	?	Inhambane	1972
Bazaruto National Park	150	Inhambane	1971
Banhine National Park	700	Gaza	1972
Zinave National Park	3700	Inhambane	1972
Gorongosa National Park	5370	Sofala	1960
Maputo Special Reserve	700	Maputo	1969
Marromeu Special Reserve	1500	Sofala	1961
Total	**100 905**		

Table 2

Changes in wildlife populations in Gorongosa National Park during and following the civil war (from Hatton *et al.,* 2001)

	1968	1970	1979	1993	1994	2000	% change
African Elephant	2200	1900	3000	4	108	160	92.7
African Buffalo	14 000	11 900	18 000	0	0	0	100.0
Hippopotamus*	3000	3200	4800	0	0	40-50	98.5
Common Wildebeest	5500	4900	1900	7	0	0	100.0
Waterbuck	3500	2500	800	200	129	500	85.7
Zebra	3000	?	?	7	65	50	98.3
Eland*	500	?	?	0	0	?	100.0
Sable Antelope	?	?	?	700	12	?	?
Hartebeest*	800	?	?	0	156	?	80.5

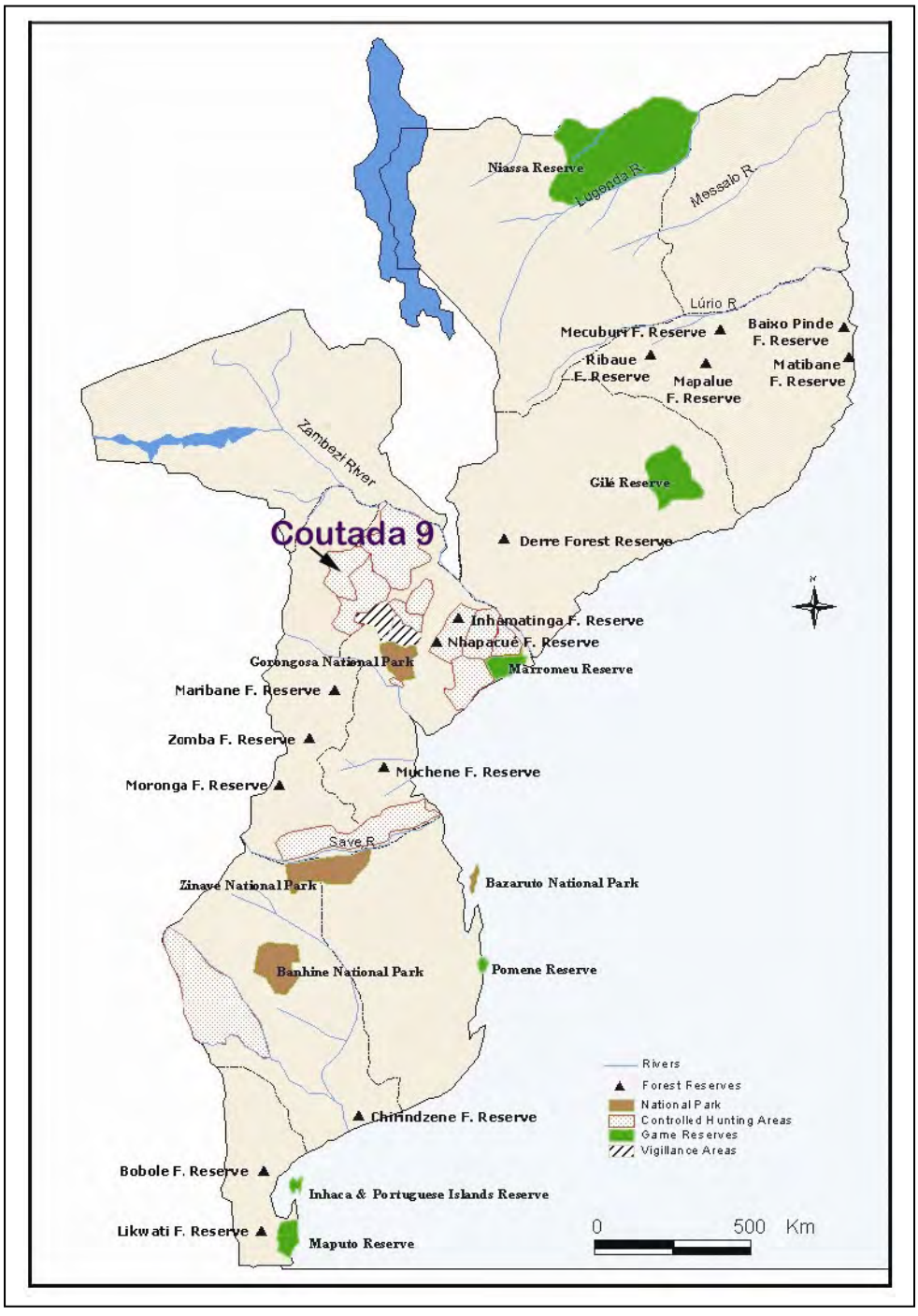
Note: * Eland *Tragelaphus oryx*; Hartebeest *Alcelaphus buselaphus;* Hippopotamus *Hippopotamus amphibus;* Sable Antelope *Hippotragus niger.*

Wildlife populations in hunting *coutadas* were also affected by excessive hunting for bushmeat during and after the civil conflict. Little information is available on the status of wildlife or habitat in the *coutadas*, though indications are that many of them have been heavily impacted by illegal hunting, unplanned settlement and slash and burn agriculture (Ministry of Tourism, 2004). Due to a lack of resources, little investment is made by government in protecting *coutadas*, making natural resources in those areas extremely vulnerable to overuse. Prior to the civil war, the hunting *coutada*s were used for safari hunting. Due to the high densities of wildlife, operators were able to sell a high quality big-game hunting safaris (Ministry of Tourism, 2004). Safari hunting re-commenced in 1993, and leases were issued to hunting operators for some of the *coutada* hunting areas. However, because of the depletion of the wildlife resource, the hunting industry in Mozambique is smaller than that in other countries in the region and is developing slowly (Lindsey *et al.,* 2007).

The focus of this study is Coutada 9 in Manica province, which forms part of a complex of multiple-use areas to the north of Gorongosa National Park (**Figure 1**).

Figure 1

Protected areas in Mozambique (taken from Hatton *et al.*, 2001)



Study area: Coutada 9

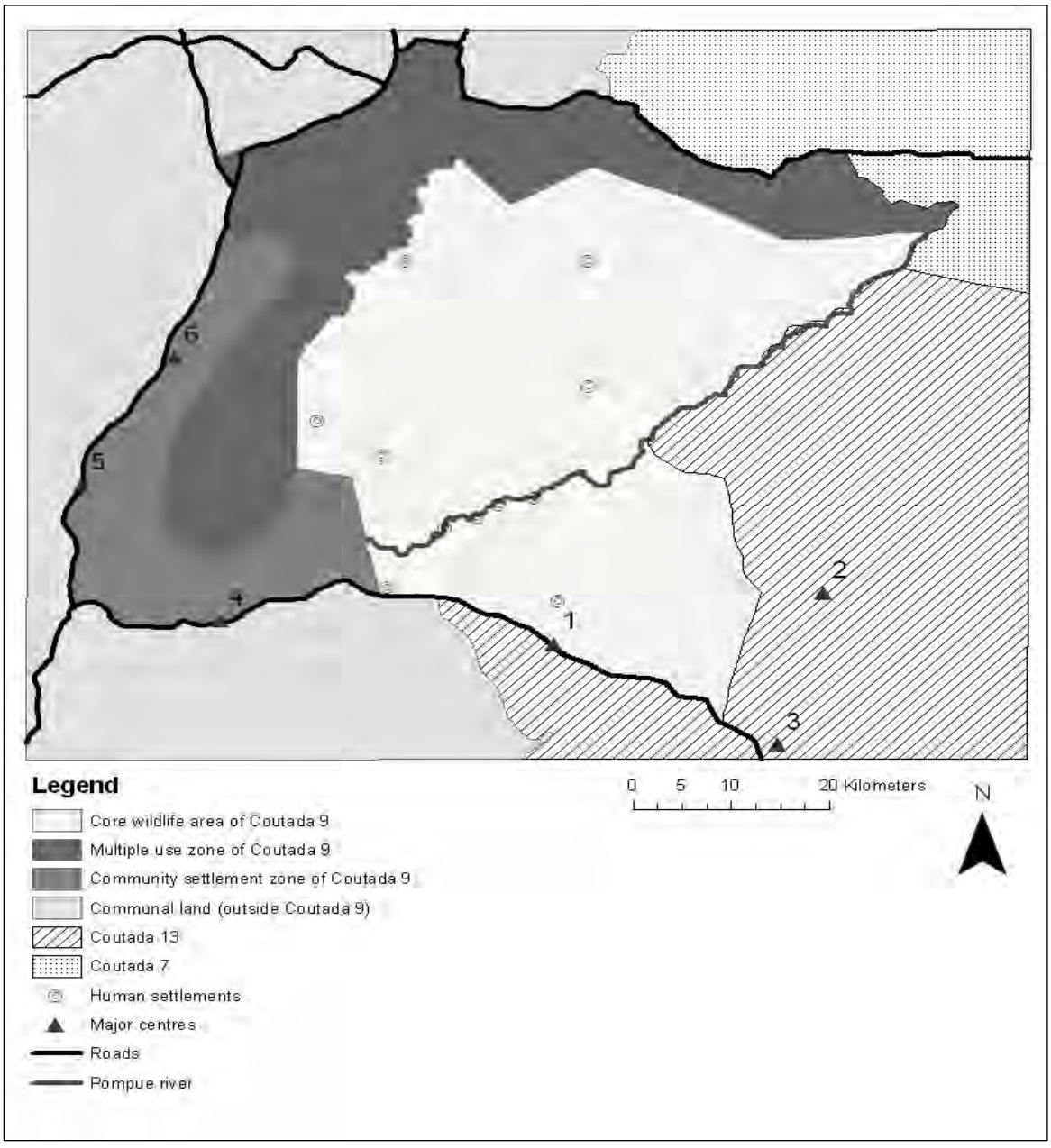
The following information is extracted primarily from Hulley-Miller (2003):

Coutada 9 is situated in Manica Province and forms part of three districts, Guro, Macossa and Tambara. The majority of the area lies within the Macossa district. Coutada 9 is approximately

3872 km^2 in size. The western boundary is the road from Chimoio to Tete, the southern boundary runs from that road along the road to Macossa and the northern boundary partially follows the road to Mungari. The eastern boundary follows the Pompue River. Coutada 13 borders on the east and part of the south and Coutada 7 to the north (**Figure 2**)

Figure 2

Plan of Coutada 9 (Scale: 1:350 000: N.B. the multiple-use and settlement zones of Coutada 9 are heavily settled and so individual villages are not depicted on the map)



Note: (Major centres: 1=Cuerva Peregosa; 2=Mussangadzi; 3=Macossa (in reality falls ~3 km south of the map border); 4=Danda; 5=Nhassacara; 6=Guro)

History

In colonial times, Coutada 9 was considered to be a prime safari hunting area. It is presently leased by Rio Savé Safaris, who hold a 15 year lease (with a 15 year roll-over period) signed in 2000. The same company holds the lease for Coutada 13. The Ministry of Tourism is the responsible government authority, having recently taken over from the Ministry of Agriculture. The area has a history of being remote and uninhabited, and during the civil war it was a Renamo-controlled area with no local residents. It was part of a larger area used as an operational base for Renamo and as their hunting area for the provision of food. As a result the wildlife in the *coutada* was heavily depleted and all infrastructure was destroyed. Arms caches continue to be recovered today.

Vegetation/topography

The *coutada* slopes generally from over 700 m above sea level in the south west to below 400 m in the north east. There are many hills and ranges of hills, with the highest point, Mt Zambelangombe, rising to 1205m. The area is mostly flat between the hills and ridges with some very hilly broken country in the north-west. The geology of the area is granite/gneiss which gives rise to light, mostly sandy soils. Annual rainfall is moderate as the area falls between the 600 mm and 800 mm rainfall isohyets. The vegetation is classified as semi-deciduous to late deciduous miombo woodland.

Credit: P. Lindsey

Mt Zambelangombe, Coutada 9

Drainage in the east of the *coutada* is mostly towards the east into the Pompue River, in the north-west into the Muira River which also flows north east while in the south west drainage is towards the South. The rivers are seasonal but dry season water is available for wildlife in places—in surface

pools, in river-sand under the surface and in some springs. Several sites of permanent water in the rivers have attracted human settlements.

Settlement

The town of Guro is situated on the western boundary of Coutada 9 and there is settlement around this town within the *coutada*, and along the road forming the southern boundary. Within the *coutada* itself there are some relatively long-standing settlements and other, more recent scattered settlement. The actual number of people living within the *coutada* is unknown. There are large numbers of people resident along all roads bordering the *coutada*. The boundaries of the *coutada* extend into the districts of Macossa, Guro and Tambara, Macossa being the main district of influence.

Local communities practice slash and burn agriculture where fields are used for one to three years and then abandoned following loss of fertility, and new fields opened. This practice exacerbates the ecological impact of farming and human settlement (see photo of slash and burn agriculture below). Communities in the Macossa District (encompassing Coutada 9) cultivate an average of approximately half a hectare, and typically grow food crops such as maize, sorghum, millet, cassava, beans, and groundnuts, and in some cases, cash crops such as sunflower, cotton, tobacco, and sesame (FAO, 2002). Food stocks from agriculture typically last five to seven months a year, leaving a period from November to March/April when food is typically short (FAO, 2002). Livestock are largely absent from Coutada 9, owing to the presence of tsetse flies, and most households only have chickens (FAO, 2002).

Credit: P. Lindsey

Slash and burn agriculture in Coutada 9

Zoning of Coutada 9

A relatively large wilderness area occurs in the central and western portions of Coutada 9. Wildlife populations occur at low densities throughout Coutada 9, but are virtually absent in the areas adjacent to human settlement as a result of disturbance and excessive illegal hunting (Connybeare, 2005). In an attempt to control unplanned settlement and illegal hunting, the current operator, in conjunction with the UN Food and Agriculture Organisation, approached the government during 2003 and proposed that the area be broken up into various zones to allow for effective land use planning. The government agreed, and now the area consists of the following zones (**Figure 2**):

- A settlement zone (565 km^2) located on the south-eastern corner of Coutada 9 where the primary land use is agriculture;
- A multiple-use zone of 1087 km^2 occurring along the east and northern boundaries of the *coutada*. In the multiple-use zone, human settlement is permitted and communities are the primary beneficiaries of safari hunting activities (accruing 75% of the trophy fees of all animals hunted). However, in reality due to the virtual absence of wildlife in the buffer zone, little safari hunting is actually conducted there.
- The core area (2120 km^2), where settlement will not be permitted and WBLU will be the primary activities. In the core area, the operator allocates 25% of trophy fees to local communities.

The zoning process is now complete, though some villages remain within the core area. The government (Ministry of Agriculture) and the local chief have agreed to the relocation of villages from the core area to the buffer zone. In return, the hunting operator has agreed to build a school and clinic for the displaced families, the construction of which is currently under way (see photo below).

Credit: P. Lindsey

Construction of a clinic in the buffer area of Coutada 9

Legal background to illegal hunting and the bushmeat trade

According to the *Mozambican Forest and Wildlife Act* (Number 10 of 1999):

- Only those in possession of a simple hunting permit, a sport hunting permit or a commercial hunting permit are allowed to hunt (Articles 21, 22, 23).
- Simple hunting permits (designed to allow communities to hunt for subsistence) are only allocated for use in multiple-use forest areas and in historical and cultural value areas (Article 21).
- A commercial hunting permit is required by those wishing to sell meat and other wildlife products (Article 23).
- Indiscriminate means of hunting, including the use of snares, traps, fire and automatic weapons are prohibited (Article 24).

Consequently, hunting (other than safari hunting) practised in Coutada 9 without a permit is illegal, as are the observed practices of hunting with snares, gin traps, automatic weapons and the use of fire.

METHODS

Illegal hunting statistics

Illegal hunting statistics were collected from game scout report forms handed in to the managers by scout leaders each month. Scout report forms detailed the date and location at which evidence of illegal hunting activity was recorded. Anti-poaching effort was recorded as the number of scout days worked per month. When depicting temporal patterns in the incidence of illegal hunting, data were adjusted in line with the deviation of anti-poaching effort from the mean each month. Illegal hunting data were collected from June 2008 to the end of March 2010. Annual, summarized data on illegal hunting were available for 2006 and 2007, though no details on monthly or spatial patterns were available for those years. Anti-poaching game scouts were not able to read maps and so the approximate area (usually equating to ~10 km^2) of the illegal hunting incident was recorded in the scout report forms.

Interview surveys

Structured questionnaire surveys were designed for the following stakeholders involved in anti-poaching, illegal hunting, and the sale of bushmeat:

a) Managers of Coutada 9
b) Anti-poaching game scouts
c) Illegal hunters
d) "Middlemen"—people who buy meat from illegal hunters, to re-sell
e) Buyers of bushmeat
f) Agricultural police (police stationed on main roads who are tasked to control the movement of agricultural products, including meat).

The purpose of these surveys was to gain insights into the way in which illegal hunting was conducted, the impacts of illegal hunting, the drivers of the trade in bushmeat, the way in which the bushmeat trade functioned, and insights into how to control illegal hunting and the bushmeat trade. All surveys were thoroughly pre-tested. Interviews were conducted by trained interviewers of the same racial group as the respondents, in either Portuguese or English (in the case of the managers). Respondents were informed that the survey was part of a university study on wildlife, bushmeat and livelihoods, and that the surveys were anonymous and individual responses confidential.

All of the managers were sampled (n=4), including one individual who managed the area from late 2002 to the end of 2007, and all of the game scouts employed at the time of sampling were interviewed (n=27). Each agricultural policeman in charge at each of the check points on the major routes out of the *coutada* was sampled (n=3).

The traditional and political leaders from all villages within Coutada 9, and every third village around the periphery of Coutada 9, were contacted and asked to organize buyers of bushmeat, middlemen, and illegal hunters, to partake in the survey, after having been told the purpose and background of the study. From each village, two buyers, middlemen, or illegal hunters were randomly selected from the people organized by the traditional leaders. One hundred and nine illegal hunters were surveyed, in addition to 76 buyers of bushmeat and 34 middlemen. A total of 253 surveys were conducted.

Statistical analyses

Because of the small sample (and "population") of managers and agricultural police, the data collected from them were analysed in a more qualitative than quantitative fashion. Data from the other surveys were analysed using multiple logistic regression, chi-squares and analyses of variance as appropriate (JMPIN, 2000). Where logistic regression was used, results are presented as $\chi 2$ values for the whole model (with only significant variables included following a backwards stepwise procedure).

Estimating potential wildlife population sizes and returns from trophy hunting

Both the size of wildlife populations in Coutada 9 and the extent of off-takes by illegal hunters are uncertain. Consequently, the most meaningful means of estimating financial impacts and opportunity costs is through estimating the annual costs of anti-poaching, coupled with the disparity between current earnings from trophy hunting and potential earnings if wildlife populations were allowed to recover fully to their realistic potential densities. To calculate potential population sizes in Coutada 9, population data from the nearby Gorongosa National Park prior to the civil war were used (1968) (Hatton, 2001). For species for which data were not available from Gorongosa, data from Savé Valley Conservancy (SVC) in Zimbabwe (the nearest other wildlife area for which recent population data are available [~250 km to the south-west]) were used, after adjusting them in accordance to the relationship between rainfall and ungulate density, following Coe *et al.,* (1976): kg/km^2 mammalian biomass = 1.552*x–0.62., where x is the log10 of rainfall.

SVC has a mean rainfall of ~535 millimetres per annum, whereas Coutada 9 has mean rainfall of approximately 800 millimetres (G. Duckworth, Mokore Safaris, pers. comm.). Using the above equation, density estimates for species in SVC were adjusted upwards by a factor of 1.94 to take into account the higher carrying capacity as a result of the higher annual rainfall. For species that do not exist in SVC (e.g. Oribi *Ourebia ourebi*), a conservative assumption was made that their potential number could be double those currently recorded in Coutada 9. For species for which the managers of Coutada 9 were not able to estimate numbers (e.g. Bushbuck *Tragelaphus scriptus*, Red Duiker *Cephalophus natalensis*, Common Duiker *Sylvicapra grimmia*), their numbers were conservatively assumed to equal the population size of the rarest of the species estimated using the methods explained previously—Southern Reedbuck *Redunca arundinum* (250 individuals). For predators, their densities were conservatively assumed to equal those in Kruger National Park in South Africa (after Mills *et al.,* 2003), an ecologically similar area to SVC. In SVC, unlike Kruger National Park, predator numbers have not yet reached their natural densities and are recovering following decades of persecution.

For the multiple-use zone of Coutada 9, maximum potential wildlife densities were assumed to be half those in the core area, owing to the fact that some land is used for agriculture and settlement and because illegal hunting is likely to be more prevalent there than in the intensively-patrolled core area.

Sustainable trophy quotas were derived from Craig and Lawson (1990), except for predators, for which it was assumed that the sustainable quota would equal two per cent of their populations (as advised by Craig Packer, author of Packer *et al.,* 2009, for Lions *Panthera leo*). Mean trophy fees, daily rates and minimum days for hunt packages in Mozambique were derived from Booth (2009). It was assumed that each individual of key species (African Buffalo, African Elephant, Leopard *Panthera pardus*, Lion, and Sable Antelope *Hippotragus niger*) would be sold as an individual hunt package which would also include "plains" game (antelope species). It was assumed that, in addition to the number of hunts sold for key species, an additional 10% of hunts could be sold for just antelope species ("plains game" hunts) (G. Duckworth, Mokore Safaris pers. comm.). It was assumed that any remaining antelopes on quota (that could not be sold as trophies in hunt packages) would be harvested for meat. It was assumed that 25% of the income from trophy fees would be allocated to communities from trophy hunting in the core area and 75% in the multiple-use zone, as per the zoning agreement.

When calculating meat production, the mean mass for adult male animals and the mean dressing percentages (as presented in Bothma, 2002) were used. Meat was assumed to have a value of USD1.17/kg, which equals the mean price obtained for bushmeat by illegal hunters. It was assumed that 100% of the meat from safari hunting in the multiple-use zone would be allocated to communities, whereas 25% of that from the core area would be allocated to communities.

The potential production of meat from harvesting elephants was estimated based on the sustainable harvesting quota (from the projected recovered population) for the species suggested by Spinage (1987): the sustainable harvesting quota (2.80%) and sustainable trophy quota (0.44%, Craig & Lawson, 1990). It was assumed that an individual elephant would yield ~909 kg of meat (Martin, 2007).

RESULTS

Manager survey

Development of Coutada 9

Key findings

- Coutada 9 has been broken into three units which will be managed by different hunting operators.
- Hunting operators have spent USD193 500 on infrastructure developments in Coutada 9 during the last eight years (most of which was spent during the last two years).
- Approximately USD33 000/month (USD396 000/year) is spent on running costs associated with managing the *coutada.*
- Primary developments have included: constructing a road network, developing boreholes and artificial water points, constructing dams to hold permanent water and reintroducing Lions.
- Planned future developments include the construction of perimeter fencing, the reintroduction of key species (especially African Buffalo), developing a headquarters and new safari camp, and providing more permanent water sources, at an estimated cost of ~USD1.16 million.
- Wildlife populations in Coutada 9 are diverse, but most species occur at densities too low to generate sufficient returns from safari hunting to cover the costs of managing and developing the area

Sub-division of blocks within Coutada 9

The core area of Coutada 9 has been broken up into four blocks, used by different shareholders of the company. Block A is ~1040 km^2 in extent, whereas the other three blocks are ~710 km^2, 200 km^2 and 170 km^2 in size. There are effectively two management blocks at present: one of 1040 km^2 and one of 880 km^2. The management of the 200 km^2 block is currently in the process of developing a management programme.

Costs of development

Managers of Coutada 9 estimate that they spend ~USD33 000 per month on running costs and have spent USD193 500 on infrastructure development and wildlife reintroductions (as depicted in photos in this section). The managers indicated that they planned to spend an additional ~USD1.2 million on future infrastructure developments and wildlife reintroductions (**Table 3**).

Table 3

Running costs, past investments and planned future investments by hunting operators within Coutada 9

Expenditure	Total (USD)
Mean monthly expenditure	33 000
Past developments	
18 boreholes, five kilometres piping, six water-points	130 000
Built three dams	32 500
Developed several hundred kilometres of roads	Part of monthly cost
Reintroduced 10 Lions	31 000
Sub-total	**193 500**
Planned future developments	
Build two scout camps	5000
Build school and clinic for communities	10 000
Upgrade waterholes	15 000
Building a managers house	50 000
Building two more safari camps	60 000
Build headquarters (accommodation, workshop, cold storage, office)	75 000
Build 13 more dams	230 000
Establish a fence around the core area	400 000
Buffalo boma and release-pen	20 000
Purchase of 500 buffaloes	300 000
Sub-total	**1 165 000**

Credit: P. Lindsey

Construction of a dam to provide a permanent water source for wildlife in Coutada 9

Credit: P. Lindsey

Release pen for Lions in Coutada 9

Wildlife populations

The large mammal community in Coutada 9 is diverse, though most species occur at extremely low densities, even in the core area (**Table 4**). Wildlife is effectively absent from the settlement area, and very rare in the multiple-use zone. Though no information is available regarding historical species compositions in the area, it is likely that Black Rhinoceros *Diceros bicornis* and White Rhinoceros *Ceratotherium simum,* Common Wildebeest *Connochaetes taurinus* and Roan Antelope *Hippotragus equinus* occurred in the area, all of which are now absent. Of the key species for safari hunting operations, African Elephants occur in reasonable numbers, though African Buffaloes, Lions and Leopards occur at extremely low densities. The densities of wildlife are markedly lower in Coutada 9 than in the nearby SVC in Zimbabwe, despite the fact that the latter area has much lower rainfall (535 ml c.f. ~800 ml), suggesting that that human disturbance and illegal hunting has had a marked impact in the former area.

Table 4

Wildlife population estimates for Coutada 9

	2005 aerial census results	Current managers estimates	Managers estimates of trends	Density	Comparative density in SVC [a]	Difference in density
Baboon	392	Present	?	?	?	-
African Buffalo	0	10	Increasing	?	?	-
Bushbuck	64	Present	Increasing	?	0.68	-
Duiker, Common	59	Present	Increasing	?	?	-
Duiker, Red	0	Present	?	?	?	-
Eland	91	300–400	Increasing	0.16	0.69	4.35
African Elephants	333	350	?	0.16	0.47	2.95
Hartebeest, L.*	119	100	Increasing	0.05	0.00	-
Hyaena, Spotted*	0	?	? [b]	0.00	0.04	-
Impala*	14	350	Increasing	0.16	5.81	36.5
Leopard	?	10	Increasing	0.00	0.10	20.9
Lion	?	11 [c]	Increasing	0.00	0.03	66.0
Klipspringer*	9	Present	Increasing	?	?	-
Greater Kudu*	552	1000	Increasing	0.45	0.50	1.10
Oribi	37	350	Increasing	0.16	N/A	-
Nyala*	0	30–50	Increasing	0.02	?	-
Reedbuck	5	100–150	Increasing	0.06	0.00	-
Rhinoceros, Black	0	0	Extirpated	0	0.01	-
Rhinoceros, White	0	0	Extirpated	0	0.05	-
Roan Antelope	0	0	Extirpated	0	N/A	-
Sable Antelope	96	150	Increasing	0.07	0.09	1.32
Suni*	0	Present	?	0.00	0.00	-
African Wild Dogs	0	0 [d]	Extirpated	0.00	0.05	-
Common Warthog*	338	1500	?	0.68	0.70	1.03
Waterbuck	0	6–10	Increasing	0.00	0.30	81.1
Common Wildebeest	0	0	Extirpated	0.00	2.12	-
Zebra	0	30–40	?	0.02	1.94	121.7
Total [e]	**2109**	**4379**				**33.7**

Notes: [a] Savé Valley Conservancy; [b] Spotted Hyaenas do persist in the area, but in numbers that are likely not viable; [c] A pride of 10 Lions was reintroduced into Coutada 9 in December 2009, prior to which only occasional dispersing males were observed in the area; [d] A pack of five wild dogs was seen in Coutada 9 in 2007 but no sign of them has been recorded since then; [e] For species where a range was presented, the mid-point value was used.
* Lichtenstein's Hartebeest *Alcelaphus buselaphus* ssp. *lichtensteinii;* Spotted Hyaena *Crocuta crocuta;* Impala *Aepyceros melampus;* Klipspringer *Oreotragus oreotragus;* Greater Kudu *Tragelaphus strepsiceros;* Nyala *Trageaphus angasii;* Suni *Nesotragus moschatus;* Common Warthog *Phacochoerus africanus.*

Anti-poaching

Key findings

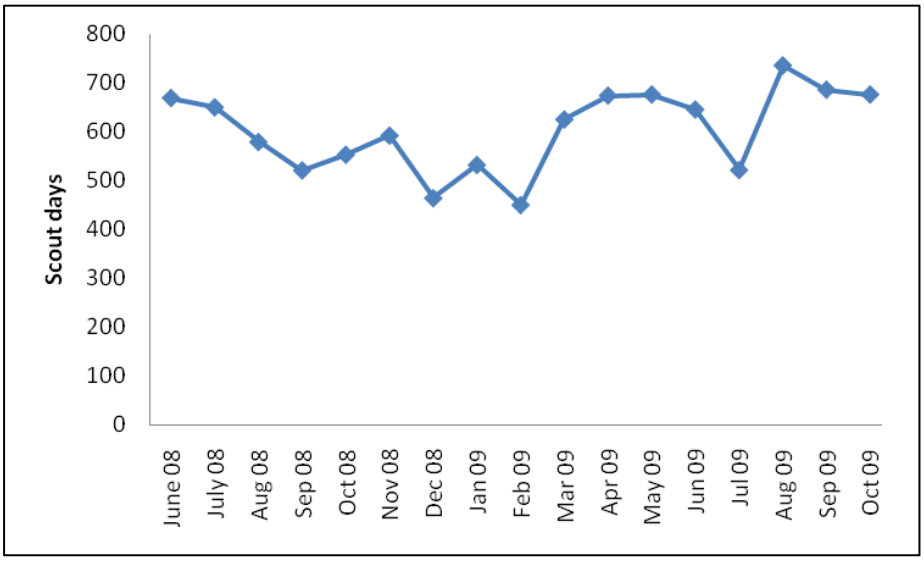
- Approximately 80% of the core area of Coutada 9 is covered by anti-poaching patrols.
- The multiple-use and settlement zones are not patrolled.
- Only 5–7% of Coutada 13 (the area adjacent to Coutada 9) is patrolled.
- A mean of 28.1 ± 1.5 game scouts (0.01/km^2) were employed in Coutada 9 during 2009.
- Scouts typically capture illegal hunters after following their footprints.
- Community game scouts are not currently effective, owing to a lack of effective incentives for them to work.

Game scouts employed by the hunting operators

Approximately 80% of the core area of Coutada 9 is covered by anti-poaching patrols, compared to 5–7% of Coutada 13. The settlement and multiple-use zones of Coutada 9 are not patrolled. The section of Coutada 13 that is covered by anti-poaching patrols is adjacent to Coutada 9, along the Pompue River (**Figure 2**). During 2009, a mean of 28.1 ± 1.5 game scouts were employed in Coutada 9, or 0.01 scouts per km^2 (c.f. 0.08 scouts/km^2 in SVC, Lindsey 2009) (**Figure 3**). There was a mean scout deployment of 622 scout days per month, or 0.30 scout days/month/km^2, compared to 1.80 scout days/km^2/month in SVC. In Coutada 9, scouts are deployed in groups (mean size 5.4 ± 0.14 men) on extended patrols of 6.6 ± 0.18 days. The scouts typically establish a camp site, from which they conduct daily patrols.

Figure 3

Anti-poaching effort (scout days per month) in Coutada 9



Poachers are typically caught when game scouts locate and follow spoor. Scouts are issued with radios and uniforms. When they are deployed in areas where poachers are known to use muzzle-loaders, the scouts are allocated firearms. However, generally they are not armed due to a fear among management of liability in the event of a fatal interaction between scouts and illegal hunters. Scouts are paid USD2.30–2.70 per day (depending on their experience) and are paid bonuses of USD2.90 per gin trap and USD12.6 per poacher caught (the bonuses are split among the group of scouts on patrol).

Management of blocks A and B estimated that the official data on illegal hunting reflected only 25% and 20% of the actual number of incidents that occur in Coutada 9. The lessee of Coutada 13 considered that <1% of illegal hunting incidents were detected by the game scouts.

Community scouts

During the zoning process, communities were encouraged to provide "community scouts" to assist with anti-poaching efforts and help protect the resource from which they received benefits through safari hunting. Approximately 40 community scouts operate within Coutada 9. They are not paid a salary by the management of the *coutada*, but they do receive bonuses for handing in gin traps, or catching poachers. Management of both blocks of the *coutada* felt that the community scouts were not effective at anti-poaching. Illegal hunting data support this assertion: community scouts handed in only 45 gin traps (1.1 traps/scout) and caught only two illegal hunters (0.05 poachers/scout) from January to October 2009, compared to the 392 gin traps removed (14.0 traps/scout) and 59 illegal hunters caught (1.5 poachers/scout) by the *coutada* managements' scouts during the same period. Managers felt that the poor performance of community scouts was the result of the modest flow of returns to the communities from safari hunting (a function of inadequate wildlife populations, especially in the multiple-use and settlement zones), and thus a lack of incentive for them to work.

Illegal hunting

Key findings

- There were 258 recorded poaching incidents in Coutada 9 and Coutada 13 from June 2008 to March 2010.
- Illegal hunting with gin traps was most commonly recorded, followed by hunting with firearms, snares and dogs.
- 1063 gin traps were removed from June to March 2010, in addition to the 3500–4000 removed during late 2002 and late 2007.
- 231 illegal hunters were caught from June 2008 to March 2010.
- Illegal hunters were caught in 33.7% of incidents where illegal hunting activity was detected.
- Only 43 animals were recorded killed from June 2008 to March 2010, a reflection of the frequency with which illegal hunters check their gin traps (meaning that animals are usually removed before scouts arrive).
- Wastage of meat/animals by illegal hunters using gin traps is rare.
- Managers feel that illegal hunting is most frequent during the late dry season, and least following the onset of the rains.
- Managers feel that the areas close to human settlements are worst affected by illegal hunting.
- When captured, illegal hunters are normally issued fines by the Ministry of Agriculture (mean value USD485.4 ± USD42.3).
- However, these fines are not enforced and therefore rarely (if ever) paid, with the effect that they offer no deterrent.
- More recently, illegal hunters have been dealt with by the police, resulting in some gaol sentences being issued as punishment.

There were 258 recorded poaching incidents in Coutada 9 and Coutada 13 from June 2008 to March 2010. Illegal hunting is most commonly practised with the use of gin traps (**Table 5**). Gin traps are

manufactured locally from steel from motor vehicle springs. Gin traps are manufactured in a range of sizes and are used to target species ranging in size from small antelopes to African Buffalo.

Credit: P. Lindsey

In 2009, a young elephant was observed in Coutada 9 dragging a gin trap which had closed on its foot

The number of poachers caught and gin traps removed have increased from 2006 to 2009 (**Table 6**). The manager that was in charge of the area from December 2002 to December 2007 estimated that 3500–4000 gin traps were removed during his tenure. Gin traps are typically disposed of by the management of Coutada 9 by encasing them in cement in building foundations.

Eight incidents were recorded of people being accidentally captured in gin traps from 2003 to 2008, though fortunately none were seriously injured. One of the managers recounted a case where an old poacher admitted to him that he had caught two people (a woman and a child) in gin traps during his career, both of whom he admitted to having killed to avoid prosecution for having inflicted severe injuries.

Illegal hunters frequently use muzzle-loading weapons (7.8% of recorded incidents, see **Table 5**), some of which are extremely old (see photos on page 21). Muzzle-loaders are also manufactured locally, using vehicle tie-rods as barrels. Cut and rounded sections of steel bars, bolts and nuts are used for ammunition in muzzle-loaders. Managers reported that they had heard of multiple incidents of illegal hunters being injured following the misfiring of muzzle-loaders.

Credit: P. Lindsey

Credit: Mokore Safaris

Credit: Mokore Safaris

Credit: P. Lindsey

Credit: P. Lindsey

Credit: P. Lindsey

***Above, from top to bottom*: Gin traps are difficult to locate, and can be extremely dangerous for humans**

***Left, from top to bottom*: Carlos Bento holding a gin trap with footplate removed, found in Coutada 9; Greater Kudu caught in a gin trap; Greater Kudu's leg broken by a gin trap**

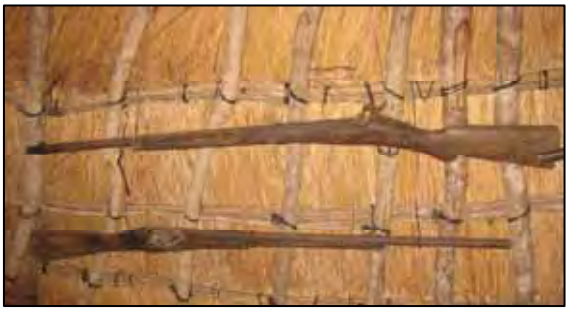
Credit: Peter Lindsey

Gin traps removed from Coutada 9—thousands are destroyed, usually by using them in the foundations of dam walls

Cane rat trap removed from Coutada 9

Credit: Mokore Safaris

Gin traps removed from Coutada 9



Credit: Peter Lindsey

Muzzle-loaders removed from Coutada 9

Credit: Mokore Safaris

Muzzle-loaders and gin traps removed from Coutada 9

Table 5

Summary of illegal hunting incidents in Coutada 9 from June 2008 to March 2010

Illegal hunting incidents	
Total incidents *	***258***
Incidents involving gin traps	88.8%
Incidents involving muzzle loaders	7.8%
Incidents involving snares	5.5%
Incidents involving bows and arrows	7.5%
Incidents involving dogs	1.2%
Gin traps removed	1063
Muzzle loaders removed	27
Snares removed	24
Poachers	
Incidents where poachers were caught (87 of 258)	33.7%
Poachers caught	231
Animals killed	
Incidents where animals were recorded as being killed	13.9%
Animals killed	43
Common Warthog	15
Greater Kudu	9
African Elephant	3
Impala	3
Reedbuck	2
Bushpig**	2
Bushbuck	1
Greater Cane Rat**	1
Duiker	1
Lion	1
Eland	1
Chacma Baboon**	1
Unknown	3

Note: * Defined as any incident in which evidence of poaching was recorded, excluding sightings of spoor which were not recorded because of the possibility the illegal hunters' footprints would be confused with those from other people living and moving through the area.
** Bushpig *Potamochoerus larvatus;* Greater Cane Rat *Thryonomys swinderianu;* Chacma Baboon *Papio ursinus.*

Hunting with snares is relatively uncommon in Coutada 9, because of a shortage of wire. The rarity of snaring in Coutada 9 is emphasized if one compares snare removals (0.02 snares/km^2/year) with the phenomenon in SVC in Zimbabwe (4.61 snares/km^2/year).

Incidents of poaching with automatic weapons were not recorded during the core study period. However, the previous manager indicated that he had recorded several incidents of illegal hunters using AK47 automatic rifles during his tenure. In August 2003, an arms cache was discovered in Coutada 9 containing 22 automatic rifles, mortars, rockets and rocket launchers and anti-personnel

mines. The previous manager also indicated that he had recorded occasional incidents of town-based illegal hunters operating in the *coutada* with a vehicle, spotlights and rifles.

When hunting Greater Cane Rats *Thryonomys swinderianus*, illegal hunters frequently use dogs, but also giant rat-traps (a larger version of the design used to catch rodent pests) (see photo on page 21).

Table 6

Illegal hunters captured and hunting tools removed from Coutada 9 from 2006 to 2009

	Illegal hunters caught	Gin traps	Muzzle-loaders	Bows and arrows	Snares	AK 47 assault rifles
2009	58	415	8	6	15	0
2008*	298	900	20	54	18	0
2007	42	702	19	18	10	0
2006	20	691	23	23	28	2
Totals	**418**	**2708**	**70**	**101**	**71**	**2**

Note: *Due to a change in personnel, data on illegal hunting were not available for the first six months of 2008; the same rate of capture of hunters and removal of hunting tools occurring in the first half as in the second half of that year was assumed.

Animals killed

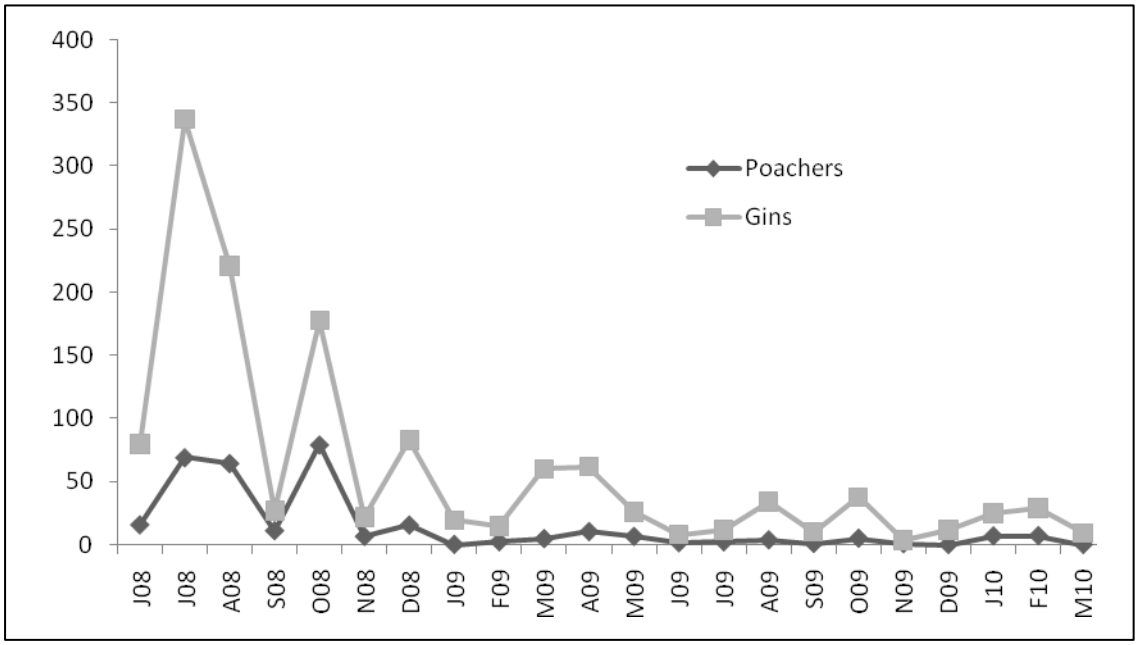
Only 43 animals were recorded as killed by illegal hunters from June 2008 to March 2010 (**Table 5**). Common Warthog *Phacochoerus africanus* and Greater Kudu *Tragelaphus strepsiceros* were the species most commonly recorded killed. Managers explained that the relatively low number of animals recorded killed reflected the fact that hunters using gin traps checked their traps very frequently, because the traps were not anchored and so it was important for them to make sure the animal did not run away with the trap. Consequently, animals are rarely found caught in traps in the same way as they are in areas such as SVC (Lindsey *et al.,* 2009), where illegal hunters use snares which are tied to trees to prevent animals leaving the site when captured. Only one animal was recorded as being found rotten in a gin trap from June 2008 to March 2010, indicating that wastage of animals by illegal hunters is not common.

Seasonal patterns in illegal hunting

Due to the short duration of time in which illegal hunting statistics are available, detecting seasonal patterns in the prevalence of illegal hunting is difficult. From June 2008 to March 2010, there was a general decline in the number of gin traps removed and illegal hunters caught (**Figure 4**).

Figure 4

Gin traps removed and illegal hunters captured within Coutada 9 (adjusted in line with deviation from the mean anti-poaching effort), from June 2008 to March 2010



However, all of the managers felt that illegal hunting generally peaked in the late dry season when wildlife was concentrated around water sources, and when food shortages among communities commenced. All of the managers also agreed that illegal hunting was least severe following the onset of the rains when wildlife was most dispersed, and when community members were occupied planting their crops.

The current managers felt that the type of illegal hunting did not vary with season. However, the previous manager indicated that the illegal hunting of elephants was more frequent in the wet season (in contrast to the hunting of other species) because some individuals within communities were issued with weapons to hunt elephants allegedly damaging crops. The previous manager indicated that such weapon allocation led to crop-raiding being used as an excuse for hunting for meat and ivory. The previous manager also said that the phenomenon of town-based illegal hunters hunting with vehicles, rifles and spotlights was more frequent near Christmas when such individuals spent time at their rural homes.

None of the managers believed that the frequency or type of illegal hunting varied in line with phases in the cycle of the moon.

Spatial patterns in poaching

Illegal hunting incidents were distributed widely within Coutada 9, with concentrations in the southern sections (**Figure 5**). Anti-poaching patrols in Coutada 13 were limited to the areas close to

Coutada 9. Most illegal hunters were captured and gin traps removed within the southern section of Coutada 9 (**Figures 6** and **7**).

Figure 5

Distribution of illegal hunting incidents in Coutadas 9 and 13 (defined as incidents where illegal hunters were caught, or their tools confiscated) (Scale: 1:350 000)

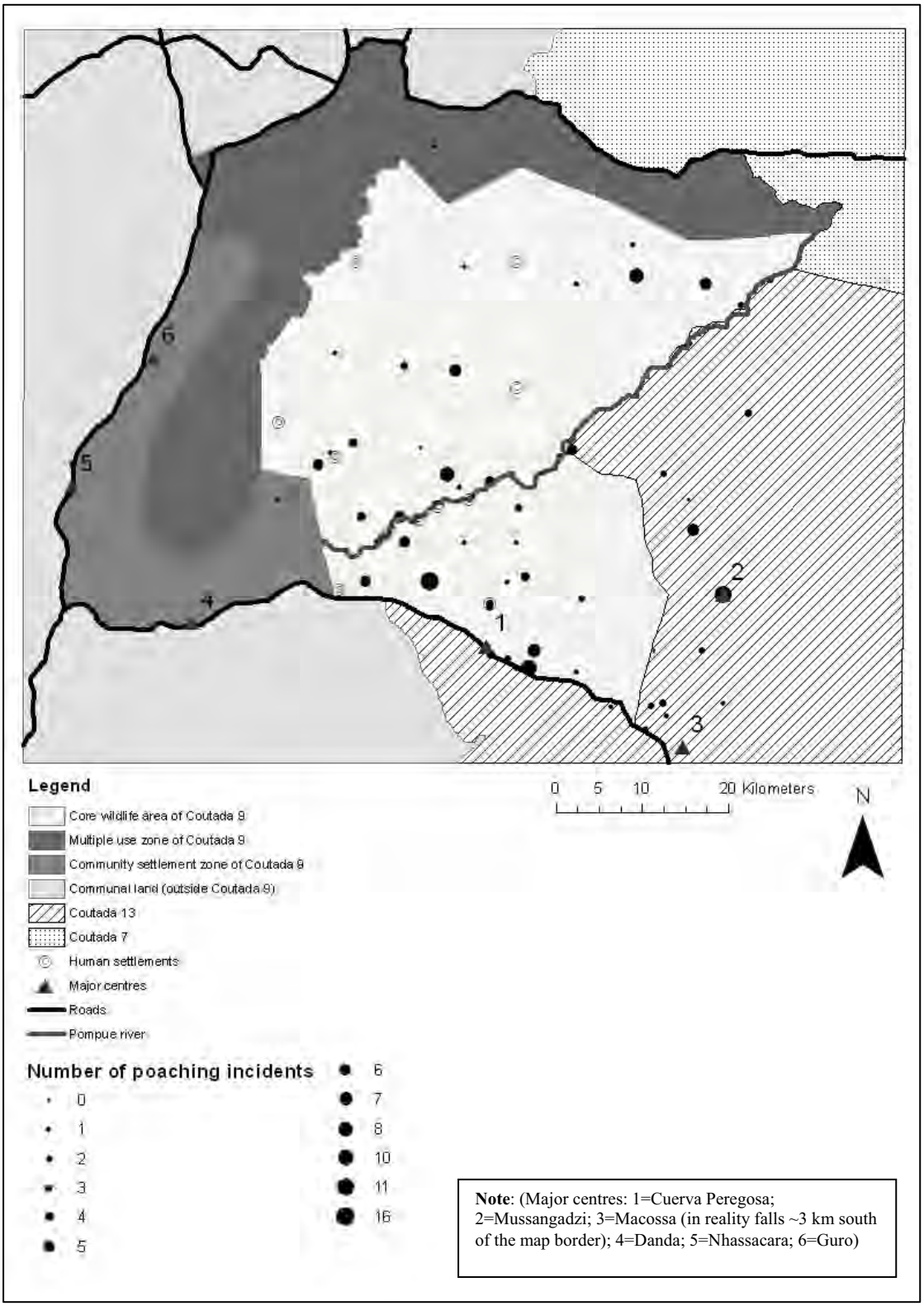


Figure 6

Spatial patterns in the capture of illegal hunters in Coutadas 9 and 13 (Scale: 1:350 000)

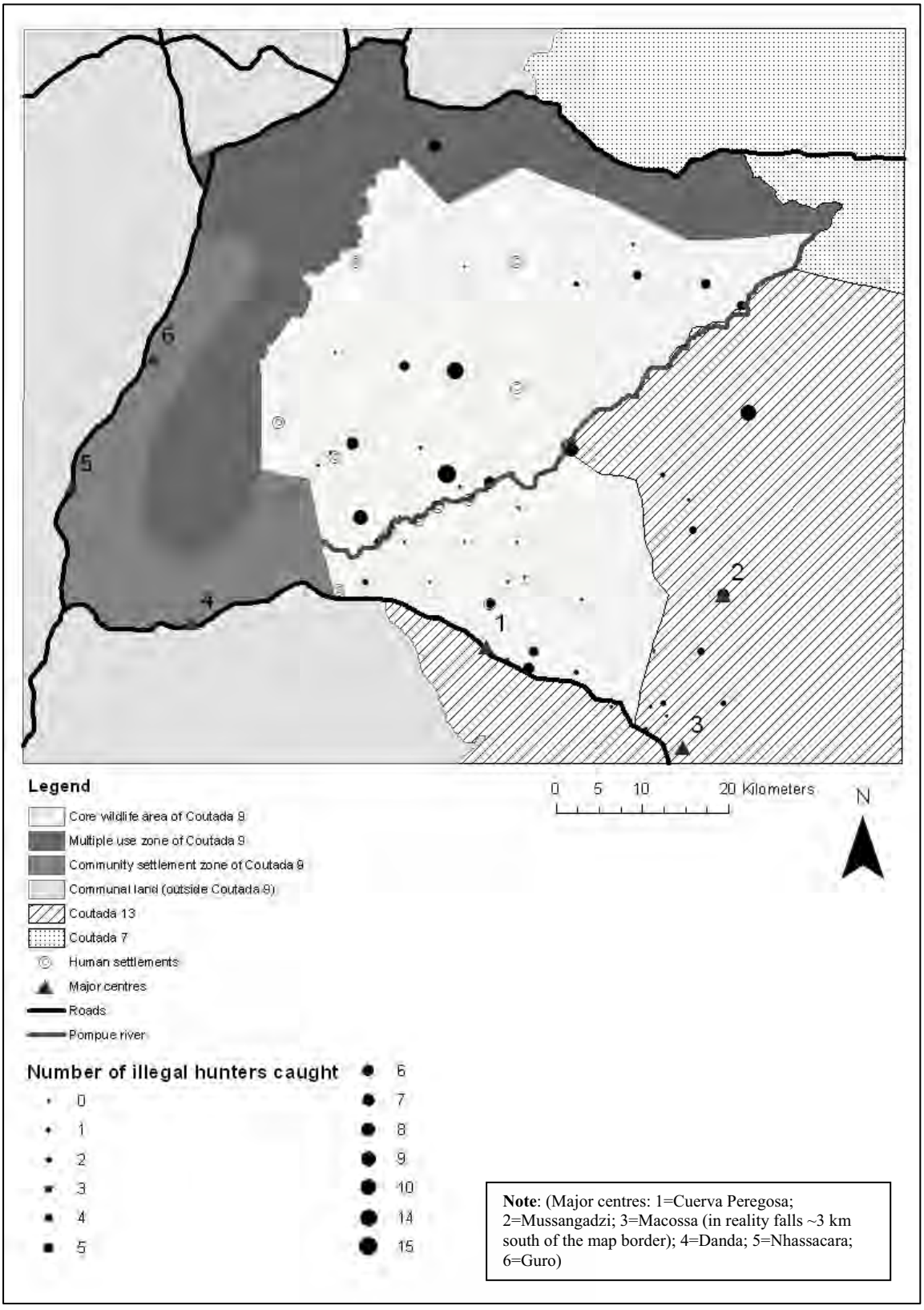


Figure 7

The spatial distribution of gin traps removed from Coutadas 9 and 13 (Scale 1:350 000)

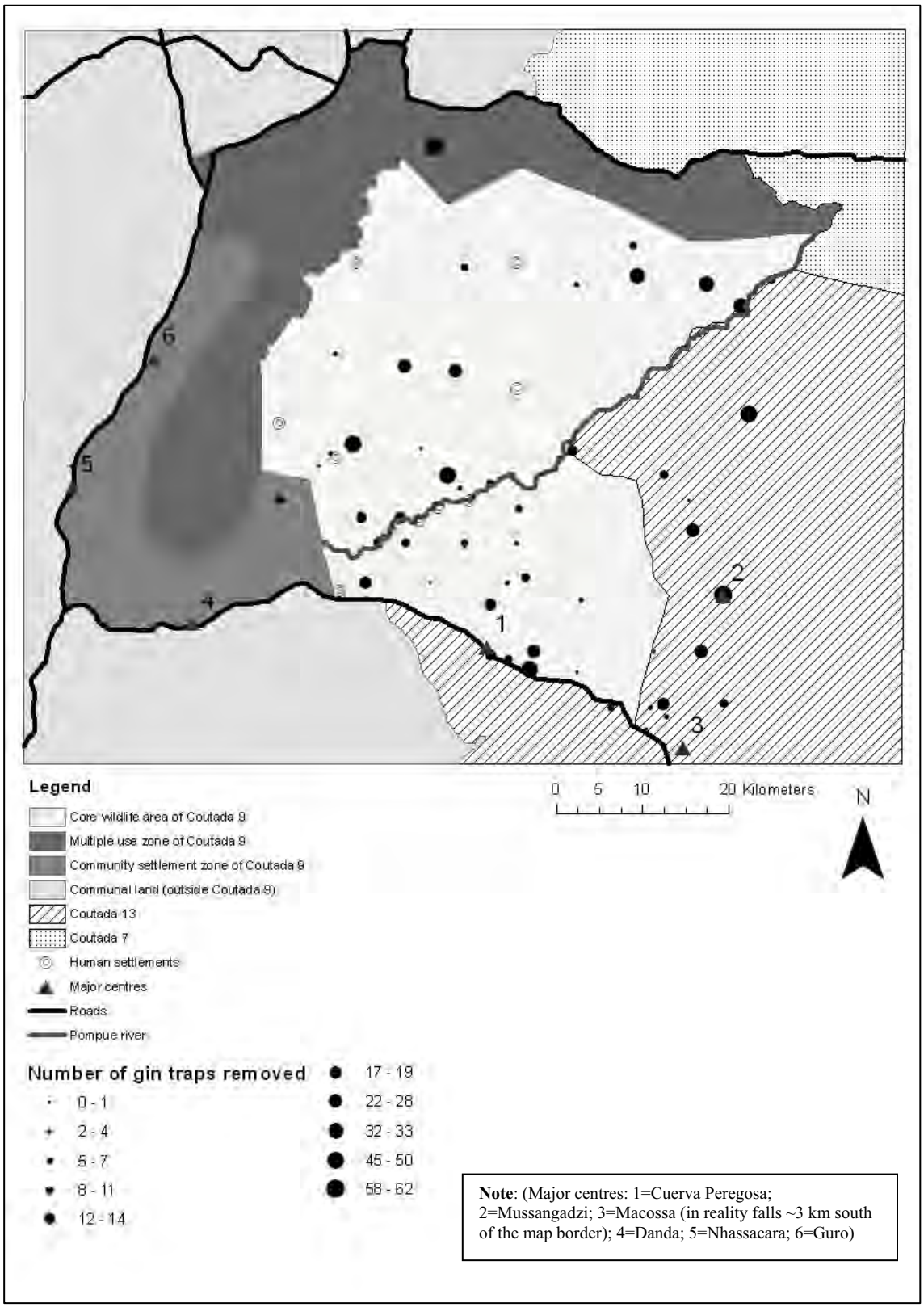
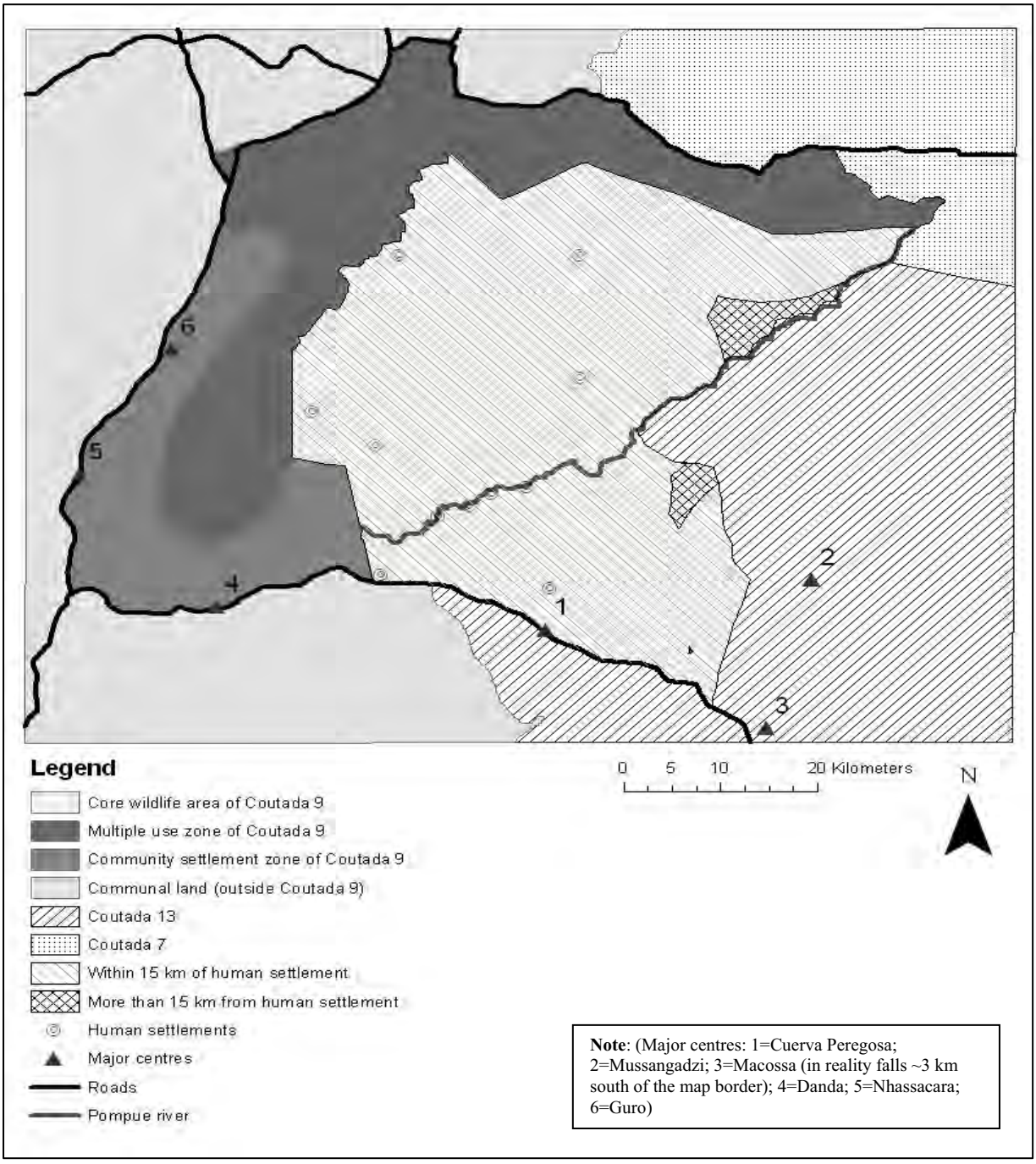


Figure 8

Human settlements within Coutada 9 and parts of the core area likely to have low intensity of illegal hunting, based on distance from human settlement (excluding all areas within 15 km of villages within Coutada 9 and from the boundary of Coutada 9 except for where the adjacent land is Coutada 13). (Scale 1:350 000)



Managers felt that the parts of Coutada 9 worst affected by poaching were the areas closest to settlements within the area, and along the boundaries. Manager B was more specific, indicating that the worst affected areas were those along the main road to Macossa (on the southern boundary), along the western boundary, and along the Pompue River. The previous *coutada* manager agreed that the

western boundary was badly affected, but also identified the northern boundary as being severely affected. Manager A felt that there was a radius of at least 15 km around each village in which the intensity of illegal hunting was high. If this assertion is correct, then the large majority of the *coutada* would be severely affected by illegal hunting (**Figure 8**). The situation he described in the areas >15 km from settlement corresponded with the suggestion of the previous manager that the eastern boundary, neighbouring Coutada 13 (or at least portions of it), was relatively free of illegal hunting. All of the managers felt that virtually all of Coutada 13 was severely affected by poaching, with the exception of a small area bordering Coutada 9 along the Pompue River, where anti-poaching effort is focussed.

All of the managers indicated that there was some spatial variation in the type of poaching. While gin traps are used everywhere, there appears to be a higher prevalence of illegal hunting with muzzle-loaders and automatic rifles in the northern areas.

Poachers caught

Four hundred and eighteen illegal hunters were captured by game scouts during the period 2006–2009 (**Table 6**). The Coutada 9 management has records of punishments alloted to 82 poachers during 2008 and 2009. Prior to July 2009, illegal hunters were taken to the Ministry of Agriculture in Macossa, which issued fines as punishments. The mean value of fines was USD485.4 ± USD42.3, compared to mean monthly earnings of illegal hunters of USD59.2. However, managers of Coutada 9 stressed that the fines were never enforced and subsequently never paid, with the effect that they provided no deterrent. Furthermore, there was a suspicion among management that scouts and illegal hunters were involved in a scam whereby hunters would be "apprehended" and taken to Macossa to be fined (in the knowledge that the fine would not be enforced). The scouts and illegal hunters would then split the bonuses paid by the *coutada*. Failure to enforce fines means that the Ministry of Agriculture misses a significant source of revenue. The manager of Block A estimated that the government lost USD120 000 in unpaid fines during 2008.

Credit: Mokore Safaris

Illegal hunter arrested within Coutada 9

Credit: P. Lindsey

Illegal hunter caught hunting with gin traps in Coutada 9

Following a complaint to the District Administrator and police in June 2009 regarding the lack of support with punishing illegal hunters, the next 12 that were caught were taken to the police in Catandica (50 km to the south-west) and were all given gaol sentences. The number of illegal hunters apprehended in June, July and August (mean 4.33 ± 0.88) was lower than in the preceding three months (mean 8.66 ± 1.9), a reflection, in the opinion of the managers, of cessation of the aforementioned scam by game scouts. Managers reported that, following the shift in punishments for illegal hunters, several scouts did not return to work.

Constraints limiting effectiveness of anti-poaching

Factors limiting effective anti-poaching effort

- Small budget, because of low returns from safari hunting, in turn because of reduced wildlife population sizes.
- The large size of Coutada 9 and Coutada 13.
- The lack of effective legal deterrents to discourage illegal hunting.

- The presence of human settlements within the *coutadas* (including within the core area of Coutada 9).
- High expenses associated with transporting illegal hunters to the police/Ministry of Agriculture.
- Lack of perimeter fencing preventing wildlife from leaving safe areas.

Managers identified the following constraints to effective anti-poaching:

1. **Returns from safari hunting are currently modest**, because of the small population sizes of most species and virtual absence of key species, and particularly the African Buffalo. This creates a challenging scenario whereby comprehensive anti-poaching is not possible due to insufficient financial resources until there is sufficient wildlife to generate elevated returns from safari hunting, but increased populations are dependent on fully comprehensive anti-poaching. The solution to this dilemma adopted by the managers is to strive to secure increasingly large sections of the "core area" over time and then reintroduce key species into the most secure areas.

2. **The large size of Coutadas 9 and 13**. The two *coutadas* are extremely large (Coutada 13—5680 km^2; Coutada 9—3872 km^2), with wildlife occurring at low densities. Providing effective anti-poaching coverage over such a large area is difficult.

3. **Lack of government support**. Managers felt that the government was not sufficiently supportive of their efforts to control poaching. Specifically, they identified the following problems:

    a. The issuance of large fines to poachers which are never collected.
    b. Punishments for repeat offenders do not differ from those granted to first-time offenders.
    c. Government officials from the Ministry of Agriculture being known to purchase meat from illegal hunters, creating a disincentive for them to control illegal hunting.
    d. The government has not been sufficiently helpful in promoting, or providing permission for wildlife reintroductions. The process for obtaining permits is opaque, slow, and bureaucratic.

4. **The fact that even the core area has human settlements within it**. The presence of settlements within the *coutadas* means that most parts of the area are within fairly close access for potential illegal hunters. The presence of people within the area makes it impossible to distinguish between the footprints of honey- or firewood- collectors and illegal hunters. Furthermore, managers indicated that honey-collecting is often used as a front for illegal hunting.

5. **The large expense associated with catching illegal hunters** and transporting them to the police only for them to be released, or issued with a meaningless fine.

6. **The fact that the Ministry of Agriculture, not the Ministry of Tourism, is in charge of managing the area**, thus leading to a situation where wildlife conservation and tourism are not prioritized. An example was provided of the Ministry of Agriculture shooting nine buffaloes believed to have eaten some cabbages. Managers also pointed out that mining and timber concessions had been granted within the *coutada* which, if used, could create more problems with illegal hunting on account of creating increased access for people.

7. **The lack of perimeter fencing**. The *coutadas* are not fenced, with the effect that wildlife can move freely in and out of them. The Pompue River system holds water perennially, but the presence of human settlement along large sections largely excludes wildlife from those areas. Consequently, wildlife is forced to move out of the area during the dry season into adjacent and less secure areas, increasing the risk of exposure to bushmeat hunters. The buffalo population of Coutada 9, for example, was severely affected by such a phenomenon. A herd of 64 animals moved out of Coutada 9 following rainfall in an adjacent area in 2006, and never returned. The buffalo population now numbers a maximum of 10 individuals. The operators in Coutada 9 have now established six artificial water-points and three dams which should reduce the tendency of wildlife to leave the core area. However, perimeter fencing is ultimately required. A fence-line with a cleared strip of bare earth on the inside would also assist with anti-poaching efforts by enabling scouts to see where illegal hunters had entered.

8. **Collusion between some scouts and illegal hunters** and involvement in illegal hunting. Managers expressed a suspicion that anti-poaching game scouts were involved in illegal hunting, either through selling meat that they found in illegal hunters' traps, the use of traps to catch wildlife while on patrol, the sale of gin traps to illegal hunters, or the arranged "capture" of illegal hunters to obtain bonus payments from management (payments which are then split between scouts and illegal hunters), in the knowledge that fines issued to illegal hunters are not enforced. The high and increasing value of gin traps creates a temptation for scouts and community scouts to sell the ones they find, rather than hand them in. Owing to the high volume of traps, matching bonuses to the value of traps becomes prohibitively costly.

9. **Conflict experienced by scouts within their communities**. Game scouts employed from communities living within and near to the *coutadas* often experience criticism and even threats from people within their community for acting to prevent them from hunting in the area.

10. **Competing time and resource commitments**. Owing to the undeveloped nature of the *coutadas*, a significant investment of money and time is required to develop the necessary infrastructure, competing directly for funds and time with anti-poaching.

Financial impacts of illegal hunting

Key findings

- The need for anti-poaching security imposes direct costs of USD60 000/per year, or USD28.4/km^2/year, on safari hunting operators in Coutada 9.
- Owing to population declines caused by historical and current illegal hunting, returns from safari hunting are ~96% less than what they could be.
- Historical and current illegal hunting imposes estimated opportunity costs of ~USD1.62 million per year in foregone potential safari hunting revenues.
- Communities incur opportunity costs of ~USD308 000/year as a result of historical and current illegal hunting.
- Historical and current illegal hunting also impose opportunity costs in terms of foregone food security benefits: ~86 t more meat than the amount presently produced could potentially be generated from Coutada 9, from safari hunting and harvesting of Impala and Greater Kudu.

A further 23.4 t of meat could potentially be generated from cropping elephants, if the population of the species were allowed to recover.

Costs of anti-poaching

The management of one section of Coutada 9 estimated that it spent USD3500/month, and that of another section, USD1500. The total of USD5000/month (USD60 000/year) corresponds to USD28.4/km^2/year, compared to USD56.7/km^2/year in SVC (an area characterized by much smaller management units held per operator).

Foregone potential trophy hunting revenues

Wildlife populations in the core area of Coutada 9 are <10% (9.8%) of what they could be in the absence of illegal hunting (**Table 7**). Gross returns of ~USD1.29 million and USD337 000 could be generated from safari hunting in the core and multiple-use areas of Coutada 9, if illegal hunting were reduced and wildlife populations were allowed to recover (which would realistically require wildlife reintroductions and augmentations) (**Tables 7**, **8**). Approximately 40% of this could be derived from buffalo alone (**Table 7**). In total, ~USD1.68 million could be generated from safari hunting and the sale of meat from the harvesting of Impala, Greater Kudu and African Elephant in the core and multiple-use zones, of which ~USD319 000 would accrue to communities (**Table 9**). A total of ~115 t of meat would be generated from safari hunting and harvesting of Impala, Greater Kudu and African Elephant, of which ~47 t would accrue to communities (**Table 9**).

In 2009, safari hunting in Coutada 9 (all occurring in the core area) generated USD63 325. In addition, 5676 kg of meat with a value of USD6640 was generated—though that value was not realized, as all of the meat was used to feed workers and visiting hunters. Consequently, a maximum of 3.8% of the potential earnings (USD1.68 million) from safari hunting and harvesting for meat in the core and multiple-use zones of Coutada 9 are realized. Historical and on-going illegal hunting can

thus be said to impose opportunity costs of USD1.62 million/year and direct costs of USD60 000 through the requirement for investment in anti-poaching security. Communities received income of USD11 606 from safari hunting in 2009, which represents 3.6% of the estimated potential community earnings of USD319 261/year. Communities thus incur opportunity costs of ~USD308 000 annually because of the suppression of wildlife populations through illegal hunting and miss out on 46.8 t of legally supplied game meat.

Credit: Mokore Safaris

Lions were reintroduced to Coutada 9 in 2009

Credit: Mokore Safaris

There are about 350 elephants in Coutada 9

Table 7

Potential wildlife populations, given reduced illegal hunting in the core area of Coutada 9, and potential safari hunting revenues (US dollars)

	Current population	Potential population	Mean off-take 2008/09	Potential quota [a]	Trophy fee [b]	Trophy revenue	Daily rate	Meat produced	Meat value	Income for communities	% of revenue
Species attracting daily rates											
African Buffalo	10	5527	0	44.2	2734	120 887	388 216	14 370	16 813	34 425	40.7
African Elephant	350	870	1.5	3.5	17 750	61 699	58 619	6309	7381	17 270	9.9
Lion	12	221	0.5	4.4	7940	35 012	65 280	N/A	N/A	8753	7.8
Sable Antelope	150	352	1	5.1	3630	18 400	64 293	641	750	4787	6.5
Leopard		74	0	1.5	4444	6595	20 423	N/A	N/A	1649	2.1
Plains game hunts [c]							26 628				
Other species											
Greater Kudu	1000	5072	4	49.0	2215	108 535	N/A	6284	7353	28 972	9.0
Eland	350	2844	3.5	39.8	2229	88 750	N/A	13 260	15 514	26 066	8.1
Waterbuck	8	1382	0	19.9	1699	33 811	N/A	2846	3330	9285	2.9
Nyala	350	700	0	11.2	2650	29 680	N/A	665	778	7615	2.4
Common Wildebeest	0	2171	0	33.7	820	27 593	N/A	4711	5512	8276	2.6
Impala	350	23 896	2	49.0	329	16 121	N/A	1705	1995	4529	1.4
Oribi	350	700	2	15.4	1055	16 247	N/A	119	139	4097	1.3
Zebra	35	1184	0	9.5	1150	10 893	N/A	1667	1950	3211	1.0
Common Warthog	1500	1500	12	17.7	400	7080	N/A	765	895	1994	0.6
Duiker, Red	?	250	0	6.8	710	4793	N/A	45	52	1211	0.4
Hartebeest	100	200	3.5	3.2	1150	3680	N/A	312	364	1011	0.3
Bushbuck		250	3	5.5	700	3850	N/A	182	212	1016	0.3
Reedbuck, Southern	125	250	2.5	5.5	759	4175	N/A	212	248	1106	0.3
Hyaena, Spotted	?	295	0	5.9	700	4126	N/A	N/A	N/A	N/A	0.3
Duiker, Common	?	250	1.5	7	439	2963	N/A	63	74	759	0.2
Total	**4690**	**47 538**				**604 889**	**623 459**	**54 156**	**63 360**	**167 063**	**100**
Total of trophy and meat income											**1 291 708**

Note: [a] Based on sustainable quotas from Craig and Lawson (1990) except for Leopards and Lions (2% off-take, C. Packer, pers. comm.), up to a maximum number equalling the number of buffaloes hunted, plus 10%. [b] From Booth (2009). [c] Rio Savé Safaris indicated that they would be able to sell an additional 10% of hunts which included only "plains game" with no "big game" included in the package.

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Table 8

Potential income from safari hunting in the multiple-use zone of Coutada 9 (US dollars)

	Potential population	Mean off-take 2008/09	Potential quota [a]	Trophy fee [b]	Trophy revenue	Daily rate	Meat produced kg	Meat value	Income for communities
Species attracting daily rates									
African Buffalo	1417	0	11.3	2734	30 991	99 523	3684	4310	27 553
African Elephant	222	0	1.0	17 750	17 756	168 69	1816	2124	15 441
Lion	57	0	1.1	7940	8976	18 449	N/A	N/A	6732
Sable Antelope	91	0	1.3	3630	4733	16 538	165	193	3743
Leopard	19	0	0.38	4444	1691	5236	N/A	N/A	1268
Plains game hunts [c]						8876			
Other species									
Greater Kudu	1299	0	12.0	2215	26 580	N/A	1539	1801	21 736
Eland	728	0	10.5	2229	23 376	N/A	3477	4068	20 140
Common Wildebeest	557	0	8.6	820	7074	N/A	1208	1413	6211
Waterbuck	310	0	4.5	1699	7579	N/A	638	746	6163
Nyala	179	0	2.9	2650	7605	N/A	170	199	5831
Impala	6125	0	12.0	329	3948	N/A	418	489	3275
Oribi	179	0	3.9	1055	4165	N/A	30	36	3146
Zebra	303	0	2.4	1150	2790	N/A	427	500	2413
Common Warthog	385	0	4.5	400	1815	N/A	196	229	1508
Hartebeest	51	0	0.8	1150	943	N/A	80	93	768
Bushbuck	64	0	1.4	700	987	N/A	47	54	776
Reedbuck, Southern	64	0	1.4	759	1070	N/A	54	64	843
Duiker, Red	64	0	1.7	710	1229	N/A	11	13	930
Hyaena, Spotted	76	0	1.5	700	1058	N/A			793
Duiker, Common	64	0	1.7	439	760	N/A	16	19	582
Total					**155 125**	**165 492**	**13 975**	**16 351**	**129 851**
Total of trophy and meat income									**336 968**

Note: [a] Based on sustainable quotas from Craig and Lawson (1990) except for Leopards and Lions (2% off-take, C. Packer, pers. comm.), up to a maximum number equalling the number of buffaloes hunted, plus 10%. [b] From Booth (2009). [c] Rio Savé Safaris indicated that they would be able to sell an additional 10% of hunts which included only "plains game" with no "big game" included in the package.

Table 9

A summary of potential income (USD) from safari hunting and the sale of meat, and of meat production (t), if wildlife populations in Coutada 9 were allowed to recover

	Core area		Multiple-use area	
	Total	Communities	Total	Communities
Trophy fees/daily rates	1 228 348	151 223	320 617	113 500
Meat value from safari hunting	63 360	15 840	16 351	16 351
Meat value from cropping Impala and Greater Kudu	21 522	5381	5936	5936
Meat value from elephant harvesting	21 836	5459	5572	5572
Total monetary value	1 335 066	177 902	348 476	141 359
Overall income for communities				319 261
Overall total income				1 683 542
Meat quantity from safari hunting (tonnes)	54.2	13.6	14	14
Meat quantity from copping Impala and Greater Kudu	18.4	4.6	5.1	5.1
Meat quantity from elephant harvesting	18.7	4.7	4.8	4.8
Total meat	91.3	22.9	23.9	23.9
Overall meat for communities				46.8
Overall total meat				115.2

Illegal hunter survey

Key findings

- Illegal hunters are most commonly in their 30s, poor, with low levels of employment, monthly income, or food security. However, it is noteworthy that ~30% of illegal hunters are over 50 years of age.
- Relative to illegal hunters in Zimbabwe, those in Mozambique are less poor and less food-insecure, but because of the prevalence of tsetse fly, levels of livestock ownership are lower.
- Relative to illegal hunters in Zimbabwe, a greater proportion of those in Mozambique are more likely to receive benefits from wildlife, and a lower proportion incur costs.
- Bushmeat is the most commonly consumed form of protein by illegal hunters.
- Illegal hunters sell ~58.0% of the bushmeat they obtain and consume the remainder.
- Forty-four percent of the cumulative income of illegal hunters is derived from the sale of bushmeat.
- Income generated from hunting is most commonly used to buy maize for consumption, and clothes.
- Bushmeat is most commonly sold to communities and in urban centres within 50 km of Coutada 9, though some buyers come from up to 230 km away.
- Most illegal hunting is conducted using gin traps (made by blacksmiths from car springs), dogs and spears or firearms (typically home-made muzzle-loaders).
- The price of gin traps is increasing at a pace far exceeding inflation (possibly due to reduced supply following the removal of 4–5000 of them from circulation by game scouts during the last eight years).

- Illegal hunting is used as a strategy to combat food shortages.
- Illegal hunters operating in Coutada 9 only rarely receive assistance from employees working for the safari company and perceive the effectiveness of anti-poaching efforts to be increasing with time.
- Almost half of illegal hunters receive benefits from wildlife in the *coutada*, either in the form of meat or income paid to communities by hunting operators.
- Illegal hunters admit to having killed many more animals than are reflected by official poaching data.
- Police and government officials regularly buy bushmeat from illegal hunters (creating a conflict of interest which potentially undermines their willingness to fulfil their legal duty to control illegal hunting).
- Most (72.6%) hunters feel that wildlife populations in Coutada 9 have declined during recent years, and that some species which used to be easy to catch are now rare (including rhinoceros species, African Buffalo, Plains Zebra and African Elephant).
- The most common suggestions from illegal hunters on how the hunting operators in Coutada 9 or government could reduce illegal hunting were to increase employment opportunities, and to work with communities to develop income-generating projects or livestock production.

Most hunters (89.7%) were supportive of the zoning plan for Coutada 9.

Illegal hunter profiles

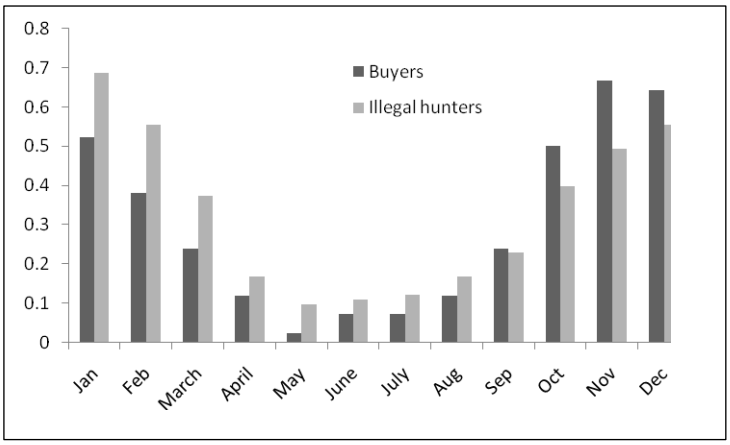
Illegal hunters were all male, with a mean age of 40.9 ± 1.2 years (**Table 10**).

Illegal hunters reported that the months they typically had most income were July (34.6%); August (45.2%); and September (32.7%), and those in which they had least income were December (40.8%); January (54.3%); and February (48.5%).

Eighty-percent (79.8%) of illegal hunters had been forced to skip meals because of food shortages, and most commonly skipped meals during January, February and March (**Figure 9**). When faced with food shortages, the most common response of illegal hunters was to: search for edible roots (44.4%); work for other people in return for money or food (37.0%); go hunting (25.9%); or kill chickens to eat (4.0%).

Figure 9

Months during which respondents reported meals were skipped most frequently



The non-vegetable proteins that had most commonly been consumed by illegal hunters during the 24 hours preceding the time of survey were: bushmeat (35.7%); chicken (11.4%); eggs (10.0%); fish (10.0%); goat (2.9%) and beef (1.4%). Of bushmeat, the

most commonly consumed species in the 24 hours were: Greater Cane Rat and other rodents (21.4%); Common Warthog (5.7%); Greater Kudu (4.3%); and Oribi (2.9%).

Illegal hunters estimated that the nearest wildlife populations from their homes were 16.1 ± 1.6 km away. Hunters living within Coutada 9 estimated that the nearest wildlife populations were 15.9 ± 1.9 km away (supporting the managers' estimation that a buffer of 15 km existed around human settlements where little wildlife occurs, due to excessive illegal hunting).

Credit: Martin Harvey/WWF-Canon

Greater Kudu *Tragelaphus strepsiceros*, one of the commoner ungulate species present in Coutada 9

Table 10

Personal characteristics of illegal hunters and buyers of bushmeat

Personal characteristics	Illegal hunters *n*=109	Bushmeat buyers *n*=76	Statistical comparisons
Male	100%	84.8%	$\chi^2 = 22.1$, *d.f.*=1, $p<0.001$
Female	0%	15.2%	
Mean age	40.9±1.2	34.7±1.8	
<20 years	1.9%	11.4%	
20–29	17.1%	32.9%	*d.f.*=1, F Ratio = 7.01, $p=0.009$
30–39	38.1%	25.3%	
40–49	13.3%	12.7%	
>50	29.5%	15.2%	
Living in Coutada 9?	66.7%	93.8%	$\chi^2 = 18.8$, *d.f.*=1, $p<0.001$
Years living in Coutada 9	23.5±2.2	13.8±1.8	*d.f.*=1, F Ratio = 8.31, $p=0.004$
Mean education			
Position of responsibility within community?	38.9%	26.3%	$\chi^2 = 1.2$, *d.f.*=1, $p=0.267$
Employed	1.8%	14.1%	$\chi^2 = 11.$, *d.f.*=1, $p<0.001$
Mean total monthly income (USD)	59.2 ± 10.2	90.4 ± 15.0	*d.f.*=1, F Ratio = 3.00, $p=0.084$
Had to skip meals during last 12 months	79.8%	53.9%	$\chi^2 = 14.5$, *d.f.*=1, $p<0.001$
Children had to skip meals during last year?	65.8%	57.5%	$\chi^2 = 0.79$, *d.f.*=1, $p=0.371$
Owning livestock?	27.5%	22.3%	$\chi^2 = 0.65$, *d.f.*=1, $p=0.425$
# livestock owned	2.22±0.5	3.78±0.9	
# Cattle	0.12±0.1	0.11±0.05	
# Sheep/goats	2.13±0.47	3.7±0.8	*d.f.*=1, F Ratio = 3.10, $p=0.080$
# Bushpigs	0	0.28±0.1	
# Domestic pigs	0.18±0.1	0.21±0.22	
Mean # of livestock sold during last year	0.61±0.17	0.99±0.24	*d.f.*=1, F Ratio = 1.68, $p=0.196$
Mean # of livestock slaughtered during last year	0.49±0.17	0.55±0.15	*d.f.*=1, F Ratio = 1.44, $p=0.232$
Mean # of people in the household	10.4	11.1±0.65	*d.f.*=1, F Ratio = 0.01, $p=0.932$
Mean # of children at school	3.9±0.4	3.72±0.33	*d.f.*=1, F Ratio = 0.02, $p=0.887$
Mean # of children dropped out of school in past year	0.37±0.1	0.80±0.16	*d.f.*=1, F Ratio = 7.14, $p=0.008$

Reasons for hunting in Coutada 9

Most (94.7%) of hunters hunt just for meat to eat or sell, the remainder sometimes hunt to obtain body parts for traditional medicine (3.9%), to obtain skins (2.1%), or Lion hearts (1.0%). Illegal hunters sell 58.0% of the bushmeat they obtain (**Table 11**). When trading meat, 38.9% always trade for cash, 48.9% sometimes sell meat for cash and sometimes barter for goods, and the remainder always barter meat for goods. When bartering bushmeat, 70.6% trade for maize, 29.4% trade for sorghum and 1.5% trade for cooking oil.

Illegal hunters obtain a mean price of USD1.17 ± 0.03/kg of bushmeat. When bartering, a mean of 2.91 ± 0.18 kg of maize is obtained per kilogramme of bushmeat. Fifty-two percent (51.6%) of hunters felt that the price of bushmeat varied with the species being sold: 76.0% felt that Greater Kudu were more expensive than other types, while corresponding percentages for other species were: Common Warthog (26.0%), Oribi (8.0%), African Buffalo (8.0%) and Sable Antelope (8.0%). The species most commonly considered to be among the cheapest were: Common Warthog (50.0%); Vervet Monkey *Chlorocebus* (*Cercopithecus) aethiops* (31.2%); Greater Cane Rat (22.1%); and Bushpig *Potamochoerus larvatus* (8.3%).

Table 11

Personal characteristics of illegal hunters operating in Coutada 9 and those operating in Savé Valley Conservancy (Zimbabwe), 250 km to the south-west (Lindsey *et al.*, 2009)

Personal characteristics	Mozambique *n*=109	Zimbabwe *n*=122	Statistical comparisons
Male	100%	100%	
Female	0%	0%	
Mean age	40.9±1.2	33.8±1.2	*d.f.*=1, F Ratio = 15.5, $p<0.001$
Mean years of education	3.22±0.10	7.49±0.20	*d.f*=1, F Ratio = 153, $p<0.001$
Employed	1.8%	14.2%	$\chi^2 = 13.4$, *d.f.*=1, $p=0.003$
Mean total monthly income (USD)	59.2 ± 10.2	10.4±5.1	*d.f.*=1, F Ratio = 35.9, $p<0.001$
Had to skip meals during last year?	79.8%	93.4%	$\chi^2 = 10.6$, *d.f.*=1, $p<0.001$
Children had to skip meals during last year?	65.8%	74.2%	$\chi^2 = 1.68$, *d.f.*=1, $p=0.195$
Owning livestock?	27.5%	63.8%	$\chi^2 = 31.2$, *d.f.*=1, $p<0.001$
# livestock owned	2.22±0.5	5.07±0.59	*d.f.*=1, F Ratio = 10.6, $p<0.001$
# of children dropped out of school in last year	0.37±0.1	0.46±0.06	*d.f.*=1, F Ratio = 1.13, $p=0.289$
Receive benefits from wildlife?	48.6%	3.91%	$\chi^2=70.5$, *d.f.*=1, $p<0.001$
Incur costs from wildlife?	63.5%	72.7%	$\chi^2=2.1$, *d.f.*=1, $p=0.146$
Proportion of bushmeat sold	58.0%	74.4%	*d.f.*=1, F Ratio = 35.3, $p<0.001$
Ever barter meat for other goods?	62.1%	71.1%	$\chi^2 = 1.92$, *d.f.*=1, $p=0.158$
Price of bushmeat per kg	USD1.17 ± 0.03	USD0.31 ± 0.02	*d.f.*=1, F Ratio = 457, $p<0.001$
Income from bushmeat	USD26.4 ± 2.5	USD7.83 ± 2.0	*d.f.*=1, F Ratio = 34.1, $p<0.001$
% of income from bushmeat	44.5%	75.3%	
Receive assistance from workers?*	0.98%	46.9%	$\chi^2=77.9$, *d.f.*=1, $p<0.001$
Ever been caught?	51.6%	59.2%	$\chi^2=1.44$, *d.f.*=1, $p=0.230$
% considering risk of capture as being high**	91.7%	41.1%	$\chi^2=40.7$, *d.f.*=1, $p<0.001$

Notes: *E.g. through information, provision of permission to hunt following payment of a bribe, collusion, etc.
**When using the most frequently employed hunting technique—gin traps in Mozambique, and snares in Zimbabwe.

Illegal hunting methods

Illegal hunters most commonly use gin traps (44.9% of respondents), followed by dogs (29.9%), firearms (18.7%), snares (11.2%), spears (10.3%), rat traps (7.5%) and bows and arrows (2.8%), to hunt in Coutada 9. Illegal hunters considered that hunting with firearms was the most risky method in terms of the likelihood of being caught by game scouts (**Table 12**), but differences in perceived risk were not statistically significant ($\chi^2 = 5.11$, *d.f.*=1, p=0.163). The hunters typically travel to their hunting areas on foot (88.7%) or by bicycle (6.5%), while some travelled sometimes by bicycle, sometimes on foot (3.2%), and rarely did any use motorized transport (1.6%). Hunters reported that they travelled for a mean of 5.66 ± 1.6 hours from their homes to the areas in which they hunted, for an estimated distance of 15.7 ± 1.7 kilometres.

Table 12

Aspects of various hunting techniques used by illegal hunters in Coutada 9

Hunting method	Mean # of people on hunting trip	Mean # of traps/snares /dogs	Perceived risk of being caught			Reasons for the method being perceived as risky
			High	Medium	Low	
Gin traps	2.51 ± 0.14	4.14 ± 0.44	91.6%	1.7%	6.7%	Effective anti-poaching efforts (100%)
Dogs	2.68 ± 0.16	4.26 ± 0.36	86.8%	0%	10.5%	Effective anti-poaching efforts (27.8%); due to the need to burn before hunting to reduce grass cover (27.8%); noise (11.1%)
Firearms	2.67 ± 0.42	n/a	100%	0%	0%	Effective anti-poaching effort (71.4%); noise (35.7%)
Snares	2.33 ± 0.5	5.81 ± 1.0	88.8%	0%	11.2%	Effective anti-poaching effort

Hunting with gin traps

The most common reasons given for hunting with gin traps were: because they were silent (27.2% of respondents who use them); they were easy to use (18.2%); they were the only hunting tools available (12.1%); they were efficient (9.1%); and they could be left, enabling the hunter to do other things while waiting for an animal to be caught (9.1%). Illegal hunters typically left gin traps in the bush for a period of 3.5 ± 0.59 days per hunting trip (range 1–7).

Hunters typically said they bought their gin traps (86.7%), though some made them (6.6%), took materials to a local blacksmith for him to make them (1.6%), or stole traps from other hunters (1.6%). Illegal hunters indicated that the mean price of a gin trap was USD8.58 ± 0.87. Hunters who provided a range of prices gave a mean range of USD6.98 ± 0.61–12.5 ± 0.97 per trap (depending on the size and quality). Eighty-four percent (83.7%) of illegal hunters felt that the price of gin traps had changed during the last year, of which 78.3% felt the price had increased from a mean of USD6.73 ± 0.49 a year ago to a mean of USD8.58 ± 0.87 presently (27.8% change, c.f. an inflation rate of 3.5% for 2009 in Mozambique, (CIA, 2010).

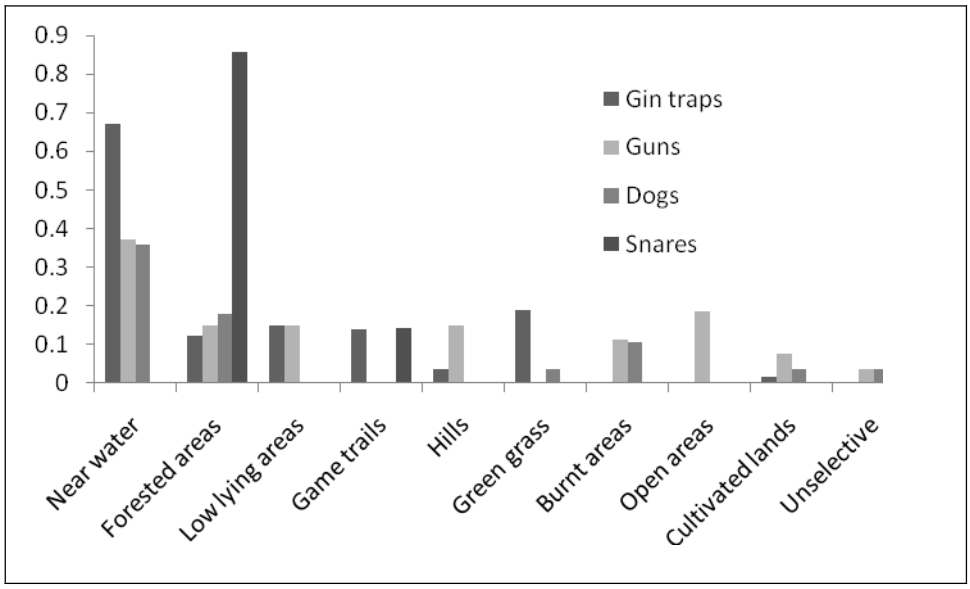
Explanations given by illegal hunters for the increased price of gin traps were: high demand (35.0%); repeated price increases from blacksmiths (15.0%); scarcity of traps (harder to come by) (15.0%); an increase in the number of people buying them (10.0%); and the increased price of bushmeat (10.0%).

Hunters felt that the people they bought gin traps from made them from old car leaf springs (95.6%) and, in a minority of cases, that they bought them from other blacksmiths and re-sold (4.1%).

Illegal hunters using gin traps typically operated in groups of 2.51 ± 0.14 people (**Table 12**). The mean number of gin traps set per illegal hunter per hunting trip was 4.14 ± 0.44 (1–15.3%, 2–2.7%, 3–15.3%, 4–10.2%, 5–16.9%, >5–18.6%). Illegal hunters spaced their traps a mean of 748 ± 162 metres apart (<100 m—32.6%; 100–500 m—21.7%; 501 m–999 m—8.7%; >1 km—41.3%). The most common locations chosen for placing gin traps by illegal hunters were: near water (67.2%); in green flushes of grass (19.0%, such as those occurring after early rains or burning); along game trails (13.8%); or in heavily forested areas (12.1%) (**Figure 10**).

Figure 10

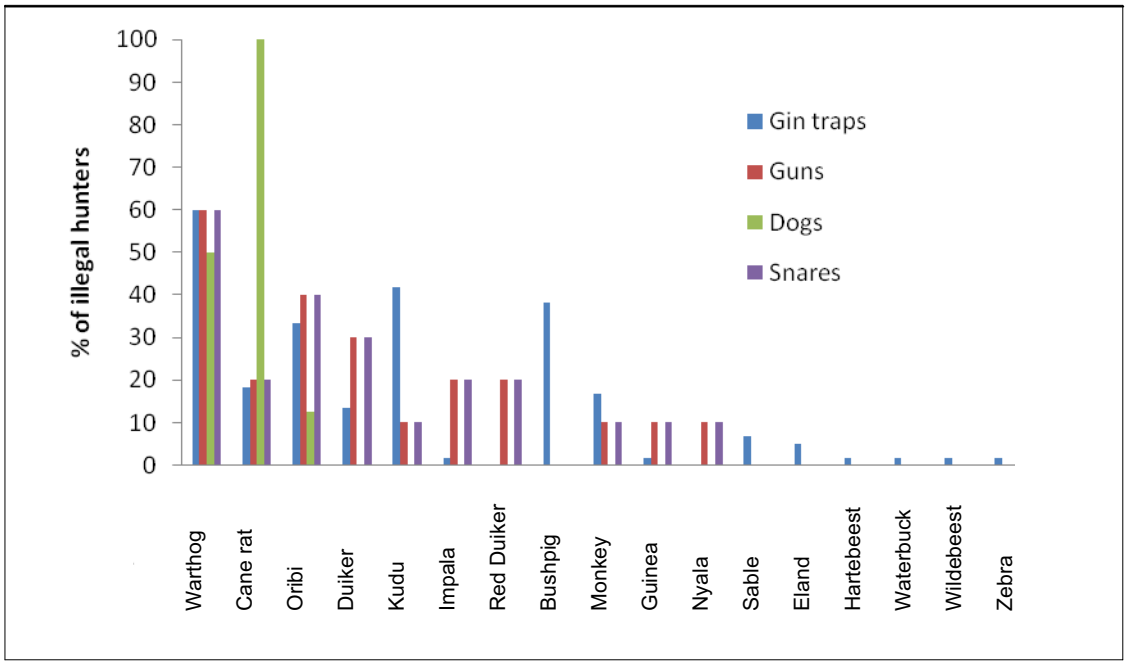
Habitat selected by illegal hunters when hunting with various methods



The species most commonly targeted by illegal hunters with gin traps were Common Warthog, Greater Kudu, Bushpig and Oribi, and the species most commonly caught in gin traps were Common Warthog, Greater Kudu, Oribi and Common Duiker (**Figure 11**). Only 3.3% of illegal hunters said that they had ever caught buffalo in gin traps in Coutada 9. Illegal hunters estimated that they typically caught 4.19 ± 0.29 animals per 10 gin traps, per hunting trip.

Figure 11

The species targeted by illegal hunters using various methods



The species that illegal hunters most commonly indicated that they would not take (i.e. if they caught them) were: Spotted Hyaena (67.3% of respondents); Lion (60.2%); and Leopard (53.1%). One quarter (24.4%) of respondents indicated that they would take any species caught.

Hunting with dogs

When hunting with dogs, illegal hunters typically operate in groups of 2.68 ± 0.16 people and take 4.26 ± 0.36 dogs. Illegal hunters using dogs select the following habitat types: near rivers (37.0%); open areas with little grass (18.5%); forested or mountainous areas (both 14.8%); and burnt areas (11.1%). They frequently burn areas prior to hunting to stimulate grass growth, to attract wildlife, to enable their dogs to run freely and to concentrate cane rats in remaining patches of vegetation (see photo on following page). The hunters felt that the practice of burning made their location more predictable to game scouts and thus increased the risk of being caught, however (**Table 12**).

The species most commonly targeted when hunting with dogs were: Greater Cane Rat (100%); Common Warthog (37.5%); Oribi (12.5%) and Vervet Monkeys (12.5%). Illegal hunters estimated that they caught a mean of 33.5 ± 5.8 animals per 10 hunting trips when using dogs. Most illegal hunters thought that the risk of being caught when hunting with dogs was high (86.8%)—because of the necessity to burn areas before hunting, which indicated to scouts where hunters would be operating (in 27.8% of cases); because of effective anti-poaching effort (27.8% of cases); and because of the noise dogs make when hunting (11.1% of cases).

Credit: P. Lindsey

Illegal hunters frequently burn areas prior to hunting, to stimulate grass growth to attract wildlife, to enable their dogs to run freely, and to concentrate cane rats in remaining patches of vegetation

Hunting with firearms

Illegal hunters who use firearms to hunt most commonly used muzzle loaders (96.5%), but also AK47 assault rifles (4.3%). They typically operate in groups of 2.67 ± 0.42 people. Firearms were most commonly used to target Greater Kudu and Common Warthog (**Figure 11**).

Sixty-eight (68.1%) of hunters purchased their firearms, most commonly from local blacksmiths (80.0% of those who purchased firearms), and in some cases decades ago, during colonial times (9.1%). Twenty-three percent (22.7%) of respondents had obtained firearms from their father or grandfather and 13.6% had obtained their firearm during the civil war. Firearms were purchased for a mean price of USD18.8 ± 8.47. When using muzzle-loaders, all illegal hunters used pieces of iron as ammunition. Ammunition was most commonly sourced locally (37.5%), from Zimbabwe (18.8%), by making it (12.5%), and by obtaining it from blacksmiths (12.5%).

Hunting with snares

Illegal hunters using snares made them from: steel wire (50.0%); wire from vehicles (25.0%); from tree bark (12.5%) or from animal skins (12.5%). Hunters using wire for snares typically purchased it (63.6%) or found it locally (27.2%). Hunters typically leave snares in the bush for 2.73 ± 0.42 days. Hunters estimated

that they caught 2.33 ± 0.49 animals/10 snare sets. The species most commonly targeted by illegal hunters using snares were: Common Warthog (60.0%); Oribi (40.0%); and Common Duiker (30.0%).

Bushmeat sale

Most hunters transported bushmeat on foot (97.1%), the remainder use bicycles. Illegal hunters were found to sell a mean of 58.0% ± 2.7 of the bushmeat that they obtained and earn a mean of USD26.4 ± 2.5 per month from selling such meat (**Table 11**). They typically used money obtained from the sale of bushmeat to pay for: food (55.2%); clothes (51.7%); soap (21.8%); hospital fees (18.3%); and school fees (16.1%). Only 2.0% of hunters said that they ever lied to buyers about the species of bushmeat on sale. They reported that bushmeat was mostly sold fresh (i.e. wet) (44.4%); sometimes wet and sometimes dried (39.4%); and dried (16.2%).

Credit: C. Bento

Bushmeat for sale near Coutada 9

Illegal hunters took a mean of 5.44 ± 1.0 days to sell their bushmeat. All illegal hunters interviewed sold bushmeat locally, in local communities (49.4%); to people living close to their home (29.2%); in nearby urban areas (20.2%); and along the main roads (6.7%). However, hunters felt that their buyers were from a variety of locations, including urban centres up to ~230 km away (**Table 13**, **Figure 12**). When asked what the profession was of the buyers of bushmeat, illegal hunters provided the following answers: everyone (57.1%); business people (17.5%); teachers (13.2%); police (9.8%); nurses (9.8%) and government officials (2.2%).

Table 13

Provenance of buyers of bushmeat sold by illegal hunters, according to the hunters, and locations where middlemen sell their meat

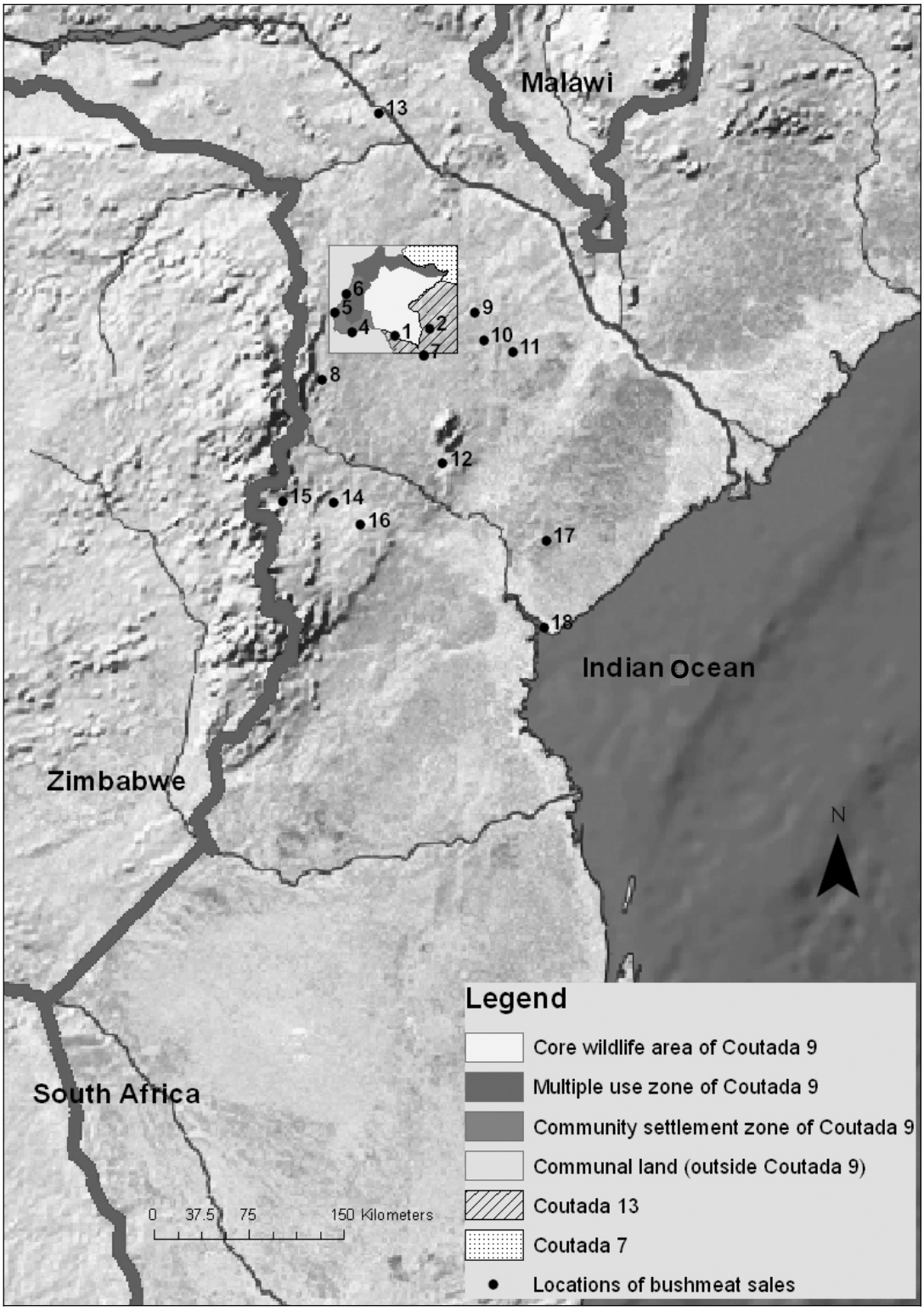
Buyers from	% of illegal hunters *	% of middlemen*	km from Coutada 9
Cuerva Peregosa	0	4.5	Within Coutada 9
Danda	0	9.1	Adjacent
Nhassacara	2.1	0	Adjacent
Guro	11.6	0	Adjacent
Local communities	54.7	0	Varied
Mussangadzi	1.1	4.5	7
Macossa	9.5	40.9	8
Barue	2.1	0	24
Catandica	23.2	63.4	26
Canxixe	2.1	9.1	36
Tucuta	0	4.5	42
Maringue	7.4	9.1	52
Gorongosa	3.2	0	100
Tete	4.2	0	122
Vanduzi	1.1	0	128
Manica	2.1	0	134
Chimoio	24.2	0	138
Sofala	2.1	0	175
Beira	6.3	0	233

Note: * Some respondents provided more than one answer and so column totals do not equal 100%

Breeding herd of Sable Antelope *Hippotragus niger*

Figure 12

Areas where bushmeat is sold and where illegal hunters and middlemen believe the buyers of bushmeat to be from



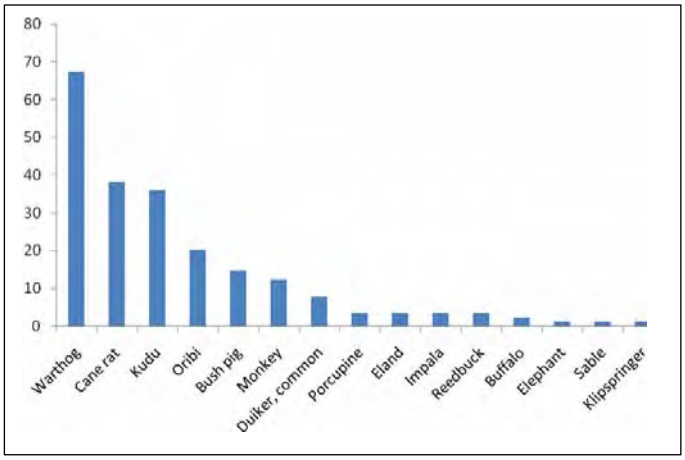
Note: 1=Cuerva Peregosa; 2=Mussangadzi; 3=Macossa; 4=Dunda; 5=Nhassacara; 6=Guro; 7=Barue; 8=Catandica; 9=Canxixe; 10=Tucuta; 11=Maringue; 12=Gorongosa; 13=Tete; 14=Vanduzi; 15=Manica; 16=Chimoio; 17=Sofala; 18=Beira

Hunting history and future intentions

Illegal hunters claimed that they had hunted: <10 times—40.2%; 11–20 times—19.5%; 21–50 times—18.4%; 51–100 times—5.7%; >100 times—16.1% in Coutada 9 previously. The species most commonly caught by illegal hunters during the last 12 months were: Common Warthog, Greater Kudu, Greater Cane Rat and Oribi (**Figure 13**). Illegal hunters (*n*=89) estimated that they had killed 2990 animals during the last year (33.5 animals per hunter, per year) (**Table 14**). Though for some species these estimates may be exaggerated (e.g. hunters claimed to have killed more reedbuck than are thought to exist in the area), they nonetheless stress that the illegal hunting data are likely greatly to under-estimate losses to illegal hunters.

Figure 13

Percentage of illegal hunters claiming to have caught various species during the last year



The illegal hunters participating in this study started hunting a mean of 10.4 ± 1.1 years ago, at an average age of 28.1 ± 1.4 years of age. Forty-three percent (42.9%) of respondents had been caught hunting in Coutada 9 by game scouts, a mean of 1.5 ± 0.1 times. Eighty-percent of illegal hunters claimed that they would not hunt in Coutada 9 again, the most common reasons being: the effective anti-poaching security (51.6%); the difficulty of hunting (22.6%); and their age (9.7%). Respondents who indicated that they did plan to hunt again gave the following reasons: the need for money (40.0%) or food (26.7%); and the difficulty of changing the habit of hunting (13.3%). Ninety-percent (90.2%) of illegal hunters indicated that they would stop hunting if the *coutada* management were to assist them in the development of a honey production and marketing project.

Table 14

Numbers of animals that illegal hunters (*n*=89) claimed to have killed during the past year

Species	Number killed
Greater Cane Rat	1280
Common Warthog	484
Greater Kudu	355
Oribi	296
Southern Reedbuck	202
Bushpig	115
Eland	108
Monkey	66
African Buffalo	32
Impala	22
Duiker	17
Klipspringer	5
Porcupine *Hystrix africaaustralis*	3
Sable	2
Impala	2
African Elephant	1

Illegal hunters suggested that, to reduce illegal hunting, the management of Coutada 9 should: provide more employment (28.0%); establish community projects (14.0%); or promote livestock production (14.0%) (**Table 15**). They also suggested that the government should provide more employment, give communities money, or develop community projects to reduce illegal hunting (**Table 16**).

Table 15

Suggested interventions by Coutada 9 management to reduce illegal hunting (ranked according to the mean percentage of respondents suggesting them)

	Game scouts	Illegal hunters	Buyers	Middlemen
Provide more anti-poaching security	54.5%	8.0%	28.3%	8.7%
Provide more employment	4.5%	28.0%	11.7%	17.4%
Establish community projects	0.0%	14.0%	11.7%	30.4%
Give communities meat	22.7%	9.0%	6.7%	0.0%
Give communities money	0.0%	3.0%	8.3%	26.1%
Establish a community hunting area Coutada 9	0.0%	7.0%	3.3%	13.0%
Promote livestock production	0.0%	14.0%	5.0%	4.3%
Work with/assist communities	0.0%	0.0%	0.0%	17.4%
Fence the *coutada*	9.1%	1.4%	5.0%	0.0%
Build schools	0.0%	6.0%	0.0%	8.7%
Zoning the *coutada* properly	4.5%	2.0%	0.0%	4.3%
Sell cheap meat to communities	4.5%	5.0%	0.0%	0.0%
Build hospitals	0.0%	5.0%	0.0%	4.3%
Build water pumps	0.0%	8.0%	0.0%	0.0%
Move people out of the *coutada*	0.0%	0.0%	1.7%	4.3%

Table 16

Suggested interventions by government to reduce illegal hunting (ranked according to the mean percentage of respondents suggesting them)

	Game scouts	Illegal hunters	Buyers	Middlemen
Provide more employment	10.0%	24.4%	33.3%	5.5%
Develop community projects	0.0%	18.6%	3.9%	27.7%
Promote livestock production	0.0%	10.5%	9.8%	22.2%
Give communities money	10.0%	17.4%	5.9%	5.5%
Strengthen penal system	35.0%	0.0%	0.0%	0.0%
Educate communities	10.0%	2.3%	11.8%	0.0%
Anti-poaching	0.0%	3.5%	13.7%	0.0%
Promote agricultural development	10.0%	7.0%	0.0%	0.0%
Zoning the *coutada* properly	10.0%	0.0%	0.0%	0.0%
Give communities bee hives	0.0%	9.3%	0.0%	0.0%
Build hospitals	0.0%	9.3%	0.0%	0.0%
Provide community hunting area in Coutada 9	0.0%	0.0%	2.0%	5.5%
Promote collaboration between operators and communities	0.0%	1.2%	0.0%	5.5%
Demonstrate benefits from the *coutada*	0.0%	0.0%	5.9%	0.0%
Move people out of the *coutada*	0.0%	0.0%	5.9%	0.0%
Sell meat to communities	5.0%	0.0%	0.0%	0.0%
Build schools	0.0%	4.7%	0.0%	0.0%
Give food to communities	0.0%	4.7%	0.0%	0.0%
Fence the *coutada*	0.0%	0.0%	3.9%	0.0%
Work with/assist communities	0.0%	0.0%	0.0%	0.0%

Perspectives on hunting and conservation

Most (76.2%) of illegal hunters felt that illegal hunting had caused wildlife populations to decline in Coutada 9 during the last 10 years. Illegal hunters felt that a number of species, such as African Buffalo, rhinoceroses, Plains Zebra *Equus quagga* and African Elephant, used to be easy to hunt but had now become difficult to hunt (**Figure 14**). They felt that some species were still declining, including Greater Kudu, Common Warthog and African Buffalo (**Figure 14**).

Almost 50% of illegal hunters receive benefits from wildlife in Coutada 9 and 63.5% felt that they incurred costs (**Table 17**). Ninety-percent of illegal hunters (89.7%) were supportive of the zoning plan for Coutada 9 developed by the *coutada* management.

Figure 14

Species that illegal hunters consider to be declining, and species that they feel used to be easy to hunt, but that have now become difficult to hunt

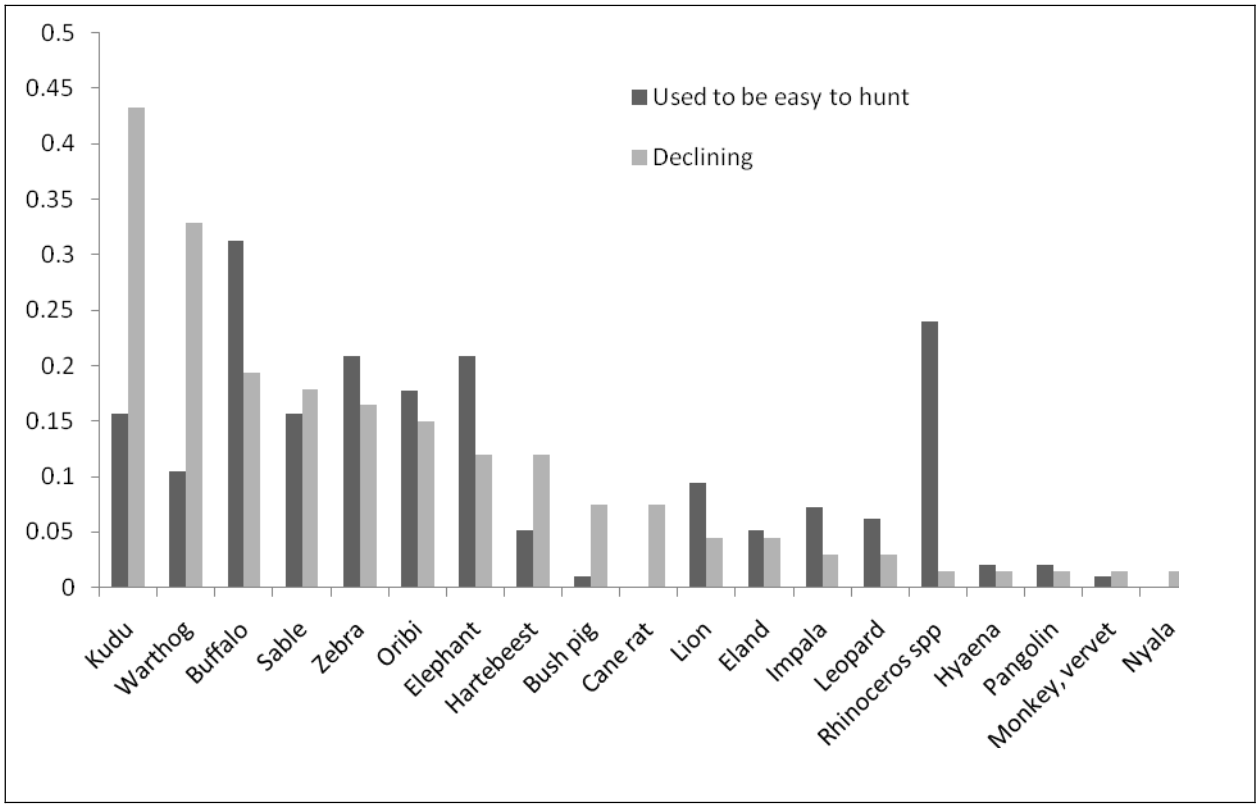


Table 17

Costs and benefits incurred by illegal hunters and buyers of bushmeat from wildlife in Coutada 9

	Hunters	Buyers
Receive any benefits $\chi^2 = 2.53$, *d.f.*=1, p=0.109	48.6%	69.6%
Wood for fuel/building	1.8%	1.3%
Hides	1.8%	1.3%
Bushmeat	58.9%	32.9%
Bushmeat from safari hunting	0%	3.8%
Honey	7.1%	0%
Cash from safari hunting	32.1%	17.8%
Pump installed by Coutada 9 managers	0%	2.5%
Clinic built by Coutada 9 managers	1.8%	4.0%
School built by Coutada 9 managers	0%	10.1%
Community committee established to work with Coutada 9	0%	2.5%
Employment	1.8%	1.3%
Incur any costs $\chi^2 = 0.81$, *d.f.*=1, p=0.365	63.5%	38.9%
Crop damage by wildlife	55.2%	37.5%
Risk to human life from wildlife	1.7%	1.4%
Ban on hunting in Coutada 9	8.6%	0%

Illegal hunters and anti-poaching security

Only 1.0% of illegal hunters indicated that they ever received assistance with illegal hunting from employees working in Coutada 9. Ninety-two (92.4%) of illegal hunters felt that the risk of being caught by game scouts when hunting was higher than five years ago, the result of improved anti-poaching effort (100%).

Comparison with illegal hunters in Zimbabwe

Relative to illegal hunters in Zimbabwe, those in Mozambique were wealthier and more food-secure, though they had fewer livestock (**Table 11**). A greater proportion of Mozambican hunters receive benefits from the neighbouring wildlife area and a lower proportion incurs costs from the wildlife area than those in Zimbabwe (**Table 11**). Mozambican hunters sell a smaller proportion of the meat that they obtain, and income from bushmeat provides a lower proportion of their total income than for Zimbabwean hunters (**Table 11**). A similar proportion of Mozambican and Zimbabwean hunters had been caught by game scouts before, though the perceived risk of being captured was higher among Mozambican hunters (**Table 10**). The degree of collusion between workers and illegal hunters in the Zimbabwean study site was higher than in Mozambique (**Table 11**).

Middlemen survey

Key findings

- Middlemen buy bushmeat from illegal hunters who hunt in Coutada 9, primarily to re-sell.
- Most bushmeat is re-sold in communities and urban centres within 50 km of Coutada 9.
- Most middlemen (88.5%) believe that the supply of bushmeat from Coutada 9 is declining due to increased anti-poaching security.

- Most illegal hunters transport bushmeat on foot from the bush, but middlemen then typically transport it using bicycles.
- Bushmeat is not sold openly because of fear of apprehension.
- Earnings from selling bushmeat are most commonly used to buy food or clothes.
- Middlemen suggested that, to reduce illegal hunting, the hunting operators in Coutada 9 and the government should assist the communities to develop income-generating projects.

Middlemen profiles

Middlemen were an average of 34.3 ± 3.1 years old and started selling bushmeat an average of 7.7 ± 1.5 years ago.

Purchase of bushmeat

Middlemen purchased bushmeat a mean of 2.44 ± 0.22 times per week and bought a mean of 30.9 ± 4.5 kg at once. Middlemen typically bought bushmeat direct from illegal hunters, but 7.7% occasionally also bought meat from other middlemen. Middlemen purchased meat from a mean of 5.5 ± 0.63 different hunters. All of the middlemen believed that the bushmeat they bought was from the *coutada*. Most middlemen (80.8%) purchased bushmeat using money, whereas the remainder bartered with goods. Middlemen paid an average of USD1.28 ± 0.11 per kilogramme for bushmeat. Middlemen most commonly purchased meat of: Greater Kudu (95.8% of respondents); Common Warthog (79.2%); Common Duiker (25.0%); Sable Antelope (16.7%); Oribi (4.1%) and Greater Cane Rat (4.1%). Middlemen were found to sell an average of 61.7 ± 7.5% of bushmeat that they purchased.

Most middlemen (88.5%) felt that the supply of bushmeat from the *coutadas* was declining, and all attributed the trend to increased anti-poaching.

Sale of bushmeat

When asked why their customers liked to obtain bushmeat, the most common responses were: out of habit (33.3%); because of its taste (20.8%); to add variety to their diet (16.7%); and because of the lack of domestic stock (8.3%). Only 4.2% indicated that their clientele liked bushmeat because it was cheap.

Middlemen sell bushmeat in villages and towns within 50 km of Coutada 9 (**Table 13**; **Figure 12**). Most (61.5%) transport bushmeat using bicycles, some use motor vehicles (46.2%), and a few transport meat by foot (3.8%). All respondents indicated that they hid bushmeat during transport, either in bags (80% of respondents) or by travelling with bushmeat at night (15.0%). Only 11.5% of respondents indicated that they had been arrested for transporting bushmeat, resulting in a fine (3.8%), confiscation of the meat (3.8%), or no punishment (3.8%). Only 11.5% of middlemen sold bushmeat at markets, the remainder selling their product at buyers' houses (88.8%). None of the middlemen interviewed said that they sold bushmeat openly, owing to fear of apprehension. Middlemen were aware of a mean of 8.3 ± 2.1 other buyers and sellers of bushmeat. Middlemen earned a mean of USD31.3 ± 7.2/month from selling bushmeat, of which an average of 42.8 ± 4.5% (USD13.4) was profit. Middlemen most commonly used earnings from the sale of bushmeat to buy: food (50.0%); clothes (41.2%); school education (fees) (33.3%) and soap (25.0%).

Only 19.2% of middlemen had sources of income other than the sale of bushmeat, mostly (60%) farming or informal trading (40.0%). None of the middlemen interviewed sold wildlife body parts other than bushmeat.

Credit: C. Bento

Hidden bushmeat being transported by bicycle

When asked what interventions the management of Coutada 9 or government could make to reduce illegal hunting, the most common suggestion by middlemen was assistance to communities in the development of projects (**Tables 14** and **15**).

Buyer survey

Key findings

- Buyers are typically wealthier and more food-secure than illegal hunters.
- Nonetheless, 53.9% of buyers indicated that they had skipped or reduced meals during the past year.
- Buyers consume bushmeat more frequently than other forms of protein.
- The price of bushmeat is highest when the levels of supply are lowest.
- The supply of bushmeat is greatest in the late dry season, partially overlapping with the period when food shortages are most severe.
- However, food shortages are also severe in January and February when the supply of bushmeat is low, indicating that the supply of bushmeat is driven by factors other than demand, such as seasonal patterns in the ease of hunting.
- A greater proportion of buyers benefit from wildlife within Coutada 9 than incur costs.

- Most (71.9%) buyers feel that the supply of bushmeat from Coutada 9 has declined during the last five years.
- The price paid for bushmeat (USD1.50 ± 0.1/kg) is similar to that for meat from domestic stock—c.f. beef—US2.29 ± 0.28/kg; chicken—USD1.91/kg; goat—USD1.54 ± 0.07/kg; and pork—USD1.22 ± 0.12/kg.
- Bushmeat from large species (African Buffalo and African Elephant) is less frequently sold today than during the civil war.
- The large majority of buyers (97.4%) are supportive of the zoning plan for Coutada 9.
- Buyers most commonly suggested that illegal hunting could be reduced through elevated anti-poaching security, through the provision of employment, and support from government and hunting operators for community projects.

Buyer profiles

Buyers were typically male, in their thirties, and were generally wealthier and more food-secure than illegal hunters (**Table 9**). Buyers reported that the months they typically had most income were July (33.3%); August (40.3%); September (47.2%); and October (36.1%).

Fifty-four percent of buyers were forced to skip meals on occasion due to shortages of food (including because of a shortage of money to buy food). Food shortages were reported to be most common during the months of November (66.6% of respondents experiencing food shortages), December (64.3%), January (52.3%) and October (50.0%). September, October and November were the three months when buyers perceived there was most bushmeat available, overlapping with the period when food shortages were most acute and the driest months (**Figures 15**, **16**). However, food shortages are also common during January and February, during which time the supply of bushmeat is lower (**Figure 15**). This suggests that the supply of bushmeat is dictated by other factors (e.g. the ease of hunting) in addition to demand.

Figure 15

Buyers' perceptions of when most bushmeat was available, and the months during which they indicated that they most commonly had to skip meals

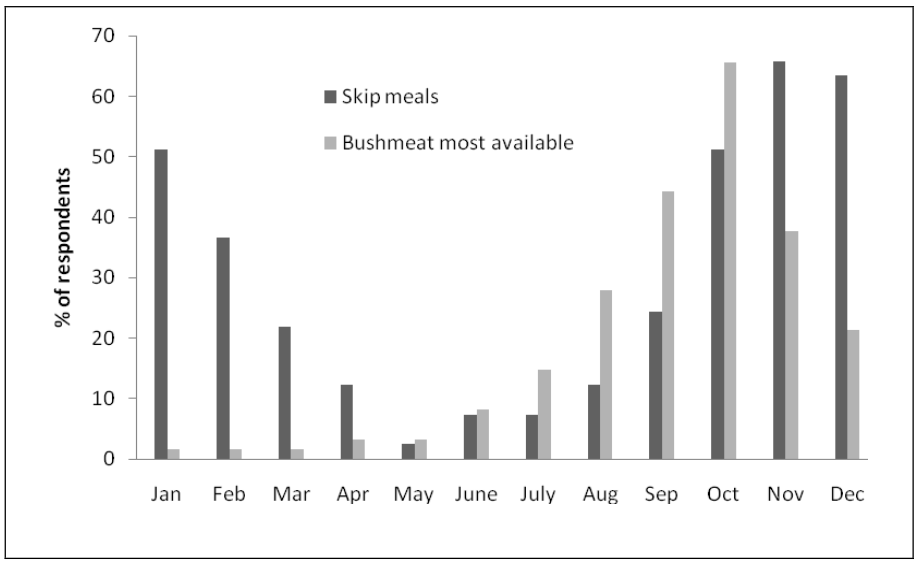
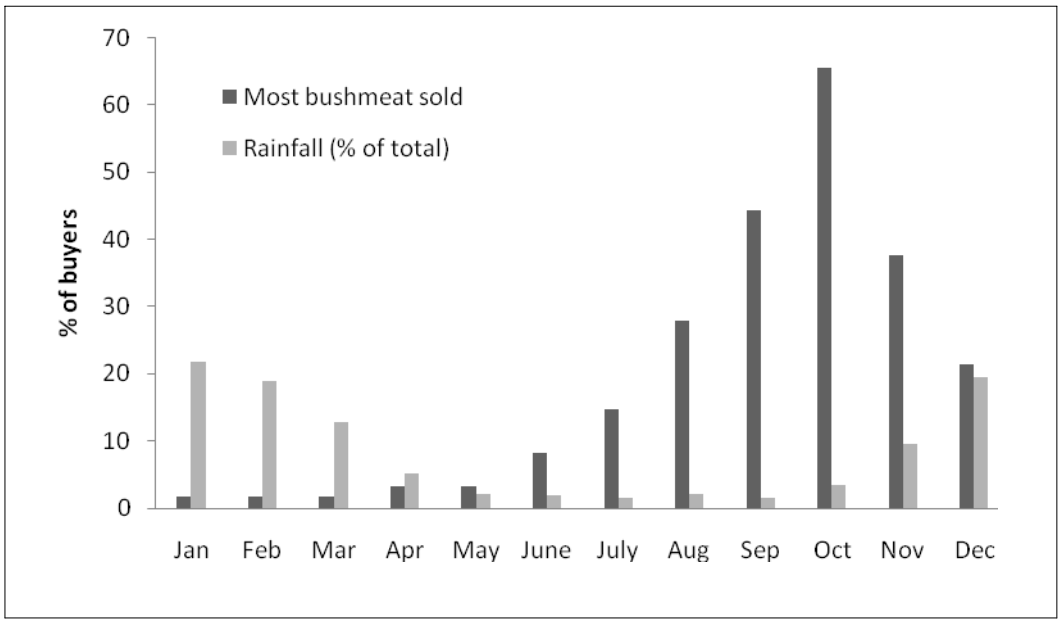


Figure 16

Buyers' perceptions of the months in which most bushmeat was available and mean monthly rainfall for Chimoio (nearest town for which rainfall data were available, ~144 km to the south-west)



Source: http://www.worldclimate.com/cgi-bin/data.pl?ref=S19E033+2100+67295W

More buyers had eaten bushmeat than other forms of protein during the 24 hours prior to interview (bushmeat—27.5%, fish—7.5%, chicken—5.0%, and goat—5.0%). When confronted with food shortages, buyers typically: worked for money or food (52.0%); found edible roots (24.0%); sold products (8.0%); sold livestock (6.0%); lent food (6.0%) or went hunting (4.0%).

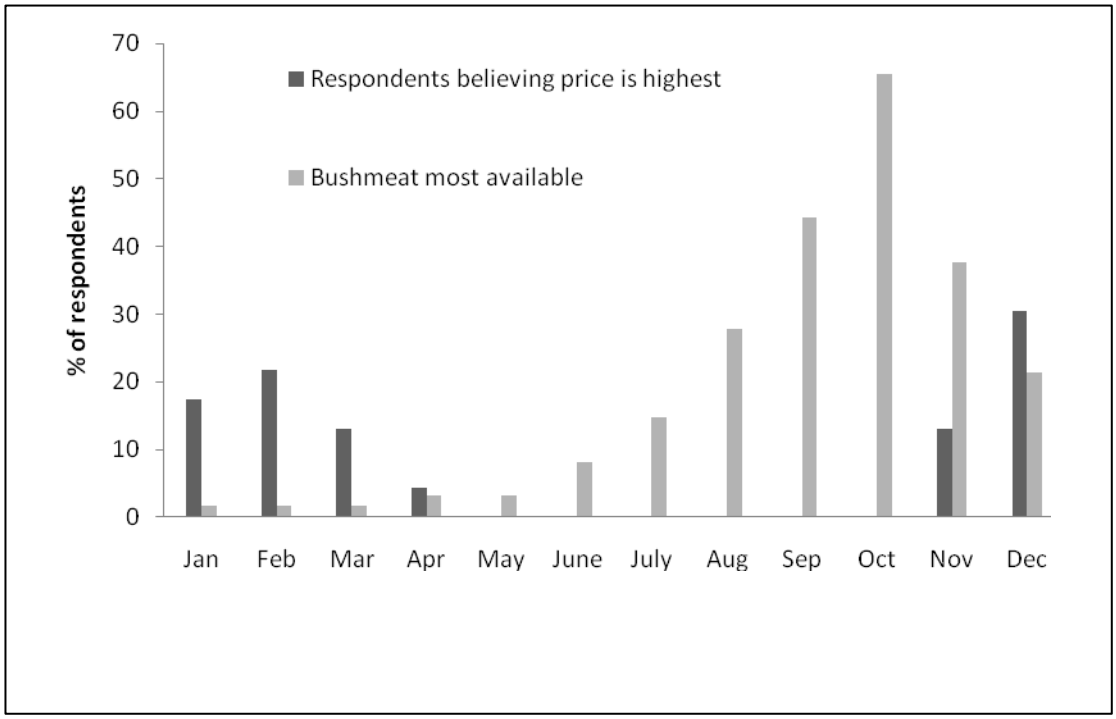
Bushmeat purchases

All buyers interviewed felt that the bushmeat they bought was sourced from the *coutada*. Buyers purchased bushmeat a mean of 1.66 ± 0.1 times per week, and bought a mean of 4.4 ± 3 kg, though the modal quantity purchased was one kilogramme. Forty-eight percent of respondents always purchased bushmeat with cash, 48.0% sometimes bartered and sometimes used cash, and 4.0% always bartered. The mean price that buyers paid for bushmeat was USD1.50 ± 0.1/kg, compared to US2.29 ± 0.28/kg for beef; USD1.91/kg for chicken; USD1.54 ± 0.07/kg for goat; and USD1.22 ± 0.12/kg for pork.

Ninety-six percent of buyers only ever bought animal products for consumption, the remainder occasionally bought body parts for traditional medicine. Buyers said they saw people selling bushmeat a mean of 2.23 ± 1.7 times per week. Fifty-two percent of respondents felt that the price of bushmeat varied with the time of the year, with the highest prices occurring during December (30.4% of respondents who believed the price varied), January (17.4%) and February (21.7%), corresponding to the months when less bushmeat is available (**Figure 17**).

Figure 17

Months when most bushmeat was available, according to respondents, and the price highest



Seventy-one percent of buyers felt that the quantity of bushmeat on sale had declined during the last five years, 25.8% felt it had increased and the remainder felt the quantities on sale had not changed. Buyers felt that the species most commonly sold were: Common Warthog (88.5% of respondents), Greater Kudu (72.1%), Bushpig (26.2%), oribi (26.2%) and Greater Cane Rat (21.3%). The most popular species of bushmeat among buyers were: Greater Kudu (59.3%), Common Warthog (28.8%), Oribi (16.9%), and Sable Antelope (8.5%). Vervet Monkey (45.1% of respondents), Spotted Hyaena (43.1%), Lion (41.2%), Bushpig (21.6%) and Cape Porcupine *Hystrix africaeaustralis* (19.6%) were the species that buyers most commonly said they would not eat.

Forty-two (42.3%) of respondents felt that the price of bushmeat varied among species. The species most commonly cited as being more expensive were Greater Kudu (according to 50% of respondents who believed the price varied), Common Warthog (13.6%) and African Buffalo (9.1%). Common Warthog (31.8%) and Bushpig (13.6%) were the species most commonly cited as being those that were less expensive.

Most buyers (65.1%) felt that the species on sale had not changed during the last five years, but the majority (65.8%) felt that the species had changed since the war. Respondents felt that meat from African Buffalo (42.8%), and African Elephant (35.7%) were sold more commonly during the war.

When asked in what form bushmeat was typically sold, 50.8% of buyers said that it was sometimes sold wet and sometimes in dried form, 36.0% said it was usually sold dry, and the remainder said that it was usually sold wet. Ninety percent (90.6%) of buyers indicated that they preferred to buy wet meat. Buyers typically

identified the type of bushmeat being sold by: the colour of the meat (39.1% of respondents); the skin of the animal (37.5%); or by relying on the seller's word (9.5%).

If caught buying bushmeat by the police or government authorities, buyers thought that they would be forced to expose the identity of the seller (38.3%), be sent to gaol (28.3%), that nothing would happen to them (26.7%), or that their meat would be confiscated (8.3%).

Perceptions of wildlife and conservation

A higher proportion of buyers reported receiving benefits from wildlife in Coutada 9 than reported incurring costs (**Table 17**). Ninety-seven percent of buyers considered wildlife to be important to them, primarily because it was a source of bushmeat (62.2%), but also because of benefits coming from the *coutada* through safari hunting (28.9%). Sixty-nine percent (69.4%) of respondents felt that illegal hunting was causing wildlife populations to decline in Mozambique.

Buyers most commonly suggested that operators could reduce illegal hunting through increased anti-poaching security, and that government could reduce illegal hunting by providing employment opportunities (**Tables 15** and **16**).

Fifty-five percent (55.1%) of buyers were aware of the zoning plan for Coutada 9 and 97.4% were in favour, because the *coutada* was for wildlife and not people (14.8%); because it would help conserve wildlife (11.1%); and because the community would get an area for hunting (11.1%). However, some respondents (11.1%) cautioned that they did not believe communities would be willing to move from the core area of the *coutada* and that the core area should be fenced.

Game scout survey

Game scouts working in Coutada 9 were a mean of 30.7 ± 1.43 years old and had worked in Coutada 9 for a mean of 5.1 ± 0.60 years. Thirty-two percent of scouts had worked as game scouts previously, all in Coutada 13. Scouts lived a mean of 3.92 ± 1.18 km from the boundary of Coutada 9, though more than half lived within or immediately adjacent to the *coutada* (52.1%).

When patrolling, scouts estimated that they saw evidence of illegal hunting (e.g. footprints, traps, sightings of illegal hunters) an average of 4.65 ± 0.64 times per week. Scouts felt that the most common methods used by illegal hunters were: firearms (75.0%); gin traps (54.2%); cane rat traps (37.5%); snares (33.3%); and spears (29.2%). Scouts felt that illegal hunting was most common during September (50.0%), October (41.7%), November (50.0%) and December (66.7%).

Scouts estimated that they caught a mean of 2.0 ± 0.38 illegal hunters per week of patrolling, most commonly by following their spoor (59.1%); by apprehending them at their camps while they dried meat (27.2%); or after seeing them in the bush and giving chase (13.6%).

Scouts felt that most illegal hunters came from: settlements immediately adjacent to Coutada 9 (52.0%); within Coutada 9 (32.0%); within five kilometres of the boundary (24.0%); five to 10 km from the boundary (28.0%); 11 to 20 km from the boundary (8.0%); 21 to 30 km from the boundary (16.0%); and from places >30 km from the boundary (20.0%).

Scouts felt that illegal hunters typically sold bushmeat to middlemen (62.5%); to middlemen and direct to end-consumers of bushmeat (25.0%); and only direct to consumers (8.8%). They felt that illegal hunters most commonly sold meat to middlemen in: Catandica (26 km from Coutada 9, 58.8%); Gurue (25 km, 23.5%); Maringue (52 km, 23.5%); Macossa (8 km, 11.7%); and Tete (122 km, 5.9%) (**Figure 12**) and most commonly sold their meat to end-consumers at: Macossa (8 km, 40.9%), Catandica (26 km, 36.3%), Guro (adjacent to Coutada 9, 18.2%), Maringue (52 km, 18.2%), and Danda (adjacent to Coutada 9, 13.6%) (**Figure 12**).

Forty-percent of scouts felt that levels of illegal hunting in Coutada 9 were declining, 52.0% felt that they were increasing and the remainder felt that pressure was constant. Eighty-eight percent (87.5%) of scouts felt that wildlife populations within Coutada 9 were increasing; the remainder felt that they are decreasing.

Some scouts had family members that they knew were involved in illegal hunting in Coutada 9 (4.0) and several were aware of staff members working for the hunting operator in Coutada 9 that were involved in illegal hunting (12.5%).

Scouts suggested several interventions that the hunting operators could make to reduce illegal hunting (e.g. improving anti-poaching security, giving meat to the communities and fencing the *coutada*) and that the government could make (strengthening the penal system relating to illegal hunting, zoning the *coutada*, and educating communities not to hunt) (**Tables 15**, **16**).

Thirty-three percent (33.3%) of scouts felt that the operators could reduce illegal hunting by collaborating more with communities. The most commonly suggested forms of engagement were through: the provision of employment (75.0%); developing agricultural projects (62.5%); zoning the *coutada* (12.5%) and giving money to communities (12.5%).

Sixty-eight percent of scouts were aware of the plan to zone Coutada 9 and 88.0% were supportive of the proposal. During comments at the end of the survey, most scouts indicated that they felt their salary was too low for the work load and risk associated with their job (63.2%). Some scouts felt that they should be paid some form of "hazard pay" to compensate for the risks involved (26.3%), others indicated that they were content in their job (10.5%) and some requested more co-operation and communication with their employers (5.3%).

Agricultural police survey

All of the agricultural police interviewed thought that bushmeat passed through their post. Those from Macossa thought that bushmeat passed through their post three times per week, whereas those from Catandica were aware of only one incident of bushmeat (an Oribi carcass) passing through and those from

the Savé River crossing (~400 km to the south of Coutada 9) felt that bushmeat passed through only once per year. The agricultural police agent from Macossa said that the species he most commonly observed passing through his post were: Oribi, Common Warthog, Greater Kudu and Common Duiker. One of the agricultural police felt that the quantities of bushmeat passing through his post had declined (because of the dissemination of fines, and the formation of community committees to conserve wildlife), whereas another felt that the quantities had increased. All the agricultural police felt that only men transported bushmeat, and that both motorized transport (trucks) and bicycles were used to transport the commodity, and all felt that people transporting bushmeat tried to conceal it. When asked in what form bushmeat was transported, the police answered: i) usually as dried meat; ii) as fresh (wet) meat over short distances and as dried meat over longer distances; and iii) as fresh meat at night and as dried meat during the day. All indicated that they confiscated any bushmeat discovered and imposed a fine on the person transporting it. All the agricultural police were aware that the illegal bushmeat trade had reduced wildlife populations in Mozambique in recent years. They suggested that, to reduce illegal bushmeat trade, livestock production should be promoted (n=2), and that the hunting laws of the country should be reviewed (n=1).

DISCUSSION

Findings from several Southern and East African nations suggest that the illegal bushmeat trade is a threat that flares up during periods of political instability, poor management of protected areas, or the exclusion of communities from the management of natural resources (Jambiya *et al.,* 2007; Lindsey *et al.,* 2009; Barnett, 1998). In Mozambique, illegal hunting was severe during the civil war, resulting in massive wildlife population declines in most protected areas and *coutadas* (Hatton, 2001). The civil war created a legacy of dependence on natural resources, including bushmeat, for survival, exacerbated by the widespread distribution of tsetse flies which largely precludes livestock production, and an over-reliance on rain-fed agriculture (Barnett, 1998). In the early 1990s, as much as 182 000–365 000 t of bushmeat was consumed annually in Mozambique, with a value of USD365–730 million (Agostini, 1993). The results of this study in the Coutada 9 area suggest that the bushmeat trade continues to provide income and food for a significant (though unknown) number of people. However, the amount of meat and money generated is a fraction of what it could be if wildlife populations were allowed to recover and if illegal harvest were replaced by legal use. The bushmeat trade in the Coutada 9 area is currently preventing rapid recovery of wildlife populations and the derivation of meaningful economic returns from WBLU.

Nature of illegal hunting

Common hunting methods for obtaining bushmeat in Africa include the use of cable snares, firearms (rifles, shotguns and military weapons), hunting with dogs and, in some cases, pitfall traps (Barnett, 1998; Noss, 1998; Looibooki *et al.,* 2002; Lindsey *et al.,* 2009). Coutada 9 is unusual in that gin traps are the most commonly employed hunting method. In addition, old-fashioned, home-made, muzzle-loading firearms are commonly used by illegal hunters. These findings contrast with those of Barnett (1998), who found that most illegal hunting in Mozambique was conducted with military firearms. Barnett's study was conducted only five years after the civil war, when military weapons were likely to be more available. Military weapons are still used, but only occasionally, indicating that the government's efforts to remove them from circulation are working. Furthermore, the use of motorized transport to extract bushmeat, as has been

observed in some parts of Mozambique (Barnett, 1998), is less common in Coutada 9, perhaps because of the low densities of remaining wildlife populations.

Gin traps are typically constructed by local blacksmiths from steel car springs and are produced in a range of sizes from those large enough to catch buffaloes, to those designed to kill small antelopes. Gin trapping is a particularly undesirable hunting technique from a conservation perspective. Gin traps are difficult to locate, making trapping challenging to control. As with snares, gin traps are indiscriminate and affect most mammals (larger than ~five kilogrammes, depending on the trap size), including some species not generally considered food items, such as predators: all age and sex classes are affected, increasing the impacts on populations. Gin traps frequently injure animals (and occasionally humans), sometimes leaving affected individuals dragging the trap for long distances. On a positive note, relative to snaring, the use of gin traps results in a much lower wastage of animals (Lindsey *et al.,* 2009). Gin traps are not typically anchored to the ground, and so illegal hunters are forced to check on them regularly to make sure that an animal captured does not leave the trapping site. Furthermore, gin traps are high-value tools and consequently, anti-poaching efforts aimed at removing them from circulation have potential to affect the profitability of illegal hunting. The removal of ~4000–5000 gin traps from Coutada 9 since 2002 has resulted in their price increasing faster than inflation. By contrast, in areas where wire is readily available (e.g. where fences are prevalent, such as in Zimbabwe (Lindsey *et al*. 2009)), the removal of snares has virtually no impact on the ability of illegal hunters to source replacements.

Similar to the situation recorded in Zimbabwe (Lindsey *et al*. 2009), illegal hunting in Coutada 9 (and the supply of bushmeat) appears to peak during the late dry season. During the late dry season, hunting is easier because grass cover (which is very tall and dense earlier in the year in Coutada 9) is reduced and water-sources are concentrated. The conditions for hunting appear to be a stronger correlate of the supply of bushmeat than demand, as supplies are low during the wet season despite high levels of demand.

Nature of the bushmeat trade

Illegal hunting in Coutada 9 is an activity conducted solely by men, in keeping with findings from Zambia and Zimbabwe (Barnett, 1998; Lindsey *et al.,* 2009). Significant volumes of bushmeat are extracted from Coutada 9 and used to generate money for food and clothes and to supplement hunters' diets. Illegal hunters sell the majority of meat that they acquire in the nearby villages and population centres. Barnett (1998) found that most hunters/traders in Mozambique used their own vehicles to transport bushmeat to markets. In the Coutada 9 area, most hunters transport meat on foot or with a bicycle and then sell the meat at nearby markets, or sell it on to middlemen. Middlemen sell bushmeat locally, but also sometimes transport the product to more distant urban centres, such as Chimoio, Beira and Tete.

The sale of bushmeat represents an important livelihood and food-security strategy for the men involved, and provides a significant proportion of their income. Earnings of illegal hunters from bushmeat (USD26.4/month) are within the range of those recorded elsewhere in Africa: USD7.83 a month in Zimbabwe (Lindsey *et al.,* 2009), USD38/month in CAR (Noss, 2002) and USD40.9/month in Zambia (Brown and Marks, 2007). Similarly, the price of bushmeat in the Coutada 9 area (USD1.17–1.50/kg) is within the range of that recorded in rural areas elsewhere in Africa (data recorded from various years, 1997–

2009): Zimbabwe, USD0.39–1.33; Tanzania, USD0.83; Botswana, USD0.85; Zambia, USD1.32-3.00; Malawi, USD0.75; Kenya, and Mozambique, USD1.03 (Barnett, 1998; Ndibalema and Songorwa, 2007; Lindsey *et al.,* 2009).

In urban markets (e.g. Libreville (Bowen-Jones *et al.,* 2003)), including some in Mozambique, bushmeat is a relatively high-value commodity, valued for its taste and perceived value (e.g. in Maputo, the price of bushmeat is USD3.40/kg (Barnett, 1998)). However, in some rural areas of Mozambique (where tsetse fly is prevalent), Tanzania, Zambia, Malawi and Zimbabwe, bushmeat is cheaper than domestic stock and is often favoured on the basis of price (Barnett, 1998; Lindsey *et al.,* 2009). In the Coutada 9 area, the price of bushmeat (USD1.17–1.50) is lower than that of beef (USD2.29/kg), but similar in price to chicken (USD1.91/chicken), goat (USD1.54/kg) and pork (USD1.22/kg), and is favoured primarily on account of its taste, availability, and because of a shortage of meat from domestic animals, rather than on the basis of its price. The price of bushmeat varies seasonally, peaking in December and January, in keeping with Barnett's (1998) findings. Seasonal price variations are likely to be based on supply, peaking during the wet season when hunting is most difficult.

The tastes of buyers in the Coutada 9 area are fairly broad, with relatively few apparent taboo or totem restrictions on the use of wildlife species, in keeping with Barnett's (1998) findings from elsewhere in the country. Due to the shortage of meat from other sources, bushmeat represents the most important source of protein for many people in the Coutada 9 area, as is the case in other rural areas with tsetse fly in Mozambique (Barnett, 1998). Buyers of bushmeat are typically those with cash income, such as teachers or businesspeople. However, of concern is the fact that the police and government officials commonly buy bushmeat, despite the fact that it is illegally sourced.

Impacts of illegal hunting on wildlife populations in Mozambique

The civil war had marked negative impacts on wildlife populations in Mozambique due to the reliance of both combatants and rural communities on natural resources for sustenance and the lack of anti-poaching presence in protected areas (Barnett, 1998). Wildlife populations were greatly depleted in most protected areas. Unplanned settlement and associated habitat destruction exacerbated ecological impacts imposed by humans. Niassa Game Reserve is one of the only protected areas to have emerged from the war and immediate post-war period with healthy wildlife populations, due primarily to its large size and isolated location (Hatton *et al.,* 2001). Many of the hunting *coutadas* were also badly affected. Coutada 7 is heavily settled by humans and has almost no wildlife as a result and Coutada 13, while retaining large blocks of wilderness, has very little wildlife remaining (N. Duckworth, Rio Savé Safaris, pers. comm.). In the core area of Coutada 9, wildlife populations are <10% what they would be likely to be in the absence of historic and present illegal hunting. Some species, including rhinoceroses, Common Wildebeest, Roan Antelope and African Wild Dog *Lycaon pictus* have been extirpated and others (e.g. African Buffalo, zebra, Waterbuck, Spotted Hyaena) persist at population sizes that are thought not to be viable. According to Barnett (1998), the reliance of rural communities on bushmeat for protein requirements elsewhere in Mozambique ensures that the bushmeat trade represents a more serious threat to wildlife populations in the country than habitat destruction. Furthermore, illegal hunting represents a severe impediment to the development of viable WBLU.

As a result of the wildlife population declines in Coutada 9, safari hunting is restricted primarily to a handful of relatively low-value antelope species. "Plains game" hunts (i.e. those involving antelopes) are difficult for hunting operators in remote parts of Mozambique to sell, because most of the same species are available in locations that are cheaper and easier for clients to reach (such as South Africa). On-going illegal hunting in the Coutada 9 area is preventing the rapid recovery of wildlife populations and the development of viable safari hunting operations. Developing viable WBLU in Mozambique will be dependent on concerted efforts to control illegal hunting. In many areas, including Coutada 9, wildlife populations have declined to the point where extensive wildlife reintroductions and augmentations are required to develop profitable ecotourism or safari hunting ventures.

Drivers of the bushmeat trade and potential solutions

Lack of land use planning

The unplanned human settlement of Coutada 9 (and Coutadas 7 and 13) has had major impacts on wildlife habitat and populations. Large areas of natural habitat have been destroyed to make way for settlement and through slash and burn agriculture. The focus of settlement along natural water courses means that the presence of humans has a disproportionately large impact on wildlife populations by reducing access to water and to the most productive vegetation. Studies elsewhere in Africa (e.g. Central Africa and Kenya) indicate that bushmeat hunting is more prevalent near human settlements and the boundaries of protected areas (Fitzgibbon *et al.,* 1995; Wilkie *et al.,* 1998; Wato *et al.,* 2006). In keeping with this pattern, wildlife is virtually absent from Coutada 9 in all areas except those distant from human settlements. To control illegal hunting effectively, there is a need for a degree of separation between human and wildlife populations. The zoning plan for Coutada 9 represents a very positive development in this regard. Encouragingly, the plan has been officially accepted by the Government of Mozambique and appears to have a high degree of support from communities in the area. Zoning should benefit communities by reducing human–wildlife conflict and by providing a clear agreement on benefit-sharing from the *coutada*. Communities living within the core area of Coutada 9 have agreed to relocate to the settlement or multiple-use zones of the *coutada*, in exchange for the construction of basic infrastructure. Following the relocation of the communities, conducting anti-poaching activities will become easier, because footprints of people within the core area will be unambiguously those of individuals engaging in illegal resource use and because, as illegal hunters will have to travel further from their residence to reach wildlife populations, the chances of their being detected by game scouts will increase. A similar zoning plan is required for the other *coutadas* and has potential to contribute positively to efforts to develop viable WBLU in other areas in Mozambique, including in the country's national parks.

In addition to the separation of wildlife and people, there is the need for an effective barrier to prevent the movement of wildlife out of the core area. At present, the lack of a barrier, coupled with the scarcity of permanent water within the core area, means that wildlife tends to move into adjacent and less secure areas if rainfall occurs earlier (or to a greater extent) there. Such movements have potential to result in the loss of significant numbers of wildlife, as occurred in 2006, for example, when the last remaining large herd of buffalo moved out of the core area following rain in an adjacent area, never to return. A plan is in place to

construct a fence around 75% of the core area (leaving a small corridor open to Coutada 13), and a donor has indicated a willingness to provide a soft loan to fund the development. Of key importance is to ensure that the fence is not constructed with material that can readily be used by illegal hunters to make snares. At SVC in Zimbabwe, for example, the perimeter fence is frequently stolen by illegal hunters to obtain material for snares (Lindsey *et al.,* 2009). While curtailing seasonal movements of wildlife may reduce the ecological carrying capacity of the area relative to that in historical times, such impacts would be likely to be greatly outweighed by reductions in losses to illegal hunting in adjacent unprotected areas.

Food insecurity: the lack of alternative sources of protein

Central Mozambique is characterized by low food security. The production of staple crops is restricted to a 4–5 month period and, owing to the prevalence of tsetse fly, livestock animals are rare. Consequently, for much of the year, communities rely to a large extent on natural resources for their protein requirements (McEwan, 1997). Food shortages are frequent and a common response of communities is to hunt for bushmeat or to purchase bushmeat from illegal hunters.

Owing to excessive historical and continuing illegal hunting, the production of bushmeat from Coutada 9 is much lower than it could be. If wildlife populations within the core and multiple-use areas were allowed to recover, a potential annual yield of 92 t of meat could be expected from safari hunting. Significantly greater quantities could be produced if certain species were harvested for meat. For example, if the population of African Elephant were allowed to recover, a sustainable harvest of 26 individuals would yield ~23.6 t of meat. The provision of a legal supply of bushmeat could reduce reliance of local people on meat supplied by illegal hunters. By focussing off-take on adult males, legal cropping can produce higher and more sustainable meat yields than unselective harvesting with unselective methods, such as gin traps. Furthermore, illegal hunters typically take many hours to transport and then sell meat and so the product is often likely to be partially decomposed and of poor quality. Reasonably priced supplies of frozen bushmeat should thus be relatively attractive to buyers.

In SVC in Zimbabwe, a cropping programme has been instigated with the objective of generating ~55 t of meat from 60 elephants as a means of providing an affordable, legal supply of bushmeat as an alternative to that sourced from illegal hunting (Lindsey *et al.,* 2009b). As wildlife populations recover, and off-takes from safari hunting in Coutada 9 increase, efforts are required to develop a system of distribution of affordable bushmeat to local communities. Wildlife harvesting programmes designed to produce meat for communities have generally failed because of the difficulty associated with identifying the ideal recipients, inadequate supply and a lack of financial viability (Barnett, 1998; De Garine and De Garine-Wichatitsky, 1999; Holmern *et al.,* 2002; Le Bel, 2004; Robinson and Bennett, 2004). Financial self-sufficiency could be achieved if part of the costs of the meat programme were supported by the hunting operators of Coutada 9 as a component of their anti-poaching budgets. The issue of identifying appropriate recipients could be overcome in the Coutada 9 area by designing the allocation process in close consultation with communities and local authorities.

Significant potential also exists in the Coutada 9 area for farming cane rats to provide a sustainable supply of bushmeat—as has been attempted in Ghana (Jori *et al.,* 1995). Cane rats are popular among hunters and

buyers in the Coutada 9 area, as they are over large areas of tropical west and central Africa (Jori *et al.,* 1995). The protein content of cane rats is higher than that of chicken or rabbit (Jori *et al.,* 1995). The production of domesticated cane rats could reduce reliance on wild animals for bushmeat and reduce the incidence of burning, which is undertaken during the hunting of cane rats to concentrate them in remaining patches of vegetation.

Unemployment: lack of alternative income earning options for illegal hunters

Illegal hunting provides the majority of income for the men involved and so developing alternative livelihood options is a crucial step towards addressing the problem. The community markets for conservation (COMACO) project in Zambia provides a potential template for intervention. The COMACO project involves provision of technical assistance for communities to increase food-crop yields and provides access through marketing to improved crop prices and has had success in reducing hunting by participants (Lewis, 2007). Fortuitously, the social and ecological issues raised by the bushmeat trade provide overlap between conservation and development agendas which may make donor funds for the start-up of such projects more accessible (Davies, 2002).

Other livelihood development strategies in the Coutada 9 area include assisting communities in the development of cane rat farming as discussed above, or in the production and marketing of honey. Natural honey is commonly exploited by communities in the area and sold in towns and along main roads. However, production is limited by lack of access to artificial hives and to urban markets. Hunting operators in Coutada 9 could potentially engage in partnerships with local communities whereby they produce artificial hives for sale to former illegal hunters and then purchase honey from them, package it, and transport it to town for re-sale. Illegal hunters were supportive of such a suggestion and >90% of them indicated that the support of the Coutada 9 management in developing such a project would be sufficient incentive for them to stop hunting. However, as several admitted, the hunters would have to be accompanied by game scouts when collecting honey, to prevent the activity from being used as a cover for illegal hunting.

Low returns from safari hunting limit incentives and anti-poaching effort

In Coutada 9, the ability of hunting operators to invest sufficiently in anti-poaching efforts is limited by the low returns from safari hunting, due in turn to the depleted state of wildlife populations. Increased investment in anti-poaching can be effective at reducing losses. In Serengeti National Park in Tanzania, for example, increased investment in anti-poaching efforts reduced illegal hunting and achieved a reversal of declining wildlife population trends (Hilborn *et al.,* 2006). An investment of USD51/km^2/year was required to reduce poaching levels to an acceptable level in Ghanaian parks (Jachmann, 2008). Expenditure on anti-poaching in the Coutada 9 area, although significant, leaves large blocks of land unprotected, including ~20% of the core area and all of the multiple-use zone. Only a small fraction of Coutada 13 is patrolled. Rio Savé Safaris management feels that the wildlife populations in Coutada 13 are so small and thinly distributed that the potential returns from safari hunting are not worth the investment in anti-poaching, given the shortage of available resources. Interventions are required to increase the profitability of safari hunting in Coutada 9 and Coutada 13 to allow greater investment in anti-poaching.

One such intervention would be through the reintroduction of key wildlife species. Managers of Coutada 9 expressed frustration at the process of applying for permits for wildlife reintroductions, noting that the procedure was opaque, circuitous, and slow. Government officials appear not to recognize the importance of such reintroductions. Permission to reintroduce Lions into Coutada 9, for example, took 18 months to Secure. Permission to reintroduce African Buffaloes has not been achieved, despite efforts spanning five years. Buffaloes are crucial for the viability of safari hunting in the area and can potentially generate 40% of all revenues because they command high trophy fees, can be used to sell hunting packages, and when re-established could be hunted in relatively large numbers. A donor has committed funds for the reintroduction of the species. If such reintroduction were permitted, financial returns to government and communities would increase dramatically and the capacity of the hunting operator to control illegal hunting would be enhanced significantly. A large buffalo population occurs in the nearby Marromeu complex and a Zimbabwean wildlife-capture team has indicated its willingness and ability to capture them in that swampy area. Key veterinary tests that should be conducted prior to such a translocation are to ensure that the buffaloes from that area are free of bovine-tuberculosis and contagious abortion (Chap Masterson, Zvakanaka Wildlife Capture Veterinary Services, pers. comm., June 2010).

Lack of legal support for wildlife as a land use

In keeping with several other southern African nations (Barnett, 1998), the penal system governing poaching in Mozambique is inadequate and does not provide a deterrent to illegal hunters. In contrast to the situation in Zimbabwe, the value fines allocated to illegal hunters are relatively high (USD485, c.f. USD0.60) (Lindsey *et al.,* 2009). However, the fines in Mozambique are not enforced, with the effect that illegal hunters are effectively released without charge. Punishments allocated to illegal hunters should reflect the value of the resource being destroyed. Strong penalties, coupled with some form of payment to the lessee of *coutadas* and their community-partners as compensation for lost income are advisable. Of great concern however, is the involvement of the police and government officials in the bushmeat trade as buyers of bushmeat. That involvement creates a situation whereby it is not in the personal interests of law enforcement agents to control a convenient supply of a bushmeat. Educational efforts coupled with the provision of legal supplies of bushmeat would be important to prevent such complicity.

Insights into promoting the effective development of *coutada* hunting blocks

Mozambique's *coutada* hunting blocks provide a key opportunity for the country to develop profitable WBLU on a large scale to complement the rapidly growing coast-based tourism industry. However, with continued unplanned settlement of the *coutadas* and continuing loss of wildlife due to the bushmeat trade, that window of opportunity is closing. At present, the attractiveness of many of the *coutada* hunting blocks to operators and investors is likely to be limited because of the presence of human settlement, shortage of wildlife and high levels of illegal hunting. Attracting private investors to the *coutada* hunting areas is crucial to facilitate their recovery, to help control illegal hunting, and to allow their development into economically productive units. Several steps are required from government to facilitate the development of the *coutada* areas and to encourage investment, including the following:

1) An assessment of the state of *coutadas*, the degree of human encroachment, and a survey of the size of wildlife populations, the presence/absence of key species and the health of wildlife habitat.
2) A zoning process (similar to that conducted in Coutada 9) in all *coutadas* to minimize further unplanned settlement and loss of prime wildlife areas, to minimize human–wildlife conflict, to ensure the retention of wilderness areas for wildlife production, to structure the involvement of communities in WBLU, and to encourage investment.
3) Efforts to attract donor funding to assist in the rehabilitation and development of *coutada* hunting areas.
4) Structuring of leases to encourage hunting operators sufficient time to invest heavily in anti-poaching and infrastructure development and to ensure that potential medium- to long-term returns are attractive.
5) Making involvement of hunting operators in anti-poaching efforts (and other aspects of management) a mandatory (and enforced) lease condition.
6) Developing a strategic plan for reintroducing key wildlife species into *coutada* hunting areas.
7) Facilitation and encouragement of efforts by hunting operators to reintroduce indigenous wildlife into *coutada* hunting areas through the provision of the necessary permissions and, where possible, the provision of animals for reintroductions.

Conclusions

Historical and present-day illegal hunting and trade in bushmeat have resulted in greatly depleted wildlife populations in Coutada 9, significantly reducing the potential for generating income from safari hunting. Furthermore, unplanned settlement has greatly reduced the area available for wildlife production. Illegal hunting and the sale of bushmeat represent an important income-generating activity for the men involved, and bushmeat contributes to food security in the area. However, due to the greatly depleted wildlife populations and use of unselective hunting methods, the quantities of bushmeat produced represent a small fraction of what they could be. A series of key interventions are required to reduce illegal hunting and maximize food-security benefits and income from the area for the private sector, communities and government. Government intervention and support is crucial, notably through strengthening and improving laws and their application to address illegal hunting, and by facilitating the rehabilitation of the area through wildlife reintroductions. The Mozambican Government should invest in the zoning and rehabilitation of *coutada* hunting blocks to prevent the loss of a potentially key opportunity for the development of WBLU in the country.

RECOMMENDATIONS

Recommendations for the management of hunting *coutadas* in Mozambique to maximize returns from WBLU and to minimize illegal hunting:

- A review of Mozambique's hunting *coutadas* to assess: the status of wildlife populations; the presence/absence of key wildlife species; the state of wildlife habitats; the degree of human settlement; the potential viability of WBLU; and the steps required to rehabilitate the areas.

- Following the review process, the *coutada* hunting areas should be zoned, following a similar model to that employed in Coutada 9, to prevent further human incursion in to the wildlife areas, to minimize human-wildlife conflict, and to provide a template for community involvement in, and benefit from, WBLU.
- Following the zoning process, consideration should be given to constructing partial game fencing (using wire mesh that cannot readily be made into snares) around *coutada* hunting areas (where required) to limit human incursion into wildlife habitat, limit movement of wildlife out of the *coutadas*, and to minimize human–wildlife conflict. Such fencing should only be considered if there is a plan in place to maintain the fencing in the long term (e.g. through agreements with operators and/or communities).
- Efforts should be made to limit supplies of wire that could be used be illegal hunters to make snares. The construction of fences using such wire should be prohibited.
- Efforts should be made to attract donor funding to assist in the rehabilitation and development of *coutada* hunting areas.
- The structure of leases for *coutada* hunting areas should be standardized and designed such that hunting operators are provided with sufficient time to invest heavily in anti-poaching and infrastructure development and to ensure that potential medium- to long-term returns are attractive.
- The involvement of hunting operators in anti-poaching efforts (and other aspects of management) should be a mandatory (and enforced) lease condition.
- A strategic plan should be developed for reintroducing key wildlife species into *coutada* hunting areas.
- Where hunting operators wish to reintroduce wildlife, government should provide a clear and simple process for applying for permission, and should actively facilitate their efforts (e.g. by providing founder animals from protected areas and/or negotiating with parks agencies from neighbouring countries for founder animals for reintroductions, providing veterinary assistance where necessary).
- Following the recovery of wildlife populations in the *coutadas*, hunting operators should be required to provide legal supplies of affordable game meat to communities to provide an alternative to illegally sourced bushmeat (which is typically acquired using wasteful and inhumane methods).
- Hunting operators in *coutadas* should be encouraged to invest in the development of sustainable and mutually profitable projects involving communities to provide alternative livelihood options for illegal hunters. Support for the development of such projects should be provided by government and/or non-governmental organizations.
- A revision of the penal system governing crimes relating to wildlife is required to provide genuine deterrents to illegal hunting. Punishments should include mandatory gaol terms and compensation, the severity of which should increase for repeat offenders.
- Police and government officials should be educated about the negative impacts of illegal hunting. Purchasing bushmeat that has been sourced illegally by members of the police or government should be considered an offence that merits dismissal and prosecution.

REFERENCES

Agostini, P. (1993). The forestry and wildlife sector of Mozambique. The World Bank. Unpublished.

Barnett, R. (1998). *Food for Thought: The Utilisation of Wild Meat in Eastern and Southern Africa*. Traffic East/Southern Africa. Nairobi.

Bennett, E., Blencowe, E., Brandon, K. Brown, D., Burn, R. Cowlishaw, G., Davies, G., Dublin, H. Fa, J. Milner-Gulland, E. Robinson, J. Rowcliffe, J., Underwood, F. and Wilkie, D. (2007). Hunting for Consensus: Reconciling Wild meat Harvest, Conservation, and Development Policy in West and Central Africa. *Conservation Biology*, 21, 884–887.

Booth, V. 2009. *A Comparison of the Prices of Hunting Tourism in southern and Eastern Africa*. Joint publication of FAO and CIC. Budapest. 40 pp.

Bothma, J. 2002. *Game ranch management*. Van Schaik, Pretoria.

Bowen-Jones, E. and Pendry, S. (1999). The threat to primates and other mammals from the wild meat trade in Africa, and how this threat could be diminished, *Oryx* 33: 233–246.

Brown, T. and Marks, S. (2007). Livelihoods, hunting and the game meat trade in northern Zambia. In: Davies, G. and Brown, D. (Eds), *Bushmeat and livelihoods*, Blackwell, Oxford, pp 92–106.

CIA (2010). World factbook: Mozambique. Available from: https://www.cia.gov/library/publications/the—world-factbook/geos/mz.html.

Connybeare, D. (2005). Aerial survey of wildlife on Coutada 9, Macossa District, Manica Province, Mozambique. Unpublished report, 10 pp.

Craig, C. and Lawson, D. 1990. *Quota setting methods for cropping and trophy hunting of wildlife species in Botswana*. Unpublished Paper, Department of Wildlife and National Parks, Gaborone, Botswana. 19pp.

Davies, G. (2002). Bushmeat and international development. *Conservation Biology* 16: 587–589.

De Garine, I. and De Garine Wichatitsky, M. (1999). Providing impala meat to local populations in Nyaminyami (Omay, Zimbabwe). *Bois et forets des tropiques* 262: 61–76.

De Merode, E. and Cowlishaw, G. (2006). Species protection, the changing informal economy, and the politics of access to the bushmeat trade in the Democratic Republic of Congo. *Conservation Biology* 20: 1262–1271.

Fa, J., Garcia Yuste, J.E., Castelo, R. (2000). Bushmeat markets on Bioko Island as a measure of hunting pressure. *Conservation Biology* 14: 1602–1613.

FAO (2002). Improving nutrition and household food security in Manica Province, Mozambique. FAO Government Co-operative Programme report, 80 pp.

Fitzgibbon, C., Mogaka, H., and Fanshawe, J. (1995). Subsistence Hunting in Arabuko-Sokoke Forest, Kenya, and Its Effects on Mammal Populations. *Conservation Biology* 9: 1116–1126.

Fusari, A. & Capaneto, G. 2006. Subsistence hunting and conservation issues in the game reserve of Gile, Mozambique. Biodiversity and Conservation, 15:2477–2495.

Gandiwa, E. 2011. Preliminary assessment of illegal hunting by communities adjacent to the northern Gonarezhou National Park, Zimbabwe. Tropical Conservation Science, 4(4):445-467.

Hatton, J., Couto, M. Oglethorpe, J. (2001). *Biodiversity and war: a case study of Mozambique*. WWF Biodiversity Support Program, Washington D.C.

Hayward, M. 2009. Bushmeat hunting in Dwesa and Cwebe Nature Reserves, Eastern Cape, South Africa. South African Journal of Wildlife Research, 39(1): 70–84.

Hilborn, R., Arcese, P., Borner, M., Hando, J., Hopcraft, G., Loibooki, M., Mduma, S., Sinclair, A. (2006). Effective enforcement in a conservation area. *Science* 314: 1266.

Holmern, T., Røskaft, E. Mbaruka, J. Mkama, S and Muya, J. (2002). Uneconomical game cropping in a community-based conservation project outside the Serengeti National Park, Tanzania. *Oryx* 36: 364–372.

Hulley-Miller, S. (2003). Management plan for the conservation of natural Resources in Coutada 9, Manica Province, Mozambique. Rio Savé Safaris report, 37 pp.

Jachmann, H. (2008). Illegal wildlife use and protected area management in Ghana. *Biological Conservation* 141: 1906–1918.

Jori, F., Mensah, G., Adjanahoun, E. (1995). Grasscutter production: an example of rational exploitation of wildlife. *Biodiversity and Conservation* 4: 257–265.

Le Bel, S., Gaidet, N., Mutake, S., Le Doze, S. and Nyamagure, T. (2004). Communal game ranching in Zimbabwe: local empowerment and sustainable game meat production for rural communities. *Game and Wildlife Science* 21: 275–290.

Lewis, D. (2007). Can wildlife and agriculture co-exist outside protected areas in Africa? A hopeful case-study in Zambia. In: Davies, G. and Brown, D. (Eds), Bushmeat and livelihoods, Blackwell, Oxford, pp 177–196.

Lewis, D. and Phiri, A. (1998). Wildlife snaring—an indicator of community response to a community based conservation project. *Oryx* 32: 111–121.

Lindsey, P.A., Romañach, S., Tambling, C., Chartier, K., Matema, S., Muphamadzi, I., Matema, C. and Muvengi, J. (2009). The illegal wild meat trade affecting wildlife-based land uses in the South East Lowveld of Zimbabwe: drivers, impacts and potential solutions. TRAFFIC report, 99 pp.

Lindsey, P. Roulet, P.A. and Romañach, S.S. (2007). Economic and conservation significance of the trophy hunting industry in sub-Saharan Africa. *Biological Conservation* 134: 455–469.

Lindsey, P.A. and Tambling, C.J. (2009). The potential production of meat from Save Valley Conservancy, Zimbabwe. TRAFFIC report, 24 pp.

Loibooki, M., Hofer, H., Campbell, K., East, M. (2002). Bushmeat hunting by communities adjacent to the Serengeti National Park, Tanzania: the importance of livestock ownership and alternative sources of protein and income. *Environmental Conservation* 29: 391–398.

Martin, R. (2007). Savé Valley Conservancy: management of the elephant population. Savé Valley Conservancy report, 74 pp.

McEwan, M. (1997). Conceptual and operational framework for the household food security and nutrition information system in Mozambique. MPF/MISAU, Maputo, Mozambique.

Ministry of Tourism, (2004). Strategic Plan for the Development of Tourism in Mozambique (2004–2013). Mozambique Ministry of Tourism report, 80 pp.

Ndibalema, V. and Songorwa, A. (2007). Illegal meat hunting in Serengeti: dynamics in consumption and preferences. *African Journal of Ecology* 46: 311–319.

Noss, A. (1998). The impacts of cable snare hunting on wildlife populations of the Central African Republic. *Conservation Biology* 12: 390–398.

Okello, M. and Kiringe, J. (2004). Threats to biodiversity and their implications in protected and adjacent dispersal areas of Kenya. *Journal of Sustainable Tourism* 12: 55–69.

Packer, C., Kosmala, M., Cooley, H., Brink, H., Pintea, L., Garshelis, D., Purchase, G., Strauss, M., Swanson, A., Balme, G., Hunter, L., Nowell, K. (2009). Sport hunting, predator control and conservation of large carnivores. *Plos One* 4: e5941.

Robinson, J. and Bennett, E. (2004). Having your wildlife and eating it too: an analysis of\ hunting sustainability across tropical ecosystems. *Animal Conservation* 7: 397–408.

Spinage, C. (1987). Review of the aerial monitoring programme of the Department of Wildlife and National Parks, Botswana. Ministry of Commerce and Industry, Gaborone, Botswana. 66pp.

du Toit, R. (2004). *Review of wildlife issues associated with the land reform programme in Zimbabwe*. World Wide Fund for Nature—Southern African Regional Programme Office, Working Paper No. 10.

Vaughn, C. and Long, A. (2007). Bushmeat, wildlife management and good governance: rights and institutional arrangements in Namibia's community based natural resource management. In: Davies, G. and Brown, D. (Eds), *Bushmeat and livelihoods*, Blackwell, Oxford, pp 177–196.

Wato, Y., Wahungu, G., Okello, M. (2006). Correlates of wildlife snaring patterns in Tsavo West National Park, Kenya. *Biological Conservation* 132: 500–509.

Wilkie, D. and Carpenter, J. (1999). Bushmeat hunting in the Congo Basin: an assessment of impacts and options for mitigation. *Biodiversity and Conservation* 8: 927–955.

Wilkie, D., Curran, B., Tshombe, R., and Morelli, G. (1998). Modelling the sustainability of subsistence farming and hunting in the Ituri forest of Zaire. *Conservation Biology* 12: 137–147.

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