

**KEY DETERMINANTS OF CONFLICT BETWEEN
PEOPLE AND WILDLIFE, PARTICULARLY
LARGE CARNIVORES, AROUND RUAHA
NATIONAL PARK, TANZANIA**

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PhD Thesis

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and
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Declaration

I, Amelia Jane Dickman, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis. The material contained in this thesis has not previously been submitted for a degree at University College London or any other university.

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Summary

Human-wildlife conflict, particularly human-carnivore conflict, is a growing problem in today's crowded world, and can have significant impacts on both human and wildlife populations. This study, based in the Idodi-Pawaga area adjacent to Tanzania's Ruaha National Park, explored the main drivers of conflict between people and wildlife, particularly five focal large carnivore species, in order to identify possible mitigation strategies. Considerable antagonism towards wildlife was reported, with particular hostility engendered by large carnivores. The main reasons given for conflict were the risks of wildlife damage, particularly livestock depredation, and attacks upon humans. Initial reports suggested that people were losing 1.2% of their livestock to predators every month, but after long-term monitoring this estimate was revised to 0.32%, and on-site follow-up visits led to a further revised figure of 0.26%, which was far less than the percentage reportedly lost to disease. Adherence to traditional livestock husbandry techniques seemed effective at limiting depredation, but follow-up surveys revealed that views towards focal carnivores remained robust even after many months without an attack. These data suggest that conflict is driven by numerous factors, rather than the risk of wildlife damage alone. Traditional pastoralists appeared less tolerant than other ethnic groups, with their history of land alienation for conservation, political marginalisation and insecurity over land tenure probably driving some of their antagonism towards wildlife. Income diversification was linked to higher tolerance, but few people received any income or non-consumptive benefits from wildlife. Conversion to an external religion, rather than retaining traditional beliefs, was also linked to a decrease in tolerance for wildlife. Overall, many different factors appeared to influence the magnitude of reported conflict, and it was clear that any mitigation efforts would have to confront the social, political, historical, economic and ecological drivers of conflict in order to develop truly appropriate and effective solutions.

Dedication

To Mum

For all the amazing love, support and wisdom,

not only for the three years of this PhD,

but for every day of every year beforehand

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I owe you all a huge amount, and I would like to reward you with something that you will find meaningful and valuable. However, failing that, here is a 90 000-word thesis on human-carnivore conflict! Enjoy!

List of Acronyms

| | |
|---------|---|
| AIC | Akaike's Information Criterion |
| DBH | Diameter at Breast Height |
| DGO | District Game Officer |
| GDP | Gross Domestic Product |
| GPS | Global Positioning System |
| HALI | Health for Animals and Livelihood Improvement |
| HDI | Human Development Index |
| HIMWA | <i>Huduma ya Injili na Maendeleo Kwa Wafugaji</i> , Swahili for 'Gospel Service and Pastoral Development' |
| IUCN | The International Union for Conservation of Nature |
| MBOMIPA | <i>Matumizi Bora ya Malihai Idodi na Pawaga</i> , Swahili for 'Sustainable Use of Wildlife Resources in Idodi and Pawaga' |
| NCA | Ngorongoro Conservation Area |
| NCAA | Ngorongoro Conservation Area Authority |
| NGO | Non-Governmental Organisation |
| PI | Principal Investigator |
| PI-WMA | Pawaga-Idodi Wildlife Management Area |
| RA | Ranching Association |
| REWMP | Ruaha Ecosystems Wildlife Management Project |
| RNP | Ruaha National Park |
| SLT | Snow Leopard Trust |
| SPSS | Statistical Package for Social Sciences |
| SSI | Semi-Structured Interview |
| TANAPA | Tanzania National Parks Authority |
| TCWP | Tanzania Canada Wheat Program |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| USAID | United States Agency for International Development |
| VGS | Village Game Scouts |

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| WCA | Wildlife Conservation Act |
| WCS | Wildlife Conservation Society |
| WMA | Wildlife Management Area |

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Chapter One

General Introduction



CHAPTER 1: HUMAN-WILDLIFE CONFLICT: AN INTRODUCTION AND LITERATURE REVIEW

1.1 Conflict between humans and wildlife: a global perspective

The 21st-century global landscape is increasingly human-dominated, with reports that every ecosystem on the Earth's surface has now been influenced by human activities (Vitousek et al. 1997). Around 40-50% of the earth's surface is estimated to have been transformed by humans, often with marked ecological effects: for instance, 10-15% of the global land surface is now covered by either row-crop agriculture or urban areas, while an additional 6-8% has undergone conversion to pasture (Olson et al. 1983; Vitousek et al. 1997). Humans are now thought to appropriate 35% of the global productivity of ocean shelves (Pauly and Christensen 1995), channel more than 40% of the world's annual primary productivity for their own ends (Vitousek et al. 1986) and utilise 60% of freshwater run-off (Postel et al. 1996; Sanderson et al. 2002). Over the past 30 years, the expansion of agriculture has affected global rates of nitrogen fixation and phosphorus accumulation, while irrigation schemes have heaped ever more demands on the world's freshwater systems (Sanderson et al. 2002; Tilman et al. 2001). The human disturbance index indicates that almost three-quarters of the Earth's habitable land surface has been disturbed by humans (Hannah et al. 1995; Hannah et al. 1994), while the recent human footprint map highlights just how significant an impact people are having on the planet (Sanderson et al. 2002). Much of this anthropogenic impact is due to the world's burgeoning human population, which currently stands at 6.5 billion and which the UN predicts to reach 8.9 billion by 2050 (UN 2004). The resultant human transformation of the global environment, as described above, has been so striking that it has been defined by some as a new geological epoch, termed the 'anthropocene' (Sanderson et al. 2002; Steffen and Tyson 2001).

With the spread of settlement and changing land use, natural habitats, and hence much of the world's remaining biodiversity, have become increasingly restricted to small, fragmented patches within a matrix of human-dominated landscapes (Laurance and Bierregaard 1997; McCloskey and Spalding 1989; Primack 1993). This intensifies the

interactions and the potential conflicts between conservation and development. These are particularly intense in African savannah ecosystems, which juxtapose spectacular biodiversity and widespread concerns over habitat and species loss alongside the pressing development needs of human populations (Homewood and Brockington 1999). This conflict is particularly problematic as the human populations concerned comprise some of the world's poorest and most vulnerable people in terms of food security, health, education, infrastructure and social institutions, as well as often being exposed to violent conflicts over natural resources (USIP 2001).

From a conservation standpoint, although some wildlife species appear to be able to withstand these pressures of habitat loss and changing land use relatively well (Anderson 1997; Nee and May 1992; Purvis et al. 2001), others are often particularly threatened by such environmental changes (Belovsky 1987; Gittleman et al. 2001; Woodroffe 2000). Certain biological characteristics make species more vulnerable to extinction, including large body size, complex social behaviour, low population density, specialised niche requirements, high trophic level and large home range size (Diamond 1984; McKinney 1997; Purvis et al. 2001; Terborgh 1974). These traits are inherent to many large carnivores (Gittleman et al. 2001; Sunquist and Sunquist 2001), making them particularly vulnerable to habitat loss and environmental change, and intensifying conservation concern for such taxa as human domination of ecosystems escalates further.

This expansion of human influence into even the remotest corners of the globe, and ever-increasing pressure on remaining natural resources, has greatly intensified the issue of human-wildlife conflict in a wide variety of situations. Human-wildlife conflict has been defined as '*When the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife*' (Recommendation 5.20, 2003 World Parks Congress) and as such, it is a very common global phenomenon. It encompasses a startlingly broad range of situations, such as vervet monkeys (*Cercopithecus aethiops*) and African elephants (*Loxodonta africana*) raiding crops (Saj et al. 2001), wild canids and rodents posing disease risks to human populations (Mills and Childs 1998; Thirgood et al. 2005), humans fragmenting and altering wildlife habitat (Vitousek et al. 1997), pink-footed geese (*Anser brachyrhynchus*) causing

agricultural damage through grazing (Patterson et al. 1989), and occasional incidents of animals such as Asian elephants (*Elephas maximas*), tigers (*Panthera tigris*) and lions (*Panthera leo*) killing humans directly (Packer et al. 2005; Sanyal 1987). This type of conflict has existed for many millennia (Kruuk 2002) and yet it is becoming an issue of mounting concern in the 21st century as humans and wildlife populations increasingly clash over space and resource use, and the need for urgent action on the subject is increasingly highlighted by many international experts (Bartels et al. 2001a; Nowell and Jackson 1996; Woodroffe et al. 2005b).

The current situation of anthropogenic dominance means that humans must now take responsibility for managing and maintaining the diversity of ‘wild’ species and ecosystems (Hutton and Leader-Williams 2003; Vitousek et al. 1997), but even such management for conservation can also have impacts in terms of human-wildlife conflict. In some areas, successful conservation initiatives have resulted in species being reintroduced to or naturally recolonising parts of their former ranges, often with negative impacts in terms of conflict with humans. A recent and well-publicised example was that of ‘Bruno’, a brown bear (*Ursus arctos*) who, following an Italian programme to reintroduce brown bears into the Alps, wandered into Germany in 2006, making him the first wild bear to be seen there for 171 years. Despite an initially warm welcome, attitudes towards the bear’s presence soon turned hostile after reports of sheep-killing, raiding of rabbit-hutches, and concerns for human safety, so after two weeks, Bavarian hunters shot Bruno amidst a storm of controversy (DeNunzio et al. 2006). On a broader scale, local people have often reacted negatively to wildlife reintroduction and recolonisation, as has been seen with grizzly bears (*Ursus arctos horribilis*) and grey wolves (*Canis lupus*) across the US (Clark and Rutherford 2005; Montag 2003; Wilmot and Clark 2005), wolves in Europe (Glenz et al. 2001), lynx (*Lynx lynx*) in Scandinavia (Swenson and Andren 2005), pumas (*Felis concolor*) in Florida (Beldon and McCown 1996; Breitenmoser et al. 2001) and wolves in Arizona and New Mexico (Parsons 1988). These examples highlight the wide range of situations that can lead to human-wildlife conflict, and especially to human-carnivore conflict, and the truly global nature of the problem.

1.2 Global extent of human-wildlife conflict

Human-wildlife conflict clearly occurs in an extremely wide range of situations globally, involving a huge array of diverse species. Here I will give a brief overview of the five most common direct causes of conflict as highlighted by Thirgood et al. (2005), namely predation upon livestock, predation upon game species, attacks on humans, crop raiding and disease transmission. This review will cover a range of wildlife species causing conflict, with a particular focus upon large carnivores.

1.2.1 Predation upon livestock

This was the most common issue cited as causing conflict between humans and carnivores in a recent study by Sillero-Zubiri and Laurenson (2001). The problem is extremely widespread, with lynx in France (Stahl et al. 2001b), brown bears in Norway (Sagor et al. 1997), pumas in Brazil (Mazzolli et al. 2002), golden jackals (*Canis aureus*) in Israel (Yom-Tov et al. 1995) and tigers in India (Sekhar 1998) causing just a handful of the problems reported across the globe. Depredation can account for a relatively small level of stock offtake, particularly compared to other causes of stock loss – for instance, African wild dogs (*Lycaon pictus*) were found to cause only 1.8% of stock losses on cattle ranches in Zimbabwe, while disease caused 23.5% (Rasmussen 1999). However, depredation can sometimes be intense – villagers in Nepal reported that 63% of all stock deaths were due to predators (Jackson et al. 1996), and even relatively low levels of stock loss can impose intolerable costs on poor households (Stander 1997). In particular, surplus killing, where predators kill multiple animals in one attack, can result in severe financial hardship to the stock-owners concerned (Nowell and Jackson 1996) and engenders particularly intense hostility towards carnivores (Jackson 2000; Oli et al. 1994). The impact of such losses can also be exacerbated further if the stock concerned is particularly valuable, represents an important bloodline, or has cultural as well as financial significance, as is the case in many traditional communities (Anon 2003; Mech 1981; Sillero-Zubiri and Laurenson 2001).

1.2.2 Predation upon game

This was found to be the second most common reason for human-carnivore conflict in the review by Sillero-Zubiri and Laurenson (2001), and has caused antagonism towards predators for centuries. In both the UK and Poland, wolves, bears and lynx were killed in royal reserves in order to protect deer populations for hunting (Sillero-Zubiri and Laurenson 2001), and such tension between hunters and carnivores continues today. Predators can undoubtedly affect prey population dynamics (Gasaway et al. 1992; Peterson 1999; Thirgood et al. 2000), and such effects have led to the killing of a variety of predators, such as lynx, wolves, red foxes (*Vulpes vulpes*), stoats (*Mustela erminea*), corvids and raptors (Reynolds and Tapper 1996; Thirgood et al. 2000; Thirgood et al. 2005).

1.2.3 Attacks on humans

Although not as common as attacks upon livestock or game species, wild animal attacks upon humans clearly have particularly significant impacts in terms of causing intense conflict (Quigley and Herrero 2005). Records of fatalities from wild animals are poorly collated or difficult to obtain in many countries, but where such data exist, they suggest that deaths from animals are a tiny minority of mortalities, e.g. 0.06% in Norway and 0.07% in the US, including domestic animals (Loe 2002). However, despite this relative global rarity, attacks on humans can pose a significant threat in some areas: for instance, the Sundarbans region of eastern India has long been a ‘hotspot’ for man-eating tigers, with around 100 human deaths reported annually (Sanyal 1987), while 100 - 200 people are killed by Asian elephants every year in India (Thirgood et al. 2005; Veeramani et al. 1996). The case of the Tsavo man-eating lions, which killed 28 people in 1898-1899, is well-known worldwide, but for many people man-eating lions and other carnivores still represent a real, daily threat rather than an interesting historical tale (Balduis 2004). Since 1990, lions have killed more than 560 people in Tanzania and injured at least another 308, with the annual rate of attacks increasing markedly over time (Packer et al. 2005). Overall, around 200 people are thought to be killed by wild animals in Tanzania annually, with man-eating lions posing a particular problem – they have been recorded as dragging

people out of huts at night, attacking them in small towns and even swimming out to riverine islands in order to attack humans (Balduş 2004). Although in a global context, the number of human fatalities due to wildlife is negligible when compared to famine, war and disease, the intensity of conflict that it generates can have very significant impacts in terms of hostility towards conserving potentially dangerous species (Thirgood et al. 2005). This is in line with research into risk perceptions, where demand for risk mitigation tends to be driven most strongly by the severity of the consequences of a hazard, rather than how often it is likely to occur (Sjöberg et al. 2004). Data on such attacks are often vague, and researchers have called for more studies to investigate the circumstances surrounding human attacks (Quigley and Herrero 2005), in order to try to reduce their prevalence and ease coexistence between humans and potentially threatening wildlife species.

1.2.4 Crop-raiding

Crop-raiding is a common flashpoint for human-wildlife conflict, with species such as bush pigs (*Potamochoeros* spp.) chimpanzees (*Pan troglodytes*), cane rats (*Thryonomys swinderianus*) and even partridges (*Alectoris chukor*) inflicting significant impacts on people in terms of crop damage (Naughton-Treves 1998; Rao et al. 2002). In Wisconsin alone, white-tailed deer (*Odocoileus virginianus*) inflict more than US\$34 million worth of crop damage annually (Naughton-Treves and Treves 2005), while studies in Latin America have found that birds and monkeys alone can destroy up to 77% of a potential crop (Perez and Pacheco 2006). In Cameroon, a single species of bird, the red-billed quelea (*Quelea quelea*) was recorded as stripping fields of up to 80% of their crops, and this same species causes significant problems to farmers elsewhere in Africa, including Tanzania (Ruelle and Bruggers 1982). Although studies suggest that small animals such as primates and rodents cause more damage than larger animals long-term (Naughton-Treves and Treves 2005), potentially dangerous megaherbivores such as African elephants cause particularly intense conflict, as they not only trample crops but occasionally kill or injure people too (Hoare 1999). Moreover, smaller losses are more easily accepted, even if cumulatively they add up to substantial levels over time, as a single crop-raiding event by an elephant can have catastrophic effects, sometimes

resulting in the loss of an entire year's production in a single raid (Naughton-Treves and Treves 2005).

1.2.5 Disease transmission

Risks of disease transmission has led to hostility towards various wildlife species worldwide: for instance, farmers in the UK are concerned about badgers (*Meles meles*), which have been implicated as vectors of tuberculosis to cattle (Hudson et al. 2002), while red foxes are a reservoir of *Echinococcus multilocularis*, a disease fatal to humans that is increasing in mainland Europe (Sillero-Zubiri and Laurenson 2001). Additionally, a variety of carnivore species, including raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*) and bat-eared foxes (*Otocyon megalotis*) act as reservoirs for rabies, which is responsible for around 50 000 human deaths worldwide each year (Charlton et al. 1998; Thirgood et al. 2005; WHO 1998). There is also a zoonotic connection with another of humankind's most devastating current diseases: African primates carrying SIV (Simian Immunodeficiency Virus) have been implicated as the original source of HIV (Human Immunodeficiency Virus), which has so far infected over 42 million people worldwide and has a fatality rate of nearly 100% (Rambaut et al. 2004; UNAIDS 2002).

1.3 Particular impact of human-carnivore conflict

Despite the large taxonomic diversity in species conflicting with humans, a variety of factors mean that large carnivores tend to generate particularly intense conflict. Their obligate carnivory results in competition with humans for both domestic and game species, and such predation can have significant economic impacts. Moreover, they are large-bodied, potentially aggressive and can sometimes kill humans themselves, which understandably generates powerful antagonism towards their presence around areas of human habitation (Baldus 2004; Sillero-Zubiri and Laurenson 2001). These factors are often compounded by an innate fear of large predators and deep-seated hostility resulting from past experiences, even if carnivores are not causing current problems (Berg 2001; Quammen 2003). Moreover, as seen with elephants causing crop damage, the potentially extremely severe consequences of a single attack by a dangerous wild animal elicits far

more hostility and fear than the cumulative damage of less immediately severe but chronic problems such as disease. Given that many of these factors are intrinsically linked with carnivore ecology and behaviour, this explains why some of the most intractable and long-standing human-wildlife conflicts found across the globe are associated with carnivores, especially the larger species, and this makes them a particularly interesting and valuable case study for research.

1.4 Impacts of human-wildlife conflict upon humans

As shown above, wild animals, particularly large carnivores, can have very significant impacts upon human communities living alongside them. These impacts can range from clear-cut economic hardship to less tangible effects such as increased opportunity costs and decreased quality of life, and are discussed in more detail below.

1.4.1 Direct economic costs of human-wildlife conflict

Living alongside wildlife can incur a substantial economic price-tag: in the United States, agricultural producers spent US\$2.5 billion to manage wildlife problems during the 1990s, while metropolitan households spent US\$5.5 billion over the same period (Bruggers et al. 2002; Conover 1997, 1998). However, although costs can clearly be substantial wherever they occur, the economic impacts of human-carnivore conflict in particular are frequently borne by those very communities least able to manage such costs. Depredation can have a significant economic impact on the owners concerned: for instance, a level of only 2% stock loss to depredation cost households in Bhutan 18% of their per capita cash income (Wang and Macdonald 2006), while depredation by wolves and snow leopards (*Uncia uncia*) cost Nepalese villagers around 50% of their average annual per capita income (Mishra 1997). The economic costs of maintaining large carnivores can extend much further than the individual farmers, however – a review by Swenson and Andren (2005) showed that in 2000 alone, the Norwegian government paid out more than US\$3 million in compensation for stock losses to carnivores. Overall, therefore, maintaining carnivores in a human-dominated landscape can incur significant direct economic costs, both to individuals and to the wider community as well.

1.4.2 Indirect costs of human-wildlife conflict

Living alongside carnivores can incur a variety of additional costs aside from the direct impact of depredation, as people have to invest more heavily in strategies such as livestock herding, guarding and predator control (Thirgood et al. 2005). These indirect costs are often harder to quantify, but can be substantial – a study in southwestern Utah revealed that sheep depredation cost US\$419 000 in direct economic losses, but at least US\$1.2 million in associated indirect costs (Taylor et al. 1979). Such costs can take varying forms – for instance, electric fencing, commonly used to protect stock or game from predators on commercial farms in Namibia, costs a staggering US\$781/km to install and a further US\$952/km/yr to maintain, while even low-technology swing gates cost around US\$43/km to install and US\$470/km/yr to maintain (Schumann et al. 2006). Specialised breeds of livestock guarding dogs can be effective at reducing conflict (Marker et al. 2005a), but these animals require significant economic investment in terms of diet, immunisation, veterinary care and neutering (Lorenz et al. 1986; Marker et al. 2005b). However, dogs in general, even those not of specific livestock-guarding breeds, can also be effective by providing warnings to people of predator presence (Ogada et al. 2003). Farmers must corral their stock at night if predators are present, possibly limiting growth rates and thereby incurring further economic penalties (Ogada et al. 2003). Additionally, surveys revealed that livestock owners in Namibia spent around N\$260 (approximately US\$22) annually on ammunition to control predators, while farmers in Botswana employed an average of 3.5 herders at a cost of around R300 (approximately US\$30) each per month (Hermann et al. 2001). However, not all these costs would disappear if predators did, due to the need to protect stock against other dangers: only 16% of farmers surveyed in northern Botswana would decrease the number of herders employed if no predators were present, as they were needed for other functions (Hermann et al. 2001), while ranchers in Kenya would require only 3% fewer herders if lions were not present, as they would still be needed to protect against theft (Frank 1998).

There may also be additional ‘opportunity costs’ associated with the presence of wild animals, as the time required for livestock protection limits the amount of time that can be invested in other potentially important activities such as attending school or assisting

with crop harvesting (Norton-Griffiths and Southey 1995). There are other, less tangible but equally important, effects as well – for instance, interviews in the Transmara district of Kenya revealed that people were afraid to conduct social and economic activities due to the presence of elephants, while the perceived danger also restricted children from travelling to and from school (Nyamwaro et al. 2006). In India, villagers were restricted from irrigating their fields at night due to the presence of tigers, while many reported hardship from having to share their houses with livestock to protect the stock from attacks (Saberwal et al. 1994). Human fatalities due to wildlife are clearly another hugely important cost to communities, which it is impossible to put an economic price on.

At a broader scale, it is often not only the wild animals themselves but also any associated protected areas that impose opportunity costs on local people. Reduced or prohibited access to resources such as firewood, water, wild meat, medicinal plants and grazing areas within reserve boundaries can intensify local hostility towards protected areas, conservation authorities and also towards the species which are the target of protection (Emerton 1999). In Madagascar, people living adjacent to Mantadia National Park have been calculated to bear costs of US\$419 per household annually (over half the annual per capita income), primarily due to restricted access to agricultural land (Sandbrook 2006; Shyamsundar and Kramer 1997). At a national scale, Norton-Griffiths and Southey suggested in 1995 that setting aside land for conservation in Kenya was effectively costing the country US\$161 million per year, as the land could generate \$203 million annually if used for farming, compared to the \$42 million generated then through tourism revenue. However, the scale and reliability of agricultural returns from these semi-arid rangelands may have been overestimated, as has been seen with economic estimates for converting land elsewhere (Balmford et al. 2002), while tourist revenue in East Africa has burgeoned over the past decade, and is now the most rapidly growing economic sector in Kenya, contributing around 13% of the country's GDP and 9% of total wage employment, with consolidated tourism earnings of over US\$1 billion in 2007 (MTK 2008).

To summarise, living alongside wild animals can impose significant costs at a variety of scales, including both direct economic costs and indirect impacts. However, when people

feel that the costs of wildlife presence are higher than the benefits, they usually take action, which can have important consequences for local wildlife populations themselves. A brief summary of these impacts is provided in the following section.

1.5 Impacts of human-wildlife conflict upon wildlife

A range of options exist for people attempting to lessen conflict with wildlife, including reducing the likelihood of attacks by using protective measures such as livestock guarding dogs, electric fencing, improved construction of livestock enclosures, toxic collars, disruptive stimuli and other aversive techniques (Marker et al. 2005a; Ogada et al. 2003; Shivik et al. 2003; Treves and Karanth 2003). However, these approaches are often combined with lethal control of predators, a strategy that has been used by humans for millennia and can have substantial impacts on the carnivore populations concerned (Woodroffe et al. 2005a). Emperor Charlemagne used professional hunters to try to eradicate wolves from the Roman Empire in AD 800 (Boitani 1995; Woodroffe et al. 2005a), while there are reports of animals being put on trial in the Middle Ages for killing humans and put to death if convicted (Evans Pritchard 1906; Robinson 2005). Even within the relative sanctity of wildlife reserves and Parks, the killing of certain species, particularly predators, was actively encouraged: staff in Kruger National Park killed 18 440 mammal, bird and reptile predators between 1903 and 1927, while African wild dogs were still being killed in Hwange National Park as recently as 1960 (Child 2002; Orford 1996). On a wider scale, governments have sponsored nationwide eradication schemes for species perceived as highly problematic, as seen with wolves and prairie dogs (*Cynomys* spp.) in the US (Mech 1970; Reading et al. 2005), whereas similar large-scale lethal control eliminated wolf, bear and lynx populations throughout Western Europe (Linnell et al. 1996). Although this type of control has always existed, advances in modern technology and weaponry means that lethal control of wildlife has become increasingly effective. A wide range of techniques now exist for controlling wildlife, such as shooting, snaring, poisoning, trapping, gassing and even electrocution and the use of explosive devices (Brand and Nel 1997; Menon et al. 1998 ; Treves and Naughton-Treves 2005; Tuytens et al. 2000), and these can have serious impacts on both target (Marker et al. 2003a; Woodroffe and Frank 2005) and non-target species (Miller et al. 1996). In

Japan, the nation's troops have been involved in the culling of black bears (*Selenarctos thibetanus japonicus*), with one 1966 'bear alert' in Hokkaido resulting in hundreds of hunters and self-defence force members employing vehicles, snow mobiles and even helicopters to kill 39 bears (Knight 2000a; Moll 1994). Bounties are still offered for black bears in Japan, and bear extermination groups have been established with marked success: between 1946 and 1994, over 77 000 black bears were killed nationwide (Knight 2000a). In some cases, lethal control by humans has been directly linked to global extinctions of species, such as the Carolina parakeet (*Conuropsis carolinensis*) in 1904, the thylacine (*Thylacinus cynocephalus*) in 1930 (IUCN 2002; Woodroffe et al. 2005a), and the Falklands wolf (*Dusicyon australis*) in 1876 (Sillero-Zubiri et al. 2004).

In many other cases, however, lethal control of wildlife as a result of conflict with humans has resulted in dramatic population declines, striking contractions in geographic range, and often local extirpation (Johnson et al. 2001; Mech 1970; Treves and Naughton-Treves 2005). Well-documented examples include the cheetah (*Acinonyx jubatus*), which has declined from an estimated population of around 100 000 individuals in 1900, spanning Africa, Asia and the Middle East, to less than 15 000 today, restricted almost exclusively to small, fragmented populations in sub-Saharan Africa (Marker 1998). Nearly 7000 cheetahs were reported as removed (usually killed) from privately owned land in Namibia alone during the 1980s, predominantly as a result of conflict with farmers (CITES 1992), and even this figure is likely to be a considerable under-estimate of the real level of human-mediated removals (Marker 2002). Similarly, after centuries of persecution, African wild dogs remain in only 14 of the 39 countries they once occupied and are now one of the world's most endangered carnivores, numbering fewer than 5000 individuals worldwide (Fanshawe et al. 1991; Woodroffe et al. 1997).

The African lion has also suffered a substantial population decline and range contraction over recent decades, and has disappeared from much of its historic range (Bauer et al. 2003; Nowell and Jackson 1996). Such range collapses are not restricted to large carnivores, however: hen harriers (*Circus cyaneus*), golden eagles (*Aquila chrysaetos*), prairie dogs and many other species have suffered similar fates and are now restricted to a small fraction of their former range (Reading et al. 2005; Woodroffe et al. 2005a).

Although these declines are often due to a multiplicity of factors, including habitat loss, degradation and fragmentation and disease risks, conflict with humans is an increasingly important factor driving declines for many species, and is therefore a highly important and increasingly urgent conservation issue (Marker and Dickman 2004; Nowell and Jackson 1996; Reading et al. 2005; Woodroffe et al. 2005a).

1.6 The importance of conserving large carnivores

Paradoxically, those species which tend to cause most intense conflict with local people are also those that are likely to have beneficial impacts at larger scales. Large predators, for example, can play an important role in maintaining a healthy ecosystem, for instance by controlling numbers of mesopredators through competition, regulating prey numbers (many of them crop pests), and maintaining a functional balance of biodiversity in local communities (Krebs et al. 1995; Logan and Sweanor 2001; Terborgh et al. 1999). Removing top predators from habitat patches often results in significant changes in community structure, which can have marked negative impacts in terms of local ecology (Berger 1999; McShea et al. 1997; Terborgh et al. 2002).

Probably of more relevance to local communities, however, are direct benefits to local people by continuing to maintain carnivores. A range of these have been identified by ecological economists, and include direct extractive uses, where the species is directly utilised, e.g. for food or body parts (Edwards and Abivardi 1998). These practices have been increasingly limited by restrictions placed upon the use of endangered species, but there is undoubtedly some ongoing use of these species for use in traditional medicine (Kenney et al. 1995; Nowell and Jackson 1996), while lions are still hunted as an important rite of passage for some ethnic groups (Maddox 2002; Spencer 1988). Trophy hunting of carnivores has the potential to generate significant economic benefits for local communities, therefore acting as an incentive to conserve species and habitats (Murphree, 2001; Leader-Williams and Hutton, 2005). Commercial hunting schemes can be problematic in several ways, including equitable distribution of revenue (Leader-Williams and Hutton 2005), the sustainability of such offtake (Creel and Creel 1998; Hoyt 1994), and ethical concerns (Treves and Karanth 2003), but can potentially offer

substantial economic incentives for maintaining conflict-causing species on private land (Kinyua et al. 2000; Leader-Williams and Hutton 2005).

Another potential benefit is through direct non-extractive use, such as photographic tourism (Edwards and Abivardi 1998). In some areas, this generates large sums of money: the economic value of a male lion in Amboseli National Park was valued at \$128 750 in 1988 (Martin and de Meulenaer 1988). A tourism-revenue sharing scheme in Uganda generated US\$83 000 and enabled the building of community facilities including 21 schools and four clinics (Archabald and Naughton-Treves 2001) while income from tourists viewing African wild dogs has been estimated to be more than sufficient to offset the local costs of maintaining them (Lindsey et al. 2005a). Again, equitable revenue sharing can be a problem with such schemes (Archabald 2000; Gosling 1999), and in some situations ecotourism initiatives have even exacerbated conflicts by habituating dangerous animals to people, as has been recorded with Asiatic lions (*Panthera leo persica*) in India (Saberwal et al. 1994). Photographic tourism is only likely to work in certain environments with adequate local involvement and planning, but in the right circumstances it can potentially provide people with powerful incentives to conserve problematic animals (Lindsey et al. 2005a).

There are also non economic values attached to conservation, such as ‘bequest values’, where future generations may benefit from the continued presence of the resource, and ‘existence values’, where people have some affinity with the species concerned and place value on its continued survival (Attfield 1998; Edwards and Abivardi 1998). Given the spiritual and totemic importance attached to large carnivores in many cultures (Ale 1998), such values are likely to resonate more for these species than for many others. As far as the international public are concerned, large carnivores are considered highly charismatic (Carvell et al. 1998), and there is widespread international support for conservation efforts aimed at their protection (Gittleman et al. 2001). Moreover, large carnivores can act as appealing ‘flagship’ or ‘umbrella’ species, as conservation efforts designed to protect them can have important effects by incidentally protecting other species, for instance by safeguarding tracts of habitat to the benefit of many smaller

species (Caro 2003; Noss 1990), or by raising public awareness regarding conservation and biodiversity issues (Dinerstein et al. 1999; Gittleman et al. 2001).

1.7 The need for conservation outside protected areas

Given the intensity of conflict that frequently arises when people and wildlife exist in close proximity to one another, concentrating on maintaining wildlife largely within the world's current protected areas may seem like an obvious solution. Indeed, as even the eminent Richard Leakey was reported by Baldus as stating in 2001:

“It is unacceptable to expect people to live cheek by jowl with animals that so adversely affect their livelihood. We have something like twenty-five thousand square miles of protected land in this country [Kenya], which should be enough to keep the lions' gene pools intact. There's no reason that they should be kept on private land.” (Baldus 2004).

However, despite the broad scope of the current protected area network, which covers over 11% of the Earth's surface (Chape et al. 2003), that alone is unlikely to be sufficient for the long-term conservation of many of these threatened species. Firstly, formal protection may not translate into effective conservation on the ground, especially in areas where local people need to utilise reserves for resources such as firewood, honey or for subsistence hunting (Green 1994; Nowell and Jackson 1996). Also, large-bodied species in particular often have vast home ranges, and the small sizes of many reserves are inadequate for their long-term conservation (Brashares et al. 2001; Woodroffe and Ginsberg 1998). These species are often those which cause most intense conflict, and their wide-ranging nature means that mortality on reserve borders can pose a major threat to survival even within reserves, with adjacent unprotected areas acting as important population 'sinks' (Woodroffe and Ginsberg 1998). Certain species, such as cheetahs and African wild dogs, suffer from asymmetric competition with other, larger carnivores, and can fare poorly in protected areas with high densities of competitors such as lions and spotted hyaenas (*Crocuta crocuta*) (Creel et al. 2001; Durant 1998). Moreover, much of the remaining range of several highly threatened species falls outside the current reserve network: for instance, less than 16% of remaining tiger habitat is protected (Miquelle et al. 1999), and this figure drops to less than 10% for leopards (*Panthera pardus*), jaguars (*Panthera onca*), pumas, and snow leopards (Nowell and Jackson 1996).

The effective conservation of such species therefore hinges on their protection over a landscape encompassing both protected areas and private land, so developing conservation-compatible land management strategies, including human-carnivore conflict reduction strategies, on human-dominated land outside the existing reserve network is crucial (Nowell and Jackson 1996). This strategy, if successful, would create ‘corridors’ of available habitat and enable linkages between protected areas, with important implications for gene flow, dispersal and the long-term persistence of previously fragmented large carnivore populations (Beier 1993; Simberloff and Mehlman 1992) at the same time as minimising the negative impacts and maximising the positive aspects of carnivore presence for reserve-adjacent rural populations.

1.8 The need for effective conflict resolution, and factors affecting conflict

Ultimately, due to increasing demands on the world’s resources, 21st century conservation will have to be conducted in an arena of increasingly fragmented ‘wild’ places within a matrix of human-dominated land. However, due to the intensity of human-wildlife conflict likely to result from such close cohabitation, it will be imperative to develop strategies which enable people and wildlife to coexist more easily in the same landscape. This will be critical both for conservation biologists aiming to maintain ecological health and integrity, for the continued persistence of many threatened species, and for local communities, in order to minimise the potentially devastating risks that dangerous wildlife can pose, both to their livelihoods and sometimes to their lives themselves.

However, developing effective and well-targeted conservation strategies is dependent upon fully understanding the complexities of the local situation. Moreover, studies have revealed marked local variation in the levels of human-carnivore conflict, with some areas experiencing few or no problems, while people at other, nearby sites report significant conflict (Stahl et al. 2002). Often, problems frequently re-occur at these conflict ‘hotspots’, even if individual, ‘problem’ animals are removed (Jackson et al. 1996; Stahl et al. 2001a). This suggests that some underlying factors may predispose an area to conflict, and gaining a better understanding of this would be extremely valuable

for assisting in conflict mitigation. A wide variety of variables have already been identified in previous studies as being potentially important contributing factors towards conflict, and these are discussed in more detail below.

1.8.1 Levels of depredation

Clearly, people suffering high levels of livestock depredation are likely to be particularly hostile towards large carnivores – for instance, there is predictably very low regional tolerance for snow leopards in areas where they frequently attack livestock (Oli et al. 1994). Even in areas where there is a strong social pressure to exhibit tolerance towards predators, high levels of livestock depredation are likely to eventually over-ride this and lead to intense hostility (Ale 1998). For instance, in Buddhist communities in the Himalayas, which traditionally disapprove of killing animals, fear of livestock depredation means that celebrations occur when wolf pups are found and removed from dens, with the live pups being destroyed with dynamite when the celebrations end (Hazzah 2006; Mishra 1997). Perceived or real threats to livestock have also been the driving force behind widespread removal of cheetahs on Namibian farmlands, where farmers reported removing an average of 19 cheetahs per farm per year as recently as 1993 (Marker et al. 2003a). The implementation of programmes to reduce depredation through improved livestock husbandry was linked to a drop in stock losses, as well as reported conflict with and removals of cheetahs, suggesting that levels of depredation were indeed a key driver of conflict (Marker et al. 2003a).

However, despite clear evidence of a link between stock depredation and human-carnivore conflict (Mishra 1997; Ogada et al. 2003; Stander 1997), there is not a simple, consistent relationship between the level of stock loss and the negativity of perceptions towards large carnivores. Research in Brazil indicated that levels of livestock depredation did not significantly affect local ranchers' attitudes towards jaguars (Conforti and de Azevedo 2003), and high numbers of cheetahs were still removed from farmland in Namibia even in areas where they were not thought to cause much depredation (Marker et al. 2003b). These counterintuitive results reveal that conflict is not merely driven by

stock losses, but is the result of a complex suite of factors. Some of these other possible contributing elements are dealt with below.

1.8.2 Human attacks

Attacks upon humans are likely to be extremely important drivers of conflict with wildlife, particularly where attacks occur with alarming regularity. For instance, between August 2002 and April 2004, at least 36 people were killed and 10 injured - many dragged out of their huts at night – by one or two lions over an area of just 350km² in southern Tanzania (Baldus 2004). Southern Tanzania has long been a hotspot for man-eating lions: in 1965, the game ranger George Rushby reported that between 1932 and 1946, lions had killed around 1500 people in an area of just 2000km² in south-western Tanzania (Baldus 2004). The rate of lion attacks appears to be increasing in Tanzania, and, quite justifiably, local people commonly report antagonism towards lions and other large carnivores, often driven by fears for their own safety (Baldus 2004; Dickman 2005; Packer et al. 2005). However, the human perception of danger posed by an animal may not be directly linked to the realistic level of threat: for instance, although wolves in North America pose very little danger to people, unlike some other species, they still remain widely feared and reviled (Kellert et al. 1996). More investigation into why certain species are feared disproportionately compared to their actual impact will shed useful light on the nature of human-wildlife conflict.

1.8.3 Cultural values

Investigating attitudes towards wildlife is a complex task, as there are a wide variety of ways in which people judge different species, and these often vary markedly between different cultural groups. Although peoples' attitudes are derived in part from their own individual experiences, they are also influenced by their peers, friends, family, teachers and local media, so there is a collective cultural element to attitudes which must be considered (Hunter 2000). In 1993, Kellert studied peoples' views towards wildlife in a range of countries, and developed a typology of attitudes (Table 1).

Table 1. Typology of attitudes towards wildlife (Kellert 1993)

| Term | Definition |
|-------------------------|--|
| Aesthetic | Primary interest in the physical attractiveness and symbolic characteristics of animals. |
| Dominionistic | Primary interest in the mastery and control of animals, typically in sporting situations. |
| Ecologistic | Primary concern for the environment as a system, and for interrelationships between wildlife species and natural habitats. |
| Humanistic | Primary interest in and strong affection for individual animals such as pets or large wild animals with strong anthropomorphic associations. |
| Moralistic | Primary concern for the right and wrong treatment of animals, with strong ethical opposition to presumed ethical exploitation or cruelty toward animals. |
| Naturalistic | Primary focus an interest and affection for wildlife and the outdoors. |
| Negativistic | Primary orientation an active avoidance of animals due to dislike or fear. |
| Neutralistic | Primary concern a passive avoidance of animals due to lack of interest. |
| Scientistic | Primary interest in the physical attributes and biological functioning of animals. |
| Theistic | Primary orientation a fatalistic belief in wildlife as controlled by external deities of non-natural forces. |
| Utilitarian-consumption | Primary interest in the practical value of animals. |
| Utilitarian-habitat | Primary interest in the practical value of habitat associated with wild animals. |

These different reasons for valuing or disliking wildlife can have important impacts in terms of how people view wildlife conservation efforts: for instance, a study by Newmark

(1996) showed that positive attitudes towards protected areas were driven primarily by utilitarian viewpoints, with the majority of people citing tourist revenue as the main benefit of such areas, rather than the intrinsic value of nature or wildlife. However, the consumptive use of wild animals is often important in traditional practices: for instance, in Nigeria, wildlife by-products are important for cultural festivals, are used widely in traditional medicine, and are used in rituals to invoke and appease gods and witches (Adeola 1992). This utilisation is often a more important utilitarian reason for people wanting to have wildlife remain around in rural areas than revenues from wildlife conservation or protected areas.

Cultural beliefs not only play a significant role in influencing peoples' attitudes towards wildlife, but can also form important tenets of local conservation (Hutton and Leader-Williams 2003). Societal taboos regarding the use of certain species or areas may result in habitat and species preservation (Gadgil and Vartak 1974; Hutton and Leader-Williams 2003), and such attitudes vary markedly between different cultures. For instance, traditional North American communities often revered the grizzly bear, while European settlers, faced with the same animals, were determined to eliminate them (Kellert et al. 1996). In Maasai societies, spotted hyaenas are often viewed with hostility disproportionate to their impact on stock, as they have many negative associations with gluttony, stupidity and witchcraft (Frank 1998; Maddox 2002). Religious beliefs can also be significant in explaining variation in attitudes towards wildlife: for instance, Hazzah (2006) showed that people who adhered to the evangelical teachings of the Kenyan Assemblies of God (KAG) church were more hostile towards carnivores. In addition, religious respondents seemed less likely to employ good livestock husbandry techniques as they trusted that God would take care of their stock for them (Hazzah 2006). Conversely, local people may sometimes have an unexpectedly benign attitude to dangerous animals because of cultural or religious beliefs, and tolerate carnivores despite depredation and other costs. For instance, in Manang, Nepal, there is a high incidence of livestock depredation by snow leopards, but the local Buddhists are particularly tolerant as they believe the cats are sacred and may embody the reincarnation of great priests, so killing them is considered a grave sin (Ale 1998). Snow leopard depredation is regarded

as a curse from the ‘mountain god’ in response to forbidden human behaviour, so the leopards themselves are rarely held accountable for attacks and are widely tolerated (Ale 1998). Understanding such variations in attitudes can be an important step towards identifying the reasons behind heterogeneity in reported conflict, as well as variation in husbandry methods, and can therefore help guide local conservation and management strategies.

1.8.4 Vulnerability and risk of people concerned

Understanding risk perception is usually of interest mainly to politicians and policy makers dealing with issues such as transport and safety (Sjoberg et al. 2004), but such studies can be valuable in examining the complex nature of human-wildlife interactions and can help inform our understanding of conflict. Risk has been defined as ‘the likelihood than an individual will experience the effect of danger’ (Short Jr. 1984), and is a combination of both the probability of an adverse event occurring and the magnitude of its consequences (Rayner and Cantor 1987). The concept and understanding of risk, as well as the reactions to it, are heavily influenced by social and cultural perceptions, values, symbols, history and ideology, particularly with regard to ideas of what the world ‘should’ be like (Boholm 1998; Sjoberg et al. 2004).

A seminal study by Starr in 1969 on how people perceive, tolerate and accept risks, revealed that people were on average 1000 times more likely to accept voluntarily undertaken risks, such as driving, to those imposed upon them externally, such as pollution, and were more accepting of risks associated with tangible benefits. Control is also an important component of risk perceptions, with people feeling less ‘at risk’ if they perceive that they have greater control over the situation concerned: for instance, drivers tend to perceive a smaller risk involved in a car journey than passengers do (McKenna 1993). While drivers may justifiably feel that they can exert more control, this relationship holds even where there is only an illusion of control, such as people regarding the chance of winning the lottery more highly if they pick the numbers themselves (Langer 1975).

In 1978, Fischhoff et al. conducted a study on the relative importance of nine key drivers of risk perception, namely (i) whether the risk was voluntarily undertaken or not, (ii) the immediacy of the effect, (iii) the extent of knowledge about the risk, (iv) whether the risk was chronic or catastrophic, (v) whether it was something that could be calmly considered or instilled a intrinsic sense of dread, (vi) the likelihood of a fatal consequence, (vii) how much was known about the risk to science, (viii) respondents' perception of control over the risk, and (ix) the newness of the risk (Fischhoff et al. 1978). This study revealed that the most important drivers of risk perception and tolerance were the level of intrinsic dread and the novelty of the risk, with more recent studies also supporting those findings (Boholm 1998; Sjoberg et al. 2004). These results are corroborated in studies of perceived danger posed by wildlife: inherent, deep-seated fear or antagonism is a key driver of hostility towards wildlife (Berg 2001), while people that have experience of living alongside wild animals tend to be less fearful of them than relative newcomers (Røskaft et al. 2003).

Being at risk from a threat is not the same as being vulnerable to it, however, as vulnerability, defined by Cutter (1996) as 'the interaction of the hazards of place.....with the social profile of communities' has both biophysical and social components (Carter 1997; Hazzah 2006; Naughton-Treves and Treves 2005). If predator attacks are more likely in areas close to forests, for example, as has been seen with puma and jaguar attacks in Brazil (Palmeira et al. 2008), then someone keeping or grazing stock in forest-adjacent land is more at risk than average. However, if that person is wealthy, has alternative sources of income and/or engages in social reciprocity with their family and community then they could actually be less vulnerable than other people (Naughton-Treves and Treves 2005). Having adequate coping strategies is therefore a key part of reducing vulnerability, and this has long been integral to traditional communities who regularly face environmental hazards (Campbell 1999). Wildlife conflicts that threaten peoples' coping strategies are particularly unwelcome – for instance, research in Tanzania showed that people were more antagonistic towards wildlife raids on crops planted in case of famine, such as cassava, than on other crops (Mascarenhas 1971). The

coping strategies employed by pastoralist communities, and the relevance to human-wildlife conflict in this area, will be discussed further in later chapters.

1.8.5 Knowledge

Previous research has demonstrated that the more knowledgeable people are about carnivores in their area, the more tolerant they tend to be of their presence (Ericsson and Heberlein 2003), while knowledgeable people are also more likely to behave in a way that lessens the chance of conflict arising in the first place (Conover 2002). However, this is not a clear-cut relationship: studies in the US have shown that knowledge is often only weakly correlated with values and attitudes towards wildlife, with correlation coefficients of 0.30 or less (Tarrant et al. 1997). Despite this, misinformation and a lack of knowledge about carnivores has been linked to higher human-wolf conflicts in southern Europe (Meriggi and Lovari 1996) and more intense jaguar-human conflicts in Brazil (Conforti and de Azevedo 2003), while Marker and Dickman (2004) attributed some of the apparent success in improving attitudes towards cheetahs to widespread environmental education programmes, which had a particular focus on cheetahs. These studies suggest that if local people show hostility but have little knowledge about carnivores in their area, then investing in conservation education could potentially be a valuable strategy for conflict resolution (Conforti and de Azevedo 2003; Kellert et al. 1996). However, the relationship between knowledge and positive action is a complex one, with aspects such as perceived individual control also important: people with an ‘internal locus of control’ expect to receive individual benefits from changing their actions, and are therefore more likely to do so than people with an ‘external locus of control’, who see no likely individual benefit from changing their actions and therefore are unlikely to do so (Hungerford and Volk 1990). Moreover, people with better education and more knowledge about wildlife are also those who are more likely to be employed by tourism initiatives (Ashley et al. 2000), which makes the true reason for any more positive views towards wildlife harder to discern. However, further investigating this relationship between knowledge and attitudes would be beneficial for deepening our understanding of the factors underlying reported conflict.

1.8.6 Livestock husbandry

In a global review, Graham et al. (2005) found no relationship between depredation and livestock management techniques, but a wide variety of studies have shown that it is likely to have effects at a local level. Regional levels of loss, and resultant conflict with carnivores, have been related to livestock husbandry in areas as diverse as Nepal (Oli et al. 1994), Namibia (Marker 2002), Kenya (Ogada et al. 2003) and Brazil (Conforti and de Azevedo 2003; Rabinowitz 2005), and it remains an important factor to consider in human-wildlife conflict studies. A wide variety of techniques exist which can be used in attempts to reduce carnivore depredations, such as aversive stimuli, protective stock collars, electric fencing and many others (Burns et al. 1996; Forthman 2000; Levin 2000; Mason et al. 2001), but these relatively high-technology approaches are unlikely to be appropriate for poor, rural areas. Some rural communities rely on ritualised approaches: for instance, villagers in Cameroon regularly use magic, including specific prayers and the carrying of amulets, in an attempt to prevent cattle depredation by lions (Bauer 1995), while using herders and guardian animals is widespread throughout Africa and elsewhere (Bauer 1995; Black and Green 1985; Coppinger and Coppinger 1980; Maddox 2002; Ogada et al. 2003).

The form of management employed can have a significant impact on rates of depredation: research has shown that extensive management, where stock ranges unattended over wide areas, has been linked to higher losses (Conforti and de Azevedo 2003), while employing herders, using guarding dogs, and keeping stock in well-made, fenced corrals at night are all potentially effective techniques for reducing depredation (Linnell et al. 1996; Marker et al. 2005a; Ogada et al. 2003). Investigating the efficacy of local, low-technology approaches to reducing depredation can have important consequences by identifying those situations where they work best, hence aiding the development of appropriate, cost-effective conflict resolution strategies for particular areas.

1.8.7 Wealth

Wealth can be an important determinant of the intensity of conflict, as previous studies have shown that losses due to depredation and the associated costs of living alongside large carnivores can represent a substantial proportion of annual income for poor households, thereby increasing hostility towards them (Oli et al. 1994; Stander 1997). Increased wealth also acts as a buffer against a single depredation event being catastrophic, making the household less vulnerable to the potential risks of carnivore presence, and as such has been identified as a key factor determining individual vulnerability to environmental hazards (Carter 1997; Naughton-Treves and Treves 2005). Wealth also allows people to lessen environmental risks by having increased access to capital or labour, enabling the use of more efficient protection strategies such as increasing the number of herders or building solid stock enclosures (Naughton-Treves and Treves 2005). The poorest people are therefore at risk of ‘compounding vulnerability’, as they are least able to either absorb the impact of losses or to protect against them (Naughton-Treves 1997). Greater affluence has also been linked to more positive views of conservation efforts (Infield 1988).

1.8.8 Income diversification

Although it can be a significant factor, an examination of wealth alone may not reveal the complexities of local conflict – sources of income must also be considered. Firstly, where people are solely reliant upon livestock for their livelihood, they have few, if any reasons to tolerate large carnivores and their attendant risks. Secondly, diversifying income can provide what has been called ‘individualist self-insurance’ (Carter 1997; Naughton-Treves and Treves 2005), which reduces vulnerability to environmental hazards in the same way that increased wealth does.

Generating income from other sources, especially those linked to wildlife and conservation, has been linked to more positive attitudes towards wildlife (McCarthy and Allen 1999; Sillero-Zubiri and Laurenson 2001), and towards higher tolerance of wildlife-related losses (Naughton-Treves and Treves 2005). Therefore, ensuring that local

people benefit financially from conservation is a fundamental tenet of community-based conservation schemes (Hackel 1999). Even where the source of income is not wildlife-related, income diversification can have a positive impact by improving the financial status of local people and thereby lessening the relative impact of a depredation event (Emerton 1998). However, in reality, conservation-related revenue rarely reaches the local households and communities most affected by wildlife presence, as shown by a cross-border study of Maasai livelihoods in Kenya and Tanzania (Homewood and Trench 2008). Moreover, even where local people do receive substantial financial benefits from wildlife-related sources, improved attitudes towards tourism are not necessarily matched with increased positivity towards wildlife, as has been seen in Indonesia (Walpole and Goodwin 2000).

1.8.9 Location and habitat

Several previous studies have shown that there is often clear spatial variation in levels of reported conflict: for instance, Stahl et al. (2002) revealed that the location of a sheep pasture had a strong influence on its likelihood of experiencing lynx depredation, while a large-scale review of wolf depredation by Treves et al. (2004) concluded that certain environmental characteristics could be used to help predict areas of intense conflict. This is not unexpected, as previous studies have shown that although carnivores may range over very large areas, they often tend to intensively use relatively small areas, which may be characterised by certain vegetative structure or other habitat characteristics (Muntifering et al. 2006). Understanding whether or not certain features of a site seem to predispose it to higher levels of conflict would be an important element in advising local stock-owners how to best manage their animals to reduce depredation, and would therefore be a valuable component of identifying effective conflict resolution strategies.

One common variable that affects levels of conflict is distance from a protected area: high levels of conflict close to reserve boundaries have been demonstrated by researchers in a range of locations, such as India (Mukherjee 2003), Kenya (Patterson et al. 2004), the United States (Primm and Murray 2005) and Tanzania (Newmark et al. 1994). However, previous research has also revealed a wealth of additional factors which may

be important as they can influence large carnivore habitat selection and use, including elevation (Mace et al. 1999), slope (Chundawat 1990), local topography (Jackson and Ahlborn 1988), aspect (Ortega-Huerta and Medley 1999) amount of woody cover (Comiskey et al. 2002; Gros and Rejmanek 1999), prey availability (Glenz et al. 2001), distance to dense vegetation (Stahl et al. 2002) and the height and percentage cover of grass and bushes (Fernandez and Palomares 2000; Muntifering et al. 2006). Therefore, variation in local habitat factors can potentially be significant in influencing disparities in the levels of large carnivore depredation experienced at a household level.

1.8.10 Prey and predator abundance

The effect of wild prey abundance on levels of depredation was documented as early as 1926, when Theodore Roosevelt noticed that jaguar depredation upon livestock in Brazil was common on ranches where wild prey was scarce, but much rarer where such prey was abundant (Rabinowitz 2005). Since then, researchers have noted this same trend of increased depredation in areas of low wild prey availability in a variety of situations, such as with pumas in Venezuela (Polisar et al. 2003), lions in Kenya (Patterson et al. 2004), red foxes in Australia (Lugton 1993) and wolves in Europe (Meriggi and Lovari 1996; Sidorovich et al. 2003). The density of livestock in an area may also be significant, however: Boggess et al. (1978) found that numbers of domestic dog (*Canis familiaris*) attacks were positively related to the number of sheep available.

As the density of prey, whether wild or domestic, increases, the density of carnivores tends to as well (Carbone and Gittleman 2002), and the relative abundance of predators is also likely to be an important factor in determining the local intensity of human-carnivore conflict. A positive relationship between carnivore density and levels of livestock depredation has been demonstrated in several studies, such as with wolverines (*Gulo gulo*) (Landa et al. 1999), red foxes (Lugton 1993) and coyotes (*Canis latrans*) (Nass et al. 1984), although the relationship is not always clear-cut: a longer-term review by Boggess et al. (1978) found no significant link between coyote density and sheep depredation.

1.8.11 Contact with and benefits from protected areas

There has been something of a paradigm shift since the 1980s regarding local involvement in conservation, moving from Park outreach and revenue-sharing initiatives to transferring ownership to people living alongside the wildlife concerned, with increased local responsibility and authority for land-use planning and resource utilisation (Hackel 1999; Sillero-Zubiri and Laurenson 2001). However, despite this seemingly positive shift, numerous case studies show that this transition of authority and the provision of benefits to local people has often not occurred in practice (Blaikie 2005). In areas where this shift has not occurred and conservation is still primarily reserve-based, building good relationships between local people and Park authorities is of fundamental importance. The existence of protected areas can result in local communities incurring significant opportunity costs due to restricted grazing, resource use and hunting (Gibson and Marks 1995; Sachedina 2008; Walpole and Thouless 2005), although reserve establishment can also actually help protect local peoples' resource rights and limit outside intervention – for instance, the designation of the Kaa-Iya del Gran Chaco National Park in Bolivia was driven by indigenous people in order to protect forest resources from advancing agriculture (Noss and Castillo 2007). However, even in such cases, people must accept some limitations on resource access, as well as forgoing alternative land use options in the future (Redford et al. 2007). Therefore, it is imperative that local communities should feel involved with and receive tangible benefits from reserves in order to minimise local conflicts (Alexander 2000). Examples of benefits can be seen from around Ruaha National Park, where tourism revenue has fed into local villages, and where villagers on the southern border of the Park have been at the heart of designating a new Wildlife Management Area (WMA), strengthening pastoral land tenure rights and increasing likely future benefits from wildlife utilisation (Coppolillo and Dickman 2007).

1.8.12 Conflict with conservation agencies and other authorities

Despite potential economic benefits, living in close proximity to a protected area can undoubtedly inflame conflicts between people and wildlife, not only because of the close

juxtaposition of human communities and potentially dangerous species, but also because of real or perceived restrictions imposed by the state or conservation agencies. As people tend to be far more willing to tolerate risks that are undertaken voluntarily, rather than those imposed upon them externally (Starr 1969), forced coexistence with reserves and wildlife can be an important component of human-wildlife conflicts. One study around Kibale National Park in Uganda revealed that domestic stock actually inflicted twice as much crop damage as wild animals, but local resentment was much higher towards wildlife, as they were perceived to be the state's property and imposed upon local people by external authorities rather than voluntarily tolerated, and people also felt constrained in their ability to act to control wild animals (Naughton-Treves and Treves 2005).

Setting aside land for conservation purposes can limit peoples' economic opportunities and restrict their land use options, and such 'forced primitivism' can cause anger and resentment towards conservation agencies as well as the species being protected (Goodland 1982; Hazzah 2006; Treves and Wallace 2006). In India, the enactment of conservation land use policies around what is now the Nanda Devi Biosphere Reserve restricted access to grazing areas, so communities had to rely heavily upon intensive cultivation and could no longer employ traditional strategies such as maintaining clear patches between farmed land and forest edges to minimise human-wildlife conflict. The increased wildlife damage suffered by reserve-adjacent communities, coupled with the lack of alternative income sources and the termination of traditional resource rights within reserve boundaries, resulted in intense hostility towards both the Reserve and its managers (Rao et al. 2002).

Researchers have found that in places as disparate as Uganda and Bolivia, local people have used human-wildlife conflict as a 'lightning rod' to express their dissatisfaction with imposed restrictions on local resource use, resented conservation rules, and the perceived failure of governments to protect peoples' resources (Treves and Wallace 2006). Similarly, intense conflict over wolf recovery in North America was recognised as being fuelled by underlying cultural conflicts, such as urban versus rural values, the imposition of national government, and arguments over resource use (Nie 2004; Primm and Clark 1996). Work in Ethiopia revealed that persecution of Ethiopian wolves (*Canis simensis*)

was actually driven by antipathy towards distant Government officials, and that the wolves were being used as surrogate, more accessible targets by local people venting their anger (Gottelli and Sillero-Zubiri 1992). In Kenya, Maasai warriors (*morani*) killed over half of the lions in Nairobi National Park after expressing their anger that the Government did not recognise the cultural value of their cattle and failed to do more to prevent lion depredation around the reserve borders (Anon 2003). Following this incident, the government immediately launched a manhunt for the lion-killers, deploying over 50 armed agents and a police helicopter in a bid to protect the remaining lions (Nyamwaro et al. 2006). Such seemingly heavy-handed actions of authority figures can also engender intense hostility and distrust from local communities. In 1997, a raid by the Ngorongoro Conservation Area Authority's (NCAA) game wardens on pastoralists that they thought were grazing illegally in the Forest Reserve resulted in three herdsmen being severely beaten with their own spears, while their cattle were slashed and killed with machetes (Lissu, 2000). The Maasai community were outraged, and although the situation was finally resolved, with the NCAA paying Tsh 1 200 000 (around US\$1970) in compensation, such events have long-lasting impacts on local peoples' perceptions of conservation authorities. Such hostility may not be immediately evident as a causal factor of the conflict at hand, so in-depth approaches are needed to start examining these possible deep-seated drivers.

1.8.13 Other contributing factors

Clearly, determinants of conflict are often site and species-specific, and many other factors have been identified as being potentially important, such as local human density (Newmark et al., 1994), effects of drought (Saberwal et al. 1994), and other characteristics of the respondents concerned, such as age (Bandara and Tisdell 2003; Lindsey et al. 2005b), gender (Hill 1998) and education level (De Boer and Baquete 1998). This highlights the complexity of factors affecting local attitudes towards wildlife, and although some variables are harder to quantify and investigate than others, it is important to recognise that conflict is probably multi-faceted and may well have deeper roots than those initially apparent. This study will aim to examine the relative importance of multiple different drivers of conflict, and identify those factors which play key roles in

determining the antagonism between humans and wildlife, particularly large carnivores, in the Ruaha landscape.

1.9 Particular focus on pastoralist-carnivore conflict in Tanzania

As shown above, large carnivores tend to cause particularly intense conflict where they are present, which poses a major threat to their continued persistence across large swathes of their historic range (Frank et al. 2006a; Marker 2002; Ray et al. 2005). Understanding the dynamics of their interactions with humans, and the attitudes of those people, particularly in reserve-adjacent areas, is fundamental to determining which management strategies can have greatest benefits for both human and carnivore populations. Tanzania is globally important for carnivores, particularly cheetahs, African wild dogs and lions (Frank et al. 2006a; Gros 2002; TAWIRI 2006, 2007a, 2007c; Woodroffe et al. 1997). The Ruaha landscape is especially significant as, unusually, it still supports an intact guild of large carnivores (Dickman 2005; WCS 2005). As across much of east Africa, the human communities in this area are predominantly pastoralists, which have been viewed disparately as either traditional communities living in harmony with wildlife (Western 1989), or as people living an backward, environmentally destructive lifestyle that threatens wildlife conservation (Collett 1987; Parkipuny 1997). Pastoralists have coexisted alongside large carnivores for millennia, continue to suffer losses due to them, have frequently borne the brunt of disadvantageous land use change, such as the gazetting of land for conservation, and have more recently have been the target of efforts to disburse the benefits of tourism and conservation (Coppolillo and Dickman 2007; Lissu 2000; Maddox 2002), although many wildlife-related benefits are yet to have significant positive impacts on pastoralist communities (Homewood and Trench 2008). All these dynamics have occurred in the Ruaha landscape, and this, combined with its global importance for large carnivore conservation, makes this study into the relative importance of different drivers of pastoralist-carnivore conflict a valuable one, with implications for other sites, both in Tanzania and elsewhere.

1.10 Research questions to be addressed in this study

As shown above, human-wildlife conflict has been investigated by many researchers in a broad variety of settings across the globe, but many of them focus on one particular aspect of conflict, such as the efficacy of livestock husbandry techniques (Marker et al. 2005a; Ogada et al. 2003), effects of local habitat (Muntifering et al., 2006), impact of local prey availability (Polisar et al. 2003) or the cultural practices and attitudes of local people (Ale 1998). Few studies, however, especially in the developing world, have aimed to simultaneously examine a broad suite of variables likely to influence conflict, and attempted to tease out which, if any, of these factors appear to be the main determinants of conflict in that area, and gain a much deeper understanding of such a complex issue with many inter-related contributing factors. This study will aim to contribute towards this gap in the existing knowledge of human-carnivore conflict, and aims to provide the model framework that can be used to assess similar conflicts in other areas.

Overall, this research aims to investigate the levels of human-wildlife conflict in the Rungwa-Ruaha region of Tanzania. This conflict will be examined in relation to land use patterns, livestock management techniques, human attitudes, the availability of economic incentives and environmental variables, in order to try to identify key drivers of conflict. The specific research aims of this project are:

- (i) To assess the attitudes of pastoralists and agro-pastoralists towards wildlife in general and five focal large carnivore species in particular (lion, leopard, cheetah, African wild dog and spotted hyaena), investigate reasons for reported hostility, and examine attitudes in relation to a variety of characteristics including wealth, ethnicity, income sources and diversification, distance from the Park boundary, gender, age and knowledge about wildlife.
- (ii) To gather in-depth knowledge of local peoples' attitudes towards wildlife, the nearby National Park, its authorities and other conservation agencies, and details of the costs and benefits they associate with the Park and wildlife presence. Respondents' attitudes will be examined in relation to a variety of

factors, such as their ethnic group, length of time in the area, and their history of interactions with conservation areas and related personnel.

- (iii) To examine the importance of depredation as a cause of stock loss relative to other causes of loss, and determine the reported frequency of sightings of and attacks by focal carnivores, as well as reported carnivore removals by interviewees. Data from initial interviews will be compared to those from long-term monitoring, to assess longitudinal patterns of depredation across the landscape, and examine whether initial assessments of loss to predators differ from long-term results.
- (iv) To assess the livestock husbandry techniques employed, such as the use of herders and dogs, and methods of boma (traditional thornbush corral) construction, and examine the apparent efficacy of different techniques in terms of how they relate to patterns of livestock depredation.
- (v) To investigate whether local variation in habitat, such as vegetation type and cover, and distance from the Park boundary, plays a significant role in affecting the likelihood of depredation occurring at a boma.
- (vi) To use the results of the study to examine which factors appear to be the main determinants of conflict in the area, in terms of both reported hostility and depredation, make recommendations for improved management and conflict resolution, and highlight avenues worthy of future research.

The urgent need for such a project has been highlighted by international experts (Niskanen 2005; Ray et al. 2005; Woodroffe et al. 2005b), and the techniques and models used here can be extended more broadly to understand the complexities of conflict in other regions where it poses a substantial threat to local communities and wildlife populations.

1.11 Structure of the thesis

This first chapter of this thesis has provided an overview of the issue of human-wildlife conflict around the globe, and demonstrated the wide variety of circumstances under which it can occur, as well as the myriad of factors that can affect its intensity. At the end

of this review, I presented the research questions that I wished to address and the overall aims of the thesis. In chapter 2, I describe the country and region where the study took place, as well as brief descriptions of the ethnic groups surveyed for the study, descriptions of the five large carnivore species focused upon, and an overview of the laws, history and policies that are likely to be relevant to the issue of human-wildlife conflict in Tanzania today. In chapter 3, I present a brief overview of the main methods used for the thesis, although further details of study methodology are provided in each of the individual chapters. In chapter 4, I present the results of an attitudinal survey into human-wildlife conflict in general, examining how the magnitude of conflict reported here compares to a similar study in northern Tanzania, which species engendered particularly intense conflict, the reasons given for that antagonism, and which respondent characteristics appeared to be linked to particularly high levels of hostility towards wildlife. In chapter 5, I focus particularly upon conflict between humans and the five focal carnivore species, the reasons for that conflict, reported levels of depredation and carnivore attacks upon humans, the level of reported retaliations against carnivores, and the key determinants of human-carnivore conflict. In chapter 6, I investigate the veracity of reported carnivore attacks, and assess which livestock husbandry techniques appeared to be linked to a lower rate of carnivore depredation. In chapter 7, I present the results of in-depth interviews with local people, examining their reported attitudes towards protected areas, Park authorities and wildlife, and investigating whether any more deep-seated factors seem likely to affect the intensity of human-wildlife conflict in this study area. In chapter 8, I discuss the implications of the study results and assess how they help us understand the dynamics of human-wildlife conflict, relate them to results from similar studies conducted elsewhere, and examine how they can help us formulate effective strategies for moving forward and trying to help mitigate conflict between humans and wildlife.

Chapter Two

Study Area



CHAPTER 2: STUDY AREA

This study was conducted in the village land associated with the Pawaga-Idodi Wildlife Management Area (PI-WMA), a 750km² area abutting the southern border of Ruaha National Park in Tanzania. Tanzania is a key location in which to study conflict between humans and wildlife, particularly carnivores, as it supports large wildlife populations, an intact guild of large carnivores and is also home to large numbers of pastoralist and agro-pastoralist groups who have to share their lives with that wildlife. Previous human-wildlife conflict studies have been conducted in Tanzania, but have largely been focused on the northern regions (Kideghesho 2006; Lichtenfeld 2005; Maddox 2002), and this study will provide a comparison from the southern part of the country, where such conflict, especially with carnivores, has often been particularly acute (Balduš 2004). The varied ethnic composition of this area, with at least 35 different ethnic groups represented, also allows for examination of how attitudes towards wildlife vary between people of different ethnic groups and lifestyles living in the same area (Nahonyo et al. 1998; Walsh 2007a; Williams 2005). A more in-depth overview of Tanzania in general, the Ruaha ecosystem in particular, the ethnic groups focused on during this study, the history and current situation regarding land tenure and wildlife policy, descriptions of the focal carnivore species, and the environmental characteristics of the study area are provided below.

2.1 Tanzania – a national overview

2.1.1 Location and brief history of establishment

Tanzania is located in East Africa, lying between 29° and 41° East and 1° and 12° South. Over 99% of Tanzania (883 000km²) is in mainland East Africa, while the islands of Zanzibar, Pemba, Mafia and Lamu, located in the Indian Ocean some 30km off the coast, comprise another 2500km² (NBS 2007). First colonised by the Germans in 1884 and named German East Africa, the country was occupied by the British during World War I, who in 1920 renamed it Tanganyika (Yeager 1989). In 1922, Tanganyika was made a mandated territory of the League of Nations and was formally placed under the control of

the British Empire (Yeager 1989). In 1946, its status changed to a trust territory of the recently formed United Nations, remaining under British mandate but with a clear expectation that the country would develop self-government and eventually become independent (Ndembwike 2006). Internal self-government was declared on 15th May, 1961, and Tanganyika became a Sovereign State on the 9th December 1961 and a Republic the following year. Zanzibar obtained independence from the UK in December 1963 and a revolution in January 1964 led to its establishment as the People's Republic of Zanzibar (Yeager 1989). On the 26th April 1964, the two Sovereign Republics joined to form the United Republic of Tanganyika and Zanzibar (renamed the United Republic of Tanzania on the 29th October 1964), representing the first and only union of independent states in Africa (Ndembwike 2006).

2.1.2 Climate

Tanzania has two rainfall regimes: the southern, south-western, central and western areas of the country have a unimodal pattern, where rain falls between November/December and April, whereas the northern coast, north-eastern highlands, Lake Victoria basin and the Zanzibarian islands have a bimodal pattern, with short rains between October and December and long rains between March and May (NBS 2007). The climate varies according to altitude, with temperatures as low as 15°C in mountainous areas of northern Tanzania and reaching 35 °C in the coastal zone around Dar es Salaam (Darch 1996).

2.1.3 Human population

The last official census was done in 2002, which revealed a population size of 34.3 million people, 44.2% of whom were below 15 years of age (NBS 2007). The United Nations Development Programme (UNDP) estimates that Tanzania was home to 38.5 million people in 2005, again with 44% of the populace under 15 years of age, and only 3% aged 65 or over (UNDP 2007). Population growth rate was 2.9% between 1975 and 2005 and is estimated to be 2.4% between 2005 and 2015, leading to a predicted population size of 49 million by 2015 (UNDP 2007). Almost a quarter of Tanzanians (24%) are urban dwellers, with this estimated to rise slightly to 29% by 2015.

Tanzania is ethnically very diverse, with more than 120 ethnic groups present in the country, and at least 87 different languages spoken in addition to Swahili and English (EALE 2008; Legere 2002). These ethnic groups differ from one another in terms of culture, language and social organisation, although these characteristics are rarely completely homogenous even within a single group. The colonial administration tended to create regional subdivisions based largely upon the ethnicity of local people, and despite attempts by the post-independence government to decrease emphasis on ethnicity and stress the concept of national unity, history dictates that the ethnic composition of the population still tends to vary substantially between different geographic areas (EALE 2008). The Sukuma are the largest single ethnic group in Tanzania, comprising around 13% of the population, while none of the other large groups individually make up more than 5% of the population (EALE 2008). Less than 1% of the Tanzanian population is made up of non-Africans, including Europeans, Arabs and Asians (EALE 2008). This large diversity of ethnic groups, none of whom predominates, may help to explain why Tanzania has not suffered from the same intensity of inter-ethnic problems seen elsewhere in Africa. However, this does not mean that the situation is entirely harmonious. Although there has been some suggestion that ethnic identities may have weakened over recent decades (EALE 2008), distrust between different ethnic groups and their ways of life can still generate substantial friction (Williams 2005; Wisjen and Tanner 2002). More detailed descriptions of the ethnic groups examined in this study are provided in section 2.2.2.

The majority of Tanzanians are religious, with an estimated 35% of the mainland population thought to be Muslim, 30% Christian and 35% holding 'indigenous beliefs'. On Zanzibar, however, more than 99% of the population are thought to be Muslim (CIA 2008). Tensions have recently been noted in Tanzania between people of different religious groups, particularly between Christians and Muslims (EALE 2008).

2.1.4 Poverty and human welfare

Tanzania is undoubtedly an extremely poor country in terms of economic wealth. It currently ranks 159th out of 177 countries in the global Human Development Index (HDI)

- a composite measure which measures a country's average achievements in terms of three main aspects: a long and healthy life, access to knowledge, and a decent standard of living - and with an HDI of less than 0.5 it is officially classified as a low human development country (UNDP 2007). Ninety percent of Tanzanians live on less than US\$2 a day, with more than half (58%) surviving on less than a dollar a day (UNDP 2007).

This poverty leads to harsh living conditions for the majority of people living in Tanzania, and is particularly acute in rural areas (FAO 2006). Forty-four percent of Tanzanians are undernourished, only 47% have access to improved sanitation, 73% live in houses with mud floors and 9.2% of households have no toilet (NBS 2007; UNDP 2007). With only 12% of Tanzanians having any access to electricity, 98% depend upon solid fuels, such as firewood, which rises to 99.9% of people in rural areas (NBS 2007). In rural areas, only around a third of people (36.3%) have regular access to an improved source of water (NBS 2007).

More than a third of all babies born in Tanzania are not expected to make it to 40 years old, and rural children are more likely to die at birth than those born in urban areas (Government of Tanzania 2005; UNDP 2007). Mean life expectancy at birth is 51 years, with females living slightly longer on average (52 years) than men (50 years) (UNDP 2007). The median age of the population is only 17.7 years old, and at least 6.5% of the population are HIV-positive (CIA 2008; UNDP 2007). Food insecurity is a major issue in Tanzania, with more than 40% of households having inadequate food and high rates of malnutrition seen across the country (Mariki 2002). Livelihood insecurity, problems with land ownership and access rights, and poor social services also contribute towards poor welfare for many Tanzanians (Mariki 2002).

On the positive side, there is a high uptake of education services - almost all children nationwide (91%) now enroll in primary education, and 84% of those who begin Grade 1 make it to Grade 5 (UNDP 2007). However, this high level of uptake does not always translate into effective learning, and many primary school leavers remain functionally illiterate (Bishop 2007). The sex ratio of pupils in primary and secondary schools is almost 1:1, but more than twice as many males as females reach tertiary education, and

women comprise less than a fifth of people earning wages outside the agricultural sector (NBS 2007). Overall, a third of adults are illiterate, with literacy rates biased towards men (78%) compared to women (62%), but literacy is improving – 78% of all 15-24 year olds are now literate (NBS 2007; UNDP 2007). Despite the poverty of its own population, Tanzania also has a particularly heavy refugee burden and now houses more than half a million refugees who have fled conflicts in countries such as Burundi and the Democratic Republic of Congo (CIA 2008; UNDP 2007).

2.1.5 Land use

In 2000, data from the United Nation's Food and Agriculture Organisation (FAO) indicated that Tanzania had 4 million hectares of arable land, with 1 million hectares of land permanently producing crops, and 43 million hectares of pasture land used to support almost 18 million cattle and buffaloes, as well as more than 16 million sheep and goats (FAO 2004). Overall, in 2000, 6% of Tanzania's land was used for arable crops, 48% was used for pasture and the remaining 46% was used for other purposes (FAO 2004). Protected areas make up a substantial proportion of this land used for 'other' purposes. Overall, over a third of Tanzania's territory (39.6%) is formally protected in some manner, which is well above the international average of 12.7% (Chape et al. 2003) and more than any other country in sub-Saharan Africa, who on average protect 10.9% of their land (EarthTrends 2003; Ndembwike 2006).

By 2003, 792 protected areas covered more than 370 000km² of Tanzania's land area, including six of over 1000km² in size (EarthTrends 2003). Eleven percent of this area (41 000km²) fell under the strictest World Conservation Union (IUCN) categories of I and II, which include Nature Reserves, Wilderness Areas and National Parks, 26% were in categories III-IV, while the remaining 63% were category VI or unclassified (EarthTrends 2003). National Parks covered a combined total area of over 48 000km², with an additional 90 000km² allocated to Game Reserves (NBS 2007; UNEP 2008). Land can fall into several categories at once, for instance, a Forest Reserve might also be part of a Game Reserve, so different protected areas often overlap. Not all of Tanzania's protected areas exclude human resource use, with the Ngorongoro Conservation Area an

internationally known example of a situation where human habitation and conservation goals have been pursued in tandem, although restrictions have been placed on some human activities such as cultivation (Lissu 2000; Tukahirwa 1997). However, Tanzania has a relatively high proportion of land (around 14%) that excludes permanent human habitation, compared to 8% and 9% for neighbouring Kenya and Uganda respectively (Thompson 1997a).

2.1.6 Economics

Tanzania is one of the poorest countries in the world in economic terms, with a per capita Gross Domestic Product (GDP) of US\$316 in 2005: less than one-hundredth of the mean per capita GDP in the UK and below-average even for low human development countries (UNDP 2007). The economy is heavily dependent upon agriculture, which accounts for around 42% of the GDP, provides 85% of export products and employs 82% of the 19.7 million people in the Tanzanian workforce (CIA 2008; UNDP 2007). Despite this, topographical and climatic limitations mean that less than 10% of the land area is used for agriculture (CIA 2008). The service industry (including tourism) is the next most important contributor in terms of the national economy, responsible for generating around 39% of the GDP, although only 3% of Tanzanians are employed in this sector (CIA 2008; UNDP 2007). The industrial sector accounts for the remaining 19% of the country's GDP and employs 15% of the workforce (CIA 2008; UNDP 2007). Tourism has grown substantially over the past two decades, with revenues ballooning from around US\$60 million in 1990 to over US\$860 million by 2004, and expected to surpass US\$1 billion in 2008 (Homewood and Trench 2008; WTO 2006).

The richest 10% of people in Tanzania hold over a quarter of the nation's wealth (26.9%), while the poorest 10% hold less than 3% of it (UNDP 2007). Interestingly, Tanzania's Gini index – a measure of a country's wealth inequality, with 0 indicating absolute equality and 100 indicating absolute inequality – is very similar, at 34.6, to that of the UK, at 36.0, with what wealth there is distributed slightly more evenly in Tanzania than in the UK (UNDP 2007). Tanzania received over US\$1.5 billion in official development aid in 2005, equating to US\$39.3 per capita, and by the end of 2007,

Tanzania had an external debt of five billion US dollars (CIA 2008; UNDP 2007). The already weak national economy is threatened further by the impact of HIV/AIDS on the working population – projections estimate that by 2015, the economy could be around 8% smaller and the GDP around 4% lower as a result of the pandemic (PHDR 2005).

2.1.7 Biodiversity

In marked contrast to its economic poverty, Tanzania is outstandingly wealthy in terms of biological riches, a quality due at least in part to the large wild areas that it still contains. The country supports at least 316 species of mammals, 1016 species of birds, 229 species of breeding birds, 335 reptile species, 121 amphibian species and 331 fish species (EarthTrends 2003). In addition to these sheer numbers, a closer examination of Tanzania's wildlife reveals high levels of endemism as well as high levels of global threat. Of all the bird species in Tanzania, 1% are endemic while 14% of the breeding species are threatened – for mammals, 4% are endemic and 13% threatened; for reptiles, 23% are endemic and 1% threatened; for amphibians a huge 33% are endemic, with unknown threat levels, and 5% of the country's fish species are under threat (EarthTrends 2003; Shemwetta and Kidegesho 2000; World Resources Institute 1995). In addition, Tanzania has over 10 000 species of higher plants, including 235 which are globally threatened (EarthTrends 2003). Due to this wealth of biodiversity, Tanzania has been classed as a 'Megadiversity Nation', alongside countries such as Indonesia and Brazil (World Resources Institute 1995), and species continue to be discovered in the country (Jones et al. 2005; Mariaux and Tilbury 2006; Rovero et al. 2008).

This wealth of wildlife is increasingly being used to generate much-needed income for Tanzania, and the country has long been a highlight for tourists interested in wildlife. Revenue from wildlife is calculated to contribute up to 16% of Tanzania's GDP – 14 of the country's National Parks generated nearly US\$52 million in 2006, while trophy hunting is also an important source of revenue, generating around \$13 million in 2006 (Baldus and Cauldwell 2004; Brockington 2005; Homewood and Trench 2008; Sachedina 2008; Shemwetta and Kidegesho 2000). Increases in employment, foreign

currency generation and the sale of local commodities are also important consequences of wildlife-related tourism (Shemwetta and Kidegesho 2000).

However, despite the current situation, the outlook is not necessarily rosy. The UNDP uses the amount of forest cover as an index of environmental change for a nation. Between 1990 and 2005, Tanzania lost more than 61 000 km² of forest cover, with an annual rate of loss of around 1%, which is twice the average for low human development countries and five times the mean global rate, and this could have significant effects on biodiversity (UNDP 2007). Moreover, there has been criticism of the wildlife sector of the economy, as it suffers from limited community participation and its growth may be unsustainable in the future, particularly outside protected areas where wildlife populations are diminishing (DPG 2007).

2.2 Pastoralists and agro-pastoralists in Tanzania

2.2.1 Overview of pastoralism and agro-pastoralism in Tanzania

Defining pastoralism is complex due to the diversity and dynamism of pastoral systems, which vary widely even within East Africa, from the highly mobile Turkana to the relatively sedentarised Maasai in southern Kenya, and from specialised camel keepers, such as the Rendille, to those who rely on a combination of cattle rearing, fishing and dryland horticulture, such as the Nuer and Dinka (Fratkin et al. 1994; Hesse and MacGregor 2006). However, pastoralists are considered to show some defining traits, such as relying upon livestock for a significant proportion of their food and income, with the livestock representing more than just an economic asset (Hesse and MacGregor 2006) while agro-pastoralists are those people who keep livestock but also practise agriculture (Fratkin 2001).

Around half of the world's pastoralists live in Africa, with 13 million Africans following predominantly pastoralist lifestyles and another 9 million practising agro-pastoralism (Fratkin 2001; Galaty and Johnson 1990), with East Africa supporting the largest variety and number of pastoral societies in the world (Fratkin et al. 1994). Pastoralism is the dominant form of land-use in the arid and semi-arid rangelands of East Africa, with over

70% of Kenya and 50% of Tanzania, Uganda, Sudan, Somalia and Ethiopia occupied by pastoralists (Fratkin 2001; Fratkin et al. 1994). Despite this, pastoralist populations are numerically small, and they are frequently disempowered and marginalised by national authorities (Fratkin 2001). Pastoralism has long been criticised as a backward and inefficient form of land use, with pastoralists viewed as obstructing modernisation and development, and as such there has been strong pressure from authorities, including the Government in Tanzania, to limit or ‘improve’ it (Hodgson 2000). Pastoralism has also been declared environmentally damaging (Lamprey 1983; Sinclair and Fryxell 1985), based largely on concerns emerging from Hardin’s ‘Tragedy of the Commons’, where communal land is over-exploited due to a lack of control over resource utilisation (Hardin 1968). However, on closer examination it became evident that pastoralists do effectively control resource use through traditional rules and limitations governing resource access (Galaty 1994; McCabe 1990). Ironically, environmental degradation is most likely to occur when pastoralists are forced to limit their movements and their traditional practices of resource use consequently break down (Hesse and MacGregor 2006; Lissu 2000).

However, attempts to restrict pastoralists’ resource access and movements often had more to do with state control and interests than environmental concerns (Anderson 1993; Lissu 2000). Tanzanian pastoralists, as others, have commonly been excluded from areas as they were demarcated for wildlife conservation, settled by villagers and cultivators during the process of *ujamaa* or ‘villagisation’, or allocated as state-operated ranches or agrobusinesses (Galaty 1994; Homewood 1995). Exclusions and restrictions on resource use have, unsurprisingly, often led to intense conflicts between pastoralists and the authorities imposing such changes (Kideghesho 2006; Lissu 2000). These changes have also often exacerbated the need for pastoralists to engage in alternative strategies to generate income (Homewood et al. 2006), such as cultivation, as seen with the ethnic groups described below.

2.2.2 Overview of the main pastoralist and agro-pastoralist ethnic groups focused on for this study

Defining and describing ethnic groups can be problematic, with the tendency to assume homogenous behaviour across an entire ethnic group rather than appreciating variation

between subunits such as clans and subclans (Spencer 1988). Moreover, different ethnic groups often have strong economic, social, structural, marital and linguistic links with one another (Coast 2004; Spear and Waller 1993), with the clear demarcation of ethnic groups sometimes considered to be a European construct of colonisers and missionaries (Wijsen and Tanner 2002). Ethnic groups may exhibit such seemingly distinct characteristics, in terms of appearance and behaviour, that it is easy to assume that they are all independent with separate ancestries and lineages, but this often not true in reality (Homewood and Rodgers 1991). For instance, the Maasai share cultural and social links with a variety of other Maa-speaking groups, which had previously been considered entirely separate ethnic groups, but these connections, and the drifting of families in and out of a pastoralist lifestyle, mean that they are all inextricably inter-linked (Homewood and Rodgers 1991). Similarly, the Hehe and Bena show very close similarities and have a shared cultural heritage and ancestry, binding them closely together (Redmayne 1968b).

However, for the purposes of this study I follow Coast (2004) in relying upon broad conceptualisations of an ethnic group, and attempt to provide a brief overview of each of the main ethnic groups focused on during this study below. As with any ethnic group, there is substantial variation between its members depending on their location, personal history and individual lifestyles, but here I present a brief summary of some generalisations considered pertinent to this study. Moreover, despite the fact that these groups usually originated in distinct areas, the national process of *ujamaa* meant that people from different ethnic groups were forced to live in close proximity with one another, with numerous people from different ethnic groups flooding into, and mixing within, the prescribed *ujamaa* villages (Sieff 1999). This enforced cohabitation within villages often caused conflict between different groups, particularly between groups that had longer-term attachments in an area, such as the Hehe around Pawaga-Idodi, and relative newcomers with different lifestyles, such as the more mobile Barabaig pastoralists (Williams 2005).

2.2.2.1 *The Maasai*

The Maasai are undoubtedly one of the best-known pastoralist groups in the world: to quote Spear (1993), 'Everyone knows the Maasai'. However, the concept of 'Maasainess', as with other ethnic groups, is tenuous at best, with the Maasai never being a single political entity, but rather comprising numerous independent groups such as the *Purko*, *Loita*, *Kaputei* and *Matapato* of Kenya, and the *Kisongo* of Tanzania, which together numbered around 350 000 in 1997 (Fratkin 1997). Despite this, the Maasai tend to have a strong sense of their own identity and can generally be described as pastoral people partly of Nilotic origin, whose ancestors moved southwards into central Kenya in the seventeenth century and then into Maasailand, which straddles the Kenyan-Tanzanian border (Lamprey and Reid 2004; Parkipuny 1997). The Nilotic linguistic group has three branches – the Plains Nilotes, which include the Maasai, the Highland Nilotes, which include the Barabaig, and the River-Lake Nilotes, which are represented by the Luo and are not included in this study (Burnett et al. 1996; Homewood and Rodgers 1991). However, the Maasai did not emerge from a single ancestral line, but developed their identity as a group more as a consequence of their reliance upon pastoralism, which set them apart from other communities who specialised in agriculture or hunting, despite extensive cultural intermixing, borrowing and multi-lingualism between all the groups (Spear 1993).

As their pastoralism was the very characteristic that set them apart from other groups, the Maasai developed an intensely pastoral culture that heavily stressed the importance of cattle (Spear 1993). As such, the Maasai have traditionally been viewed as 'pure pastoralists' (Anderson 1993; Brown 1971), with their famed reliance upon blood and milk from cattle rather than meat, although this is more of a social ideal than a historical reality (Arnhem 1985; Homewood in press; Hughes 2006). Despite this perception of 'pure' pastoralism, the Maasai have always resorted to activities outside of pastoralism when circumstances demand it, and present circumstances mean that cultivation is becoming a much more common livelihood strategy amongst the Maasai, although livestock usually remains a fundamentally important resource (Coast 2004; Homewood et al. 2006; Spear and Waller 1993). Cattle remain the central value in the Maasai culture-

complex, and have fundamental social, political, religious and cultural value in addition to their economic worth, while land is also invested with cultural and social meaning (Arnhem 1985; Ndembwike 2006; Shorter 1974). The strength of the emotional bond that Maasai have with cattle is reflected in the extensive cattle-related vocabulary that they have developed, which is absent from other cattle-keeping groups (Wijsen and Tanner 2002). The Maasai are one of the five ethnic groups to speak KiMaa, and they have animist beliefs based on the concept of a God called ‘Enkai’ or ‘Ngai’, who is believed to have a direct link to the Maasai through their cattle (Philtar 2008). Maasai culture traditionally prohibits the consumption of wild animals, although many who fell on hard times and could not afford to keep cattle historically became poor ‘*Ndorobo*’ hunter-gatherers, and the Maasai do have a history of hunting animals for skins, adornment and trade (Shorter 1974; Spear and Waller 1993). Around 80 000 – 90 000 Maasai were thought to live in Tanzania in the 1980s (Arnhem 1985).

The Maasai in the Idodi-Pawaga study are *Iparakuyo* Maasai, who tend to distinguish themselves from the *Kisongo* and *Salei* Maasai of the plains and highlands of northern Tanzania, but nevertheless retain a strong sense of Maasai identity, particularly when interacting with farmers from the Hehe or Bena ethnic groups, or with local officials or non-governmental organisations (NGOs) (Williams 2005). The *Iparakuyo* once lived in Maasailand, in northern Tanzania, but ceded control of their homeland to the *Kisongo* during wars which occurred between the 1820s and the 1880s (Galaty 1993; Williams 2005). Following this, they began moving south-east across Tanzania, and reached the Pawaga-Idodi region in the early 20th century, with reports of them first immigrating into Pawaga in 1928 and Idodi in 1954, and usually lived along the southern and south-eastern borders of the area which was to become Ruaha National Park (Redmayne 1964; Williams 2005). Despite now often having lived in the area for generations, the Maasai, along with other pastoralist groups, are commonly disdained by people more reliant upon agriculture within Pawaga-Idodi, such as the Hehe, who view themselves as the ‘indigenous’ occupants of the area, and to this day pastoralists in the area often remain marginalised, disempowered and denied sufficient land rights, although they are gradually becoming more involved in local governance (Williams 2005).

2.2.2.2 *The Barabaig*

The Barabaig are a pastoral subset of the Datoga people, a Nilotic people who dominated large areas of northern Tanzania in the 18th century, but were forced out of much of their original homeland by the Maasai (Kjaerby 1989; Sieff 1999). They are classified as Highland Nilotic people, whose ancestors participated in the broad Nilotic migration from Sudan along the Nile, and are distantly related to the Maasai. The Datoga were originally concentrated in the Arusha, Dodoma, Singida and Shinganya regions, while the Barabaig specifically are known to have lived in Hanang District in the Arusha region of northern Tanzania since the 19th century (Lane 1995; Sieff 1999). The Barabaig used to occupy the Serengeti and Ngorongoro Highlands, but surrendered that land to the more powerful and numerous Maasai over 150 years ago, whereupon they moved south and then back into Hanang (Lane 1995). The Barabaig are traditionally semi-nomadic pastoralists (Arnhem 1985), but are increasingly diversifying into agriculture, as has been seen with other pastoralist groups (Fratkin 2001), and have lost over 50% of their grazing land to cultivation (Lane 1995). However, as with the Maasai, cattle retain a particularly important position in Barabaig society, providing both a cultural and existential focus, and all cattle are named, branded and their pedigrees memorised (Klima 1970; Lane 1996; Tomikawa 1972). Smallstock have less cultural value, but nevertheless may make an important contribution in terms of economic value (Sieff 1999). Smallstock are also a valuable source of meat, as cattle are very rarely slaughtered, although meat from cattle that have died can make an important contribution to the Barabaig diet (Sieff 1995). Donkeys are also kept and are used primarily as transport animals, although they are also increasingly used to plough fields as people rely more heavily upon cultivation (Sieff 1999). Work by Sieff (1999) showed that the Barabaig were one of the poorest pastoral groups in East Africa, with fewer average livestock holdings per capita than other groups, such as the Maasai or Rendille.

The Barabaig are known to be proud warriors, with young men traditionally having to prove their bravery by killing ‘an enemy of the people’, namely someone who was not a Datoga, or a dangerous animal such as a lion or buffalo (Leader 2008). Tattooing and scarification around the eyes is a common Barabaig symbol of identity. The Barabaig

tend to be looked down upon by other Tanzanians who judge them as primitive, and they are often disparagingly referred to as ‘Mang’ati’ by people from other ethnic groups, which is derived from the Maa words ‘il Mang’ati’, meaning ‘the enemy’ (Lane 1995). The majority of Barabaig people (there are around 100 000 in Tanzania) speak in the Barabaig dialect, although some speak Swahili or Iraqw (Leader 2008). Traditionally, they hold animist beliefs and practice rituals based on one God, known as ‘Aseeta’ (Leader 2008).

Over the past 50-70 years, the Barabaig have gradually emigrated further south, due to the loss of grazing areas in their traditional homeland, often to Iraqw agro-pastoralists who converted pasture land into agricultural land (Lane 1996; Williams 2005). Another significant driver of their movement southwards was the state appropriation of a large portion of their customary grazing lands (around 100 000 acres) in the 1970s, which was then allocated to commercial wheat farms under the Tanzania Canada Wheat Program (TCWP) (Lane 1996; Williams 2005). Many Barabaig families moved into the Pawaga-Idodi area from the 1980s onwards, often as environmental refugees from the socio-environmental impacts of the TCWP land appropriation (Williams 2005). Although other ethnic groups have also moved into the area recently, such as the Sukuma, the Barabaig remain the least accepted group of newcomers, due in part to their high mobility within the landscape, and to their relatively low investment in socio-economic relations with their neighbours (Williams 2005).

2.2.2.3 The Hehe

The Hehe are a collective group of culturally and linguistically similar people who come from the south-western highlands of Tanzania, the area now known as Iringa District, which lay along the slave trade route from present-day Zambia to the Indian Ocean (Gewald 2006). The Hehe are famed for their warlike nature as, under their legendary leader Mkwawa, they defeated a German force invading the highlands in 1891, and used the spoils of victory, as well as traditional rituals and ‘war medicine’, to cement their reputation as a successful warrior group, with their name possibly derived from their war cry ‘*Ahela*’ meaning ‘the enemy runs’ (Mumford 1934; Redmayne 1968a; Shorter 1974).

The Hehe are closely related to the Bena ethnic group, in terms of both culture and language, with their ruling dynasties descended from two brothers (Redmayne 1968b). Despite these close ties, the Hehe used their force to drive neighbouring Bena communities off some of their land, as happened in the Battle of Mgodamtitu in 1874 (Monson 2000). Today the Hehe are predominantly agriculturalists, and although pastoralism is also practiced to varying degrees and cattle still have social and economic value in Hehe society, this is not to the extent seen with the Maasai and Barabaig (Friis-Hansen 1999). Captured cattle are traditionally valued as a source of meat, however, with meat and beer apparently being foodstuffs particularly favoured by the Hehe, and they also engage in hunting to procure meat (Redmayne 1968b). They speak KiHehe, a Bantu language, and in 1994, the Hehe were thought to number around 750 00 people in Tanzania. Europeans initially mistook Hehe people to be Muslims due to their traditional toga headwear (Redmayne 1968b), but they have now been converted in large numbers to Christianity by missionaries (Joshua Project 2008).

Traditionally, the Uhehe area (homeland of the Hehe people) lies between the Ruaha and Kilombero rivers, in the northern part of the Southern Highlands (Redmayne 1968b). Some Hehe people have lived in the Pawaga-Idodi area since before the first German settlers arrived, but many more arrived from the Ruaha River valley following the gazetting of the Park and the state-enforced process of *ujamaa* villagisation, where people were resettled into villages (Williams 2005).

2.2.2.4 *The Bena*

The Bena are a Bantu subgroup, and originally come from the mountains in Iringa region's Njombe District, in south-western Tanzania, where they are predominantly cultivators, growing cold-weather resistant crops such as potatoes, wheat, rye, and maize (Juntunen 2005; TTN 2008). However, there is considerable diversity in their livelihood strategies, which can include pastoralism, agriculture and other strategies – for instance, the Bena in Mgodamtitu used to be cattle herders before their land was seized by the Hehe, and they then converted to rice cultivation and fishing, while Bena around Lake Nyasa are often fish traders (Monson 2000; Nindi 2007). In Ilembula, southern Tanzania,

Bena people cultivate maize and legumes for daily subsistence, and also keep cattle, but the majority of them have no regular cash income, as climatic limitation mean that they often cannot grow enough crops to sell (Juntunen 2005).

As mentioned above, the Bena have close cultural and linguistic ties with the Hehe ethnic group, due to their shared ancestry. Kinship ties are very important in Bena society, and dead ancestors are called the 'living-dead', as they are believed to live on in the world of spirits, from where they are still thought to be able to bless or punish their living descendants (Juntunen 2005). Around 100 years ago, German missionaries arrived in the Njombe area and evangelised the area, so there is a relatively strong Christian influence, particularly Lutheran, amongst the Bena (TTN 2008). There are thought to be around 670 000 Bena in Tanzania today, and their traditional language is KiBena, which has seven dialects (TTN 2008). The Bena began arriving in the Pawaga-Idodi area in the 1970s and 1980s, and were relatively well-accepted by the Hehe agro-pastoralists already resident in the area, due to their relatively close cultural, linguistic and agricultural links (Williams 2005).

2.2.2.5 The Sukuma

The Sukuma originally come from the Shinyanga, Mwanza and Tabora regions in north-west Tanzania, with the term 'Sukuma' often translated to mean 'northerners' (Coppolillo 2000; Wijzen and Tanner 2002). The Sukuma are the single largest ethnic group in Tanzania, thought to number around six million people in 1997 and now numerous in every region (EALE 2008; Galaty 1988; Wijzen and Tanner 2002). Their native language is a Bantu one called KiSukuma, and they were traditionally farmers, although, as with other groups, income diversification is increasing (Wijzen and Tanner 2002). They are also usually involved in cattle keeping and often have large numbers of cattle, which play a key role in many social activities and help define social status, but the Sukuma do not appear to have the same complex emotional relationship with cattle that the Maasai do (Wijzen and Tanner 2002). The Sukuma are traditionally hostile towards the Maasai due to their propensity for raiding cattle, although this is undoubtedly an activity that they engage in too (Brockington 2008; Wijzen and Tanner 2002). Their religious beliefs are

based largely on the concept of ancestral spirits, and very few Sukuma have converted to Christianity (around 12% nationwide) or Islam, despite a long history of evangelising from missionaries (Wisjen 1997). The Sukuma have a strong belief in witchcraft and have been linked to mass killings, predominantly of post-menopausal women – the Tanzanian Government recorded 826 witch killings between 1985 and 1988, mainly by Sukuma people (Abrahams 1994).

Despite their northern roots, Sukuma agro-pastoralists gradually moved from the Shinyanga region into Maswa, Geita and Nyamwesi, where the Nyamwesi, agriculturalists who speak the same language as the Sukuma, live (Galaty 1988). During the German colonial period, there was a drive to increase the export of agricultural products such as cotton, and the Sukuma engaged heavily in cotton production between the 1930s and the 1970s, so that by the late 1970s over 90% of all cotton produced in Tanzania came from Sukumaland (Williams 2005). However, between the 1940s and 1960s, the number of livestock in Sukumaland nearly doubled, leading to a scarcity of grazing land, especially as many of the former rangelands had been converted into cotton fields (Charnley 1997; Williams 2005). This was a factor in the southwards movement of the Sukuma within Tanzania, although environmental degradation, the effects of Government tsetse control schemes and land alienation have all been cited as additional likely drivers for their migration south (Brockington 2005; Coppolillo 2000; Galaty 1988). The Sukuma are now well established in this study area, particularly the Pawaga district, where they live in diverse communities comprised of many different ethnic groups.

2.3 The importance of Tanzania for large carnivores

2.3.1 Carnivore biodiversity in Tanzania

Tanzania supports 35 species of carnivores, including globally significant populations of large carnivores, notably lions, cheetahs, African wild dogs and spotted hyaenas (TAWIRI 2006; TAWIRI 2007a; TAWIRI 2007c). As such, Tanzania is a global hotspot for carnivores, particularly for species vulnerable to extinction (Mills et al. 2001), and is

a priority for carnivore research and conservation (IUCN 2006b; Nowell and Jackson 1996; Woodroffe et al. 1997). More details of the five large carnivore species focused on for this study are provided below.

2.3.2 Description of the large carnivore species focused on for this study

This study focused particularly upon five large carnivore species, namely the lion, leopard, cheetah, African wild dog and spotted hyaena, as they are species which tend to cause particularly intense conflict with humans (Dickman 2005; Marker 2002; Rasmussen 1999; Ray et al. 2005). A brief overview of each focal carnivore species, alongside information on their global conservation status, population trends and status in Tanzania, is provided below.

2.3.2.1 The lion

The lion, Africa's largest cat and one of its most important flagship species, once ranged extensively throughout Africa, Europe, the Middle East and Asia (IUCN 2006c; Nowell and Jackson 1996). They were extirpated from Europe in the first century AD and from north Africa, the Middle East and Asia between 1800 and 1950, apart from a small relict population of Asiatic lions which still persists in India (Bauer and Van Der Merwe 2004; Nowell and Jackson 1996). In Africa, they have been extirpated from around 80% of their original range (IUCN 2006b).

Around a million lions are thought to have existed in Africa in pre-colonial times, but this dropped to around 200 000 by 1975, and to less than 100 000 by the early 1990s (Frank et al. 2006b). By 2002, Africa's remaining lion population was estimated to be around 22 600, with 49% of those (11 123) thought to be in East Africa and 31% (7073) in Tanzania alone (Bauer and van der Merwe 2002). However, the importance of Tanzania was almost certainly underestimated in that study, as there were no population estimates for some important areas where lions are known to persist, including Tarangire and the Ruaha ecosystem (Bauer and van der Merwe 2002; Bauer and Van Der Merwe 2004). Another comprehensive survey suggested that 39 373 lions remained in sub-Saharan Africa by 2002, with Tanzania holding around 9537 lions, around 24% of the total

(Chardonnet 2002). Tanzania's lion population is an important economic asset for the country, both in terms of attracting international tourists to the country's protected areas, and in terms of trophy hunting revenue – in the 1990s, lions generated 12% of Tanzania's trophy hunting income, despite only comprising 2 - 4% of animals taken as trophies annually (PAWM 1995; TAWIRI 2007c; Whitman 2006).

The lion is listed as Vulnerable by the IUCN, indicating a high risk of extinction in the wild, and is thought to have experienced a population reduction of 30 - 50% over the past two decades (IUCN 2006c). Causes for this dramatic decline include conflict with humans, habitat loss through agriculture and human settlement, and loss of wild prey (Hilton-Taylor 2000; Ray et al. 2005), with retaliatory or pre-emptive killing of lions by rural people identified as the single most important threat to remaining lion populations in East and Southern Africa (Frank et al. 2006a). Retaliatory killing was also deemed to be one of the primary threats to Tanzania's lion population, alongside land use change and inadequate management, although it was envisaged that the development of Wildlife Management Areas (WMAs) would help to address the latter issue (TAWIRI 2007c).

2.3.2.2 The leopard

The leopard has the widest geographical distribution of any wild felid, occurring throughout Africa, the Middle East, India and Asia, and is relatively adaptable to habitat change and the impacts of human settlement (Nowell and Jackson 1996; Ray et al. 2005). While it therefore still occurs across much of its historic range, the leopard has undergone marked declines where there has been extensive habitat conversion, dense human settlement and loss of wild prey (Martin and de Meulenaer 1988; Santiapillai et al. 1982), and as such has declined across much of north Africa and west Africa, as well as across parts of southern Africa (Nowell and Jackson 1996; Ray et al. 2005). In 1988, Martin and de Meulenaer (1988) estimated the sub-Saharan leopard population to be 714 000, although this was based largely on the relationship between leopard density and rainfall, and as such is widely considered to be an overestimate (Norton 1990; Nowell and Jackson 1996). Using this technique, Tanzania was estimated to hold just under 40 000 leopards, which was the seventh largest national estimate from the 41 countries examined

(Martin and de Meulenaer 1988). In sub-Saharan Africa, leopards are not currently considered to be endangered and are not listed by IUCN, but regional populations are increasingly threatened by habitat loss, exploitation and conflict with humans (Myers 1986; Nowell and Jackson 1996). The primary threats to Tanzania's leopards were determined to be the same as those for lions, i.e. retaliatory killing, land use change and inadequate management (TAWIRI 2007c).

2.3.2.3 *The cheetah*

Cheetahs once ranged the length of Africa, as well as into the Middle East and the Indian subcontinent, with their global population estimated at around 100 000 animals in 1900 (Marker 2002; Wrogemann 1975). During the 20th century, they underwent a dramatic decline in both numbers and geographic range, and are now largely restricted to sub-Saharan Africa, although small numbers remain in northern Africa and one relict population of Asiatic cheetahs (*Acinonyx jubatus venaticus*) still persists in Iran (Marker 1998). In 1975, Myers estimated that 7000 - 23 000 cheetahs remained in Africa, but cheetahs are known to have been extirpated from at least 13 countries between the 1950s and 1990s, and an 'optimistic' estimate in 1998 placed the remaining number of cheetahs worldwide at 12 000 (Marker 1998). Cheetahs are listed as Vulnerable by the IUCN, and are considered to be facing a high risk of extinction in the wild (Hilton-Taylor 2000).

Many of the remaining cheetahs now live in small, fragmented populations that are unlikely to be viable in the long-term, with the only remaining strongholds for cheetahs being Namibia and Botswana in southern Africa, and Tanzania and Kenya in East Africa (Bartels et al. 2001b). The importance of Tanzania for cheetahs was highlighted by Myers (1975), who thought that it might hold 10% of the global cheetah population, and by Gros (2002), who estimated that Tanzania supported around 600-1000 cheetahs, and voiced concern over the conversion of pastoralist rangelands, which supported perhaps half of the country's cheetahs, to agro-pastoralism and commercial uses. The causes for the cheetah's widespread decline are primarily habitat loss and conversion, conflict with humans and dwindling prey populations (Marker 2002; Nowell and Jackson 1996). Human-cheetah conflict has been a particularly intense problem in Namibia, where

farmers halved the Namibian cheetah population in just over 20 years as a result of perceived conflict (Marker 1998; Morsbach 1987). Loss of habitat, land use change, retaliatory killing and unregulated tourism are thought to be the most important threats currently facing Tanzania's cheetahs, with snaring, death on the roads and disease considered less important, although more information is needed to ascertain the true impact of these various threats (TAWIRI 2007a).

2.3.2.4 The African wild dog

The African wild dog has undergone a dramatic decline over the past century, and this trend has only accelerated since the 1960s (Woodroffe et al. 1997). Once distributed through much of sub-Saharan Africa and found in 39 countries, African wild dogs have now been extirpated from 25 of those countries (Ray et al. 2005; Woodroffe et al. 1997) – a magnitude of decline second only to the Ethiopian wolf in terms of larger African carnivore range contractions (Ray et al. 2005). Today, they are extinct across most of their former range in west and central Africa, while populations in east and southern Africa are restricted to pockets of low human density (Woodroffe et al. 1997). The last estimate, in 1997, put the world population of African wild dogs at between 3000 and 5500, in perhaps 600 - 1000 packs, with most of the populations outside reserves (and sometimes those inside) still declining (Woodroffe et al. 1997). The largest populations are now found in Botswana, Namibia, Zimbabwe, South Africa, Zambia and Tanzania. Tanzania now supports more wild dogs than any other country, with the population in southern Tanzania critically important, as it may represent the only East African wild dog population that is viable in the long term (Woodroffe and Ginsberg 1999a).

African wild dogs tend to live at very low densities, making them particularly susceptible to habitat fragmentation, and this has been a problem for wild dogs across their range (Woodroffe et al. 1997). The primary reason for wild dog declines, however, is persecution by people – historically, Governments have sponsored campaigns to eradicate wild dogs, even from within reserves, and intense persecution continues today, usually in response to perceived conflict with livestock (Ray et al. 2005; Woodroffe et al. 1997). The wild dog is listed as Endangered by the IUCN, as it is considered to be facing

a very high risk of extinction in the wild (IUCN 2006a), and has been named by Mills et al. (2001) as the second-highest priority terrestrial carnivore species for conservation action in Africa, after the Ethiopian wolf. Human persecution has been named as one of the main threats facing wild dogs in Tanzania, alongside habitat loss, habitat change and disease (TAWIRI 2006).

2.3.2.5 *The spotted hyaena*

Although few hyaena population surveys have been conducted, spotted hyaenas are thought to occur in 37 countries in Africa, with a tentative estimate for global population size of 27 800 – 48 200 (Mills and Hofer 1998). Tanzania is thought to hold between 10 200 and 12 200 spotted hyaenas, making it the single most important country for spotted hyaenas in the world, with around 7000 persisting in the Serengeti ecosystem alone (Mills and Hofer 1998). Most of the populations within parks in southern Africa are thought to be stable, but Mills and Hofer (1998) reported that many populations in East and West Africa were declining, even within reserves.

Spotted hyaenas have a very catholic diet and broad habitat associations, so declines are driven more by anthropogenic pressures rather than ecological changes, although habitat loss is also a concern (Mills and Hofer 1998; Ray et al. 2005). Persecution by humans is the main cause of population decline, with people killing hyaenas to protect stock, for fun, for target practice, or out of fear of the animal (Glickman 1995; Mills and Hofer 1998). Hyaenas have long been feared and reviled even more than most large carnivores, mainly due to the perception of them as hermaphrodites, scavengers, ugly, dangerous, gluttonous and associated with witchcraft (Glickman 1995). Within Tanzania, snaring was found to be the most important mortality factor for hyaenas in the Serengeti ecosystem, resulting in a population decline in that area (Mills and Hofer 1998), while populations outside protected areas in Tanzania are declining due to persecution (Mchitika 1996; Mills and Hofer 1998). The spotted hyaena is listed by the IUCN as Lower Risk: Conservation Dependent (IUCN 1996), but this should not lead to complacency: the species was ranked third in the priority list of African carnivore species for conservation action (Mills et al. 2001). The main threats to spotted hyaenas in

Tanzania are anthropogenic killing and poisoning – problems which are caused at least in part by peoples’ negative attitude towards the species in general (TAWIRI 2007b). Spotted hyaenas feature heavily in Tanzanian folklore and supernatural myths, and they are sometimes kept captive by local healers so that they can be utilised for traditional medicine (TAWIRI 2007b).

2.4 Overview of land tenure policies in Tanzania

Tanzanian land tenure policies are numerous and complicated, and an in-depth review of them would take up a considerable amount of time and space. However, the legality and stability of land tenure rights are key issues affecting pastoralist communities in particular, and insecurity or disenfranchisement related to land access and tenure rights can increase hostility towards local or national authorities (Kideghesho 2006). This in turn can increase hostility towards wildlife, particularly if it is perceived as belonging to the Government, as evidenced by the spearing of rhinos in the Amboseli area of Kenya after Maasai pastoralists were evicted in the 1970s (Kideghesho 2006, Western 1984). Therefore, outlining and explaining the land tenure situation in Tanzania is a key part of understanding any underlying hostilities felt by pastoralists towards local authorities, Parks staff or the Government, which may in turn affect the degree of human-wildlife conflict experienced in the study area.

2.4.1 Historical land tenure policies in Tanzania

In 1895, an Imperial Degree formulated by the Germans decreed that land ownership in German East Africa should be managed as under German rule, which meant that all land was treated as crown land unless alternative ownership could be proved, either by documentary evidence in the case of private landowners, or by use and occupation in the case of traditional communities (Olenasha 2005). Under this feudal system, traditional users were often marginalised and the system enabled the sovereign to exploit land relatively freely.

Once the British acquired Trusteeship of Tanganyika, they developed legislation related to land tenure in 1923, namely the Land Tenure Ordinance. This decreed that all lands

should be public lands, with no occupation or use valid without the Governor's consent, unless titles to the land were acquired before the Ordinance was enacted (Olenasha 2005; Shivji 1998; Tenga 1992). Moreover, even rights of occupancy granted under the Ordinance could be revoked for 'good cause', or when the President deemed that it was in the public's interest to do so (Tenga 1992). Customary rights to land were mentioned in the preamble, highlighting 'native use and customs', but these were not included in the provisions of the Ordinance and therefore were not enshrined in law. In 1928, an amendment to the Land Tenure Ordinance specifically dealt with customary law and defined it as one of the 'deemed rights of occupancy' (Shivji 1998). However, the section of the Ordinance that dealt with these deemed rights was merely declaratory, and did not entrench these rights in law, meaning that land occupied by indigenous people remained public lands, and were still under the control of the state and subject to Government disposition (Shivji 1998). The occupation and utilisation of land by customary holders was recognised by the law, which assumed consent on the part of the Governor, and as such were considered to be 'permissive rights' (Shivji 1998). However, should the situation change and the state deem that such land should be alienated, it could legally be done by withdrawing this 'assumed consent', meaning that although customary titles were recognised in the law, they were not protected by it in the same way as other land-owners were (Shivji 1998). Therefore, 'ownership' under customary law was frequently considered – and indeed remained - inferior to other forms, with tribes viewed as 'savages' who were not thought to have the administrative or legislative systems deemed necessary to truly 'own' the land (Tarayia 2004). In a civil case as recently as 1988, it was even argued that the Barabaig were not truly 'citizens' of Tanzania and therefore could not be defined as 'natives' under the Ordinance, while the Maasai were denied customary land ownership around Mkomazi Game Reserve as other ethnic groups had originally occupied the land first (Olenasha 2005). The widespread definition of lands as public lands, and the second-class status afforded to ideas of customary law, meant that native Africans were commonly dispossessed of their land, which was often used instead for colonial exploitation.

2.4.2 Changes in land tenure policies post-independence

Shortly after independence, in 1962, the Government reformed existing land tenure policies by converting freehold lands into government leases, abolishing feudal systems of land ownership, and developing policies that were intended to exert greater state control over agro-pastoralists and pastoralists. For instance, the 1964 Range Development Act led the way for the creation of Range Development Commissions, which were charged with issuing by-laws to govern land use by pastoralists (Williams 2005). Significantly, these new regulations included ones to quash all customary land rights in an area, and if people failed to adhere to the new regulations then they could be evicted from the area, with no alternative land provided elsewhere (Sundet 1997; Williams 2005; Wily 1988). The subsequent 1965 Land Tenure (Village Settlement) Act allowed customary land rights to be replaced by ‘derivative rights’, where plots of land could be allocated to ‘progressive’ farmers who would help the country’s economic growth, while the 1967 Land Acquisition Act enabled the state to ignore customary rights in the interests of ‘public purposes’ (Shivji and Maina Peter 2000; Sundet 1997; Williams 2005). These changes increasingly encouraged individual rather than community-based land tenure, imposed top-down control over land rights, and reduced local involvement in land-use planning and management (Williams 2005).

The Arusha Declaration of 1967 outlined President Nyerere’s vision of ‘*ujamaa*’ (literally translated as ‘familyhood’ or ‘unity’), where the nation’s economy would be overhauled through socialism and self-reliance, and the industry, transport and agriculture systems nationalised (Williams 2005). The *ujamaa* villagisation process was also announced, where scattered rural communities were to be consolidated into productive, communalised and self-reliant *ujamaa* villages during ‘Operation Vijiji’ (Shivji 1994; Williams 2005). The state envisaged economic communal production schemes that would lead to national surpluses of food crops, while clustered populations would ease the provision of services such as education (Hyden 1980; Williams 2005). However, many rural Tanzanians resisted the concept of *ujamaa*, as their own priorities differed from those of the state, and although many groups, such as the Maasai, often engaged in reciprocity amongst kin, the enforced application of this to the wider setting of an entire

ujamaa village, including to people from different ethnic groups and backgrounds, was an alien concept and therefore a source of tension (Hyden 1980; Williams 2005). In another move that increased tension and resentment, land that was originally under customary ownership was often alienated through government allocations in the name of ‘public interest’ or ‘national projects’ (Shivji 1998; Tenga 1992), and this led to particularly intense conflict between the National Agriculture and Food Corporation (NAFCO) and Barabaig pastoralists in the Hanang District of Arusha region (Lane 1996; Shivji 1998).

Initially voluntary, *ujamaa* was decreed to be compulsory in 1973, with everyone compelled to resettle in designated *ujamaa* villages by the end of 1976 (Williams 2005). However, the planning of *ujamaa* villages often left much to be desired, with complete disregard for any existing customary land tenure systems, and little thought given to the suitability of nearby land for grazing and agriculture, or access to necessary resources such as water (Shivji 1994; Shivji 1998; Williams 2005). Nevertheless, ‘Operation Tanzania’ to enforce villagisation was implemented in earnest, with nearly five million peasants and pastoralists resettled into the *ujamaa* villages (Hyden 1980; Shivji 1998; Williams 2005). This was often done forcefully, with the assistance of militias and Field Force Units, and there are reports of peoples’ existing homes having been burnt down with little prior notice (Shivji 1998; Williams 2005). No legal framework was developed for what was effectively a major change in the country’s land tenure systems, apparently because of the perception that as the state technically owned all of the land in Tanzania, it could re-allocate it as it wished without causing significant legal and social repercussions (Shivji 1994).

However, decentralisation was acknowledged as a failure by President Nyerere in 1977 (Nyerere 1977), local government structures were introduced in 1978, and the *ujamaa* process ceased in the early 1980s, as political leaders realized the need for macro-economic reform and increased market liberalisation to help the ailing national economy (Shivji 1998; Williams 2005). Furthermore, some of the people who had been divested of their customary rights to land during villagisation began filing lawsuits over the legality of that land alienation, demanding to reclaim it from the new occupiers, which would

have displaced many people from their newly settled villages (Shivji 1994). Alarmed by the spectre of possible large-scale civil unrest, the Government hastily pushed through the Regulation of Land Tenure (Established Villages) Act No. 22 of 1992, which extinguished any rights to use or own land in accordance with customary law on village land within the recently designated *ujamaa* villages, offering no compensation to those affected by this new legislation (Ojalammi 2006; Shivji 1994). The passing of this legislation went against the recommendations of the Land Commission, which advised that the country's land tenure system should be closely examined and overhauled, rather than rushing through panicky ad-hoc legislation to deal with the problem (Shivji 1994). The new Act was legally flawed and was challenged in the High Court almost immediately, leading to an amendment of the Act being passed in 1995 (Ojalammi 2006; Shivji 1994).

At the same time that the villagisation process was being developed and implemented, the Tanzanian Government entered into an agreement with the United States Agency for International Development (USAID) to conduct a ten-year Maasai Range and Management Project, which involved US\$23 000 000 of USAID funding, expatriate expertise and support from the Tanzanian Government (Homewood and Rodgers 1991). The project aimed to create Ranching Associations (RAs) covering the entire Maasai District (which should have improved land tenure security for pastoralists and agro-pastoralists), to order to increase the livestock productivity of the Maasai, increase the efficiency of livestock marketing and provide more technical input into livestock production (Homewood et al. 2004; Moris 1981; Ojalammi 2006). This project had worthy aims, intending to understand Maasai methods before attempting to foster further development, but in reality there was little consultation with the Maasai, with development initiatives that were 'planned for the Maasai and not with them' (Homewood and Rodgers 1991; Parkipuny 1975). The project did achieve the installation of technical infrastructure such as dips and dams, but this had the unexpected consequence of encouraging mass immigration of pastoralists and farmers to areas developed in this way (Homewood and Rodgers 1991; Ndagala 1990). Moreover, the establishment of RAs was seen to conflict with the nationwide *ujamaa* programme that

was already underway, and the project collapsed by 1979 and was superseded by the villagisation strategy (Homewood et al. 2004).

Overall, the villagisation process, during which previously transhumant pastoralists were often made to settle into a sedentary mode of life, has been blamed for significant social and environmental degradation in rural areas (Beinart 2000; Ndagala 1990). It increased local conflicts over land tenure, with the registration of village grazing lands in an attempt to prevent their alienation leading to intense hostility between different groups of land users (Homewood et al. 2004). Ultimately, it had a huge impact on Tanzanian land tenure in general, with alienation of village land and trampling of customary rights occurring on a scale even greater than during colonial times (Shivji 1998; Tenga 1987). Assaults on customary land tenure continued even after this period, however – in 1987, under powers granted through the 1973 Rural Lands (Planning and Utilisation Act), the Prime Minister issued the Extinction of Customary Land Rights Order, which quashed existing customary land rights in Arumeru, Babati, and Mbulu Districts, and followed it with another Order in 1989 covering areas in Hanang District that were claimed by local Barabaig pastoralists as theirs through customary right (Tenga 1992). Such changes have been decried as unconstitutional, as Article 14 of the Constitution's Bill of Rights guarantees 'the right to a decent living in society', and this is clearly impossible for pastoralists to attain if their pastoral lands are taken away from them by the state in this manner, apparently without the necessary due process of the law and fair compensation (Tenga 1992).

In 1991, a Presidential Commission of Inquiry into Land Matters was established, which recognised that Tanzania was in need of a coherent land use policy in order to address the inequalities and complaints of many Tanzanian citizens (Olenasha 2005; Shivji 1998). The chairman of this Commission reported that they received 'overwhelming evidence showing large-scale encroachment of customary individual land and village lands by parastatals, District Development Corporations (and) state organs such as the army, prisons, national service, parks and reserves' (Shivji 1995). Amongst their final recommendations for a Land Policy, the Commission stated that land should be used for 'pastoral communities [to attain] food self-sufficiency' and explicitly stated that of all the

multiple land regimes, ‘none of which should be considered superior to the other and interests under all of them should enjoy equal security of tenure under the law’, with security of land tenure dependent upon ‘use and occupation’. They also recommended that village land be self-governed by all adult members of that village in Village Assemblies, rather than by Village Councils, to prevent relatively few people making important decisions over the entire village’s resources (Olenasha 2005). The Council system clearly had implications for the likelihood of corruption, and in some areas village land was redistributed by local elites, abusing their power and engaging in nepotism so that they and their relatives benefited from the system, while many ‘ordinary’ poorer people were unable to become involved or exert any influence (Shivji 1998). In other areas, such as in the Mara region, unscrupulous officials took advantage of the lack of legal rights over village land and allocated some of it to rich and powerful outsiders, at the expense of poorer local villagers themselves (Shivji 1998).

To make matters worse, when Tanzania’s National Land Policy was finally enacted in 1995, it emerged that few of the Commission’s recommendations had been taken on board, and that the policy had been developed by American consultants, which led to anger amongst Tanzanians (Olenasha 2005). The Policy retained the colonial ideas of ‘radical title’, where the President could alienate land for ‘public interest’, although a definition of such ‘interest’ is not included. However, it does state that ‘full, fair and prompt’ compensation should be awarded to landowners whose land is taken by the Government. The equal consideration of multiple land use strategies was not explicitly mentioned, nor was whether or not the security of land tenure should depend upon use and occupation. Some powers were awarded to Village Assemblies, although the powers of the Village Council were retained as well, with the Commissioner of Lands ultimately empowered to make final decisions.

Although the Land Policy does stress that market operations should not disadvantage pastoralists, there is concern over how some of the fundamental principles of the Policy might affect pastoralists, for instance the principle that is to ‘ensure that land is used productively’. This concept of productivity is not defined, and pastoralism has often been regarded as a primitive and unproductive form of land use, which ‘wastes’ the potential

of the land and can be environmentally damaging (Howell 1987; Maddox 2002; Verlinden et al. 1998). Another of the long-term objectives of the Policy was to prohibit nomadic pastoralism and shifting cultivation, which could clearly have significant impacts on the lifestyles of existing pastoralist groups in Tanzania (Lissu 2000). Overall, the new legislation further facilitated the control of land by the President's office, enabling the continued acquisition of land and natural resources by the state and external investors, at the expense of rural Tanzanians themselves, 85% of whom directly depend upon the land for their livelihoods (Igoe and Brockington 1999; Lissu 1999)

The development of the Land Policy led to the enactment of two major pieces of legislation concerning land tenure, namely the 1999 Land Act (which was amended in 2004) and the 1999 Village Land Act, which have particular relevance to pastoralists and villagers (Olenasha 2005). The Land Act recognises three categories of land, namely Reserve land, which includes National Parks and other protected or reserved areas, Village land and General land, which include any public land which is not either Reserve land or Village land, and includes 'unoccupied or unused village land' under this category. Under the Village Land Act, however, General Land is merely classified as any public land that is not either Reserve land or Village land. Although this seems a small detail, the difference in categorisation could have serious implications for the management of unoccupied or unused village land, as if the definition of the Land Act prevails, it would facilitate the alienation of such land by the Commissioner for Lands if so desired, with village authorities having no power to prevent this (Olenasha 2005). This is of particular concern to pastoralists, whose mobility means that they often leave large tracts of their traditional grazing areas 'unused' while they move temporarily to other areas. It is possible that such areas could therefore be classified as General Land and be placed under the powers of the Commissioner for Lands and the Government, which have already clearly expressed their negative views regarding nomadic pastoralism in the Land Policy, and there have already been examples of such land being confiscated as 'no-man's land' (Lissu 2000).

The bulk of the Village Land Act deals with the thorny issue of customary rights to land, which are recognised as valid within the Act and can be registered using a Certificate of

Customary Occupancy. This theoretically makes getting a title to land easier, although it remains difficult in practice, and concerns have been voiced that this system could place pressures on pastoralist communities where resources are traditionally shared, thereby creating conflicts between titled individuals within that community (Olenasha 2005; Shivji 1999). However, some feel that these interpretations of the Land Acts are too pessimistic: the new policy has been termed the ‘best land law passed in Africa in terms of vesting authority and control over land at the local level’ and has been praised for placing pastoralists on an equal footing with agriculturalists, while some people have dismissed the fears of widespread land appropriation as ‘unjustified’ (Palmer 1999), even though some such alienation has already occurred (Lissu 2000). The Land Acts also encouraged districts to establish ‘land banks’, where ‘unused’ land was earmarked so that it could be used by outside investors, and this created fears of further land expropriation by pastoralists, as rangeland could potentially be construed as unused ‘wilderness’ by land planners (Sachedina 2008). Consequently, around Emboreet Village, adjacent to Tarangire National Park, such rangeland was hastily subdivided by the Village Council and allocated to individuals in order to avoid land appropriation for the ‘land banks’, which resulted in the loss of grazing land as villagers leased land to farmers to prevent it being classed as ‘unused’ and alienated from them (Sachedina 2008).

Overall, the new Land Acts have been criticised as failing to make a significant departure from the original British Land Tenure Ordinance of 1923, increasing even further the powers of the Ministry of Land, particularly the Commissioner, and allowing the President to still retain ultimate control over Tanzanian land (Shivji 1999). In a review of both Acts, Shivji (1999) denounces them for failing to ensure that land management is participatory, for failing to suggest an effective method for resolving boundary disputes, for failing to secure customary land rights, for failing to devolve power to local people rather than the executive arm of the Government, and for placing control over land in the hands of the Ministry rather than with locally elected and more accountable and representative bodies, such as the village assemblies (Shivji 1999). To summarise, Tanzania’s land tenure policies are complex and numerous, but even after recent revisions, the security of land tenure for rural Tanzanians remains tenuous and threatened

by external interests, particularly for politically disempowered groups such as mobile pastoralists.

2.5 Wildlife utilisation and legal status in Tanzania

2.5.1 A brief history of wildlife utilisation policies in Tanzania

Traditionally, wildlife utilisation has been very state-centric in Tanzania, with large state-sponsored protected areas and strict controls on local access to wildlife resources, often including the prohibition of consumptive use by local people (Lissu 2000; Nelson et al. 2007). The first recorded conservation legislation in the country was enacted seven years after colonisation, in 1891, when the Germans introduced hunting restrictions in order to safeguard wildlife, so that it could be utilised for colonial recreational hunting as well as exploited for commercial products such as ivory (Majamba 2001; Nelson et al. 2007). By 1896, further legislation meant that any hunting should be carried out only if the hunter had purchased a licence to do so, and the traditional uses of nets, pits and spears for hunting were banned (Koponen 1994). This meant that, after only a few years of colonial rule, wildlife had changed from a locally and customarily managed resource to an asset that the colonising powers had legal dominion over (Nelson et al. 2007). The first legally protected areas were also established by the Germans, as hunting reserves, and by 1913 there were 14 such game reserves, covering 3% of German East African land (Koponen 1994). Usually, local people were permitted to remain in these areas, but their rights of wildlife utilisation were often limited by rules imposed by the colonial powers (Nelson et al. 2007).

Once the British acquired control of the country, they re-gazetted the German game reserves, but increased control over so-called 'complete' game reserves, where local hunting was prohibited and the Governor had power over who was permitted to enter, settle within or cultivate land in these reserves (Nelson et al. 2007; Neumann 1998). The British passed the Game Preservation Ordinance in 1921, the first formal wildlife conservation legislation in Tanganyika, while in 1922, several smaller game reserves were amalgamated to form the Selous Game Reserve, a process which entailed the

removal of 40 000 local people (Kjeckshus 1996; Nelson et al. 2007; WSRTF 1995). The man in charge of this operation, Rooke Johnston, apparently believed that the 'development [of the Selous] depended on the eradication of all human rights and interests in the areas' (Kjeckshus 1977; Nelson 2002). Johnston himself apparently said of his work, 'I went all out to achieve what I had conceived in 1931 to be the betterment of Liwale District and its people, namely its elimination' (Nelson 2002).

The initial suggestion of creating National Parks in Tanganyika came from the state's first director of game preservation, who proposed in 1928 that Mount Meru, Ngorongoro Crater and Kilimanjaro be given National Park status, although there was no formal means of doing so at the time (Neumann 1998). However, the strongest pressure for such a move came from politically powerful conservation societies in Europe, particularly the Society for the Preservation of the Fauna of the Empire (SPFE) in England, who were keen for African wildlife to be better protected from the threats posed by local people (Neumann 1998). A preparatory report regarding the creation of National Parks was developed and circulated to African colonial governments for comment, and the Tanganyikan officials raised concerns about the potential impact of such Parks on local customary rights in terms of hunting, grazing and accessing forest products. Consequently, a clause was added to ensure that proposed National Parks would not 'interfere with the rights at present of the native inhabitants to pasture or to forest produce' (Neumann 1998). Following the 1933 Convention for the Protection of Fauna and Flora of Africa, which was held in London, an international agreement was produced enabling the creation of National Parks within the colonies, and although they stressed that they need not be entirely devoid of human settlement, it was clear that any human activities within Park boundaries would be closely regulated by the relevant authorities (Neumann 1998).

The creation of National Parks within Tanganyika was formally enshrined in law in May 1940 with the passing of the Game Ordinance legislation, which declared Serengeti National Park as the first protected area of its kind in the country (Neumann 1998). This new law did not change the fact that remaining customary rights to land were allowed to continue within areas gazetted as National Parks or Game Reserves, as was the traditional

hunting of hunter-gatherer groups such as the *Ndorobo*, although the Governor retained the power to withdraw such rights in National Parks if it was considered to serve the national interest (Nelson et al. 2007). The National Parks Ordinance of 1948 explicitly allowed the entry of people ‘whose place of birth or ordinary residence is within the Park’, but it was virtually impossible to determine exactly who this covered and therefore who had any legal rights in the area (Neumann 1998). Even claims of ancestral heritage by the Maasai, who were known to have lived in the Ngorongoro region for at least 150 years, were dismissed by international conservationists, who claimed that ‘the Ngorongoro Crater was not original Maasai land’ (Neumann 1998). In the early 1950s, discontent increased as local peoples’ resource use within protected areas was increasingly restricted, and particular conflict was generated by the banning of cultivation within the Serengeti-Ngorongoro protected area in 1954 (Arnhem 1985). This conflict was resolved with the re-gazetting of the Serengeti National Park for wildlife and the Ngorongoro Conservation Area for both pastoralism and wildlife in 1959, but a new National Parks Ordinance later that year deemed that communities had no customary land rights in Serengeti or any future National Parks (Nelson et al. 2007).

Contrary to what had been promised, restrictions on local peoples’ access to wildlife only intensified following independence (Kideghesho 2006), with the Arusha Declaration of 1967 continuing to perpetuate the paradigm that local communities posed a threat to wildlife and natural resources (Thompson 1997a). The 1960s and 1970s saw the creation of new National Parks with little apparent concern for local resource use or traditions, which unsurprisingly fuelled intense conflict between conservation authorities and local people (Neumann 1992). For instance, the upgrading of Tarangire Game Reserve, which became Tarangire National Park in 1970, meant that pastoralists were excluded from an important dry season grazing resource (Igoe and Brockington 1999). The 1974 Wildlife Conservation Act (WCA) repealed colonial ordinances, but retained colonial ideologies and practices by emphasising state control over local involvement, for instance in the development of the trophy hunting industry (Nelson et al. 2007). As well as not reinstating traditional rights over wildlife or enabling local access to these resources, the WCA did not even specify that local hunter-gatherer groups could utilise wildlife, as the

original Game Ordinance passed by the British had done (Nelson et al. 2007). The WCA does empower the Director of Wildlife to allocate hunting rights or licences to ‘Authorised Associations’, which may include local villages, but in practice this has mainly been used to develop the commercial trophy hunting trade rather than enable local people to utilise wildlife resources (Nelson et al. 2007). In the late 1970s, Tanzania’s worsening economic condition resulting from the war with Uganda restricted funds available for wildlife protection, while international prices soared for rhino horn and ivory (Nelson et al. 2007). These factors led to a huge upsurge in poaching, with devastating impacts on the country’s black rhino (*Diceros bicornis*) and elephant populations, and not even the strict conservation policies could protect them, particularly as much of Tanzania’s wildlife lives outside reserve boundaries (Borner 1981; Nelson et al. 2007). This heralded the advent of a new era in Tanzania’s wildlife management strategy, where communities were viewed more as possible partners in wildlife management, rather than regarded solely as a threat. The next section deals with that era.

2.5.2 Involving local people in Tanzania’s wildlife utilisation strategies

Spurred on by community conservation developments elsewhere in Africa, by the 1980s Tanzania had initiated several new schemes where local people were involved in managing wildlife resources (Nelson et al. 2007). Moreover, the country’s existing policies on wildlife utilisation were reviewed and a new Policy developed which explicitly included rural Tanzanians themselves in Tanzanian wildlife management (Leader-Williams et al. 1996; Nelson et al. 2007). The Wildlife Policy of Tanzania was released in 1998 and specifically promotes the devolution of control over wildlife to local people and private land owners, in order for them to directly gain fair and equitable benefits from wildlife presence on their land (Nelson et al. 2007; The United Republic of Tanzania 1998). The primary instrument for doing this was proposed to be through the development of WMAs on village land, which local villages would demarcate, manage wildlife utilisation within them, and thereby gain ‘substantial tangible benefits’ from wildlife (The United Republic of Tanzania 1998)

Tourism endeavours outside protected areas can be particularly attractive to tourists, as such areas are usually less crowded with other visitors, often (at least in Tanzania) support just as much wildlife as within reserve boundaries, permit certain activities prohibited within Park boundaries, such as safaris on foot and night drives, and can incorporate a cultural component (Nelson et al. 2007). Tourism in such areas has grown substantially over the past decade, and villages can reap substantial economic benefits – for instance, Ololosokwan village in northern Tanzania received around US\$60 000 from tourism on its land (Nelson and Ole Makko 2005). Such revenues are hugely important to local communities and clearly provide a direct, tangible incentive to conserve wildlife and habitat on community land (Baldus 2004). However, these deals arranged by villages were criminalised in 2007 by a Ministerial declaration, which stated that all such arrangements should pass through the central control of the Department of Wildlife (TNRF 2007). Furthermore, conflicts are emerging where hunting concessions are leased by the Wildlife Division on community lands. While the 1999 Land Acts mean that the communities have a right to that land, the 1974 WCA does not allocate them the revenue generated by hunting on that land, and the hunting operators are only required to ‘support community development’ rather than share revenues directly with local people (Nelson et al. 2007). In response, the Government developed regulations which outlined proper procedures for hunting companies, but they also prohibited tourism initiatives within hunting concessions without the approval of the Wildlife Division. As hunting concessions often incorporate village land, this directly contravenes the aims of the Wildlife Policy by imposing state-level control over wildlife resources on village land once more, and threatens the rights of local people to utilise wildlife and generate benefits autonomously (Nelson et al. 2007; Nshala 2002).

Unfortunately, a decade on from the new Wildlife Policy, relatively little authority over wildlife management has been devolved to the local level in reality and, as seen elsewhere, such transition of power to local people has been hampered by political, social, economic and ideological obstacles (Brockington 2002b; Nelson et al. 2007; Ribot 2002). Moreover, the creation and expansion of protected areas has continued across Tanzania, often with substantial impacts on local people. The 1994 formation of Ikorongo

and Grumeti Game Reserves, west of Serengeti National Park, created an ongoing legal battle with local communities over rights to land, while recent revisions of the Tarangire National Park boundary, combined with the gazetting of the Mkungunero Game Reserve in 1996, have resulted in conflicts with local villagers as their land comes under state control (LHRC 2003; Masara 2005; Nelson et al. 2007). In the area south of Ruaha National Park, hundreds of people have recently been evicted from the Usangu Game Reserve, which is to be upgraded to National Park status and annexed to the existing Park (Nelson et al. 2007; Ubwani 2006).

The development and implementation of WMAs has been slow, but the first ones are now established, including the Pawaga-Idodi WMA (PI-WMA) in this study area. Their creation has by no means been trouble-free, however, with some local communities understandably hostile towards the idea of another wildlife-related land designation, given the long history of eviction and disempowerment resulting from actions linked to conservation. This was seen in the Simanjiro region of northern Tanzania, close to Tarangire National Park, where local people were strongly resistant to the idea of establishing WMAs in the area, as they believed that they were merely another vehicle for the Government to alienate village land in the name of wildlife conservation (Sachedina 2006). The process for establishing a WMA has also been criticised as too long, complex and bureaucratic for rural communities to easily engage in, with some suggesting that this complexity is an intentional barrier erected by the state to prevent extensive decentralisation of control over wildlife resources (Nelson et al. 2007). Even when WMAs finally become established, the level of control exerted by local communities is relatively limited – the user rights to wildlife are limited and insecure, being based on 3-year agreements, the state's Wildlife Division retains all control over the allocation of hunting blocks, all investments within WMAs require Ministerial approval, and, critically, there are no regulations on how revenues generated from WMAs on village lands should be shared (Nelson et al. 2007). Further criticisms have also been levied at WMAs already in place: in Babati District, there were complaints that families had been evicted for the creation of Burunge WMA, that the area demarcated had not been agreed with the Village Assembly, that corruption of village leaders had occurred,

and that some entire villages concerned had not even accepted the creation of a WMA (Igoe and Croucher 2007; Sachedina 2008). However, some people have already used newly created WMAs to their advantage, albeit at the expense of others – in Minjingu Village, close to Tarangire National Park, recent immigrants into the area were given land adjacent to the WMA (which bordered the Park), so that they would form buffers between the protected area’s wildlife and the farms of people already established in the area (Sachedina 2008). This new era of involving local people in managing Tanzania’s wildlife is a long-overdue and potentially promising step for the country, but only time will reveal the extent to which such schemes can overcome the historical, social, cultural and economic challenges to effective implementation, demonstrate their long-term benefits and pitfalls, and show whether or not WMA creation has any impact on the issue of human-wildlife conflict outside protected areas.

2.6 Overview of the Rungwa-Ruaha study area

This study was conducted on the village land associated with what is now the Pawaga-Idodi Wildlife Management Area, a 750km² area which adjoins the south-eastern border of the Ruaha National Park (RNP) in central Tanzania (Figure 1). The coordinates of survey locations ranged from 07° 19’ S to 07° 36’ S and from 35° 05’ E to 35° 29’ E.

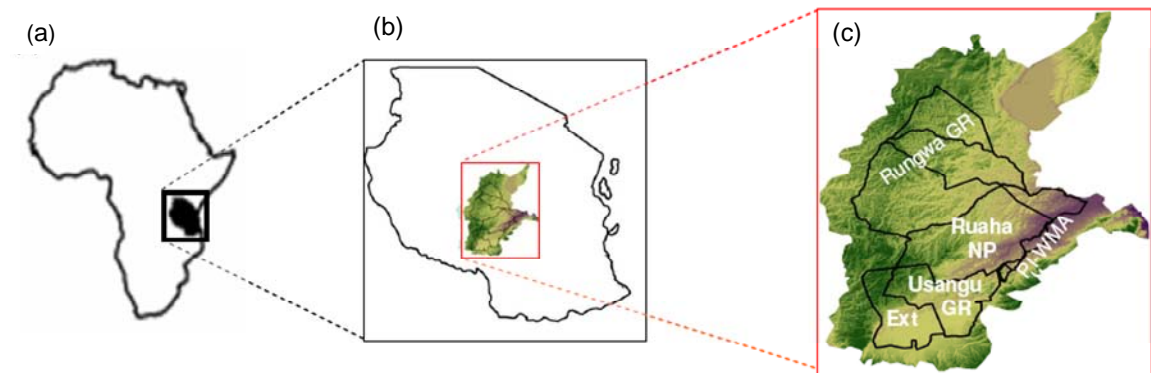


Figure 1. The location of the study area in (a) East Africa, (b) Tanzania and (c) the Rungwa-Ruaha complex

2.6.1 Biophysical characteristics of Rungwa-Ruaha

The study area is part of the Rungwa-Ruaha region, which covers over 45 000 km² and encompasses the 10 300km² Ruaha National Park and its adjacent Game Reserves as well as the PI-WMA, an area formally part of the Lunda-Mkwambi Game Controlled Area. The PI-WMA is a vital part of the Rungwa-Ruaha ecosystem, as it provides dry season habitat for many of Ruaha National Park's species (Dickman 2005). The Ruaha River runs along the border of RNP and is a key resource for wildlife in the area, drawing species towards the park boundary with the PI-WMA. The area is one of outstanding biodiversity and species endemism (WCS 2005), is situated within one of the World Wide Fund for Nature's 'Global 200' ecoregions (Olson and Dinerstein 1998), and encompasses two Important Bird Areas and two proposed Ramsar sites (WCS 2005). The area harbours an intact large carnivore fauna, including the continent's third largest population of African wild dogs, and is part of a priority 'hotspot' for African carnivore conservation (Mills et al. 2001; WCS 2005). The importance of the Ruaha complex for carnivores was highlighted by Chardonnet in 2002, who estimated that the area held around 3360 lions (around 8.5% of sub-Saharan Africa's entire lion population), although the methodology for deriving this figure was unclear (TAWIRI 2007c). The Ruaha complex also supports one of the largest remaining elephant populations in Africa, with an increasing population of over 40 000 elephants in the 1980s, with around 25 000 within the Park boundaries and the rest on other land use types (Barnes and Douglas-Hamilton 1982).

The area is also of international ecological significance as it is the only protected area system which represents the transition between the East African *Acacia-Commiphora* zone to the Southern African *Brachystegia* or Miombo zone (Williams 1999). The climate is semi-arid to arid, with approximately 500mm of rainfall annually, which peaks in December-January and March-April (Arnold 2001; Walsh 2000). The vegetation is a mix of typical East African semi-arid savannah vegetation and Zambezian *miombo* woodland, with common species including *Acacia*, *Combretum* and *Commiphora* (Sosovele and Ngwale 2002).

2.6.2 History of human use and establishment of protected areas in Rungwa-Ruaha

Located as it is in the Great Rift Valley, there is likely to have been some human settlement in and around what is now Ruaha National Park for as long as anatomically-modern humans have existed, and there are colonial accounts of rock art within what is now the Park (Coppolillo and Dickman 2007). The German colonial government established the Saba River Game Reserve as a hunting reserve in 1910, which covered most of what now termed the Ruaha Landscape (Coppolillo and Dickman 2007; Mtahiko 2004). There appears to have been relatively little permanent settlement in the area at the time of the Saba River Game Reserve designation, although over 40 place names are recognised in that portion of the landscape, suggesting that the area was relatively well-known and probably seasonally used by local people (Coppolillo and Dickman 2007).

The 1921 Game Preservation Ordinance re-gazetted Game Reserves created under the German colonial regime, and there was a general trend towards the expansion of existing protected areas in order to preserve wildlife (Neumann 1998). The Rungwa Game Reserve was created in around 1937, and in 1949, the Senior Game Ranger proposed that it should be expanded and designated as a National Park (Williams 2005). A major famine later that same year forced many of the inhabitants of the Greater Ruaha valley to move out and find better grazing and access to water in the Idodi and Pawaga rangelands, and this opened the door for the authorities to begin the eviction of families from the valley and expand the Reserve (Williams 2005). The expansion was formally enacted on 1st October 1951, with evictions occurring over the next few years. These were sometimes violent – when settlements in Njongomeru, along the Ruaha River, were evicted, eyewitnesses said that people were ordered out and then burnt out of their homes (Nganylika, cited in Williams 2005). Many of the evictees moved to Usangu, an area which has recently also been upgraded to National Park status. Ruaha National Park was formally gazetted in 1964, and covered 10 300km² of land between the Great Ruaha and Mzombe Rivers. By this time, all the people living north of the Great Ruaha had been removed, which involved the relocation of over thirty scattered human settlements within that area (Savidge 1968; Williams 2005). Over the following 10 years, people from all of

the settlements immediately south of the Great Ruaha were also evicted, as part of the state-led villagisation process (Williams 2005).

The Rungwa, Kizigo and Muhezi Game Reserves, adjacent to Ruaha National Park, were established between 1974 and 1984 (Coppolillo and Dickman 2007). In 1996, the Utengele Swamp hunting block south-west of the Park was upgraded to become the Usangu Game Reserve, in response to the large numbers of Maasai and Sukuma pastoralists moving into the area in search of better grazing land (Coppolillo and Dickman 2007). Those pastoralists already settled in the area were compensated and left, but a lack of enforcement meant that many of them returned almost immediately (Coppolillo and Dickman 2007). The ongoing influx of pastoralists and livestock to the Usangu Game Reserve has been implicated, justifiably or not, in the drying of the Great Ruaha River, which once flowed year-round but since 1992 has been drying up completely in the dry season (Sokile et al. 2003). This is of both ecological and economic importance, as the Great Ruaha River generates over 70% of Tanzania's electricity supply through hydro-electric power (Coppolillo and Dickman 2007). In 2006, the situation was so bad that the production of the Kidatu hydro-electric plant was reduced by 50% and the Mtera hydro-electric plant was forced to close entirely, both of which are major suppliers of energy for Tanzania (Coppolillo and Dickman 2007).

The drying was linked in particular to the degradation of Ihefu Swamp within the Usangu Game Reserve, where around 170 000 head of cattle were being illegally grazed (Coppolillo and Dickman 2007). There has been much debate in the anthropological and conservation literature about the degree to which pastoralist communities actually degrade the habitat they use, with the argument of the 'environmentalism of the poor' (Ramachandra and Martinez Alier 1997) suggesting that as local people are immediately dependent upon environmental resources they have a particularly keen interest in their conservation, and many examples cited of 'indigenous' soil and water strategies that avoid long-term degradation (Beinart 2000; Reij et al. 1996). In this area, however, there was a rapid influx of pastoralists and their livestock, perhaps without the normal social strategies that would limit grazing and resource use (Lane 1995), and the resultant overgrazing is thought to have had direct effects on the ecology of the swamp, reducing

drainage into the Great Ruaha River. However, others contend that irrigation by farmers is actually the main reason for the ecological changes (Walsh 2000), while the results of hydrological modelling and long-term monitoring also contest the view that livestock overgrazing is primarily responsible for the drying of the river, suggesting instead that the abstraction of water downstream for irrigation of rice crops, particularly during the dry season, is the major driver of such changes (Lankford et al. 2004). Moreover, these hydrological analyses challenged the assumption that the power cuts were due to water shortages in the Upper Ruaha, but posited that they were more likely to be due to mismanagement of the reservoir and excessive releases of water for electricity generation, resulting in insufficient water storage after several dry years (Lankford et al. 2004). However, citing the power shortages as a reason, the Tanzanian Government expanded the boundaries of the Usangu Game Reserve and upgraded it to National Park status, allowing the Tanzania National Parks Authority (TANAPA) to take control and improve enforcement of the regulations prohibiting grazing and consumptive use (Coppolillo and Dickman 2007). This could be interpreted as another case where pastoralists are blamed for degradation and environmental changes without sufficient evidence of cause and effect, but where the degradation narrative was useful for increasing state control over land use and resources in an area. As no settlement is permitted within Park boundaries, at least three villages will have to be resettled under these new conditions. Currently, the area is set to be annexed to Ruaha National Park, which would make Ruaha the largest National Park in Africa at just over 20 000km², but the final boundaries have not yet been set (Coppolillo and Dickman 2007).

2.6.3 Current land use within the Ruaha landscape

Although consumptive use was allowed in the Saba River Game Reserve during colonial times, this was outlawed once the area was given National Park status in 1964, as no consumptive use is permitted within National Park boundaries (Coppolillo and Dickman 2007). Low-volume trophy hunting is still permitted within the adjoining Game Reserves, which is predominantly conducted by expatriate hunters (Coppolillo and Dickman 2007). The PI-WMA will incorporate non-consumptive use through photographic tourism over

81% of the area, and consumptive use through hunting over the remaining 19% (Coppolillo and Dickman 2007).

The Muhezi Game Reserve was designated as a 'multiple use' Game Reserve in 1995, allowing beekeeping and artisanal gold mining within the Reserve in an effort to provide tangible benefits to reserve-adjacent communities (Coppolillo and Dickman 2007). However, although the Rungwa-Kizigo-Muhezi complex of Game Reserves does generate over US\$850 000 annually, this money goes directly into the Tanzanian central treasury, so such benefits are not actually visible or particularly relevant to the local communities (Coppolillo and Dickman 2007). There are substantial side-effects that have been associated with this permitted extractive use, particularly those of setting fires and illegal hunting. Honey collecting provides a legal reason for people to enter the Reserve, but managers and rangers complain that the majority of people are using this permission to mask illegal activities, particularly hunting, once they are within the Reserve (Coppolillo and Dickman 2007). Similarly, the access allowed to artisanal miners opens up a potential route for access into the protected area, and although only 12 original miners were authorised to remain within the Reserve, literally hundreds of people are reported to have claimed access under these 12 permits (Coppolillo and Dickman 2007). However, there is little independent evidence to assess the true impact of access to the Reserve through honey collecting and mining, with these complaints based on anecdotal evidence from managers and rangers.

Hunting, grazing and human settlements are all permitted on the village land bordering the PI-WMA, and the people in the villages associated with the WMA are a diverse combination of small-scale farmers, agro-pastoralists and migrant pastoralists (Sosovele 2004). The area provides valuable grazing land for pastoralists, and is also used as an important irrigated agricultural area by local farmers (Williams 1999). Wildlife densities are estimated to have halved in this region between 1990 and 1995 due to uncontrolled hunting and human population growth, while livestock numbers are thought to have doubled over the same period (Arnold 2001).

The study area is an important area for pastoralists, as it forms a movement corridor linking this pastoralist rangeland with those to the north-east, north-west and south-west of the Rungwa-Ruaha system (Williams 1999). The dominant ethnic group in the region is the Hehe, who are traditionally agriculturalists, but various pastoralist groups have moved into the area over the past 70 years, including the Baraguyu, Bena, Maasai, Sukuma and Barabaig (Hyden 1980; Williams 1999; Williams 2005). The numbers of Bena and Gogo people have increased substantially in the region over the past 20 years (Williams 1999), as have the numbers of Maasai. This gradual in-migration of different people, including farmers, agro-pastoralists and pastoralists, means that the study area now supports a heterogeneous mix of ethnic groups and lifestyles (Arnold 2001), with an increased influx of pastoralists and agro-pastoralists, particularly Barabaig and Sukuma, into the area following the gazettement of the Usangu Game Reserve (IRG 2000). Although official censuses do not record the ethnicity of people living in the area, a study ten years ago identified 35 different ethnic groups represented in the Idodi-Pawaga area (Nahonyo et al. 1998). People from different ethnic groups are generally intermixed in the study villages, although informal 'clusters' exist, where members of the same ethnic group live relatively close together: for the Hehe and Bena, these clusters are usually situated relatively close to the village centres, while the Barabaig and Maasai (the relative newcomers) tend to have homesteads further out of the village. This study focuses mainly on four ethnic groups, namely the Maasai, Barabaig, Hehe and Bena, alongside some people of the Sukuma ethnic group, to allow comparisons between people who traditionally rely more heavily upon pastoralism and those who are more reliant upon agriculture.

2.6.4 Community wildlife initiatives in the study area

TANAPA began benefit-sharing programmes from Tanzanian National Parks, including Ruaha, in 1988, which became the Community Conservation Service (CCS) initiative (Hartley 1997). Under this programme, National Parks provide Support for Community-Initiated Programmes (SCIP), with usual budgets of US\$30 000 - 40 000 per year (Coppolillo and Dickman 2007). This money usually goes to improve local infrastructure in the community and is intended to provide lasting benefits from a local Park's presence

(Coppolillo and Dickman 2007). In January 1993, a community component was added to the Ruaha Ecosystems Wildlife Management Project (REWMP), which was originally focused on planning within the park borders, and this community work continued until June 1996 (Walsh 2000). REWMP successfully lobbied for local villagers to gain the revenues that they were entitled to from trophy hunting in the area, as well as negotiating an effective framework for discussing and resolving conflicts between local people and resident hunters (Walsh 2000).

Following the cessation of the REWMP, the community aspect of that work was then taken up by the MBOMIPA (*Matumizi Bora ya Malihai Idodi na Pawaga*, or ‘Sustainable Use of Wildlife Resources in Idodi and Pawaga’) project, which began in 1997. This scheme, covering 4000km² and encompassing 40 000 people in 19 villages (Sosovele 2004), aimed to generate revenue through both consumptive and non-consumptive use of wildlife, and use that revenue to benefit local people, by improving health and education services as well as local infrastructure (Walsh 2000). Within MBOMIPA, a formally Maasai-focused NGO called HIMWA (*Huduma ya Injili na Maendeleo Kwa Wafugaji*, the Swahili for ‘Gospel Service and Pastoral Development’), represents the interests of pastoralists from different ethnic groups within the project (IRG 2000; Walsh 2007b). The project was successful in generating revenue, with an income of nearly US\$22 600 in 2002, which was an average of nearly US\$1200 per village, making it by far the highest source of community income in the area (Walsh 2003). Moreover, most of this revenue actually made it back into the rural economy, which was a significant change from previous wildlife-related revenue streams in the area. Revenue from MBOMIPA has gone into constructing classrooms, health facilities, improving roads, providing conservation education and other community developments, while there has also been an important increase in strengthening human capital, for instance through the training of more than 190 Village Game Scouts (VGS) in the project area (Walsh 2003). However, pastoralists often receive less tangible benefits than other groups, particularly as they tend to be more mobile, less likely to send their children to school, less socially engaged within villages, and politically disempowered in comparison

to the local elites who are likely to dominate benefits for themselves (Platteau and Gaspart 2003; Williams 2005).

One of the primary objectives of the MBOMIPA project was to create a WMA on the southern border of Ruaha Park, in the southern part of what was then the Lunda-Mkwambi Game Controlled Area, which would be managed by the villagers of Pawaga and Idodi (Walsh 2000). The creation of the PI-WMA in March 2007 symbolised a new and important shift in local peoples' involvement with wildlife management. Twenty-one villages within this area are currently in the process of receiving user rights to allow them to manage the PI-WMA and thereby receive direct revenues from wildlife utilisation in the area (Coppolillo and Dickman 2007). The data provided in this thesis, which was conducted in the three years leading up to the official WMA formation, provide important information on local peoples' views towards wildlife before the WMA was developed, and will therefore form a valuable baseline to examine whether or not the WMA proves effective in generating tangible benefits from wildlife and reducing human-wildlife conflict in this important landscape.

Chapter Three

General Methods



CHAPTER 3: GENERAL METHODS

3.1 Chapter summary

This chapter provides an overview of the general methods used for this thesis, as well as details of the common analytical techniques used once data were compiled. The majority of the data were collected using interviews of pastoralists and agro-pastoralists living in the Idodi and Pawaga districts of Tanzania. Methods used included both semi-structured and unstructured interviews for different sections of the thesis, while additional relevant data were collected from analyses of vegetation plots, livestock husbandry methods and boma characteristics. A range of parametric and non-parametric statistics were used through the thesis. Further details on the specific methods used are provided at the start of each data chapter.

3.2 Overview of study methodology

Due to the interdisciplinary nature of this project, and the variety of factors examined as possible important determinants of conflict, the study required the utilisation of various different techniques, including semi-structured and unstructured interviews, event diaries and long-term monitoring, examination of livestock bomas and habitat analyses. Each of these methods will be outlined below, providing the reasons for their use, a brief background and an overview of the methodology employed, with more details provided in each of the relevant data chapters.

3.2.1 Semi-structured interviews

Semi-structured interviews (SSIs) formed the primary method of data collection for chapters 4 and 5 of the thesis, which examined conflict with wildlife in general and carnivores in particular. These interviews have previously been used to assess attitudes in a wide range of situations, such as measuring views on deforestation in Vietnam (Pham and Rambo 2003), knowledge of biodiversity in the U.S. (Hunter and Brehm 2003) and perceptions of wildlife conservation in the U.S., Germany and Japan (Kellert 1991). Semi-structured interviews enable respondents to provide more elaborate and complete

answers than fully structured questionnaires, and are flexible enough to allow people to explain their views in their own words, which can be valuable in terms of truly understanding the nature of a particular situation (Hunter and Brehm 2003; Schensul et al. 1999). However, SSIs have drawbacks in terms of the time and money needed to collect and analyse large amounts of data this way, and they can also be biased both by the interviewer and by the articulacy of the respondent concerned (Glastonbury and MacKean 1991). Specific interviews designed to assess losses to and conflict with wildlife are subject to particular biases, such as the general exaggeration of losses, lack of accuracy, the tendency of respondents to overestimate losses caused by more high-profile species compared to less visible, smaller ones, and the inclination to attribute losses as depredation even if they may have been caused by other causes such as disease or theft (Cozza et al. 1996; Niskanen 2005; Rasmussen 1999). Moreover, gaining sufficient trust from interviewees in order to be told potentially sensitive information (such as the killing of protected species) is a process that takes considerable time (Bauer and Hari 2001; Scholte et al. 1999), so this has to be considered during both the study design and interpretation of results.

However, despite these caveats, SSIs can be used to effectively assess attitudes, and have provided valuable information regarding peoples' perceptions of large carnivores in previous studies (Conforti and de Azevedo 2003; Marker et al. 2003b; Oli et al. 1994). The interviews used here (Appendix I) were designed in a similar way to those used by Maddox (2002) to assess attitudes of pastoralists towards wildlife in northern Tanzania, so that the results found here could be compared to those from that study. The survey was designed following the guidelines set out by Schensul et al. (1999), with simpler and less contentious questions posed towards the start of the survey and more complex or sensitive issues only raised later on, when there was more chance that the confidence of the respondent had increased. However, it must be borne in mind that, as with all surveys, people will only report what they feel comfortable doing so, meaning that the results should always be interpreted with some caution.

The household or *olmarei* was chosen as the sampling unit, following Maddox (2002), and interviews were restricted to one respondent per household. At each village, the

chairman and/or headman was approached and the purpose of the research explained. The chairman or headman was then asked for locations of Maasai, Barabaig, Hehe and Bena households around that village, as these were the four main target ethnic groups, and as many as possible of those locations were visited. However, several villagers from the Sukuma ethnic group approached us and were keen to be involved, so they were included in the survey as well to see whether views varied between different ethnic groups. Visits to households were often made ($n = 26$ occasions) without completing a questionnaire, due either to the household having moved on as part of their shifting nomadic lifestyle, or someone of necessary seniority not being present. The most senior member of the household present was asked for permission to conduct the interview, and asked to participate. Women deferred to men in seniority, so interviewees were predominantly male, but interviews were conducted with women where they were happy to do so. No-one of appropriate seniority that was approached refused to participate in the survey. All interviewees were adults (≥ 18 years old) and self-classified into young adult or elder age sets, as well as providing their actual age.

In total, 268 initial surveys were conducted, although in one case the respondent had to leave mid-way through the interview as he was called away to a family emergency, so the sample size is 267 for some of the analyses. Over half of the 268 surveys (56.3%, $n = 151$) were administered with the principal investigator (PI) present, along with a Tanzanian research assistant and translator, while the remaining interviews ($n = 117$, 47.3%) were conducted without the PI present to establish whether the presence of a foreigner affected respondents' answers. The majority of interviews were conducted at the respondent's household, but four interviews had to be conducted in the village because the respondents were engaged in business there and could not travel back to their households. Interviews were conducted in Swahili and took approximately one hour to complete. At the majority of interviews, people apart from the target individual were also present, and the number and status (whether superior, equal or inferior social rank) of onlookers was recorded. Discussions with local people from each of the target ethnic groups ($n = 12$ people: 3 Maasai, 2 Barabaig, 3 Hehe, 3 Bena and 1 Sukuma) were conducted in order to develop the following matrix for deciding the relative social

ranking of different people, and this was used for determining the status of onlookers (Table 2). However, although this provides a basic guide, it should be remembered that peoples' status depends not only upon their age and gender, but also upon their social importance, for instance by belonging to a very wealthy family or being a relative of a local leader. There were no obvious cases during the study interviews where social importance conflicted with the determination of social status using the table below, but it should be borne in mind that it is not an exhaustive classification.

Table 2. Matrix used to determine the relative social status of a respondent compared to that of any onlookers

| Age and gender of people present | | Onlooker | | | |
|----------------------------------|-------------------|--------------------------|--------------------------|--------------------------|--------------------|
| | | Young adult woman | Elder woman | Young adult man | Elder man |
| Respondent | Young adult woman | Equal | Elder woman superior | Young adult man superior | Elder man superior |
| | Elder woman | Elder woman superior | Equal | Young adult man superior | Elder man superior |
| | Young adult man | Young adult man superior | Young adult man superior | Equal | Elder man superior |
| | Elder man | Elder man superior | Elder man superior | Elder man superior | Equal |

Key issues covered during the SSI included knowledge and identification of local wildlife species, classification of species depending on how problematic they were considered to be, views towards wildlife, levels of livestock losses attributed to various causes, details of carnivore attacks on livestock and people, descriptions of which livestock management strategies were employed and their perceived effectiveness, details of any carnivore sightings, and the approximate numbers of large carnivores killed by the respondent. Further questions were asked on household income, particularly the main and subsidiary sources of income, in order to put into context local households' involvement in the tourist economy and the relative importance of income from livestock, agriculture and wildlife to respondents' livelihoods. Information was also gathered on a range of other variables, such as the respondents' ethnic group, level of stock ownership, relative

amounts of stock loss and use, and the details of any depredation events reported. The initial survey is provided in Appendix I. Information on the respondents' religious affiliations was gathered after the initial survey, when a similar survey in Kenya had revealed that religion could be an important factor in conflict between humans and carnivores (Hazzah 2006).

Respondents were also asked to independently list ('free-list') all species that they could think of that occurred around their household. Following Maddox (2002), these free-lists were used to assess, through a classical multidimensional scaling (MDS) approach based on relative distance between species names in the list, whether or not respondents viewed carnivores as a distinct grouping.

Levels of conflict were also assessed in a similar way to Maddox (2002): respondents were shown picture cards of 20 species (Appendix II) and were asked whether or not they recognised the species, and if they misidentified it then they were told the correct species. If they knew which species it was, they were then asked whether or not it occurred in the area around their household (defined as within a day's walk), and if so, were asked to classify them as either posing no problem, a small problem or a large problem, and to explain the reasons for any problems. These cards included one picture of a tiger in order to judge respondents' reliability in recognising local species. Responses were then coded, where 'no problem' = 0, 'small problem' = 1 and 'big problem' = 2, and a mean problem score for all local species was then calculated for each respondent. This score was used as the main index of conflict. There is clearly an issue with this calculation of a mean score, as a 'big' problem may not in reality equate to twice the intensity of a 'small' problem, but Maddox (2002) used a similar scoring technique during a study into human-wildlife conflict in northern Tanzania, so the calculation of a mean conflict score was used here in order to produce comparable results. Also following Maddox (2002), a hierarchical cluster approach was used to examine which species tended to have similar reported conflict scores. These data were primarily used for chapter 4 of the thesis, although the focal carnivore scores in particular were used for chapter 5.

3.2.2 Examination of livestock husbandry and boma construction

The aim of this examination was to assess the management strategies used by different households to reduce livestock depredation, and to relate these to reported rates of livestock depredation, predominantly for chapter 7 of the thesis. Employing certain livestock husbandry strategies has been identified as an important factor in previous carnivore conflict studies (Hemson 2003; Marker et al. 2005a; Ogada et al. 2003), and the information gathered here was used to try to identify the most effective strategies for reducing livestock depredation in this particular area. Data on reported livestock husbandry techniques was collected through questions in the semi-structured interviews, with particular attention paid to the reported use of herders and dogs to protect stock, and how livestock was said to be managed both in the day and at night (e.g. herded, corralled, enclosed in huts, free-ranging etc). Specific information collected during the interview included:

- The use of dogs, and number of dogs per head of stock
- The use of herders, in particular adult herders
- Whether and how livestock were reportedly enclosed at night
- What respondents perceived to be the most effective livestock husbandry measures
- Whether respondents used these preferred methods or not, and if not, why not
- The use of lethal control measures, e.g. trapping and poisoning predators

Detailed information was also collected on the circumstances surrounding any reported incidences of depredation, which provided an opportunity to examine whether or not the reported livestock husbandry practices, such as having an adult herder with livestock or enclosing them in a boma at night, were actually in place when attacks occurred. Such data were also collected when follow-ups were conducted on reported depredation incidents reported through long-term monitoring, as described below (see section 3.2.4).

Various characteristics of boma construction have been identified as important factors influencing the likelihood of a boma suffering a predator attack (Ogada et al. 2003), with

variables such as the height and thickness of boma walls, the number of internal ‘rooms’ in a boma complex, the placement of thornbush stems and the material used to close the entrance gates to the boma all potentially important (Frank et al. 2006a; Ogada et al. 2003). Therefore, after conducting the semi-structured interview, permission was sought to examine the respondents’ livestock bomas, and this was always granted. In the four cases mentioned above, where the interviews were not conducted at the actual household, permission was given for the survey team to travel out and examine the respondent’s livestock boma complex the following day. Each household usually had more than one individual thornbush boma, which were collectively referred to as the households’ boma complex. At each household’s boma complex, the following metrics were assessed at each livestock boma:

- Number of livestock enclosed in each boma
- Number of internal ‘rooms’ within the boma complex
- Number of external gates
- Material used to close boma gates
- Presence of an outer boma
- Height of boma walls
- Width of boma walls
- Diameter of boma
- Proportion of thornbush stems facing outwards (which can allow predators easier access over boma walls, with outward-facing stems acting as a ‘ramp’)
- Number of weaknesses in the boma walls which may allow a predator access

Both the stem placement and the number of weaknesses were subjectively assessed and the result converted to a score on a scale of 0 - 2, with a higher score indicating better quality (Table 3).

Table 3. Scores assigned to quality of stem placement and number of weaknesses in boma walls examined

| Variable | Assessment | Score |
|----------------------|--------------------------------|-------|
| Stem placement | Most/all stems facing outwards | 0 |
| | Half stems facing outwards | 1 |
| | None/few stems facing outwards | 2 |
| Number of weaknesses | Many weaknesses | 0 |
| | Several weaknesses | 1 |
| | None/few weaknesses | 2 |

During examination of the bomas, respondents were also asked whether or not they had made any changes to the structure of the boma since any of the reported attacks by focal carnivores, and the long-term monitoring and revisits to boma mentioned below (section 3.2.4) also allowed us to assess how often changes occurred to boma structure. These data were used for chapter 6 of the thesis. When the characteristics of the entire boma complex were being examined, the means across all individual livestock bomas were used for analyses.

3.2.3 Examination of habitat around bomas

A fine-scale assessment of the habitat around boma complexes was conducted to try to identify whether certain habitat characteristics seemed to predispose specific locations to a higher risk of depredation. Several studies have examined this in other areas, e.g. Stahl et al. (2002) for lynx depredation in the French Jura, Nyhus and Tilson (2004) for tiger attacks in Sumatra, and Muntifering et al. (2006) for cheetahs in Namibia. The methodology here was based upon that used in the Namibian study (Muntifering et al. 2006).

Fine-scale habitat assessments were conducted by randomly selecting an azimuth, and walking on that compass bearing 25m from the boma complex wall. That spot formed the centre of a 6m x 6m square which was used as the initial sampling unit of analysis for the habitat and vegetation work. After sampling was conducted in this plot, the process was then repeated by walking 25m from the boma complex wall on a second bearing 90° from

the first azimuth, and this was done twice more until four 6m x 6m plots had been assessed (Figure 2).

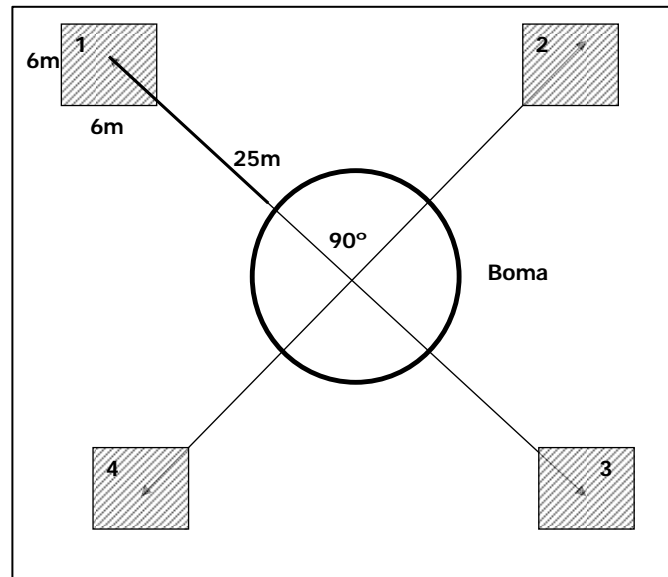


Figure 2. Schematic diagram of the four plots used to conduct fine-scale vegetation and habitat analyses around each of the study boma complexes

The measurements taken from each vegetation plot included the following variables:

- Percentage of vegetative ground cover
- Percentage of canopy cover
- ‘Predator sighting visibility’, following Muntiferi et al. (2006) i.e. how far away a human can be seen from a predator’s approximate eye height (defined as 65cm), measured with a rangefinder
- Density of woody stems (shrubs and trees)
- Mean height of herbaceous vegetation
- Mean shrub height
- Mean tree height
- Height and diameter at breast height (DBH) of nearest tree

A rangefinder was used to measure the distance from the boma to the nearest dense vegetation (defined as a clump of vegetation that could not be seen through and was more than 1m in width), while a handheld Garmin 12XL Global Positioning System (GPS) was

used to record the location of the boma, so that direct distance from other points of interest, such as the Park boundary, could be calculated. These data were mainly used for chapter 6 of the thesis.

3.2.4 Event diaries, long-term monitoring and follow-ups on reported attacks

To supplement the data on stock losses collected from the semi-structured interviews, long-term data were collected on a randomly selected subset of 200 of the initial survey households, where, following Maddox (2002), householders were asked to keep ‘event diaries’ of the dates and magnitude of stock loss incidents, in order to assess the relative impact of depredation events compared to other causes of loss, such as disease, theft and accidents. However, in five cases people moved away from their original households, while in a further four instances people stopped keeping livestock during the study period, so these respondents were dropped from the study, leaving long-term data on 191 people over a 12-month period. At the end of every month, the PI and/or a Tanzanian assistant would travel to each of the households engaged in long-term monitoring, and collect information on the magnitude and causes of stock loss over the past month. This provided a more accurate estimation of the frequency of losses over a one-month period, rather than relying on recall and estimation of dates, which are often inaccurate (Maddox 2002). This technique therefore enabled the degree of initial exaggeration of depredation rates to be estimated, as over-estimating the magnitude of losses to predators, even unintentionally, is a well-known concern in carnivore conflict studies (Marker et al. 2003a; Mishra 1997; Rasmussen 1999). These data were used for chapter 5 of the thesis.

However, people may still intentionally over-exaggerate the extent of wildlife damage in the hope of compensation or other assistance (Bulte and Rondeau 2005; Schwerdtner and Gruber 2007). In order to investigate this, either one or two local assistants were employed and trained in each village, and they visited each household involved in the long-term monitoring at least once a week, to see whether any depredation incidents had reportedly occurred. These assistants were well-known in the villages and were intended to be accessible contact points so that people could inform them of any attacks by focal carnivores as soon as they occurred, and they used mobile phones to report any incidents

back to the PI and team as soon as possible. Upon receipt of such reports, the PI and trained Tanzanian assistants would visit the household, collect as much information as possible on the reported attack and examine the alleged attack site for signs such as carnivore spoor and drag marks, to try to verify whether or not a depredation incident seemed to have occurred, and if so, which species was probably responsible. Wherever possible, carcasses of dead livestock were also examined for location and characteristics of bite marks, and whether bruising was evident under the skin (indicating that such bites occurred when the animal was still alive, rather than during scavenging), and methods of carcass consumption, but often carcasses were eaten by families almost immediately after location, to avoid meat spoiling in the heat, so this was usually not possible. Data on the circumstances of the attacks were also compared to the initial reports of methods of livestock husbandry used, to see which husbandry methods had in fact been in place when attacks occurred.

3.2.5 Unstructured interviews

Unstructured or in-depth interviews are those which do not have strictly predefined questions, and are used to allow investigators to learn more about the complex behaviour of people without imposing prior categorisations and therefore limiting their responses (Punch 1998). This approach allows researchers to gain a more holistic view of an interviewee's point of view, and can highlight important avenues that are worthy of future consideration (Berry 1999). Moreover, conducting unstructured interviews, which often take the form of seemingly informal discussions, allows people to explain their thoughts in their own words, and the specific language chosen can be very indicative of respondents' underlying perceptions and attitudes (Knight 2000b). Although there is no set structure decided *a priori*, the interviewer must still have a clear idea of the aims and intended format of the interview in order to elicit the desired information, for instance by asking more probing questions to further the discussion where necessary (Berry 1999; Patton 1987).

In order to learn more about peoples' views towards the National Park, wild animals, wildlife authorities and other relevant topics which might influence the stated degree of

conflict with wildlife, 30 of the initial survey respondents were randomly selected to participate in more detailed unstructured interviewing, and the resultant data are provided in chapter 6. Once the respondents had been selected, each one was visited by the PI and two Tanzanian assistants (all of which were already known to the respondent) at their household, and the aims of the interview were explained to the intended participant. Everyone selected for participation agreed to be interviewed, and although some of the material was potentially sensitive, everyone appeared happy to answer all of the questions posed to them.

Following Wenden (1982), the guided interview form of the unstructured interview was used, i.e. a checklist was developed so that certain key topics would be covered during the discussion. These topics included the respondent's background, the length of time they had lived in the Pawaga-Idodi area, the reason they moved here, attitudes towards the local area in general, attitudes towards Ruaha National Park in general, attitudes towards Park authorities and other wildlife-related authorities, personal experiences and interactions with the Park, perceived costs and benefits of the Park's presence, who those benefits went to, views towards wild animals, perceived costs and benefits of wild animal presence, views towards the five focal carnivore species (lion, leopard, cheetah, African wild dog and spotted hyaena) in particular, and the perceived costs and benefits of those focal species' presence. The interview also probed the extent to which local respondents made the connection between any benefits from the Park and the presence of wildlife, particularly focal carnivores, and hence the extent to which people were making the link between wildlife-based revenue and incentives for wildlife conservation. These data were used for chapter 7 of the thesis.

All the interviews were conducted in Swahili, and the intended questions were all discussed at length with native Swahili speakers before use, to ensure that the intended meanings remained clear after translation, and were appropriate and sensitive to the participant's context and world view, as what may make sense to one person may be interpreted quite differently by someone from another group (Berry 1999; Borgerhoff Mulder and Coppolillo 2005; Cicourel 1964). Following Kvale (1996), all attempts were made to keep the questions relatively short, clear and jargon-free, to avoid any confusion

during ensuing discussions, and any confusing elements were followed up and clarified with the participant immediately. Interviews took between one and two hours to complete. All participants were happy for the interviews to be recorded onto a hand-held MP3 player, and the records were checked and transcribed later to ensure that the notes taken during the interviews were correct.

3.2.6 Statistical analyses

Unless otherwise stated, data analysis was conducted using the Statistical Package for Social Sciences (SPSS) PC version 14.0 (SPSS Inc., Chicago, USA). The one-sample Kolmogorov-Smirnov test was used to check assumptions of normality, with parametric statistics used where data were normally distributed, and data transformed for parametric analysis or subjected to non-parametric analyses where the assumption of normality was violated. Levene's test was used to check equality of variances. One of the most common statistics used was the chi-squared test: the chi-squared test for goodness of fit was used to examine the proportion of cases that fitted into different categories of a particular variable, while the chi-squared test for independence was employed to assess whether two categorical variables were related. Other tests used in the thesis included the Mann-Whitney U test, which was used to compare the median differences of a continuous variable between two independent groups, while the Kruskal-Wallis H test (the non-parametric alternative to the univariate analysis of variance) was used to compare differences in a continuous variable between three or more groups. This test produced a Kruskal-Wallis chi-squared statistic, denoted as KW χ^2 in the results. The independent-sample t-test was used to compare mean differences in a continuous variable between different groups of respondents, while the paired samples t-test was used to compare the means of a variable measured from the same group of people on two different occasions. The Wilcoxon's signed ranks test (also known as the Wilcoxon matched pairs signed ranks test) is the non-parametric alternative to the paired samples t-test, and was used to compare variation in a non-normally distributed variable between two points in time.

Univariate analysis of variance (ANOVA) was used to compare the mean scores of a continuous variable between two or more groups, while Pearson's correlation was used to

explore the strength of the relationship between two normally distributed continuous variables, and Spearman's rank was used for non-parametric correlation analysis. General linear modelling was used to determine which factors appeared to most heavily influence conflict scores, utilising Akaike's Information Criterion (AIC) in order to select the most parsimonious model with the lowest AIC score as the one that provided the best explanation of which factors were most important (Norusis 2005). Using AIC for model selection is superior to simple hypothesis testing, as it provides an accurate measure of the strength of each possible model to the overall set of contender models, thereby allowing the strongest one to be selected (Hazzah 2006; Mazzarolle 2006).

Principal components analysis, a form of factor analysis, was used to examine the underlying structure of some complex variables, such as the characteristics of livestock bomas. Bartlett's test of sphericity (Bartlett 1954) and the Kaiser-Meyer-Olkin (KMO) statistic (Kaiser 1974) were used prior to principal components analysis to examine whether data violated the assumption of factorability of the correlation matrix, and therefore whether they were suitable for this type of analysis. Kaiser's criterion, that an eigenvalue should have a value of 1.0 or more for retention, was used to determine how many factors to retain to explain sufficient variance in the data set, but this approach has been criticised for leading to the retention of too many factors (Pallant 2007). Therefore, Catell's scree test (Catell 1966) was also used, to visually determine from a scree plot where the shape of the plot changed, indicating the number of factors that should be retained. Factor scores were saved following principal components analysis, and compared between different groups of interest, such as livestock bomas that were attacked and those that were not.

Discriminant function analysis was used to explore the predictive ability of a set of independent variables on a categorical dependent variable, such as whether a location had experienced a carnivore attack or not, to see which variable or set of variables best predicted the occurrence of attacks. During this analysis, Box's M test was used to test the null hypothesis of equal population covariance matrices, while Wilk's lambda was used to examine the proportion of the total variance in the discriminant scores not explained by differences among the groups. Unless otherwise stated, all tests were two-

tailed and the level of statistical significance was defined as $P < 0.05$, although P values of < 0.1 was considered to indicate trends that may be worthy of future investigation.

Chapter Four

Reported Attitudes Towards Wildlife of Pastoralists and Agro-Pastoralists Living Close to Ruaha National Park, Tanzania



CHAPTER 4: REPORTED ATTITUDES TOWARDS WILDLIFE OF PASTORALISTS AND AGRO-PASTORALISTS LIVING CLOSE TO RUAHA NATIONAL PARK, TANZANIA

4.1 Chapter summary

This chapter aims to examine the magnitude of human-wildlife conflict reported by pastoralists and agro-pastoralists living adjacent to Ruaha National Park, and to determine the most important drivers of that conflict. Results showed high levels of conflict with wildlife, similar to or higher than has been documented in northern Tanzania, with particular hostility towards carnivores in general and large carnivores in particular. Traditional pastoralists reported greater conflict than agro-pastoralists, possibly because of their relative dependency upon livestock and a lack of alternative income sources. People reported lower conflict if they had greater numbers of income sources, yet very few people reported receiving any income from the nearby National Park, so this is likely to exacerbate conflict with wildlife, particularly in areas with high exposure to tourism. Interviewees who reported higher levels of livestock depredation also reported higher conflict with wildlife. On average, people reported losing 1.2% of their livestock to predators every month, although long-term monitoring and follow-up visits suggested that the figure was around 0.26%. People who retained traditional religious beliefs appeared to be more tolerant of wildlife than people who had converted to an external religion. However, much of the variance in conflict was not explained by the factors explored here, indicating that other drivers are likely to play important roles as well. Possible reasons for these trends, and suggestions of how to use these results to develop and target conflict mitigation efforts, are discussed.

4.2 Introduction

Determining the magnitude and drivers of human-wildlife conflict is fundamental to identifying the most promising strategies for effective mitigation, with important consequences both for local people and for wildlife populations in an area (Walpole et al. 2003). Such conflict is often particularly acute around the borders of protected areas,

where wildlife can have significant negative impacts on local people, and retaliatory killing of wildlife can affect their populations both on the human-dominated land concerned and within adjacent protected areas (Woodroffe and Frank 2005; Woodroffe and Ginsberg 1998). The importance of mitigating such conflict has been highlighted by international experts, who state that, based on both theoretical and empirical evidence, ‘wildlife conservation is unlikely to succeed in sub-Saharan Africa unless it is able to enlist the support of reserve-adjacent dwellers’ (Thompson and Homewood 2002).

In this study, those reserve-adjacent dwellers are primarily pastoralists and agro-pastoralists who rely upon mixed strategies of livestock-rearing and crop cultivation for their livelihoods. Pastoralism and agro-pastoralism have been the dominant forms of land use across much of East Africa’s rangelands for centuries (Spear and Waller 1993; Thompson and Homewood 2002), and pastoralists have coexisted with wildlife for millennia (Lamprey and Reid 2004). Such coexistence has often been lauded for its harmonious nature, with no large mammal documented as going extinct in over 3000 years of coexistence with pastoralists (Western 1989). However, the tolerance of traditional communities for wildlife, particularly predators, has been noted as declining in some important areas of East Africa, such as around the Masai Mara National Reserve, the area between Amboseli and Tsavo National Park, the Tarangire-Manyara ecosystem and the Ngorongoro Conservation Area, and this has been flagged as cause for significant concern (Frank et al. 2006a). The causes behind this apparently increasing intolerance were described by Frank et al. (2006a) as unclear, and, as discussed in chapter 1, the determinants of human-wildlife causes are often multiple and varied. However, there is good evidence from East Africa that pastoralists are increasingly concerned about further land alienation in the name of conservation, the loss of traditional grazing areas to protected areas or agriculture, and the lack of tangible benefits or revenue from conservation, and such factors are likely to play an important role in driving this increasing conflict with wildlife (Homewood et al. 2004; Kideghesho 2006; Sachedina 2008).

A model developed by the Carter Center for Conflict Resolution in Washington D.C. defined three basic levels of factors affecting conflict, namely the dispute level, the

underlying level and the deep-rooted level (Quinn, pers. comm.). Dispute level factors are the immediate, evident sources of conflict, such as the numbers of livestock killed by wild animals, and these have most frequently been the subject of studies into human-wildlife conflict, often revealing strong links with the intensity of conflict (Oli et al. 1994). Underlying factors are those that are likely to intensify conflict, such as the poverty of the person concerned or the level of their reliance upon the resource concerned (e.g. livestock), and such factors have also been shown to exacerbate hostility towards wildlife (Stander 1997). Deep-rooted factors are those based in culture, society and attitudes that affect how people view themselves and the world around them, and these can play an important, but frequently ignored, role in affecting conflict intensity. Examples of such factors include whether someone has a rural or urban background, their religious beliefs and their cultural perceptions, and such factors can substantially affect the magnitude of human-wildlife conflict in an area (Hazzah 2006). Numerous deep-seated factors are likely to play a role in the dynamics between people and wildlife here, such as attitudes towards protected areas, conservation authorities, concerns over insecurity of land tenure, experiences of past evictions from areas gazetted as reserves, concerns over the threat of land alienation in the name of wildlife conservation, and beliefs and folklore about certain species (Kideghesho 2006; Knight 2000b; Sachedina 2006). Many of these factors will be discussed further in chapter 7 of this thesis.

This chapter will examine the magnitude of reported human-wildlife conflict around Ruaha National Park in Tanzania, and will examine a variety of different factors from all three levels defined in the Carter Center model, to try to determine the key factors influencing conflict intensity in this landscape. The specific aims of the chapter are to:

- (i) Describe the characteristics of the respondents in this survey, in terms of factors such as level of stock ownership, magnitude of losses to wildlife, ethnic group, religious beliefs and income sources, which might affect their views towards wildlife;
- (ii) Assess the reported attitudes towards wildlife of pastoralists and agro-pastoralists living in the area adjacent to Ruaha National Park;

- (iii) Compare the levels of human-wildlife conflict reported here to results from similar studies conducted elsewhere in Tanzania,
- (iv) Examine which factors appear to be strongly linked to the magnitude of reported conflict.

4.3 Methods

4.3.1 Overview of survey

The bulk of the data for this chapter were collected using a semi-structured survey design (Appendix I), following a similar format to that used by Maddox (2002) to survey Maasai pastoralists in northern Tanzania. A review of the use of semi-structured interviews is given in chapter 3. The survey was pre-tested on 25 people of varying ages, sexes and backgrounds to ensure clarity before use. It assessed attitudes towards wildlife in general, as well as towards five focal large carnivore species (lion, leopard, cheetah, African wild dog and spotted hyaena), which were chosen due to their tendency to cause intense conflict, as well as their conservation concern, although respondents were not informed of this particular interest in large carnivores. The survey covered five main areas of interest: (i) the socio-economic characteristics of respondents, in terms of their livestock holdings, transactions, losses and income sources, (ii) interviewees' attitudes and knowledge regarding wildlife, particularly focal carnivores, (iii) the reported frequency of focal carnivore sightings and attacks, (iv) actions reportedly taken to control carnivores and (v) details of livestock husbandry techniques. This chapter will report on the results from sections (i) and (ii), with a focus on all wildlife species, rather than carnivores in particular.

Information on respondents' religious affiliation was not gathered at initial interviews but was collected in the third year of the study, during feedback of results to participants, partly because by then the survey team had a very good relationship with respondents, which enabled potentially more intrusive questions to be asked, and partly because a study in Kenya had only recently identified the likely importance of religious affiliation on pastoralists' views towards wildlife (Hazzah 2006). However, religious affiliations are

extremely unlikely to have changed between the initial survey and when the data on religions were collected, and indeed this never appeared to be the case when the issue was discussed with respondents, so this time-lag should not have caused any problems.

4.3.2 Calculating respondents' vulnerability scores

Data on level of stock ownership, income diversification and additional stock holdings for the household were used to calculate a vulnerability score for each respondent, allocating a score of 1 for each of the following three vulnerability factors: (i) if the number of stock owned was below the study mean, (ii) if they had no stock elsewhere, and (iii) if they had no cash income or were solely reliant upon livestock for any cash income. Therefore, each respondent was scored on a scale of 0 - 3, with a score of 3 if they exhibited all three vulnerability factors and 0 if they had none of them.

4.3.3 Free-listing, species identification and conflict scores

The free-listing procedure (more details are given in section 3.2.1) was used to assess whether or not people tended to group carnivores together into a distinct grouping. This was done by examining how closely various species were associated in free-lists and compiling a matrix of the mean Euclidean distances between different species named, using a multi-dimensional scaling procedure (ALSCAL) in SPSS. This was then presented graphically on a multi-dimensional plot to allow the determination of different 'groupings' of species (Bernard 2002; Maddox 2002).

During the interview, respondents were shown 20 photographs (Appendix II), of 19 African species and one tiger in order to check respondents' reliability. Each photograph was presented and the interviewee asked to identify the animal concerned. If the identification was incorrect, the respondent was told the correct animal before proceeding, with discussions and explanations provided so that the respondent was clear exactly which species was being discussed, such as a cheetah rather than a leopard. The percentage of African species correctly identified was used as an index of wildlife knowledge in later analyses. Respondents were then asked whether each species occurred around their household (defined as within one day's walk) and if so, whether they were a

big problem, a small problem or no problem to the interviewee. These classifications were coded as 0 = no problem, 1 = small problem and 2 = big problem to enable a mean conflict score to be determined for each respondent across all species in their area, and this was used as the main dependent variable for examination of factors affecting the intensity of conflict. Hierarchical cluster analysis was performed on respondents' conflict scores, to examine which species tended to be given similar conflict rankings. In order to compare the conflict scores here with those from Maddox (2002), these conflict scores were recoded to follow his protocol, i.e. 1 = big problem, 2 = small problem and 3 = no problem. Therefore, in those comparative analyses, a higher conflict score actually indicates less of a perceived problem. Maddox (2002) presents his results as a bar chart, so his scores are derived from that graph, as the raw scores were not available to convert to the scheme used in this study – the comparison is therefore not exact, but provides a good guide to how reported conflict varied between the two studies.

4.3.4 Sampling frame and survey technique

The aim was to visit all 20 villages in the study area, and to interview at least 50% of households from each of the four target ethnic groups in the area, namely the Maasai, Barabaig, Hehe and Bena. Interviews were also conducted with a small number of Sukuma people who were keen to participate - these were not one of the target ethnic groups, but the results were retained to provide more information on how attitudes differed between various ethnic groups. Interviews were conducted by the PI and local assistants, with two assistants also conducting interviews alone after careful training, in order to examine whether results differed when the foreign PI was present from when only Tanzanians were present. Interviews were conducted in Swahili and took approximately one hour to complete. As the majority of interviews could not be conducted in isolation, the number of people present apart from the interviewee and interviewers was noted, as well as the status of those people, in terms of whether they were of inferior, equal or superior rank to the interviewee (see section 3.2.1). The exact location of the household was recorded using a hand-held GPS device, so that the distance to other important variables, such as the National Park boundary, could be determined.

4.3.5 Event diaries and long-term monitoring

Almost three-quarters of the initial survey households (71%, $n = 191$) also underwent long-term monitoring over a 12-month period, during which time a trusted household member in each household was equipped with an event diary in order to record all instances of livestock loss. Trained enumerators from that village, either with or without the PI, visited each household at the end of every month for a 12-month period to collect the data, although additional visits frequently also occurred. These data were used to examine the relative importance of, and temporal variation in, different causes of stock loss over the year. The data were only included as long as the subject remained at the household where the original data on attitudes and stock loss had been collected, and as long as they still kept livestock. During the course of the study, five respondents moved away and four stopped keeping livestock, so a total of nine households eventually dropped out of the study during the 12-month period.

4.3.6 Statistical analyses

All statistical analyses were conducted in SPSS 14.0 (SPSS Inc, Chicago). The one-sample Kolmogorov-Smirnov test was used to check assumptions of normality, with parametric statistics used where data were normally distributed, and non-parametric alternatives used when the assumption of normality was violated. Tests used in this chapter include the Mann-Whitney U, Kruskal-Wallis H test, chi-squared, the independent-samples t-test (using Levene's test for equality of variances), univariate analysis of variance (ANOVA), Pearson's and Spearman's correlations and general linear modelling. All tests were two-tailed and significance was defined as $P < 0.05$, although P values of < 0.1 were considered to indicate trends that may be worthy of future investigation. Further details of the statistical approaches used are presented in chapter 3.

4.4 Results

4.4.1 Respondent characteristics

4.4.1.1 Numbers, ethnicity and location of respondents

Overall, 268 initial interviews were conducted in 20 villages across what was the Lunda-Mkwambi Game Controlled Area, part of which has now been designated as the Pawaga-Idodi Wildlife Management Area (Table 4).

Table 4. Survey effort for 20 villages visited during the course of the study, in Idodi and Pawaga districts

| Idodi District | | Pawaga District | |
|--------------------------|----------------|--------------------------|----------------|
| Village | No. interviews | Village | No. interviews |
| Idodi | 18 | Ilole | 8 |
| Kitisi | 4 | Isele | 14 |
| Mafuluto | 36 | Itunundu | 4 |
| Mahuninga | 7 | Kimande | 5 |
| Makifu | 16 | Kinyika | 2 |
| Malinzanga | 64 | Kisanga | 4 |
| Mapogoro | 5 | Luganga | 11 |
| Nyamahana | 26 | Magozi | 8 |
| Tungamalenga | 16 | Mbolimboli | 4 |
| | | Mbuyuni | 6 |
| | | Mkombilenga | 10 |
| Total Idodi = 192 | | Total Pawaga = 76 | |

The number of surveys carried out in each village differed, due to varying numbers of households from target ethnic groups in each village, as well as to difficulties with access to some villages in the rainy seasons, but the aim of interviewing 50% of households from the four target ethnic groups was achieved (Table 5), while an additional six interviews were conducted with Sukuma respondents at their request. Overall, therefore, just over half the respondents (55.6%, $n = 149$) came from ethnic groups with a traditional pastoralist background, while 44.4% ($n = 119$) came from groups with a traditional agro-pastoralist background.

Table 5. Coverage of the four main target ethnic groups in the study area

| Ethnic group | No. households in area | No. households visited | % households visited |
|--------------|------------------------|------------------------|----------------------|
| Maasai | 136 | 105 | 77.2 |
| Barabaig | 56 | 44 | 78.6 |
| Hehe | 110 | 62 | 56.4 |
| Bena | 68 | 51 | 75.0 |
| Total | 512 | 262 | 71.8 |

The locations of all the 268 households surveyed are shown in Figure 3, in relation to the Park, the WMA and other livestock-owning households which were not surveyed.

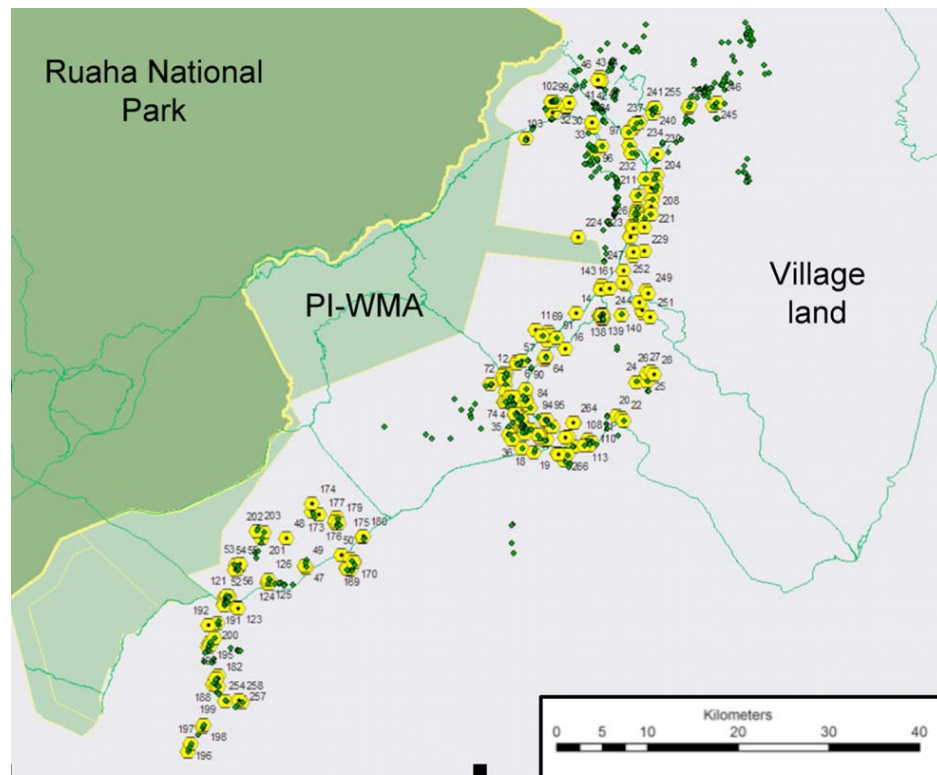


Figure 3. Location of the 268 households where initial surveys were conducted (shown in yellow with black centres). The plain green dots show other livestock-owning households known in the study area. Figure from Peter Coppolillo, WCS

Respondent households were located an average of 18.5km (\pm 6.7km) from the National Park boundary, with one household less than 4.5km from the Park boundary, and a further four located within 5km of the boundary. The maximum distance of a surveyed household from the Park boundary was 30.4km (Figure 4).

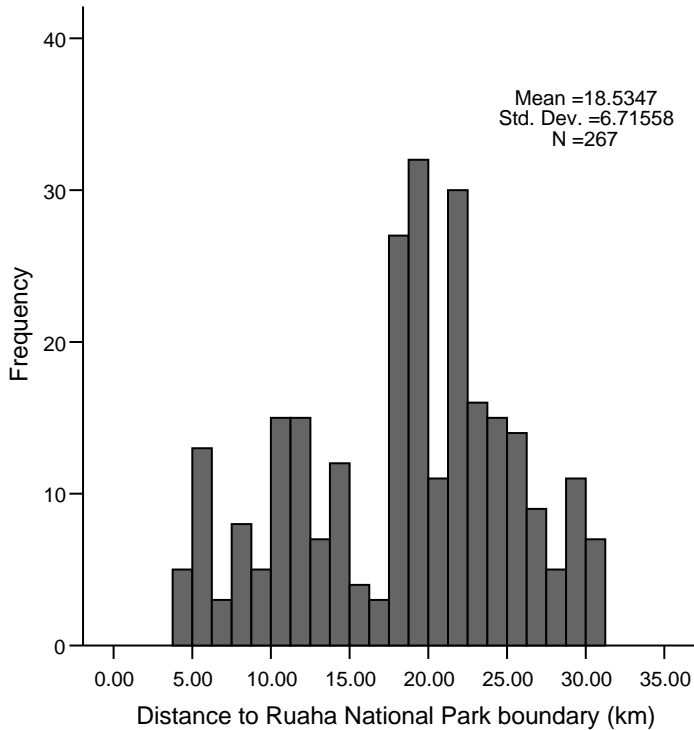


Figure 4. Straight-line distance from respondents' households to the Ruaha National Park boundary

Average distance from a household to the Park boundary differed significantly between ethnic groups (KW $\chi^2 = 62.5$, $df = 4$, $P < 0.001$). Barabaig households (the most recently arrived ethnic group) were situated closest to the Park, with a mean distance of 12.0 ± 7.4 km, while Bena respondents (who had generally lived in the area longer) tended to live further away from the Park boundary, being on average 23.0 ± 4.8 km from the Park boundary (Figure 5).

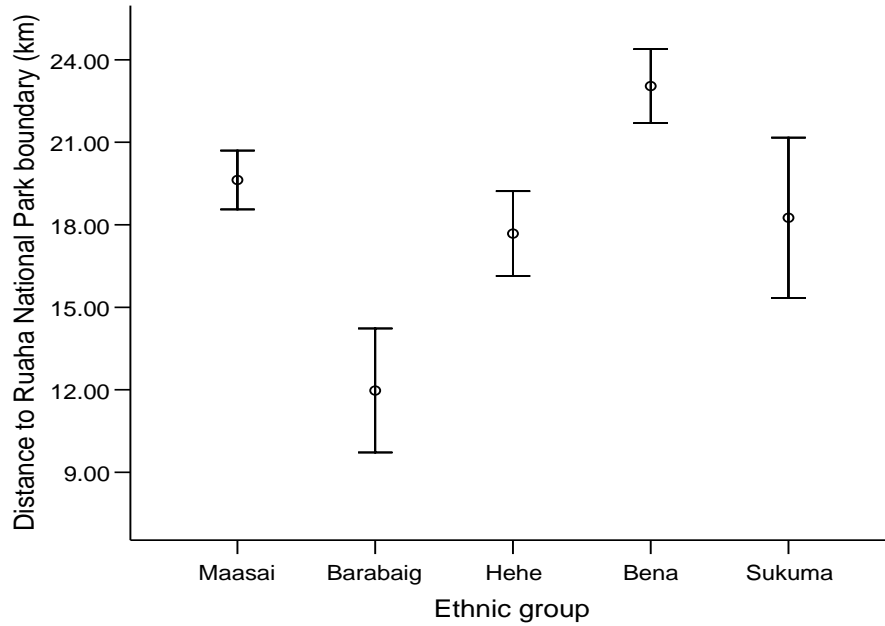


Figure 5. Mean straight-line distance of households of different ethnic groups from the Ruaha National Park boundary. Error bars denote 95% confidence intervals

The length of time that a respondent had lived at their present location was known in 208 cases, and indicated relatively long average tenure (mean = 10.7 years), with a large range (0 - 61 years). Length of time lived at the current location differed significantly between ethnic groups ($z = -2.23$, $P = 0.026$; Figure 6), with traditional pastoralists usually having been settled for only $4.5 (\pm 5.6)$ years, compared to an average of $15.0 (\pm 13.1)$ years for other groups.

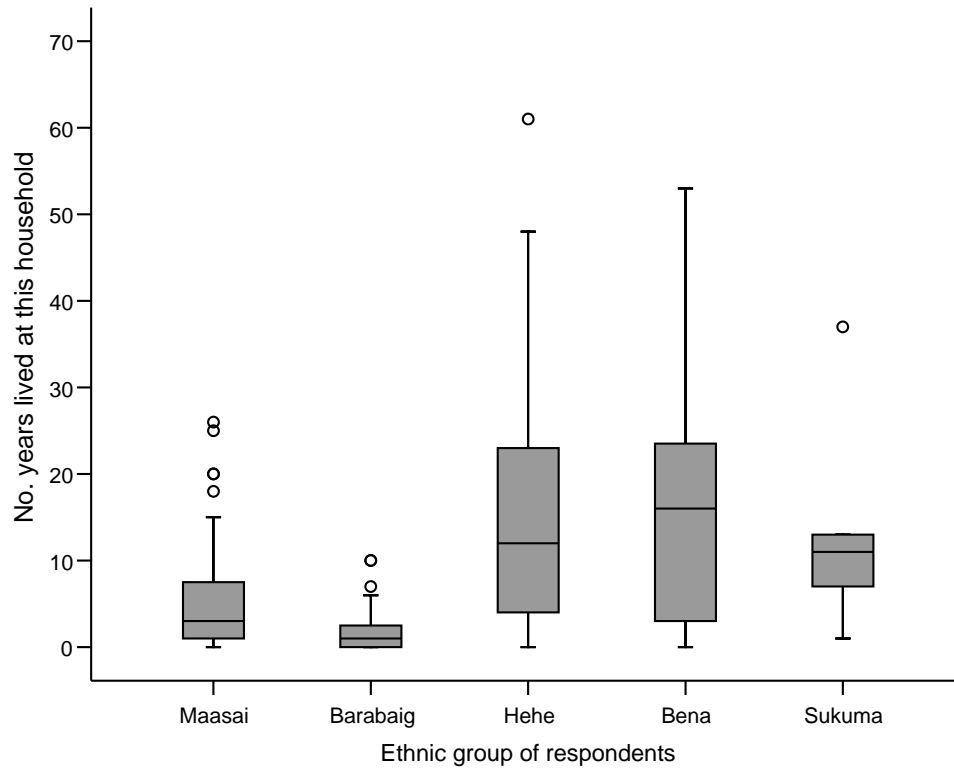


Figure 6. Length of time lived in current location, broken down by ethnic group of respondent

4.4.1.2 Group composition at interviews

The PI was present for 56.3% of interviews, while the remainder were carried out by Tanzanians alone. Although only one person was interviewed at a time, the surveys were very rarely conducted with just the respondent there – onlookers were present in 97.8% of cases, with a mean of 3.71 adults present in addition to the target respondent and the interviewers. Young adults were present in 73.4% of interviews (mean 1.1 young adults present), while elders were present on 50.4% of occasions (mean 0.73 elders present). People of superior social status to the respondent (see section 3.2.1) were listening to the interview in 23.5% of cases, equals only were present in 49.3% of cases, and no equals or superiors were present in 27.2% of cases. The status of onlookers present did not vary significantly between respondents of different ethnic groups ($\chi^2 = 5.68$, $df = 8$, $P = 0.686$).

4.4.1.3 Demography of respondents

Respondent ages ranged from 18 to 84 years old, with a mean age of 39.5 years (Table 6). There was a significant difference between ethnic groups in terms of mean age of respondents ($\chi^2 = 13.2$, $df = 4$, $P = 0.010$), with the Hehe respondents older than average, and the Maasai younger. Men accounted for 77% of interviewees, with no significant difference in the proportion of genders interviewed between different ethnic groups ($\chi^2 = 1.47$, $df = 4$, $P = 0.832$). The respondent was the head of the boma in 61.6% of cases ($n = 165$), and unsurprisingly this was strongly linked to gender – women were the head of the boma in only 8.4% of cases (Table 6).

Table 6. Demographic characteristics of respondents, showing breakdown of gender, age set and average age for each ethnic group

| | Maasai | Barabaig | Hehe | Bena | Sukuma | Overall |
|------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| No. male respondents | 79 | 33 | 48 | 42 | 4 | 206 |
| No. female respondents | 26 | 11 | 14 | 9 | 2 | 62 |
| Total no. respondents | 105 | 44 | 62 | 51 | 6 | 268 |
| No. male boma heads | 63 | 22 | 37 | 26 | 3 | 151 |
| No. female boma heads | 6 | 2 | 4 | 1 | 1 | 14 |
| No. males of young adult set | 35 | 14 | 7 | 12 | 1 | 69 |
| No. females of young adult age set | 8 | 4 | 3 | 2 | 0 | 17 |
| Total no. young adult age set | 43 | 18 | 10 | 14 | 1 | 86 |
| No. males of elder age set | 44 | 19 | 41 | 30 | 3 | 137 |
| No. females of elder age set | 18 | 7 | 11 | 7 | 2 | 45 |
| Total no. elder age set | 62 | 26 | 52 | 37 | 5 | 182 |
| Mean age in years (\pm SD) | 36.3 (\pm 11.6) | 38.7 (\pm 15.4) | 45.7 (\pm 16.4) | 39.1 (\pm 15.2) | 40.5 (\pm 11.8) | 39.5 (\pm 14.5) |

4.4.1.4 Religious affiliation

The religious affiliation of the respondent was known in 88.1% of cases ($n = 236$), with Lutheranism and Catholicism the most common religions adhered to (Table 7). The religious affiliation for the remaining 21.9% respondents ($n = 32$) was not known as this was asked after the initial interviews were conducted, and we were not able to locate all 268 of the original respondents during the time available to follow up regarding their religious beliefs.

Table 7. Reported adherence to various religious affiliations, broken down by ethnic group

| External religion adhered to | Ethnic group | | | | | Total |
|------------------------------|--------------|-----------|-----------|-----------|----------|------------|
| | Maasai | Barabaig | Hehe | Bena | Sukuma | |
| Catholic | 5 | 0 | 30 | 21 | 0 | 56 |
| Lutheran | 37 | 0 | 4 | 24 | 0 | 65 |
| Muslim | 1 | 0 | 3 | 1 | 2 | 7 |
| None – traditional beliefs | 40 | 27 | 6 | 1 | 2 | 76 |
| Anglican | 3 | 0 | 7 | 0 | 0 | 10 |
| Christian (general) | 7 | 6 | 2 | 1 | 0 | 16 |
| Tanzanian Assembly of God | 5 | 0 | 0 | 1 | 0 | 6 |
| | 98 | 33 | 52 | 49 | 4 | 236 |

Clearly, not all religious affiliations were represented equally ($\chi^2 = 167$, $df = 6$, $P < 0.001$), and they varied between ethnic groups ($\chi^2 = 70.3$, $df = 4$, $P < 0.001$) – for example, the majority of Hehe respondents were Catholic, while most Barabaig respondents said that they did not follow an external organised religion but retained traditional beliefs instead.

4.4.1.5 Income sources and diversification

The vast majority of respondents (97.4%, $n = 261$) had at least one strategy for generating cash income, while seven people said that they did not have any cash income, but just lived subsistence lifestyles. The number of sources of income ranged from 0 - 3, with a mean of 1.46 (± 0.56), with a full breakdown of reported income sources shown in Table 8. Only four respondents (two Maasai and two Barabaig, all men) reported receiving any income from tourism related to the National Park: two by selling meat to park workers, one by selling handicrafts from their household to tourists on their way to the Park, and

one by working at a tourist camp. Two of these lived in Tungamalenga (the closest village to the Park gate), one lived in Mapogoro and one lived in Mbuyuni. Therefore, only 1.5% of respondents in the study received any income from tourism in the Park, despite all living 30km or less from the Park boundary. One person had another conservation-related income, however, by being a natural resources scout on village land, while two respondents had other income sources, namely selling alcohol.

Table 8. Sources of cash income reported by interviewees, broken down by ethnic group

| Sources of cash income | Maasai | | Barabaig | | Hehe | | Bena | | Sukuma | | Total | |
|---------------------------------|----------|------|----------|------|----------|------|----------|------|----------|-------|----------|------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % |
| None, just subsistence living | 0 | 0.0 | 0 | 0.0 | 5 | 8.1 | 2 | 3.9 | 0 | 0.0 | 7 | 2.6 |
| Livestock only | 62 | 59.0 | 37 | 84.1 | 10 | 16.1 | 16 | 31.4 | 0 | 0.0 | 125 | 46.6 |
| Livestock & crops | 41 | 39.0 | 5 | 11.4 | 41 | 66.1 | 29 | 56.9 | 6 | 100.0 | 122 | 45.5 |
| Livestock & Park tourism | 1 | 1.0 | 2 | 4.5 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 3 | 1.1 |
| Livestock, crops & Park tourism | 1 | 1.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 |
| Livestock, crops & game scout | 0 | 0.0 | 0 | 0.0 | 1 | 1.6 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 |
| Livestock & selling alcohol | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 2.0 | 0 | 0.0 | 1 | 0.4 |
| Crops only | 0 | 0.0 | 0 | 0.0 | 4 | 6.5 | 3 | 5.9 | 0 | 0.0 | 7 | 2.6 |
| Crops & selling alcohol | 0 | 0.0 | 0 | 0.0 | 1 | 1.6 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 |

Livestock represented a particularly important asset, used by 94.4% of people ($n = 253$) for income generation, and was relied upon as the sole source of revenue for just under half of the respondents overall, with higher reliance for the Maasai and Barabaig. Crops provided income for 49.3% of respondents ($n = 132$), while an additional 20 people grew them for subsistence purposes only. Almost three-quarters of respondents (71.3%, $n = 179$) said that livestock was their most important income source (Figure 7), with all Barabaig respondents predominantly reliant upon it. Maasai respondents also relied significantly more heavily on livestock than crops ($\chi^2 = 68.1$, $df = 1$, $P < 0.001$), while the Hehe relied on crops more than livestock ($\chi^2 = 5.23$, $df = 1$, $P = 0.022$), and the Bena ($\chi^2 = 2.00$, $df = 1$, $P = 0.157$) and Sukuma ($\chi^2 = 0.67$, $df = 1$, $P = 0.414$) interviewees relied equally upon livestock and crops. These results support the broad classification of Maasai

and Barabaig respondents as pastoralists, while interviewees from other ethnic groups are considered agro-pastoralists, although the relative reliance of individual households upon livestock or crops will also be considered in later analyses.

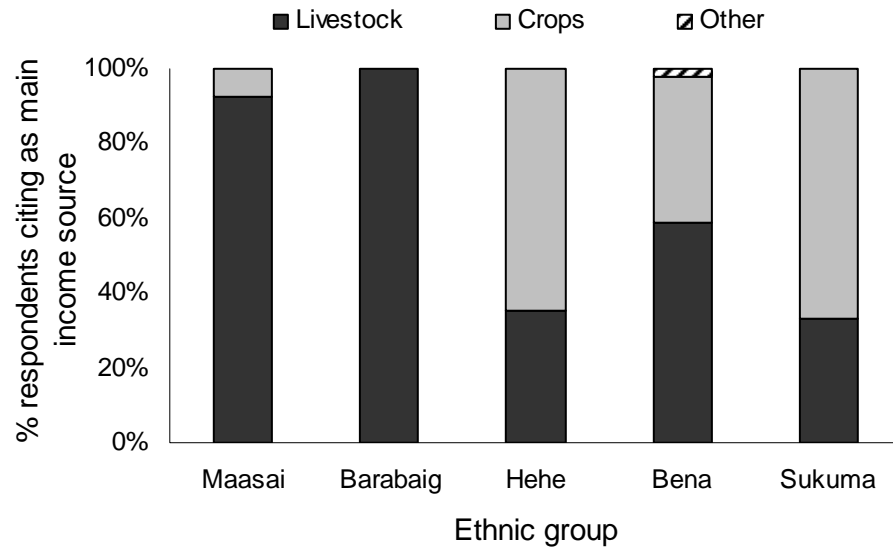


Figure 7. Main sources of income reported by respondents of each ethnic group

4.4.1.6 Stock ownership

Respondents reported owning between 2 and 526 head of stock at the household visited, with a mean of 95.3 (\pm 100.1) head of stock at each household. Smallstock were the most common livestock type owned, being kept by 91.4% of people ($n = 245$) and accounting for 52.6% of all stock holdings reported. This was closely followed by cattle, which were owned by 90.7% ($n = 243$) of respondents and comprised 46.2% of stock owned, while less than a third of respondents (28.7%, $n = 77$) kept donkeys, which accounted for only 1.2% of stock owned. Composition of stock owned varied between ethnic groups – for instance, 2% or less of Hehe and Bena respondents kept donkeys, whereas 89% of Barabaig interviewees did (Table 9).

Table 9. Composition of respondents' livestock holdings, separated by ethnic group

| Types of livestock owned | Maasai | | Barabaig | | Hehe | | Bena | | Sukuma | | Overall | |
|------------------------------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|
| | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % | <i>n</i> | % |
| Cattle only | 2 | 1.9 | 0 | 0.0 | 6 | 9.7 | 10 | 19.6 | 0 | 0.0 | 18 | 6.7 |
| Cattle & smallstock | 69 | 65.7 | 5 | 11.4 | 38 | 61.3 | 35 | 68.6 | 0 | 0.0 | 147 | 54.9 |
| Cattle & donkeys | 0 | 0.0 | 5 | 11.4 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 5 | 1.9 |
| Cattle, smallstock & donkeys | 31 | 29.5 | 34 | 77.3 | 1 | 1.6 | 1 | 2.0 | 4 | 66.7 | 71 | 26.5 |
| Smallstock only | 2 | 1.9 | 0 | 0.0 | 17 | 27.4 | 5 | 9.8 | 2 | 33.3 | 26 | 9.7 |
| Smallstock & donkeys | 1 | 1.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.4 |

Barabaig respondents owned the most stock overall, averaging 157 (± 132) head of stock per household, followed by Sukuma (mean = 106 \pm 129), Maasai (105 \pm 100), Hehe (73 \pm 83) and finally Bena respondents, who owned 48 (± 37) head of stock on average. There was significant variation between ethnic groups in the number of cattle (KW $\chi^2 = 59.5$, $df = 4$, $P < 0.001$), smallstock (KW $\chi^2 = 14.6$, $df = 4$, $P < 0.001$), donkeys (KW $\chi^2 = 130$, $df = 4$, $P < 0.001$) and total stock (KW $\chi^2 = 41.8$, $df = 4$, $P < 0.001$) owned (Figure 8).

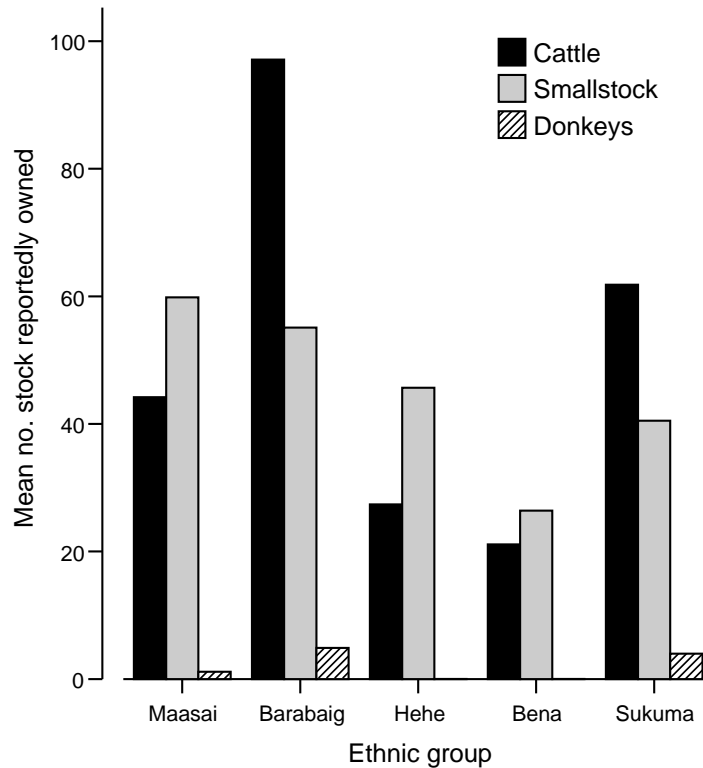


Figure 8. The mean number of stock reportedly owned by respondents from different ethnic groups

The distributions of different stock types kept are shown in Figure 9. These were significantly non-normal for all types (cattle: $z = 3.44$, $P < 0.001$; smallstock: $z = 3.49$, $P < 0.001$; donkeys: $z = 6.54$, $P < 0.001$; all stock: $z = 3.44$, $P < 0.001$) but log-transformation resulted in normalised distributions, so the transformed metrics were used for later analyses where appropriate. The unequal distribution of stock ownership meant that 17.5% of the households ($n = 47$) owned more than half (50.2%) of the total stock, while 14.9% ($n = 40$) owned over 50.7% of the cattle.

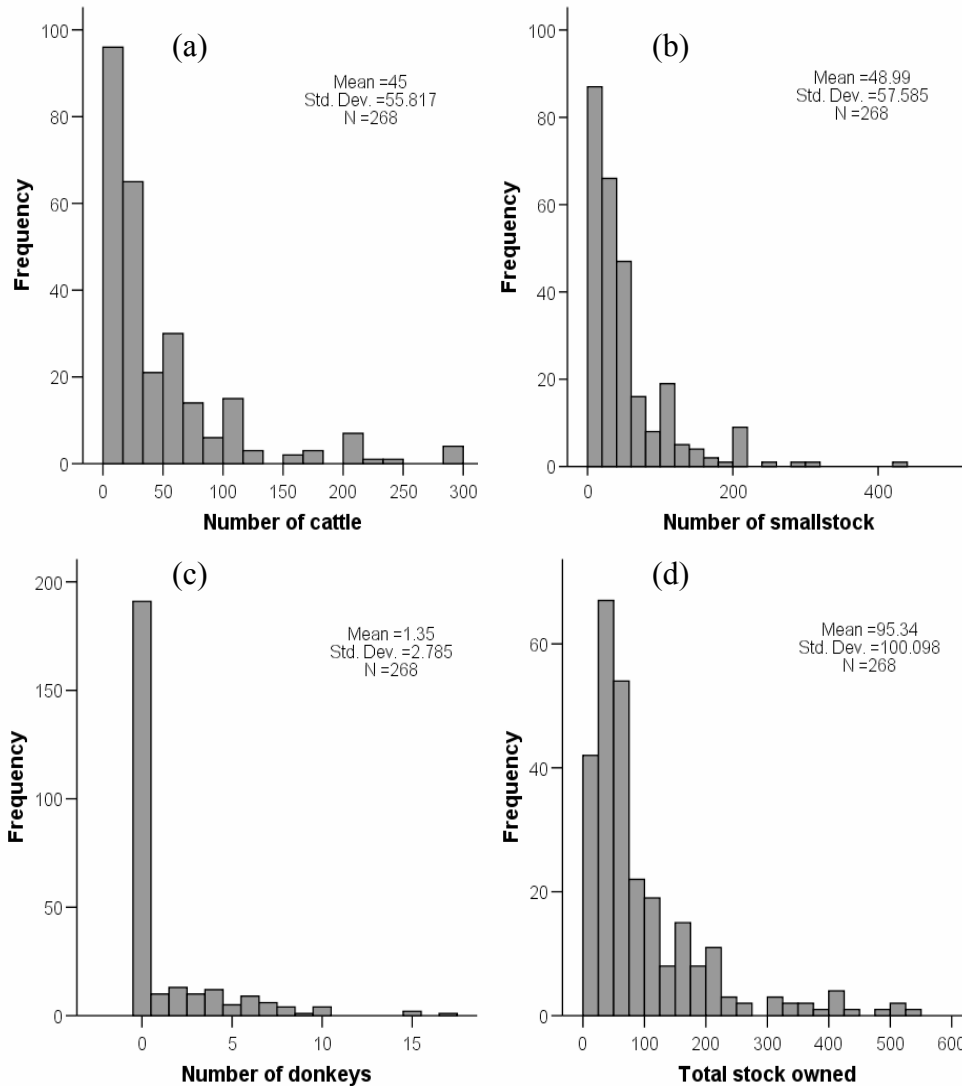


Figure 9. Frequency of the number of (a) cattle, (b) smallstock, (c) donkeys and (d) all stock reportedly owned by all respondents combined

The majority of respondents said that they had all their stock at the household visited, while 9.7% ($n = 26$) reported having additional stock holdings elsewhere. The likelihood of reported additional holdings varied between ethnic groups ($\chi^2 = 10.8$, $df = 4$, $P < 0.030$), with the Maasai and Barabaig apparently more likely to use this option than other groups. It was also strongly linked to gender, with none of the female-run households having stock elsewhere, and to wealth of stock holdings, with wealthier people more likely to have additional livestock at another location ($z = -2.74$, $P = 0.006$). The average vulnerability score across all respondents was 2.1 (± 0.72), with no significant variation

between ethnic groups ($z = -0.76$, $P = 0.940$). Female-led households had greater vulnerability scores (mean 2.36 ± 0.50) than male-led ones (mean 1.96 ± 0.77), a difference that was just below the level of statistical significance ($z = -2.45$, $P = 0.061$) but could nevertheless be socially important, particularly as there were relatively few female-led households, which would reduce the power of this statistical test.

4.4.1.7 Initially reported levels of stock gain and loss

Data on stock acquisitions was collected for 60 respondents, and all but one (98.3%) acquired stock during the month asked about. Interviewees reported acquiring an average of 25.8 stock per month (mainly smallstock: Figure 10), with births accounting for 94% of acquisitions, purchases for 4.2% and gifts or lending for 1.8%.

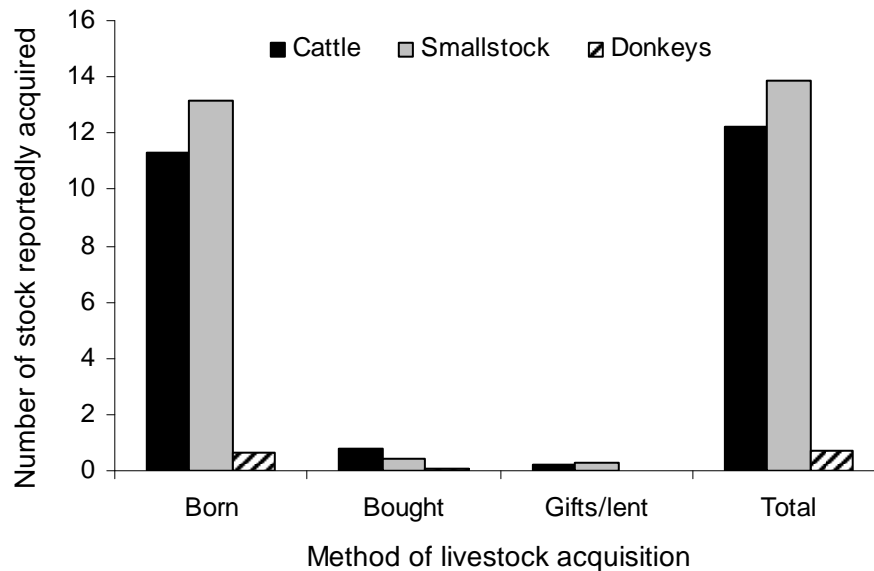


Figure 10. Number of stock acquired, and methods of stock acquisition, reported by interviewees for the month preceding the survey

Reported data on stock losses and utilisation over a month-long period indicated that respondents lost slightly more stock than they used overall, although more cattle were used (i.e. sold, slaughtered or given away) than lost (i.e. stolen, killed by predators or died: Table 10).

Table 10. Levels of livestock use and loss reported by interviewees for the month preceding the survey, separated by stock type

| | | Cattle | | Smallstock | | Donkeys | | Overall | |
|-------------------------|---------------------|-------------|---------------------|--------------|---------------------|-------------|---------------------|--------------|---------------------|
| | | Mean no. | Mean % of herd size | Mean no. | Mean % of herd size | Mean no. | Mean % of herd size | Mean no. | Mean % of herd size |
| Stock uses | Sold | 3.20 | 8.96 | 4.93 | 11.49 | 0.08 | 3.90 | 7.42 | 9.50 |
| | Slaughtered | 0.23 | 0.83 | 1.70 | 4.34 | 0.00 | 0.00 | 1.77 | 2.41 |
| | Given away | 0.47 | 1.01 | 0.54 | 1.36 | 0.08 | 3.19 | 0.95 | 1.25 |
| All stock uses | | 3.91 | 10.81 | 7.17 | 17.19 | 0.16 | 7.09 | 10.14 | 13.16 |
| Stock losses | Stolen | 0.92 | 2.28 | 1.42 | 3.64 | 0.04 | 2.78 | 2.14 | 2.81 |
| | Killed by predators | 0.24 | 0.33 | 0.98 | 2.13 | 0.11 | 2.20 | 1.15 | 1.21 |
| | Died | 1.61 | 3.71 | 8.34 | 14.25 | 0.08 | 1.59 | 9.11 | 9.80 |
| All stock losses | | 2.77 | 6.32 | 10.74 | 20.02 | 0.23 | 6.57 | 12.40 | 13.82 |

The majority of people (85.8%, $n = 230$) utilised at least one stock animal for selling, slaughter or gifts in the month reported, while 73.5% ($n = 197$) lost at least one animal to theft, depredation, disease or other causes. Stock losses were clearly a significant cause for concern as, overall, people lost an average of 1.42 head of stock for each one utilised. Although the reported number of livestock lost to depredation was relatively small, it still equated to over 10% of all stock uses, so must still have a considerable impact on local peoples' livelihoods. The ratio of stock lost to that utilised reported in initial interviews varied according to the month being asked about, with particularly high relative rates of loss in December and January (Figure 11).

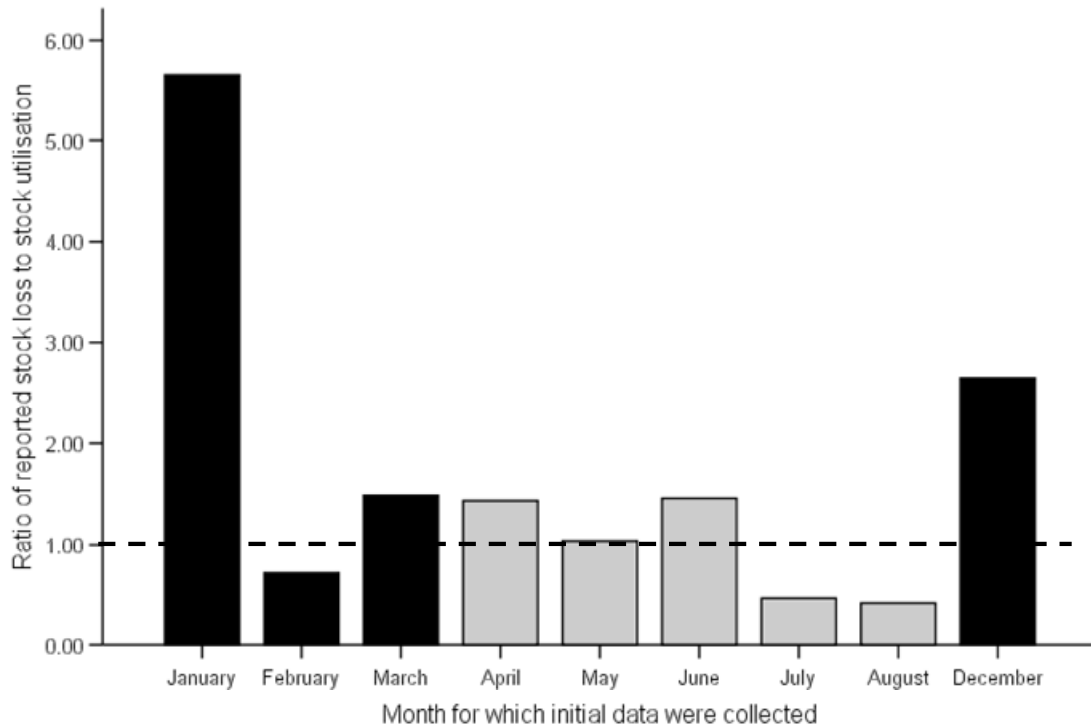


Figure 11. Relative ratios of stock loss and use reported in initial surveys, for the month preceding the survey. The dotted line denotes parity, where equal amounts of stock are lost and used, with bars above this line indicating that more stock were lost than used, and bars below it indicating that more stock were used than lost. Black bars depict rainy season months, while grey bars depict dry season months

4.4.1.8 Initially reported causes of stock loss

Examination of the reported causes of loss revealed that increased disease was the main driver behind the observed peaks of losses revealed above (Figure 12). Rates of depredation were reported to peak slightly in June, remaining at a low, steady level for the other months monitored. Theft also peaked slightly in the dry season, while other causes of loss remained relatively stable across time.

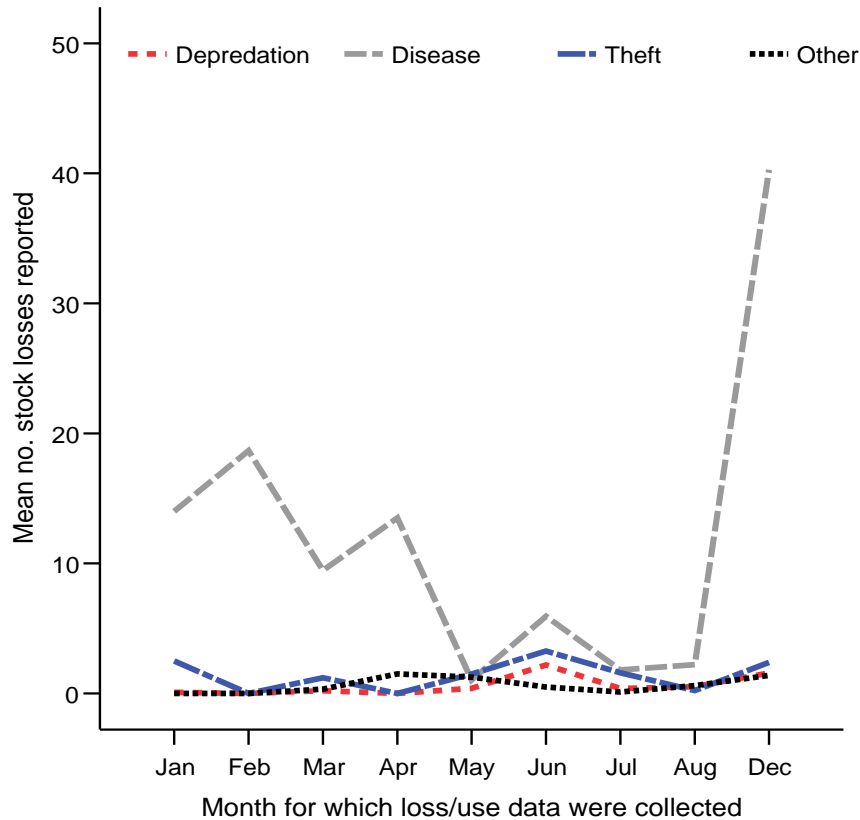


Figure 12. Mean number of reported livestock lost due to different causes, for each month that initial data on stock loss and use were collected

Disease was the main cause of livestock loss overall by far, as well as being the main cause of loss for each individual stock type apart from donkeys, for which theft and depredation were the most important causes of loss (Figure 13). Overall, disease accounted for 68.8% of all stock losses initially reported, theft accounted for 17.3%, depredation accounted for 9.3% and all other losses combined accounted for 4.7%.

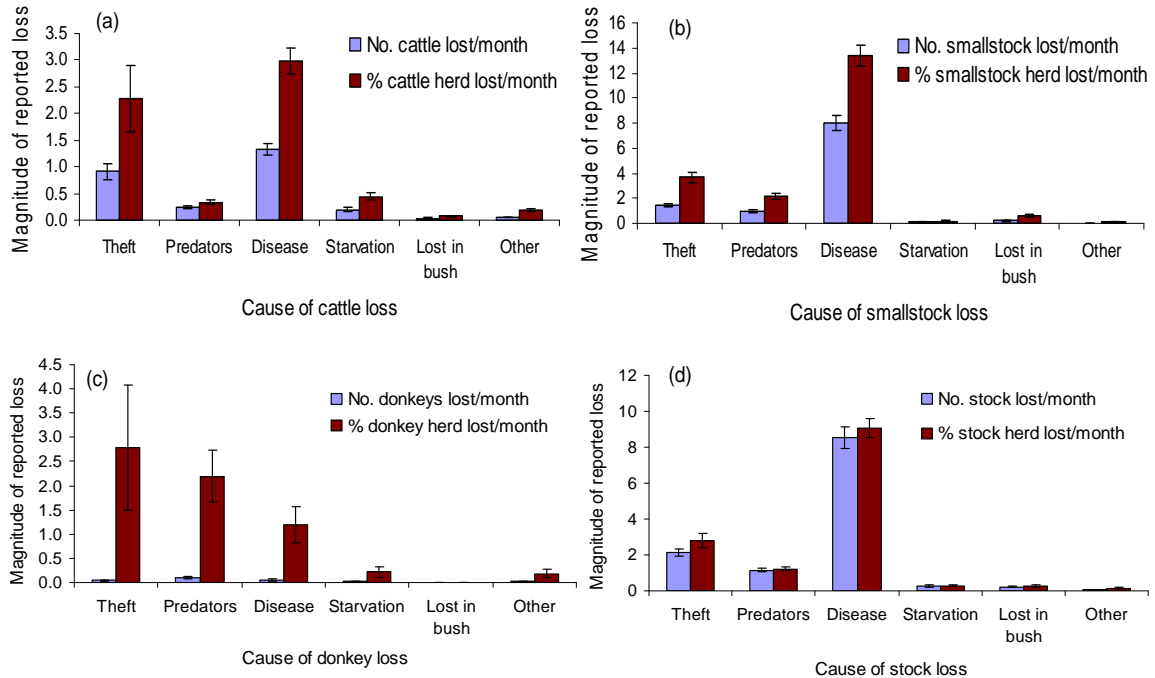


Figure 13. Number and percentage of livestock reported lost in a monthly period to various causes, for (a) cattle, (b) smallstock, (c) donkeys and (d) all stock. Error bars denote the standard error of the mean

There was some measurable impact of living nearby the Park, with a significant relationship between proximity to the Park and the number of livestock reported as lost ($r_s = -0.126$, $n = 267$, $P = 0.039$). However, there was no relationship between distance to the Park and the percentage of stock reported as lost ($r_s = -0.040$, $n = 267$, $P = 0.514$), presumably as the ethnic group living closest to the Park, the Barabaig, were the wealthiest in terms of stock ownership. This relationship was driven by disease rather than depredation, with a significant relationship between proximity to the Park boundary and the number of livestock reportedly lost to disease ($r_s = -0.146$, $n = 267$, $P = 0.017$), but no relationship for the number of stock reportedly lost to depredation ($r_s = -0.085$, $n = 267$, $P = 0.167$) or any other causes. Interestingly, respondents who adhered to an external religion reported losing fewer livestock to depredation, both in terms of number ($z = -2.57$, $P = 0.010$), and percentage ($z = -2.45$, $P = 0.014$) of stock, than respondents who adhered to no external religion and retained their traditional beliefs.

The relative importance of different causes of stock loss varied between different ethnic groups, with theft being more important for the traditionally pastoralist groups (Figure

14). Disease was the most significant cause of loss for all ethnic groups, with depredation having the most a noticeable effect on the Maasai, followed by the Barabaig and, to a lesser extent, the Hehe respondents.

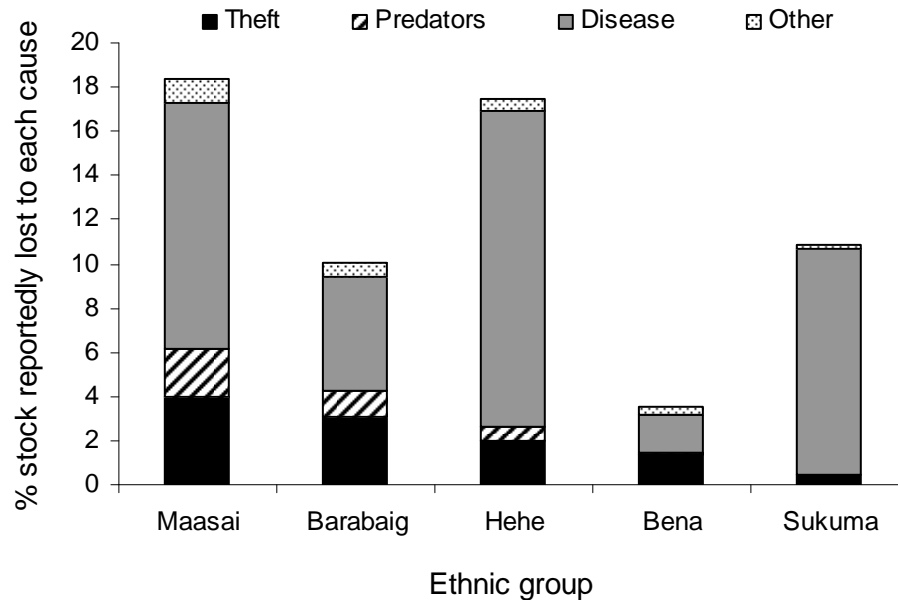


Figure 14. Percentage of total livestock herd reportedly lost to various causes, separated by ethnic group of the respondent

4.4.1.9 Levels and causes of loss revealed through long-term monitoring

Data from the event diaries revealed the levels of loss to different causes and how they fluctuated over a year-long period (Figure 15). This long-term monitoring revealed that in an average month, 0.32% of livestock were reportedly killed by predators, 0.58% were stolen, 4.41% died from disease and 0.64% were lost to other causes. This suggests that the data provided in initial interviews either came from exceptionally bad months for stock loss, or that people over-estimated the impacts of all types of stock loss. This is not surprising as people are likely to have trouble in exact recollections of stock losses over a certain period of time. Initial estimates of stock loss to depredation were 3.8 times higher than that revealed through long-term monitoring, losses to theft were 4.8 times higher and other deaths (mainly disease) were 1.9 times higher. This tendency to over-estimate losses at first may account for the sharp peak of losses reported in March 2007 (Figure 15), when the bulk of initial reports on stock loss were collected. However, conditions in

the rainy season may also drive higher stock losses at this time of year, and further data are required to examine this trend further.

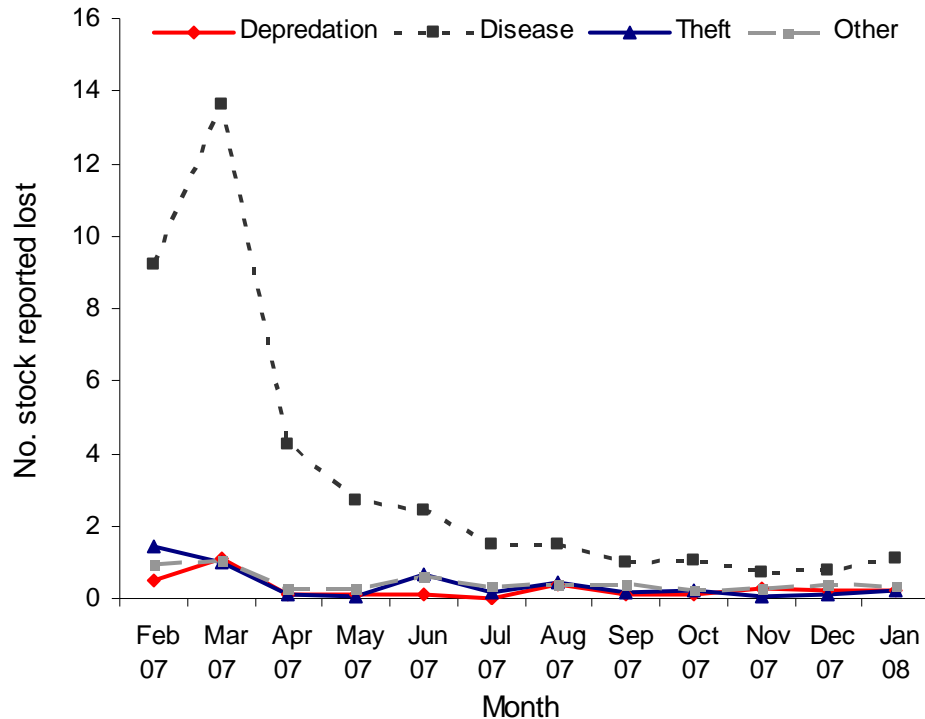


Figure 15. Data on the reported level and temporal variation of stock loss to different causes, as determined through long-term monitoring of 191 households across the study area

4.4.2 Respondents' free-listing of wildlife species

Respondents mentioned between zero and 15 species when asked to list all the wild animals they could think of that lived around their household, with a mean of 4.6 species named each, and a total of 35 species named across all respondents. Multidimensional scaling suggested that carnivores were viewed as a loose grouping, with wild dogs, leopards and lions most closely associated with one another in lists, and cheetahs and hyaenas viewed as slightly more distinct (Figure 16).

8.2% of people, but giraffes (*Giraffa camelopardis*), elephants, lions and crocodiles (*Crocodylus niloticus*) identified correctly by over 95% (Figure 17).

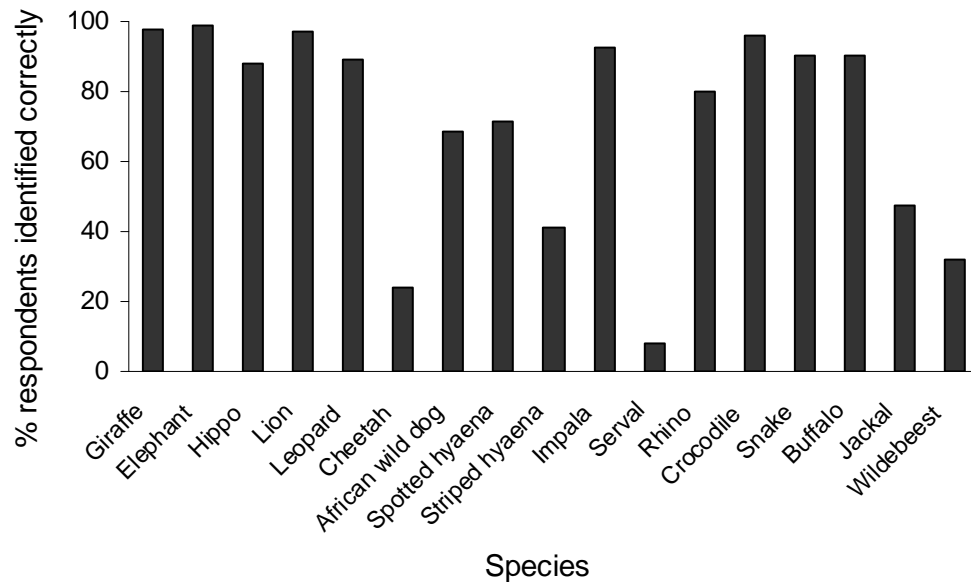


Figure 17. Percentage of respondents that identified various photographs of African species correctly

The level of species identification was significantly influenced by ethnic group (KW $\chi^2 = 18.2$, $df = 4$, $P = 0.001$), with Bena interviewees recognising least species or species groups (mean = 10.9 ± 2.5) and Maasai recognising most (mean = 12.5 ± 2.4). Overall, respondents from traditional pastoralist groups identified significantly more species than those without such a background ($z = -3.56$, $P < 0.001$). Women had a much lower rate of species identification than men, a relationship that was significant both overall ($z = -5.62$, $P < 0.001$) and for each ethnic group (Maasai: $z = -3.33$, $P = 0.001$; Barabaig: $z = -2.28$, $P = 0.023$; Hehe: $z = -3.30$, $P = 0.001$; Bena: $z = -2.81$, $P = 0.005$; Sukuma: $z = -2.00$; $P = 0.046$).

4.4.3.2 General attitudes towards wildlife

When asked about their views towards wild animals living in the area around their village, just under a third of respondents (30.6%, $n = 76$) said they were happy with all the wild animals living around the village, while 10.5% ($n = 26$) weren't happy with any of them. The remainder had mixed views, such as only being happy with animals causing

no problems (24.2%, $n = 60$), only being happy with herbivores (7.3%, $n = 18$), or being happy with most wildlife apart from a few particular species (9.3%, $n = 23$). Lions were the most commonly mentioned species when this was the case, being cited in 35% of cases, with hyaenas mentioned in 29% of cases and elephants in 17%. Leopards, jackals, wild dogs, buffaloes (*Syncerus caffer*), monkeys, baboons (*Papio cynocephalus*), snakes, hippos (*Hippopotamus amphibius*), cheetahs, and even impala (*Aepyceros melampus*) and kudu, were also specifically mentioned as problematic animals by small numbers of respondents. Conversely, 6% of respondents ($n = 16$) specifically mentioned animals that they particularly liked, with dikdiks (*Madoqua kirkii*) particularly favoured, cited in 50% of those cases and impala in 16%. Giraffe, kudu, zebra (*Equus burchelli*) and monkeys were also liked by some respondents, and one even mentioned liking having lions around.

4.4.4 Conflict scores with wildlife species

The mean conflict score across all 19 species shown was 0.96 (± 0.46), with significant variation between different species (KW $\chi^2 = 1120$, $df = 18$, $P < 0.001$; Figure 18). There was significant variation amongst survey respondents in their mean conflict scores assigned to wildlife species ($\chi^2 = 230$, $df = 107$, $P < 0.001$).

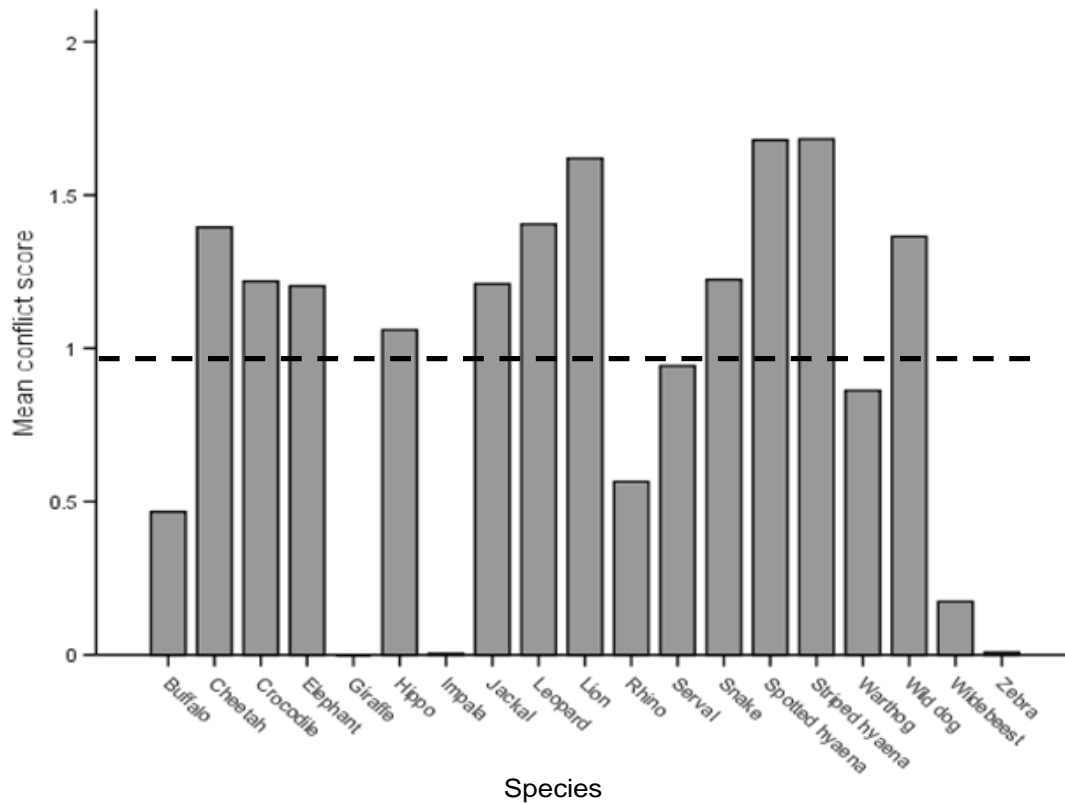


Figure 18. Mean conflict scores assigned by respondents to the African species shown in the survey. The dotted line shows the mean across all species

Carnivores were ranked as significantly more problematic than herbivores ($z = -25.9$, $P < 0.001$) and all other species ($z = -23.1$, $P < 0.001$), and the five focal carnivore species were ranked significantly higher than all other species ($z = -21.2$, $P < 0.001$) as well as other carnivores ($z = -8.12$, $P < 0.001$).

A hierarchical cluster analysis on the reported conflict scores for each species revealed three distinct clusters of species in terms of their degree of perceived conflict with respondents (Figure 19). Cluster 1 consisted of the lowest conflict-scoring species, all of which were herbivores, Cluster 2 comprised species which caused occasional problems or were rarely around the study area, while Cluster 3 contained all the species cited as posing considerable danger to people and/or livestock: namely the five focal large carnivore species as well as crocodiles, snakes, elephants and hippos.

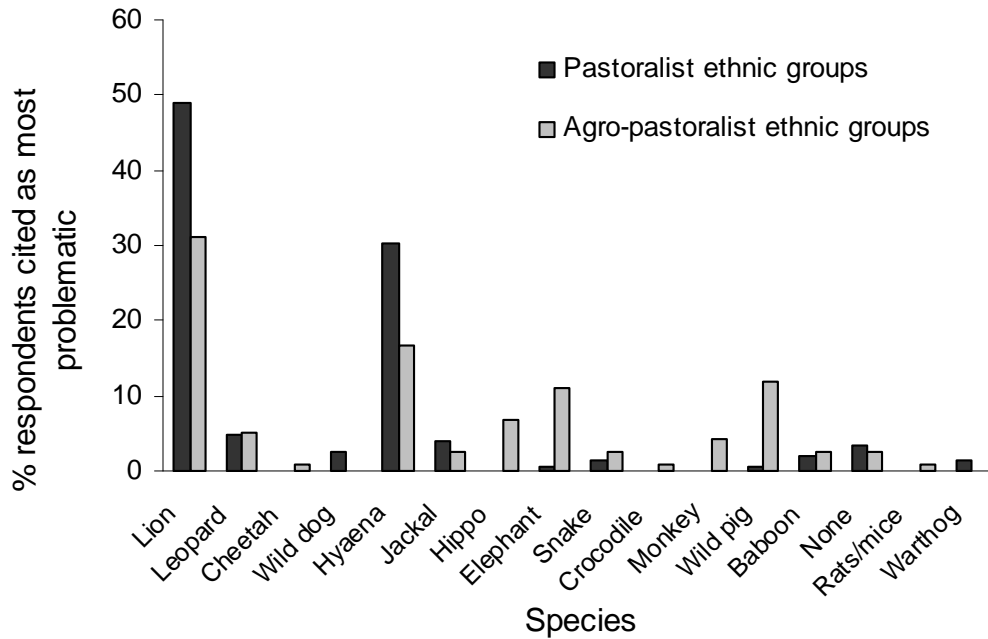


Figure 20. Species named as the single most problematic one by survey respondents, separated into those from traditional pastoralist and agro-pastoralist groups

4.4.5 Comparison of conflict scores with elsewhere in Tanzania

In 2002, Maddox documented levels of conflict between pastoralists and wildlife in northern Tanzania, focusing exclusively on the Maasai. A comparison of the scores found in this study with his results shows that, across all respondents, conflict scores around Ruaha tended to be similar to or slightly lower than those found in northern Tanzania, apart from for wild dogs, hippos, servals and crocodiles, which had higher conflict in Ruaha, and buffaloes and wildebeest (*Connochaetes taurinus*), which had higher conflict in northern Tanzania (Figure 21).

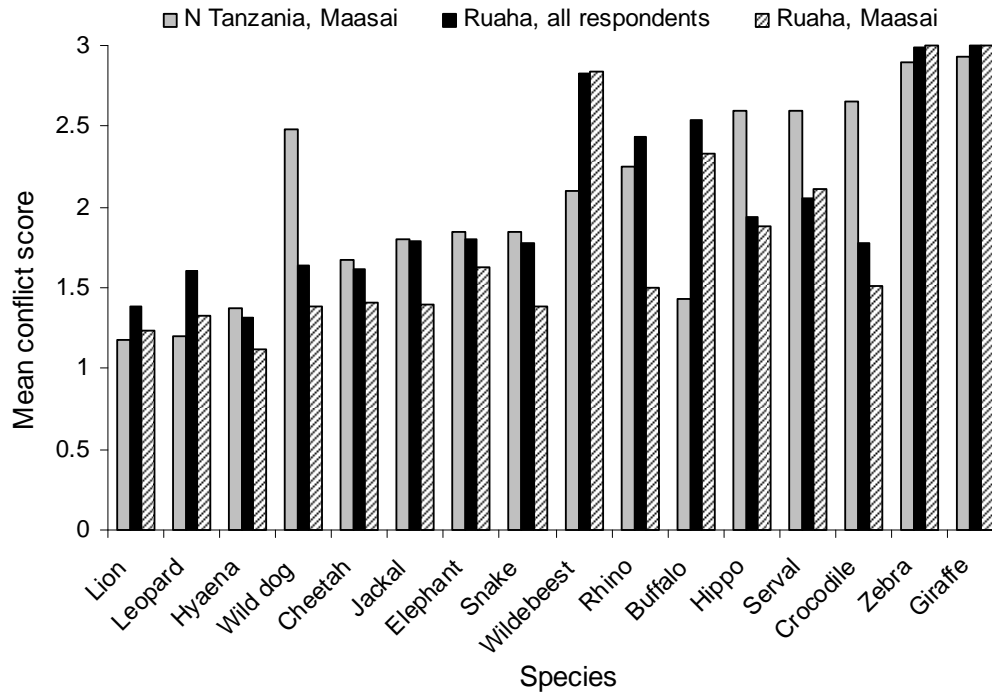


Figure 21. Comparison of reported conflict scores found by Maddox (2002) for Maasai in northern Tanzania with those in this study, for all respondents and for Maasai alone. Here the scoring system by Maddox (2002) is used, so higher conflict scores denote less of a perceived problem

When restricted to just Maasai respondents, however, the Maasai around Ruaha reported more intense conflict with all of the carnivores except for lions and leopards, where the scores were similar. The Maasai in this area also reported notably higher conflict with rhinos, hippos and crocodiles than those in northern Tanzania, but substantially less conflict with wildebeest and buffaloes. When examined across all species, mean conflict scores reflected slightly higher conflict overall around Ruaha, a difference that became more marked when just the Maasai respondents were considered.

4.4.6 Key determinants of conflict with wildlife

The level of overall reported conflict with wildlife varied significantly between respondents ($\chi^2 = 231$, $df = 107$, $P < 0.001$). Initial tests to explore factors influencing attitudes suggested that levels of reported conflict were significantly affected by respondents' ethnic group ($F = 10.8$, $df = 4$, $P < 0.001$), with agro-pastoralists more tolerant than people from traditional pastoralist backgrounds ($t = 4.54$, $df = 266$, $P <$

0.001). Levels of conflict varied by village ($F = 1.72$, $df = 19$, $P = 0.033$), with conflict higher in Idodi than Pawaga district and the highest reported conflict in Tungamalenga. Conflict also varied between religious affiliations ($F = 3.28$, $df = 6$, $P = 0.004$), with interviewees who did not adhere to an organised religion apparently more tolerant of wildlife than other people, even though they reportedly suffered more from depredation. Intensity of conflict varied between people with different primary income sources ($F = 6.09$, $df = 2$, $P = 0.03$), with least hostility amongst those who diversified their income from livestock ($t = -2.71$, $df = 245$, $P = 0.007$) and those with a greater number of income sources ($r = -0.134$, $n = 268$, $P = 0.028$). Levels of reported conflict also increased with both the number and percentage of stock (particularly smallstock) killed by predators (number: $r = 0.236$, $n = 268$, $P < 0.001$; percentage: $r = 0.248$, $n = 268$, $P < 0.001$), and increased with the level of wildlife knowledge exhibited by the respondent ($r = 0.377$, $n = 208$, $P < 0.001$). The magnitude of reported conflict increased with the number of adult onlookers present at the interview ($r = 0.152$, $n = 268$, $P = 0.013$) and was higher if the PI was present at the interview than if it was Tanzanians alone ($t = 3.01$, $df = 266$, $P = 0.003$). The intensity of conflict did not seem to be significantly affected by how far away the respondent lived from the Park, their age, gender, the status of any onlookers, whether or not the respondent was the head of the boma, their calculated vulnerability, the number of stock owned, the number and percentage of cattle and donkeys lost to predators, and the number and percentage of stock lost to disease or overall.

Clearly, however, many of these factors are correlated with one another – for instance, the lower conflict scores reported by agro-pastoralists may actually reflect their higher levels of income diversification, or their greater distance from the Park and its attendant wildlife. To examine this in more detail, a general linear model (GLM) procedure was employed, to determine which factors were still retained in the most parsimonious model with the lowest Akaike's Information Criterion (AIC) score. The relative importance of ethnic group, distance from the Park, district, number of onlookers, whether or not the PI was present at the interview, time lived in the area, age, gender, wildlife knowledge, number of stock owned, number of income sources, primary source of income, vulnerability score, adherence to an external religion, number and percentage of each

stock type lost to predators and number and percentage of overall herd size lost to all causes, were examined with relation to the mean conflict score. The original model had an AIC score of 115.1, while the final model had an AIC score of 87.2. This model retained the number of livestock reportedly killed by predators, the number of sources of income and adherence to an external religion as the most important variables influencing the magnitude of reported conflict with wildlife (Table 11).

Table 11. Final output from general linear modelling procedure used to examine conflict with wildlife, showing the variables which contributed to the model with the lowest AIC score

| Source | Numerator <i>df</i> | Denominator <i>df</i> | <i>F</i> | <i>P</i> |
|--------------------------------|---------------------|-----------------------|----------|----------|
| Intercept | 1 | 231 | 191.61 | 0.000 |
| No. stock killed by predators | 1 | 231 | 14.45 | 0.000 |
| No. sources of income | 1 | 231 | 7.05 | 0.008 |
| Adherence to external religion | 1 | 231 | 5.31 | 0.022 |

Dependent Variable: Mean conflict score for all species

However, this model only accounted for 20% of the variation in reported conflict, suggesting that much of the variation is determined by factors not assessed here. Likely factors include more deep-seated ones such as attitudes towards the Park and concerns about resource exclusion, and these will be examined further in chapter 7.

4.5 Discussion

Survey respondents clearly regarded wildlife in this area as causing significant problems, with conflict levels similar to or higher than has been reported elsewhere in Tanzania (Maddox 2002). Given the potential impacts of intense human-wildlife conflict on wildlife populations, and the global importance of this area for biodiversity conservation, it is imperative to understand the main drivers of this hostility. Carnivores, particularly lions, hyaenas, leopards, cheetahs and African wild dogs, were ranked as significantly more problematic than other species, and the factors affecting this intense conflict will be examined further in the next chapter.

Initial statistical analyses here suggested that the intensity of conflict varied significantly between respondents of different ethnic groups, with agro-pastoralist groups tending to exhibit more tolerance than other groups. This was unexpected, as the tolerance of traditional pastoralists in particular for wildlife has been well-documented (Western 1989). However, the high levels of conflict between pastoralists and wildlife seen here supports the contention of Frank et al. (2006a) that in many areas of East Africa, the levels of pastoralists' tolerance are actually much lower than might be expected. However, the fact that ethnicity was not retained as one of the most significant variables in the final model suggests that variation in conflict between ethnic groups here is driven primarily by the fact that pastoralists reported suffering more depredation, and were particularly dependent upon livestock for their livelihoods, with less of the income diversification that proved to be an important determinant of conflict in the final model. This relationship between increased sources of income and lower conflict is understandable, as it reduces the vulnerability of a household to a predator attack or other unexpected event (Cutter et al. 2000; Naughton-Treves 1997).

According to Turner et al. (2003), three main factors affect the level of vulnerability, namely entitlement, coping and resilience. Entitlement, whether through legal or customary means, involves the ability to access resources needed in times of hardship (Hazzah 2006), and in traditional societies this is often achieved through systems of social reciprocity between households, particularly among extended families (Bell 1984; Naughton-Treves and Treves 2005; Scott 1976). Although such systems have been well-documented in pastoralist societies (Lamprey and Reid 2004), there was little evidence of it in this study – the vast majority of stock acquisition was reportedly through purchase or breeding, with less than 2% reported to be through gifts or lending. Traditional networks for lending may have been disrupted by the high levels of immigration that has occurred into the study area, while it must also be borne in mind that reported levels and sources of stock gain may be biased by people being unwilling to discuss their acquisition of stock by borrowing. Coping, another of the main factors affecting vulnerability, may again include dependence on local networks for communal resource sharing, on other sources of income, such as tourism (Campbell 1999; Naughton-Treves and Treves 2005). It was

striking how few of the respondents in this study received any income from tourism or the nearby Park (fewer than 2%), despite its close proximity. This compares very poorly to pastoralists living close to some other protected areas that have been studied – for instance, revenue from tourism-related activities contributed over 30% of the income for Maasai households adjacent to the Maasai Mara National Reserve (ACC 2001; Lamprey and Reid 2004). However, a study in Ngorongoro showed that less than 10% of Maasai households in the area received any income from tourism, despite the high level of international tourism (Thompson and Homewood 2002). Similarly, a cross-border study of five sites across East Africa revealed that very few people studied received any income from wildlife, despite often living in close proximity to important wildlife areas, and where they did receive income, it usually contributed less than 5% of mean annual income (Homewood and Trench 2008). Interestingly, conflict levels here were considerably higher in Idodi district, where the villages tend to have more tourist traffic and infrastructure, than in Pawaga, and conflict was highest in Tungamalenga, the village closest to the Park's entrance gate. This suggests that the combination of higher potential expectations of returns from tourism, from increased exposure to it, juxtaposed with the reality of the low benefits actually received, may result in more intense conflict than in areas with less tourist exposure. Ruaha National Park undoubtedly does bring some benefits to local communities, such as through the 'Support for Community-Initiated Programmes' (SCIP; Coppolillo and Dickman 2007) but these programmes tend to focus on improved infrastructure rather than tangible economic benefits that go directly to local households. Improving the direct economic linkages between the protected area and local communities is therefore something that must urgently be addressed to help redress the cost-benefit balance of living adjacent to the protected area and reduce conflicts. The very recent establishment of the Pawaga-Idodi Wildlife Management Area, where revenues from wildlife should directly benefit local villages, will provide an interesting case study to examine if and how attitudes towards wildlife change once the WMA is fully operational and pastoralists have greater opportunities to diversify income strategies. As with any such scheme, however, there is a risk of 'elite capture', where the most powerful stakeholders dominate the benefits and limit the returns received by the poorest and most vulnerable households (Platteau and Gaspart 2003; Sandbrook 2006).

The lack of equality even amongst the households studied here is evident: less than 15% of households owned more than half the stock, which is similar to the levels of inequality seen in other studies of pastoral stock ownership (Bekure et al. 1991; Lamprey 1984; Thompson 2002).

Having livestock in more than one household is another coping strategy that buffers people against a sudden catastrophic event at a single location, and was used by around 10% of respondents here. However, it was evident that this mechanism was only used by wealthier people, suggesting that poorer householders suffered from compounding vulnerability, as has been seen in other studies (Carter 1997; Naughton-Treves 1997) – not only did their lower stock wealth make them more vulnerable to a sudden stock loss, but they were less able to buffer against this by keeping stock in an additional location. Shifting from pure pastoralism to agro-pastoralism is another common coping mechanism to buffer against environmental risks, and has been noted in numerous studies, with 46% of Maasai households cultivating in Kajiado, Kenya (Coast 1998) and 53% having cultivated over the past decade in Talek, also in Kenya (Thompson and Homewood 2002). This was also seen in this study, with nearly 40% of the Maasai currently cultivating crops, although far fewer of the Barabaig diversified in this way. The low levels of income diversification and alternative coping strategies may be one of the reasons why traditional pastoralists here reported more intense conflict towards wildlife than their agro-pastoralist counterparts. However, cultivation is by no means a reliable strategy for generating income, or even food, as climatic limitations and wildlife damage means that many people often fail to harvest crops even if they invest their labour and resources in them (Homewood and Trench 2008). The last main factor affecting vulnerability, resilience, is the ability to recover to the original state after some perturbation (Turner et al. 2003). Given the few other income sources and the apparently limited levels of social reciprocity, opportunities for resilience initially seem limited in this study area. However, the high rate of stock theft (averaging 19% of stock losses) suggests that this may be being used to improve resilience. Stock-raiding is a common occurrence in pastoralist societies and has been suggested as integral to the success of nomadic pastoralism, as it provides a means for recouping losses and redistributing

livestock wealth when households are affected by disease, drought and other causes of stock loss (Gray et al. 2003). Maasai and Barabaig respondents suffered more loss from theft than other groups, and anecdotal evidence suggested that this was because they tended to participate in more stock raids themselves, so would have those stock stolen back in turn.

Therefore, the variation seen in conflict intensity between ethnic groups is multifaceted and understandable, especially if it is mediated by a lack of income diversification from livestock and a lack of tangible benefits from the nearby Park. Even when communities benefit from wildlife-related revenues, pastoralists often fail to profit, as they are often politically disempowered within villages (Williams 2005), and therefore do not have the power to ensure that they receive an equitable share of any benefits. The link between higher conflict and higher levels of livestock depredation seen here is also completely understandable and echoes the results of other studies around the world, where high depredation results in intense human-wildlife conflict (Thirgood et al. 2005). More details on the nature and frequency of depredation events reported in this study, as well as their relationship with conflict, are provided in the next chapter. However, it should be noted that initial estimates of depredation levels (which were strongly linked to perceived conflict here) tended to be considerably over-estimated in initial surveys, as were losses to all other causes. The causes of discrepancies between initial and long-term monitoring are hard to discern, as some months may indeed be much worse for pastoralists – for instance, in early 2007, there was an outbreak of Rift Valley Fever in the study area and this did result in a sharp increase in livestock deaths. However, such inflation in the estimation of damage, particularly to wildlife, has been noted in previous studies and is a particular problem when large, symbolic species are concerned (De Boer and Baquete 1998; Naughton-Treves and Treves 2005). This may be driven by a hope that compensation or other support might be provided (Hazzah 2006; Nyhus et al. 2003), and highlights the danger of relying on one-off surveys to estimate the impact of wildlife-related damage on local communities. Repeated follow-up surveys and regular contact with respondent households are therefore much more likely to provide accurate estimations of the relative impact of different causes of stock loss on pastoralist

households. Moreover, it should always be remembered that surveys, by their very nature, rely on peoples' perceptions of a situation and on what they are willing to discuss and report, so any results, although still interesting and important, should always be interpreted with some caution. It would be valuable to independently monitor herds and verify losses so that the true levels and causes of stock loss could be investigated, allowing the veracity of these initially reported levels to be assessed.

Religious affiliation appeared to be strongly linked to the intensity of conflict, with people who retained traditional beliefs tending to be more tolerant of wildlife than people who adhered to external religions. Traditional religious beliefs have been linked previously to increased protection of local species, as has been seen with Buddhist communities in Nepal (Ale 1998), while both this study and one by Hazzah (2006) found that adherence to external religions was linked to increased conflict with wildlife in pastoralist societies. The reasons for this are unclear, although Hazzah (2006) suggested that religious respondents may have lower standards of livestock husbandry, as they trust God to protect them. Hazzah (2006) highlights the pressing need to examine the relationship between religious beliefs and the quality of livestock husbandry, and this will be one of the variables examined in chapter 6 of this thesis. It is also possible that contact with missionaries somehow makes respondents less tolerant of wildlife, perhaps by trying to make them change their traditional beliefs and practices, thereby increasing their susceptibility to wildlife-related livestock losses. However, initial results here show that religious respondents actually reported losing less stock to depredation than others, making the increased reported conflict even less explicable. One possibility is that people who feel more supported, for instance by a relatively powerful church, may feel more confident and able to voice dissent or complaints, while other people without such support structures may be more hesitant to do so. This hesitance to speak up unless backed by more powerful organisations has been seen in a variety of other cases: for instance, during the 1943 reclassification of the Ziama forest reserve's boundaries in Upper Guinea, the colonial administration thought that 'local interests had been satisfied' during consultations (Fairhead and Leach 1994). However, local people only complained formally about the land alienation involved in this process in 1955, once they had

achieved representation at the national level through a sympathetic organisation and were therefore able to voice dissent against more powerful people (Fairhead and Leach 1994; Fairhead and Leach 2000).

Another unexpected result was that people with increased knowledge of wildlife actually exhibited higher animosity, as increased awareness and knowledge has usually been linked to lower conflict with wildlife (Biggs 1988; Ericsson and Heberlein 2003). However, knowledge about wildlife was correlated with ethnic group, with traditional pastoralists tending to exhibit more wildlife knowledge, so the factors intensifying hostility to wildlife and conservation among pastoralists may be an important driver of this trend. Moreover, the source of any 'education' may be an important factor here – if people are hostile towards wildlife as a surrogate for the Park or other authorities, then having contact with those people, even in an 'educational' context, may actually have the opposite effect of what is intended and inflame conflict rather than reduce it. This will be examined further in chapter 7 of this thesis. It was also evident that there was a strong social component to explaining conflict – the intensity of reported conflict increased as the number of onlookers did, and higher conflict was also reported if the PI (a foreigner) was present. These results are understandable, particularly as people may expect more help from an outsider if they exaggerate any problems, but highlight the fact that researchers can change the metric of interest just by their presence, and it is something that should be documented and accounted for in similar studies.

Overall, therefore, this study highlights the wide variety of factors that inter-relate to shape peoples' attitudes towards wildlife. Identifying key factors linked to higher conflict can help target households where conflict is likely to be intense, and help determine the best strategies for attempting to mitigate human-wildlife conflict. For instance, these results suggest that people who adhere to external religions, who have reportedly suffered livestock depredation and who have few or no alternative income sources to livestock, are likely to be particularly hostile towards wildlife. A rapid assessment of households using these few key variables could identify likely conflict hotspots and target conflict resolution efforts in those areas. It was interesting to note that the factors identified as key drivers of conflict here were extremely similar to those found by Hazzah (2006) in

Kenya, where the level of cattle depredation to predators, dependence upon livestock, and religious affiliations were the most effective predictors of the magnitude of conflict between Maasai pastoralists and lions, suggesting that such trends may be useful indicators even across different regions. Based on the results from this study, the most important initial strategies for reducing conflict would be reducing the number of livestock killed by predators, increasing the opportunities for alternative income generation amongst local people, and working with missionary and religious groups to incorporate a conservation message. The complexity of human-wildlife conflict in this area means that only a broad, multifaceted approach, which builds on the results here to address as many of the drivers of conflict as possible, is likely to actually result in decreased conflict and easier coexistence in this important area, which would have valuable benefits both for wildlife and human populations.

Chapter Five

Views towards focal carnivores in Pawaga and Idodi districts, and key determinants of human-carnivore conflict



CHAPTER 5: VIEWS TOWARDS FOCAL CARNIVORES IN PAWAGA AND IDODI DISTRICTS, AND KEY DETERMINANTS OF HUMAN-CARNIVORE CONFLICT

5.1 Chapter summary

This chapter aims to examine the level of and reasons behind human-carnivore conflict experienced by pastoralists and agro-pastoralists living close to Ruaha National Park. Conflict with carnivores, particularly lions and spotted hyaenas, was reported as high, with the majority of respondents viewing them as highly problematic. Conflict scores for different species were highly correlated with one another, indicating that people tended to ‘tar all carnivores with the same brush’. There was general concurrence that carnivore populations had declined over recent years, but the majority of people still wanted carnivores to decline further or disappear entirely from the study area. The most frequently cited reason behind carnivore conflict was livestock depredation, but attitudes remained relatively constant regardless of monitored depredation history. Despite the attention paid to reducing depredation in conflict mitigation strategies, multivariate analysis suggested that the most important drivers of conflict examined here did not include levels of depredation experienced, but rather were ethnicity, adherence to an ‘external’ organised religion, direct sighting of a focal carnivore and conflict with other wildlife species. These characteristics could be used to identify high-conflict households and prioritise sites for conflict mitigation action, and suggest that reducing depredation alone will not be enough to substantially improve attitudes. Other, more deep-seated factors are also likely to play important roles in determining hostility towards carnivores and other wildlife, and these will be examined later, in chapter 7 of this thesis.

5.2 Introduction

The research into human-wildlife conflict conducted for chapter 1 revealed that the five large carnivore species forming the main focus of this thesis were associated with particularly high conflict in the study area. Tanzania has been highlighted as globally important for the conservation of carnivores in general (Mills et al. 2001) and for lions

(Bauer and van der Merwe 2002; TAWIRI 2007c), cheetahs (Gros 2002; TAWIRI 2007a), spotted hyaenas (Mills and Hofer 1998; TAWIRI 2007b) and African wild dogs (TAWIRI 2006; Woodroffe and Ginsberg 1999b) in particular, with the Ruaha ecosystem supporting both nationally and globally important populations of all these species (WCS 2005). However, many of Africa's large carnivore species have undergone precipitous declines over the past century (Frank et al. 2006b; Marker 1998; Woodroffe et al. 1997), and are now facing an uncertain future across much of their range unless threats to their survival are addressed urgently. One of the most pressing of these threats is conflict with humans, particularly in reserve-adjacent or unprotected areas (Marker et al. 2003a; Ray et al. 2005), and conflict has unequivocally been named as the primary threat to continued lion survival on Africa's rangelands (Frank et al. 2006a). Clearly, conflict is not only detrimental to carnivores but to human communities as well, with livestock depredation, attacks upon humans and the general fear of living alongside dangerous animals causing major problems for local people (Balduş 2004; Bauer 1995; Dickman 2005).

The local communities in this study are pastoralists and agro-pastoralists, and such traditional societies have long coexisted with predators in relative harmony (Kideghesho 2006; Western 1989). However, conflict between pastoralists and large carnivores in East Africa has been intensifying in recent years (Frank et al. 2006b), and it is critical to mitigate these conflicts in order to improve the chances of effective long-term carnivore conservation on East African rangelands. In order to resolve the problem, it is imperative to first understand as much as possible about both the magnitude of conflict and its key determinants, and that is the overall aim of this chapter. Here, working in villages situated close to Ruaha National Park, I will examine local peoples' attitudes towards large carnivores, the magnitude of reported conflict, reasons given for conflict, and investigate which factors (including those characteristics of survey respondents detailed in chapter 4) are most closely linked to high levels of human-carnivore conflict. From these results, possible strategies for mitigating this conflict can then be suggested. The specific aims of the chapter are as follows:

- (i) Examine what people report knowing about large carnivores in the study area, how problematic each species was thought to be and the main reasons reported for those problems;
- (ii) Assess local peoples' reported attitudes towards focal carnivores, in terms of how much they liked or disliked them, and their views on both past and desired future carnivore population trends;
- (iii) Explore the level of human-carnivore interactions reported, including sightings of carnivores, carnivore attacks upon livestock or humans, and human attacks upon carnivores, and compare these data to elsewhere in Tanzania;
- (iv) Study the robustness of attitudes towards carnivores over time, by examining whether or not people's views towards carnivores change according to their experiences of depredation over a year-long period;
- (v) Examine which factors appear to be particularly important drivers of human-carnivore conflict in the study area.

5.3 Methods

5.3.1 Survey and respondents

Data for this chapter were drawn from responses to the same survey used in chapter 4 (Appendix I), and a more detailed overview of the survey methodology is provided in Section 3.2.1. The same group of respondents was used, totalling 268 respondents, and their characteristics, in terms of ethnicity, age, gender, religious affiliation, demography, stock ownership and income sources are all detailed in section 4.4.1. The information for this chapter came from the sections of the survey which dealt with attitudes and knowledge regarding focal carnivores, the frequency of focal carnivore sightings and attacks, and the actions taken to control carnivores. The sampling frame and survey technique remain the same as described in Section 4.3.4.

5.3.2 Assessing human-carnivore conflict and consistency of attitudes

As explained in section 4.3.3, every respondent was shown a picture of each focal carnivore species, and asked whether they knew what it was and whether it occurred in

the area around their current household (with ‘area’ defined as within one day’s walk). If there was confusion over the species’ identification, the correct identification was provided, and discussions undertaken with the respondent to ensure that the correct species (for instance a cheetah rather than a leopard) was being discussed by the respondent. If people knew the species and thought that it occurred locally, they were asked to classify it as posing a big problem, a small problem or no problem, following the scheme used by Maddox (2002). People were also asked to provide reasons for their problem classification. The assessment of the level of problems was then converted into a conflict score for every respondent, both for each individual focal carnivore species and as a mean across all focal carnivore species, using the classification 0 = no problem, 1 = small problem and 2 = big problem. This focal carnivore conflict score was used as the dependent variable in the analysis of key determinants of human-carnivore conflict.

Conflict scores were also compared with respondents’ views on desired future population trends of carnivores, to assess whether people were positive, consistent or negative in their views towards each focal carnivore species, using the scheme shown in Table 12.

Table 12. Comparison of respondents’ reported problems with focal carnivore species, and their stated desired trend for that species, to determine their views towards that species

| Problem with focal carnivore species | Desired population trend for that species | | | |
|--------------------------------------|---|---------------|------------|------------|
| | Increase | Stay the same | Decrease | Disappear |
| Big problem | Positive | Positive | Consistent | Consistent |
| Small problem | Positive | Positive | Consistent | Negative |
| No problem | Positive | Consistent | Negative | Negative |

Data on focal carnivore interactions (all sightings, and attacks upon livestock and humans) were restricted to those that had occurred around the current household. Sightings of focal carnivores were classified as negative if they involved the animal stalking or attacking livestock or humans, and neutral if the respondent perceived no aggression or direct threat on the part of the carnivore. All of the interactions described fell into one of these two categories.

5.3.3 Long-term monitoring and follow-up surveys

A follow-up survey was conducted with 51 of the 191 respondents whose households underwent long-term monitoring to assess rates of depredation over a 12-month period (see section 4.3.5) in order to assess if and how their attitudes towards wildlife had changed from the initial survey. The follow-up survey consisted only of the presentation of photographs of survey species, and the respondent was asked to complete the problem classification for a second time, so that a second conflict score could be calculated. This allowed any change in conflict to be examined in relation to personal experiences of depredation over a year-long period, enabling the robustness of peoples' attitudes towards focal carnivores over time to be assessed.

5.3.4 Statistical analyses

All statistical analyses were conducted in SPSS 14.0 (SPSS Inc, Chicago). The one-sample Kolmogorov-Smirnov test was used to check assumptions of normality, with parametric statistics used where data were normally distributed, but non-parametric alternatives used where the assumption of normality was violated. Levene's test was used to examine equality of variances. Tests used in this chapter include the Mann-Whitney U, Kruskal-Wallis H test, chi-squared, independent samples t-tests, Spearman's rank correlations, Wilcoxon's signed ranks test, paired samples t-tests and general linear mixed modelling. All tests were two-tailed and significance was defined as $P < 0.05$, although P values of < 0.1 was considered to indicate trends that may be worthy of future investigation. Further details of the statistical approaches used are provided in chapter 3.

5.4 Results

5.4.1 Knowledge and descriptions of focal carnivore species

As presented in section 4.4.3.1, respondents were very good at identifying lions and leopards, with 97% and 90% recognising those species respectively. The level was slightly lower for spotted hyaenas and wild dogs, and only around a quarter of people correctly identified the cheetah when first shown the survey photograph. However, when

discussions were held with respondents over the differences between cheetahs and leopards, which was seen to be an issue during a similar study conducted by Maddox (2002), the vast majority were clear that there were two separate species of large spotted cats, and 60% could confidently describe differences between them, referring to differences in coat colour, body size and shape, whether they were social or solitary, hunting techniques or some combination of these. A further 17% were less certain but did mention some differences of coat pattern, morphology or spoor, while the remaining 23% were unable to explain exactly how the two species differed.

5.4.2 Descriptions of focal carnivore species

When asked to provide descriptions of the species concerned, details of morphology and perceptions of threat commonly arose in responses for all the focal species (Table 13).

Table 13. Characteristics mentioned by survey respondents in descriptions of each of the five focal carnivore species

| Characteristics mentioned in species' description | % respondents mentioning factor for that species | | | | |
|---|--|---------|---------|----------------|------------------|
| | Lion | Cheetah | Leopard | Spotted hyaena | African wild dog |
| Morphology | 52.8 | 53.8 | 54.8 | 50.7 | 50.7 |
| Ugliness/beauty | 1.4 | 0.0 | 1.4 | 1.4 | 0.0 |
| Behaviour | 2.8 | 1.5 | 12.3 | 8.2 | 12.3 |
| Vocalisations | 2.8 | 0.0 | 1.4 | 5.5 | 1.4 |
| Social structure | 1.4 | 1.5 | 1.4 | 0.0 | 2.7 |
| Hunting method | 9.7 | 16.9 | 19.2 | 19.2 | 19.2 |
| Threat to stock/humans | 48.6 | 50.0 | 46.6 | 47.2 | 51.4 |
| Bad animal | 2.8 | 0.0 | 0.0 | 4.1 | 2.8 |
| Surplus killing | 1.4 | 3.1 | 2.7 | 5.5 | 11.0 |
| Other | 1.4 | 4.6 | 6.8 | 2.7 | 1.4 |

* Column percentages do not add up to 100% as respondents could mention numerous different factors

Morphology was the single most common aspect of descriptions, with people often referring to the large size and the manes of lions, the spotted coats of cheetahs and leopards, the relatively short hindquarters of hyaenas and the patchy coats and domestic-

dog-like appearance of wild dogs. Sometimes people described particular species as beautiful, in the case of the leopard, which was said to have an ‘attractive shiny coat’ or ugly, in the cases of the lion and spotted hyaena. Behaviour was most commonly alluded to in the cases of leopards and wild dogs – for leopards this often referred to the animal eating ‘like a human being, by eating some meat and then storing the rest in a tree to eat later when full’, and for wild dogs behavioural observations usually centred around the animal ‘always being in a hurry’ and ‘always being ready to fight’, although people mentioned that wild dogs were known to be scared of lions. Unsurprisingly, vocalisations were most often described when referring to hyaenas and lions, with one man complaining that hyaenas were a nuisance as ‘their noise at night interferes with his time with his wife’. The social structure of animals was rarely mentioned, even for relatively social species such as lions and hyaenas, with the wild dogs’ habit of ‘walking in groups’ usually mentioned alongside the fear of them killing large numbers of stock at one time. Hunting methods were described relatively often, with people differentiating between the rapid, aggressive kills of the leopard with the slower kills of the cheetah, which were often attributed to the cheetah having teeth that curved or pointed inwards, and sometimes enabled people to save livestock from cheetah attacks.

The threat posed by carnivores was mentioned in the descriptions almost equally to their morphology, with people often referring to them as dangerous to livestock, and dangerous to people in the case of lions, leopards, hyaenas and African wild dogs. Despite all four species being mentioned as threatening to humans in these initial descriptions, only lions, hyaenas and wild dogs were ever mentioned as ‘bad’ animals, with all three described as ‘enemies’ of people and their stock. Surplus killing was a phenomenon that caused particular animosity, and was mentioned for all five species, although most commonly for wild dogs. One respondent noted ‘They can be in groups of 40 wild dogs, and can kill up to 20 or 30 domestic stock in a very short time. A dog will kill one animal, leave it for another dog and then kill another’, while another said ‘It [the wild dog] is so dangerous an enemy, and can kill 30 goats in the bush in one day’. A range of other characteristics were also mentioned in species descriptions, such as the red eyes of hyaenas in torchlight at night, the ‘thieving’ nature of lions and their tendency to

prowl around a strong boma until the cattle stampeded out, the concept that cheetahs ‘eat rats and drink milk’, the fact that leopards crouch hidden in the bush and suddenly appear, and the description of wild dogs being ‘like soldiers’, as they moved around in groups and were able to kill large numbers of animals at once. Overall, the main focus of species’ descriptions was fairly equally split between perceptions of threat and references to morphology or ecology for all species, even those shown in chapter 4 to be considered particularly problematic (Figure 22).

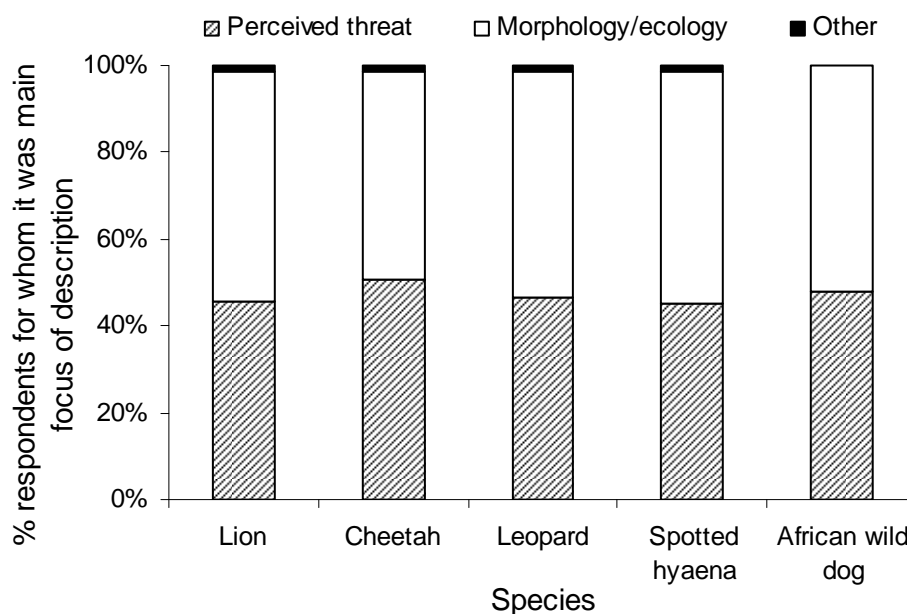


Figure 22. Main focus of the initial descriptions given by respondents for each of the focal carnivore species

5.4.3 Magnitude of reported conflict with focal carnivores

5.4.3.1 Reported conflict scores

The data in section 4.4.4 revealed that survey respondents rated carnivores as causing significantly greater conflict than other species, and a summary of the conflict scores for the focal carnivore species being examined here compared to other species are shown in Figure 23.

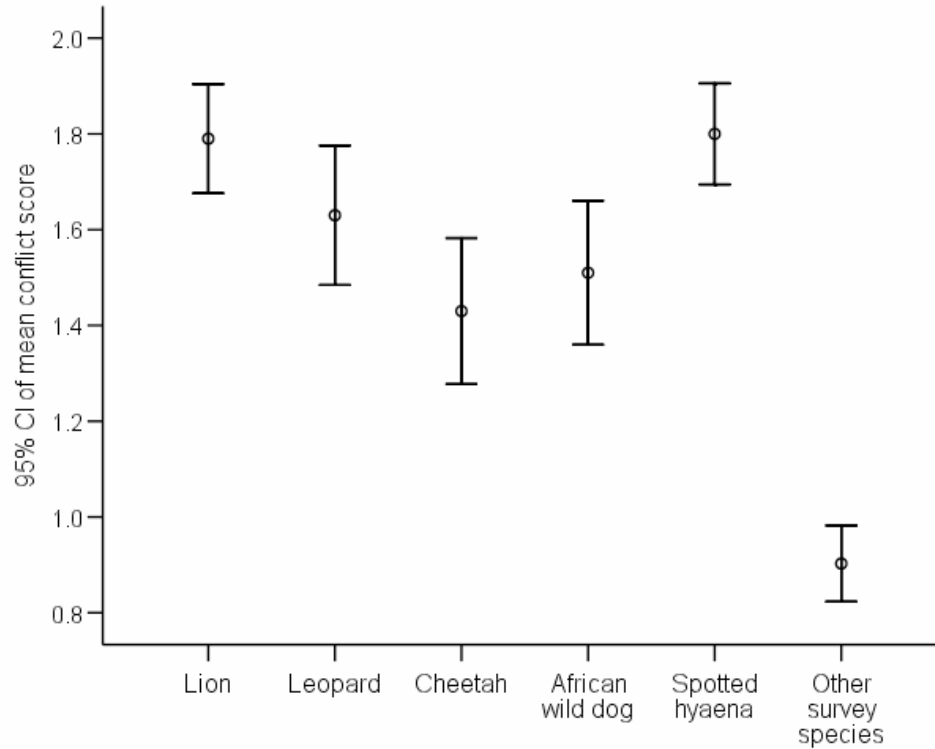


Figure 23. Error bars showing mean conflict scores with 95% confidence interval (CI) for the five focal carnivore species and other survey species

The five focal carnivore species differed significantly from one another in terms of their conflict scores (KW $\chi^2 = 32.7$, $df = 4$, $P < 0.001$), with lions having the highest scores and cheetahs the lowest. Interestingly, the higher the conflict score assigned to a focal carnivore species, the less likely it was that perceived threat was the primary focus of the initial descriptions of that species described above ($r_s = -0.92$, $n = 5$, $P = 0.026$; Figure 24).

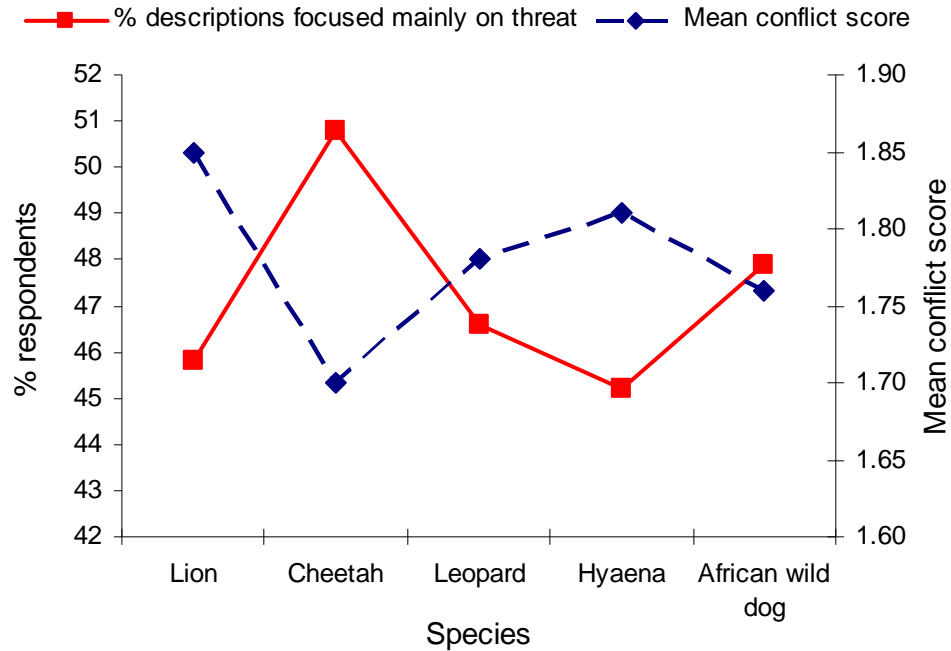


Figure 24. Mean conflict scores assigned to focal carnivore species, alongside the proportion of respondents that described them mainly as a threat

This suggests that although a threat to livestock was commonly given as a reason for disliking large carnivores (see section 5.4.3.2), other factors are also likely to influence conflict. These might include antagonism towards species because of the way they look – this was particularly true for hyaenas and lions, which were considered to be ugly. Alternatively, people may be more aware of those species which caused greater conflict and had more to say about them, meaning that descriptions were less likely to be limited to a simple summary focused only upon threat, such as ‘They kill livestock’. However, there was no evidence that people did mention more characteristics in their descriptions of some species rather than other ones (KW $\chi^2 = 4.10$, $df = 4$, $P = 0.392$), so this relationship remains to be explained.

Conflict scores were highly correlated between all focal carnivore species (Table 14), indicating that the more highly people rated one species in terms of conflict, the more likely they were to rate others highly too.

Table 14. Spearman's rank correlation coefficients between conflict scores assigned to the five focal carnivore species

| | | Lion conflict score | Leopard conflict score | Cheetah conflict score | Wild dog conflict score | Spotted hyaena conflict score |
|-------------------------------------|-------------------------|---------------------------|------------------------------|------------------------------|-------------------------------|--|
| Lion conflict score | Correlation Coefficient | - | 0.39 | 0.46 | 0.39 | 0.34 |
| | Sig. (2-tailed) | - | < 0.001** | < 0.001** | < 0.001** | < 0.001** |
| | <i>n</i> | - | 178 | 117 | 161 | 199 |
| Leopard conflict score | Correlation Coefficient | 0.39 | - | 0.58 | 0.52 | 0.34 |
| | Sig. (2-tailed) | < 0.001** | - | < 0.001** | < 0.001** | < 0.001** |
| | <i>n</i> | 178 | - | 121 | 151 | 181 |
| Cheetah conflict score | Correlation Coefficient | 0.46 | 0.58 | - | 0.51 | 0.32 |
| | Sig. (2-tailed) | < 0.001** | < 0.001** | - | < 0.001** | < 0.001** |
| | <i>n</i> | 117 | 121 | - | 105 | 118 |
| Wild dog conflict score | Correlation Coefficient | 0.39 | 0.52 | 0.51 | - | 0.43 |
| | Sig. (2-tailed) | < 0.001** | < 0.001** | < 0.001** | - | < 0.001** |
| | <i>n</i> | 161 | 151 | 105 | - | 163 |
| Spotted hyaena conflict score | Correlation Coefficient | 0.34 | 0.34 | 0.32 | 0.43 | - |
| | Sig. (2-tailed) | < 0.001** | < 0.001** | < 0.001** | < 0.001** | - |
| | <i>n</i> | 199 | 181 | 118 | 163 | - |

**Correlation is significant at the 0.01 level (2-tailed).

For all the focal carnivore species, over half the respondents living alongside them said that they caused big problems, and this proportion rose to around three-quarters for lions and spotted hyaenas (Figure 25). Despite the large majority of people citing lions as the single most problematic species (see section 4.4.4), slightly more people claimed to have big problems with spotted hyaenas, although the difference was not statistically significant ($\chi^2 = 0.97$, $df = 1$, $P = 0.325$).

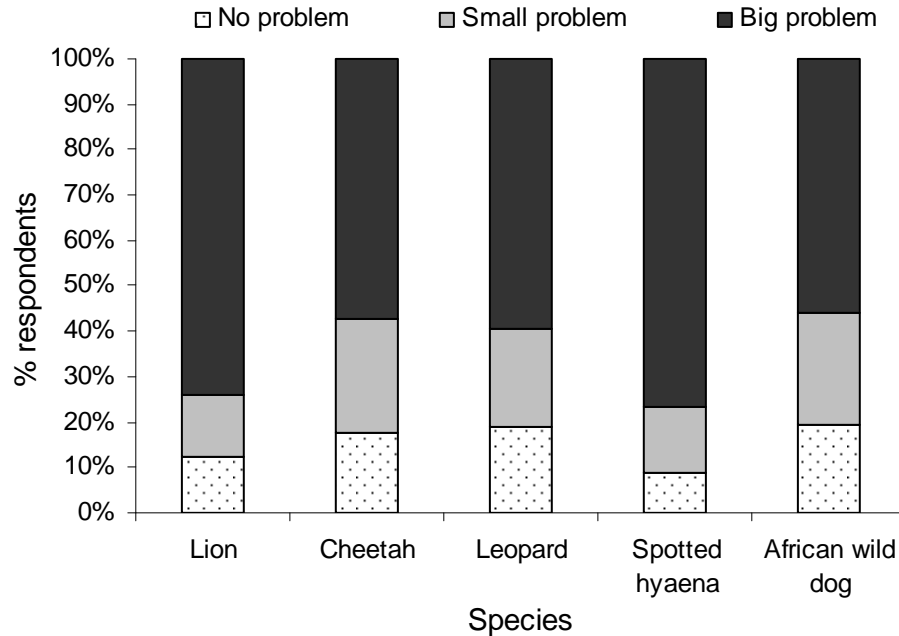


Figure 25. Percentage of respondents reporting no problem, a small problem or a big problem with each of the focal carnivore species living around their villages

Species varied significantly in how often they were perceived to cause big problems ($\chi^2 = 59.8$, $df = 4$, $P < 0.001$), with spotted hyaenas reportedly causing big problems most commonly and wild dogs causing them least often. There was no difference between species in terms of people reporting small problems ($\chi^2 = 4.33$, $df = 4$, $P = 0.363$) or no problems ($\chi^2 = 7.58$, $df = 4$, $P = 0.108$) with them.

Reported problems with lions diminished as distance from the Park increased ($r_s = -0.19$, $n = 211$, $P = 0.005$) but there was no significant relationship for other focal species (cheetahs: $r_s = 0.08$, $n = 123$, $P = 0.366$; leopards: $r_s = -0.09$, $n = 194$, $P = 0.204$; hyaenas: $r_s = -0.02$, $n = 227$, $P = 0.791$; wild dogs: $r_s = -0.05$, $n = 169$, $P = 0.513$). Overall, there was no relationship between reported conflict with focal carnivores and distance from the Park ($r_s = -0.05$, $n = 249$, $P = 0.483$).

5.4.3.2 Reported reasons for conflict with focal carnivores

The reasons that people cited for having problems with large carnivores are shown in Table 15. Lions were cited as causing problems to all stock, particularly large animals such as cattle, and this, combined with the threat that they posed to people, probably

explains why lions were the species that caused the highest reported conflict in the study area. The link between high conflict and attacks on cattle and humans is demonstrated by the fact that attacks on large stock were more commonly associated with a big problem than a small one for all species apart from hyaenas, while attacks on humans were associated with large problems for all species. In contrast to lions, all the other carnivores mainly caused problems by depredation on small stock, which are less valuable both economically and socially in pastoralist households. All the species were considered to pose a threat to humans by at least some respondents, with people most fearful of lions, followed by leopards and hyaenas and then cheetahs and wild dogs (Table 15).

Table 15. Reasons given by survey respondents as to why focal carnivore species were considered to pose problems to them, broken down by the magnitude of reported problem

| Magnitude of problem | Reason for problem | % respondents citing that reason for problem with species in question | | | | |
|----------------------|--------------------------|---|---------|---------|----------------|------------------|
| | | Lion | Cheetah | Leopard | Spotted hyaena | African wild dog |
| Big problem | Threat to small stock | 1.9 | 85.9 | 74.1 | 60.6 | 68.4 |
| | Threat to large stock | 27.8 | 1.4 | 0.0 | 2.9 | 0.0 |
| | Threat to all stock | 46.2 | 8.5 | 18.1 | 30.9 | 29.5 |
| | Threat to humans & stock | 23.4 | 4.2 | 6.9 | 5.7 | 2.1 |
| | Threat to humans only | 0.6 | 0.0 | 0.9 | 0.0 | 0.0 |
| | Other | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Small problem | Threat to small stock | 3.4 | 87.1 | 83.3 | 51.5 | 85.4 |
| | Threat to large stock | 17.2 | 0.0 | 0.0 | 12.1 | 0.0 |
| | Threat to all stock | 65.5 | 9.7 | 14.3 | 27.3 | 14.6 |
| | Threat to humans & stock | 13.8 | 3.2 | 2.4 | 3.0 | 0.0 |
| | Threat to humans only | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Other | 0.0 | 0.0 | 0.0 | 6.1 | 0.0 |
| Overall | Threat to small stock | 2.1 | 86.3 | 76.6 | 59.1 | 73.5 |
| | Threat to large stock | 26.2 | 1.0 | 0.0 | 4.3 | 0.0 |
| | Threat to all stock | 49.2 | 8.8 | 17.1 | 30.3 | 25.0 |
| | Threat to humans & stock | 21.9 | 3.9 | 5.7 | 5.3 | 1.5 |
| | Threat to humans only | 0.5 | 0.0 | 0.6 | 0.0 | 0.0 |
| | Other | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |

The only other reason given for considering focal carnivores problematic, apart from the risk of attacks on livestock and humans, was a dislike of scavengers, which was mentioned for spotted hyaenas in a small number of cases.

5.4.4 Attitudes towards focal carnivores

5.4.4.1 Affection and hostility towards focal carnivores

All five carnivore species were disliked by the majority of respondents (Figure 26), and were all disliked by a similar percentage of people ($\chi^2 = 0.60$, $df = 3$, $P = 0.896$). None of the carnivore species were liked by more than a quarter of people, with lions and leopards seemingly liked slightly more than the others, but this difference was not statistically significant ($\chi^2 = 0.40$, $df = 2$, $P = 0.819$).

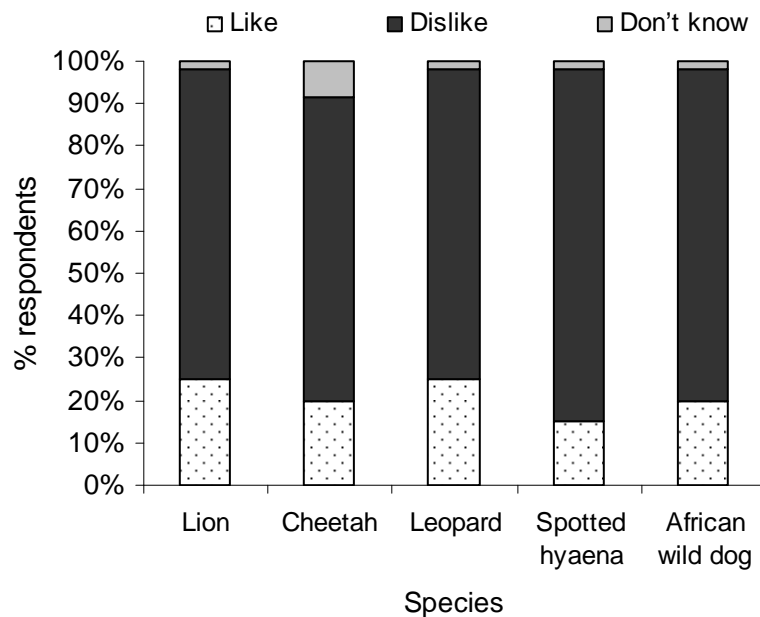


Figure 26. Percentage of respondents claiming that they liked, disliked or did not know how they felt about each of the focal carnivore species

The tendency of large carnivores to attack stock or humans was a very important driver of peoples' views towards them – most people who disliked them cited those reasons, and most people who liked them had no problem with them at present (Table 16). Other reasons given for people disliking species included thinking that they were intrinsically 'bad' animals, thought of as 'vermin', being disturbed by them at night or seeing no positive aspect of having them around. There was a wider variety of reasons given by people who liked various focal carnivores, such as admiring their beauty, feeling that it was important to have them around, thinking that their children needed to grow up with

these animals around, or simply being used to having them as part of the local environment. Few people thought that carnivores were good for generating tourist income, with this being mentioned most often for hyaenas. It was interesting to note that although lions were considered to be by far the most problematic species to have around (see section 4.4.4), they were also the species that people most often thought should remain around for their children. Conversely, although hyaenas were ranked as the most important species for generating tourist income and the joint-highest in terms of importance of having them around, no-one mentioned that they should remain around for the next generation.

Table 16. Reasons given by survey respondents for liking or disliking each of the focal carnivore species

| View towards species | Reason given for view | % respondents giving that reason for each species | | | | |
|----------------------|--------------------------------|---|---------|---------|----------------|------------------|
| | | Lion | Cheetah | Leopard | Spotted hyaena | African wild dog |
| Dislike species | Threat to livestock | 79.5 | 93.0 | 90.9 | 80.0 | 89.3 |
| | Threat to humans and livestock | 20.5 | 7.0 | 9.1 | 12.0 | 10.6 |
| | Bad/ugly animal | 0.0 | 0.0 | 0.0 | 6.0 | 6.4 |
| | Disturbed by calls at night | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 |
| | No reason to have them around | 0.0 | 0.0 | 0.0 | 2.0 | 0.0 |
| Like species | Should be around for children | 13.3 | 8.3 | 6.7 | 0.0 | 8.3 |
| | Important to have them around | 13.3 | 16.7 | 13.3 | 33.3 | 33.3 |
| | Beautiful | 13.3 | 16.7 | 20.0 | 11.1 | 0.0 |
| | Causes few/no problems | 26.7 | 25.0 | 33.3 | 22.2 | 16.7 |
| | Good for tourism/income | 6.7 | 8.3 | 6.7 | 11.1 | 8.3 |
| | Likes its social structure | 0.0 | 0.0 | 0.0 | 0.0 | 16.7 |
| | Used to having them around | 13.3 | 8.3 | 6.7 | 11.1 | 8.3 |
| | No particular reason given | 20.0 | 16.7 | 13.3 | 11.1 | 8.3 |

*Respondents could cite more than one reason so column percentages may exceed 100%

Despite the high levels of reported conflict, respondents actually seemed to quite like the focal carnivores themselves, particularly the large cats (Figure 27). Significantly fewer

people said they disliked lions than reported any problems with them ($\chi^2 = 20.6$, $df = 1$, $P < 0.001$), and the same was true for cheetahs ($\chi^2 = 6.75$, $df = 1$, $P = 0.009$), leopards ($\chi^2 = 20.6$, $df = 1$, $P < 0.001$) and wild dogs ($\chi^2 = 9.94$, $df = 1$, $P = 0.002$). Spotted hyaenas were also disliked by fewer people than they were reported as caused problems to, although this difference was not statistically significant ($\chi^2 = 3.53$, $df = 1$, $P = 0.060$). When the analyses were restricted to people who reported big problems with that species (Figure 27), respondents still liked lions more than would be expected ($\chi^2 = 20.6$, $df = 1$, $P < 0.001$), although the relationship was no longer evident for cheetahs ($\chi^2 = 1.72$, $df = 1$, $P = 0.679$), leopards ($\chi^2 = 2.50$, $df = 1$, $P = 0.114$) or wild dogs ($\chi^2 = 0.31$, $df = 1$, $P = 0.579$). Spotted hyaenas ($\chi^2 = 0.00$, $df = 1$, $P = 0.997$) were disliked almost exactly in proportion to how often they were reported as causing big problems.

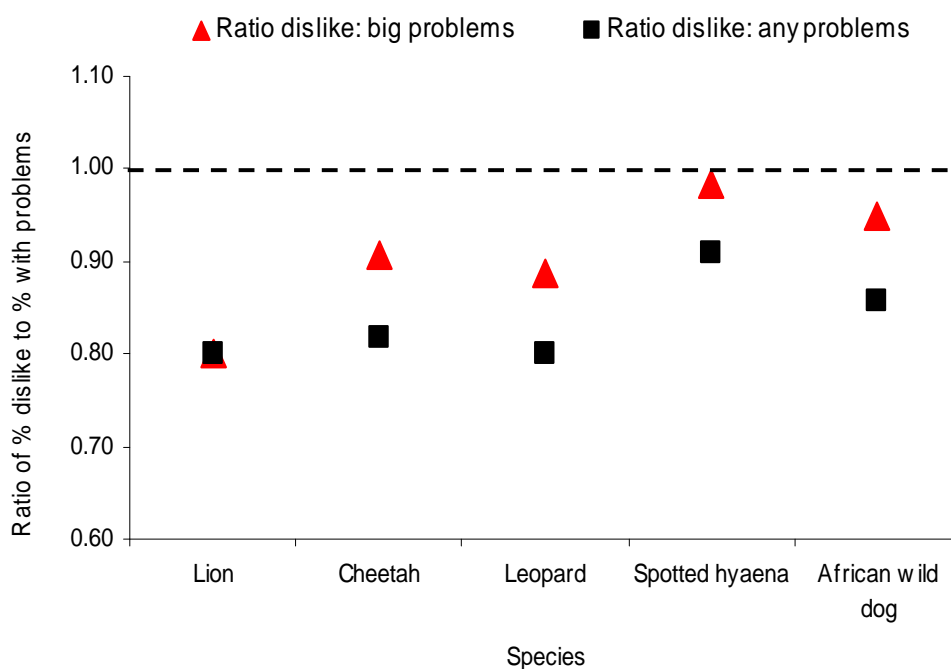


Figure 27. Ratio between the percentage of people saying they had either a big problem or any problem with each of the focal carnivore species, and the percentage saying that they disliked that species. The dotted line indicates parity, where the ratio is 1:1

Overall, there was no relationship between how often people disliked lions and their conflict score ($r_s = 0.11$, $n = 56$, $P = 0.426$), and the same was true for cheetahs ($r_s = 0.23$, $n = 46$, $P = 0.123$), leopards ($r_s = 0.07$, $n = 55$, $P = 0.632$) and wild dogs ($r_s = 0.11$, $n =$

56, $P = 0.432$). There was an indication of a trend for spotted hyaenas, but it was not statistically significant ($r_s = 0.23$, $n = 55$, $P = 0.085$).

5.4.4.2 Past and future population trends of focal carnivores

For all five focal carnivore species, the majority of respondents that voiced an opinion thought that the species had declined in the area since they arrived (a mean time of 13.0 ± 12.6 years; Figure 28).

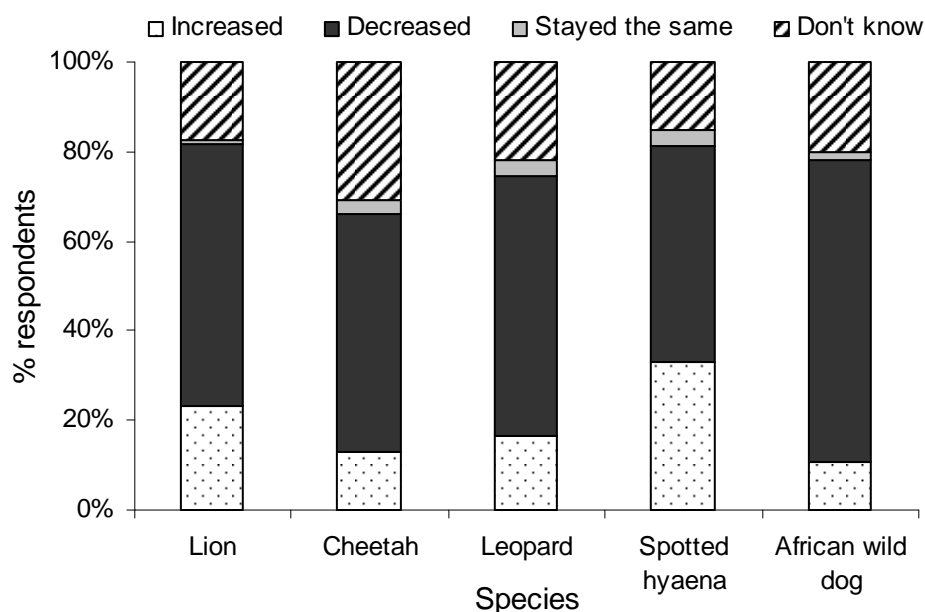


Figure 28. Respondents' views on the change in local population size of each focal carnivore species since the respondent arrived in the area

For most focal carnivore species, over half the respondents said that they wanted their numbers to decline or disappear entirely from the study area. The only exception to this was for cheetahs, where the proportion of people wanting a decline or disappearance was slightly under half, at 45.7% (Figure 29).

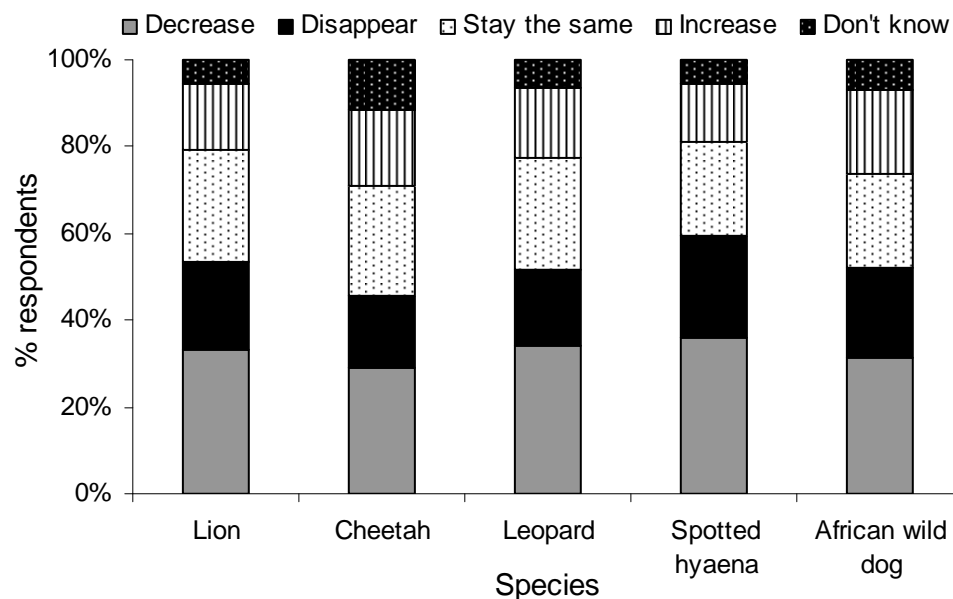


Figure 29. Desired future population trends stated by respondents for each focal carnivore species in the study area

Respondents from different ethnic groups varied significantly in their stated desired population trend for lions ($\chi^2 = 37.0$, $df = 16$, $P = 0.002$), cheetahs ($\chi^2 = 33.2$, $df = 16$, $P = 0.007$), leopards ($\chi^2 = 41.3$, $df = 16$, $P = 0.001$), spotted hyaenas ($\chi^2 = 48.0$, $df = 16$, $P < 0.001$) and wild dogs ($\chi^2 = 48.1$, $df = 16$, $P < 0.001$; Table 17). Respondents from traditional pastoralist groups were more likely to want focal carnivore species to decline or disappear – for four of the five species, more than half the Maasai and Barabaig interviewees wanted them to decline or disappear, with that number dropping to 49% ($n = 21$) for Barabaig respondents in relation to cheetahs. Conversely, the only instances where over half the respondents of other ethnic species wanted a species to decline or disappear was for lions, where 51% ($n = 26$) of Bena interviewees reportedly wanted decline or extirpation. The Sukuma appeared to be particularly tolerant of continued carnivore presence, with none of them wanting lion, cheetah, leopard or spotted hyaena populations to decrease, although this was based on a small sample size. People usually had the same views for all five focal species – in 70% of cases ($n = 186$), whatever they wanted for one species they wanted for all of them.

Table 17. Desired future population trends for each focal carnivore species in the study area, as expressed by survey respondents of different ethnic groups

| Species | Desired population trend | % respondents from each ethnic group | | | | |
|---------------------|--------------------------|--------------------------------------|---------------------------|-----------------------|-----------------------|------------------------|
| | | Maasai <i>n</i> = 105 | Barabaig <i>n</i> = 43 | Hehe <i>n</i> = 62 | Bena <i>n</i> = 51 | Sukuma <i>n</i> = 6 |
| Lion | Disappear | 24.8 | 23.3 | 16.1 | 17.6 | 0.0 |
| | Decrease | 39.0 | 32.6 | 25.8 | 33.3 | 0.0 |
| | Stay the same | 21.0 | 25.6 | 32.3 | 25.5 | 50.0 |
| | Increase | 11.4 | 11.6 | 21.0 | 19.6 | 0.0 |
| | Don't know | 3.8 | 7.0 | 4.8 | 3.9 | 50.0 |
| Cheetah | Disappear | 21.9 | 23.3 | 12.9 | 7.8 | 0.0 |
| | Decrease | 36.2 | 25.6 | 22.6 | 27.5 | 0.0 |
| | Stay the same | 21.0 | 20.9 | 32.3 | 27.5 | 50.0 |
| | Increase | 12.4 | 11.6 | 24.2 | 25.5 | 0.0 |
| | Don't know | 8.6 | 18.6 | 8.1 | 11.8 | 50.0 |
| Leopard | Disappear | 21.0 | 27.9 | 11.3 | 11.8 | 0.0 |
| | Decrease | 41.0 | 37.2 | 27.4 | 29.4 | 0.0 |
| | Stay the same | 22.9 | 16.3 | 32.3 | 29.4 | 50.0 |
| | Increase | 11.4 | 11.6 | 22.6 | 23.5 | 0.0 |
| | Don't know | 3.8 | 7.0 | 6.5 | 5.9 | 50.0 |
| Spotted hyaena | Disappear | 29.5 | 25.6 | 22.6 | 13.7 | 0.0 |
| | Decrease | 44.8 | 37.2 | 27.4 | 31.4 | 0.0 |
| | Stay the same | 14.3 | 18.6 | 25.8 | 29.4 | 50.0 |
| | Increase | 7.6 | 11.6 | 19.4 | 21.6 | 0.0 |
| | Don't know | 3.8 | 7.0 | 4.8 | 3.9 | 50.0 |
| African wild dog | Disappear | 23.8 | 32.6 | 12.9 | 13.7 | 16.7 |
| | Decrease | 41.0 | 32.6 | 22.6 | 25.5 | 0.0 |
| | Stay the same | 18.1 | 16.3 | 27.4 | 25.5 | 33.3 |
| | Increase | 11.4 | 9.3 | 32.3 | 29.4 | 0.0 |
| | Don't know | 5.7 | 9.3 | 4.8 | 5.9 | 50.0 |

These views were not necessarily completely clean-cut – for example, 10.9% of respondents ($n = 29$) specifically said that they wanted lions to remain around in general, and were even happy them to increase ‘elsewhere’ or ‘in the bush’, but not around this area. This was also mentioned by 10.1% ($n = 27$) for leopards, and by 8.6% ($n = 23$) for hyaenas, cheetahs and wild dogs.

Attacks on livestock were the most commonly cited reasons why people wanted the decline or disappearance of lions (mentioned by 94% of those respondents, $n = 134$), with similar proportions for cheetahs (95%, $n = 115$), leopards (94%, $n = 130$), spotted hyaenas (95%, $n = 151$) and wild dogs (96%, $n = 133$). As might be expected from this, people who wanted lions to decline or disappear reported significantly higher conflict with them than those who did not ($z = -2.32$, $P = 0.020$), and the same was true for leopards ($z = -2.38$, $P = 0.017$), hyaenas ($z = -2.21$, $P = 0.027$) and wild dogs ($z = -2.10$, $P = 0.036$). However, this was not the case for cheetahs ($z = -1.58$, $P = 0.115$), where people wanted them to decline or disappear despite not suffering higher conflict. This may be explained by cheetahs being ‘tarred with the same brush’ as other carnivores despite having the lowest conflict scores: in 79% ($n = 201$) of cases, whatever trend people wanted for one carnivore they wanted for them all.

Despite depredation clearly affecting negative attitudes, two respondents actually mentioned that depredation could be beneficial as it allowed families to eat the meat of livestock that had been killed. Another reason for wanting carnivore declines, mentioned by 4% of people ($n = 12$) was hostility towards Park authorities and the Government for not controlling the animals better and keeping them within the boundaries of the nearby Park rather than ‘allowing’ them onto village land.

Tourism was mentioned as the single most common reason for people wanting carnivore numbers to increase, with 22% of respondents mentioning this for spotted hyaenas, 20% for lions, 19% for leopards, 17% for cheetahs and 16% for wild dogs. The primary reasons for people wanting carnivores to remain at the same level were a lack of real problems at current population levels, followed by a feeling that wildlife belonged to the

Government and that it was beyond the remit of local people to have an opinion on what should happen to their numbers.

For all species, half or less of the respondents stated a desired future population trend that was consistent with the magnitude of the problem previously cited for that species (Figure 30). The level of consistency varied significantly between species ($\chi^2 = 27.4$, $df = 4$, $P < 0.001$), with people far less consistent in the relationship between problems and desired trends for cheetahs and wild dogs than for hyaenas and lions. How positive people were about focal carnivores did not vary significantly between different species ($\chi^2 = 2.44$, $df = 4$, $P = 0.636$), but negativity did ($\chi^2 = 12.8$, $df = 4$, $P = 0.012$), with people particularly negative towards cheetahs and wild dogs in terms of desired population trends compared with how problematic they were actually considered to be.

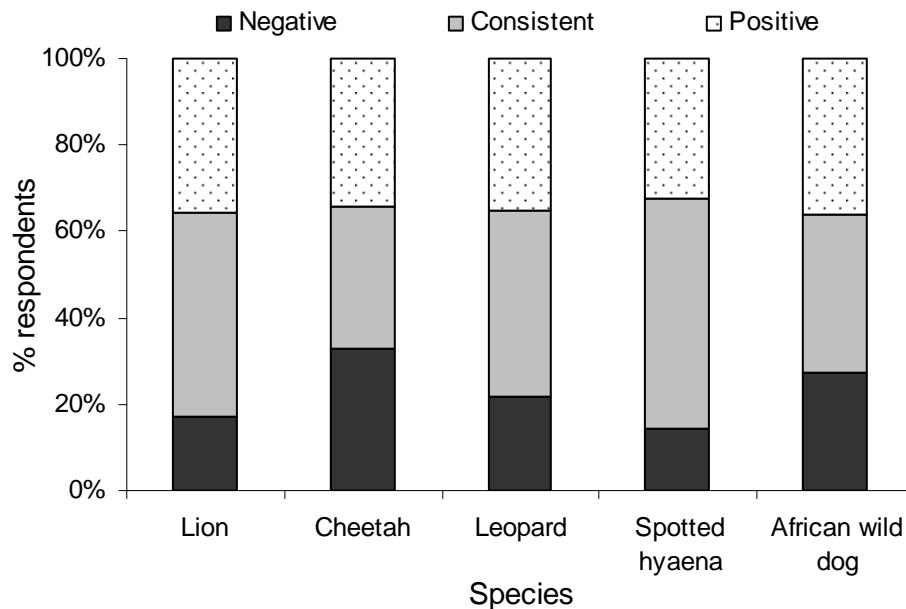


Figure 30. Percentage of survey respondents that were consistent, positive or negative in terms of desired population trends of focal carnivore species compared to how problematic they were thought to be

5.4.5 Interactions with focal carnivores

5.4.5.1 Reported sightings

Nearly three-quarters of respondents (72.7%, $n = 194$) reported seeing at least one of the focal carnivore species around their current household. A third of those (34%, $n = 66$) had seen one species, 24% ($n = 47$) had seen two, 12% ($n = 24$) three, 19% ($n = 36$) four and 11% ($n = 21$) had seen all five focal carnivores nearby. On average, respondents had seen 1.8 (± 1.6) of the focal species around their current household. There was significant variation between focal carnivore species in how many people reported having seen them ($\chi^2 = 147$, $df = 4$, $P < 0.001$) with lions reportedly seen by most people and cheetahs by least (Figure 31).

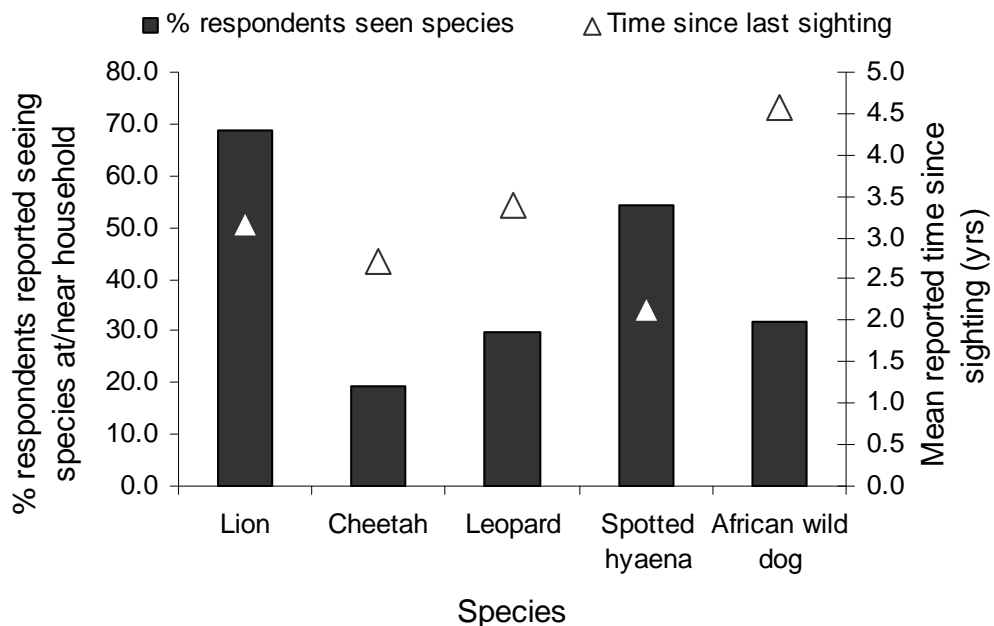


Figure 31. Percentage of study respondents that claimed to have seen each of the focal carnivore species around their present household, and mean reported time since last sighting

Species varied significantly in how recently they were reported as last being seen (KW $\chi^2 = 31.8$, $df = 4$, $P < 0.001$), ranging from a mean of 2.1 (± 3.9) years since the last hyaena sighting to a mean of 4.6 (± 5.5) years since the last wild dog sighting (Figure 31). Time

reported since last sighting of any predator around the target household ranged from 0 – 21 years, with a mean of 1.8 (+ 3.3) years.

The proportion of sightings classified as being negative differed significantly ($\chi^2 = 19.7$, $df = 4$, $P = 0.001$) between focal species, with people experiencing most negative interactions with hyaenas and least with wild dogs (Figure 32). Overall, the majority of carnivore sightings around study households (61.5%, $n = 294$) were classed as negative experiences, with people experiencing significantly more negative sightings than neutral ones for lions ($\chi^2 = 6.88$, $df = 1$, $P = 0.009$) and hyaenas ($\chi^2 = 33.3$, $df = 1$, $P < 0.001$). People had roughly equal proportions of negative and neutral sightings for cheetahs ($\chi^2 = 0.69$, $df = 1$, $P = 0.405$), leopards ($\chi^2 = 1.03$, $df = 1$, $P = 0.311$) and wild dogs ($\chi^2 = 0.58$, $df = 1$, $P = 0.448$).

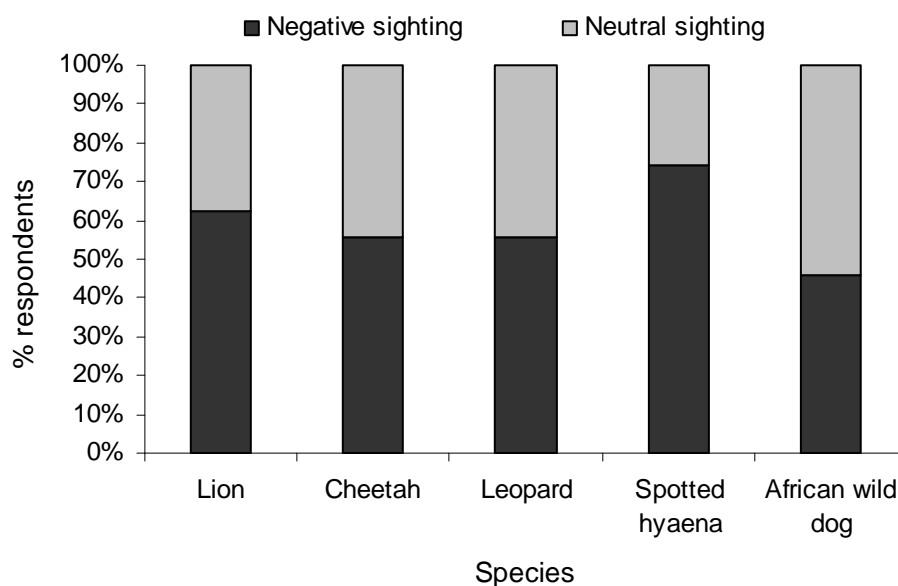


Figure 32. Proportion of focal carnivore sightings around study households that were classified as negative or neutral

5.4.5.2 Reported attacks on livestock

Over half the respondents (56.7%, $n = 152$) reported suffering a carnivore attack on livestock at their current household. Of these, 44.7% ($n = 68$) had attacks by one focal

species, 27.0% ($n = 41$) by two, 15.1% ($n = 23$) by three, 9.2% ($n = 14$) by four and 3.9% ($n = 6$) had attacks by all five species. On average, respondents had experienced livestock depredation by 1.18 (± 1.3) of the focal carnivore species. There was significant variation between focal species in terms of how many households suffered attacks ($\chi^2 = 73.3$, $df = 1$, $P < 0.001$), with most households suffering attacks from hyaenas and least from cheetahs (Figure 33). Overall, households experiencing focal predator attacks were no closer to the Park boundary than those that did not ($z = -1.23$, $P = 0.219$). Further details on the characteristics of attacks are provided in chapter 6.

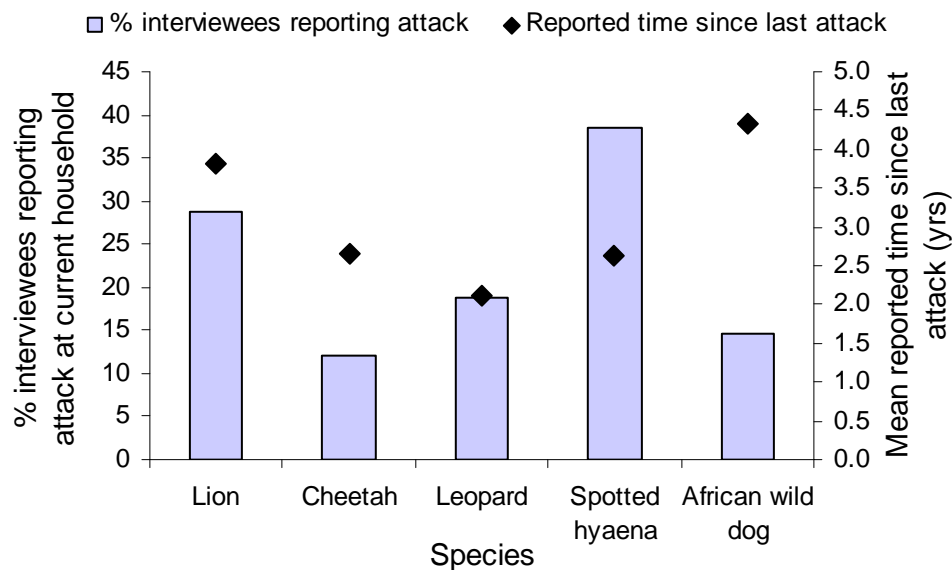


Figure 33. Percentage of interviewees reporting attacks by each of the focal carnivore species at their present household, and mean reported time since last attack

The occurrence of depredation by focal carnivores varied significantly between ethnic groups ($\chi^2 = 20.3$, $df = 4$, $P < 0.001$), with 72.4% ($n = 76$) of Maasai households having experienced an attack, followed by Barabaig (62.8%, $n = 27$), Bena (43.1%, $n = 22$), Hehe (40.3%, $n = 25$) and Sukuma (33.3%, $n = 2$). Therefore, people from traditional pastoralist groups were significantly more likely to report having experienced a carnivore attack than respondents from other groups ($z = -4.37$, $P < 0.001$). This was probably related to the fact that they owned more stock, as people who reported suffering a depredation event tended to have more stock than those who did not ($z = -4.62$, $P < 0.001$).

For all focal species, over three-quarters of respondents thought that attacks on their stock had declined since they came to this household (Figure 34). The percentage of people that thought attacks had decreased was similar across all focal species ($\chi^2 = 7.39$, $df = 4$, $P = 117$).

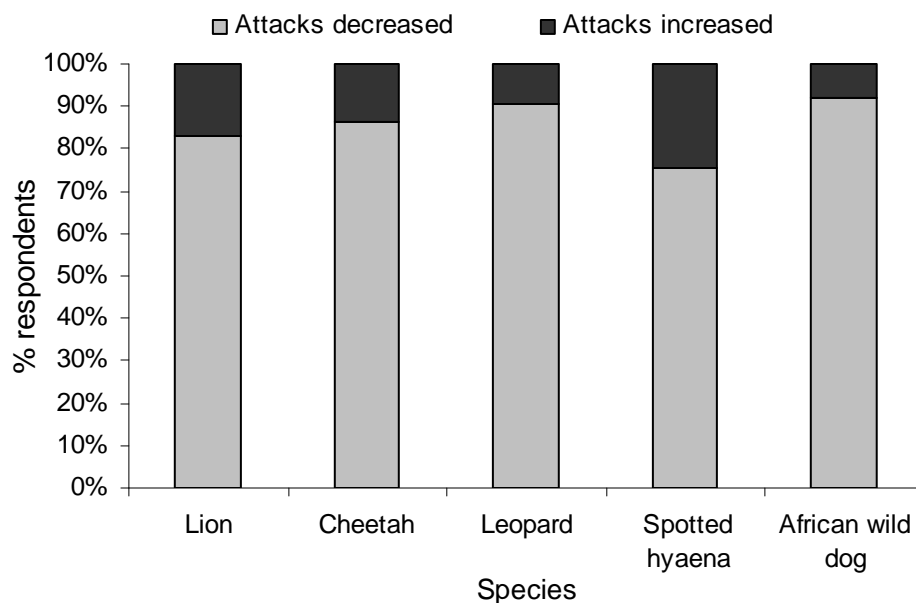


Figure 34. Percentage of respondents stating how attacks by each focal carnivore species have changed since coming to this household

5.4.5.3 Reported carnivore attacks on humans

Despite the widespread fear of attacks, relatively few respondents ($n = 10$, 3.7%) reported a carnivore attack on humans at their current household. Time since the attack ranged from 1 - 27 years, with a mean of 8.2 (± 8.7) years. Lions reportedly caused 60% of attacks ($n = 6$), spotted hyaenas caused 30% ($n = 3$) and leopards caused 10% ($n = 1$). In 60% of cases ($n = 6$), attacks just resulted in injuries, including all hyaena and leopard attacks, but 67% ($n = 4$) of the lion attacks resulted in death. Human attacks were reported from five villages (Figure 35), but there was no significant difference in the mean level of conflict between villages where human attacks had occurred and those where they had not, either for all focal carnivores ($t = -1.18$, $df = 18$, $P = 0.26$) or for lions, which were the primary culprits ($t = -0.91$, $df = 18$, $P = 0.37$).

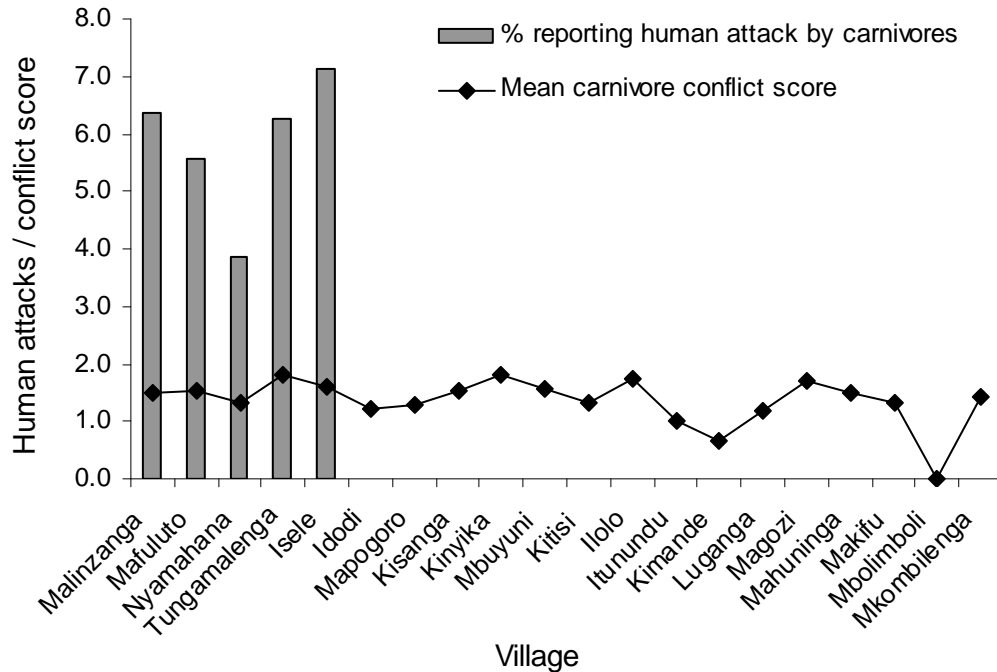


Figure 35. Percentage of respondents in each village reporting a carnivore attack on humans at their current household, and mean carnivore conflict score for each village

Households that suffered a human attack were no closer to the Park boundary than those that did not ($z = -0.46$, $P = 0.64$). Forty percent of attacks ($n = 4$) were on Hehe people, while 30% ($n = 3$) were on Maasai and 30% were on Barabaig people ($n = 3$), with none of these ethnic groups reporting significantly more attacks than any other ($\chi^2 = 4.95$, $df = 4$, $P = 0.29$). Children were attacked in 50% of cases ($n = 5$) and adults attacked in the other 50%, with leopards only attacking children but spotted hyaenas and lions attacking both adults and children. In 50% of attacks ($n = 5$), victims were sleeping, with 60% ($n = 6$) of attacks happening at night. However, only one night-time attack took place inside a hut – the remainder involved people staying outside to protect stock or crops. Of the four day-time or evening attacks, victims were tending stock in three cases and harvesting crops in the other. Males were attacked in 80% ($n = 8$) of cases, with attacks split equally between the wet and the dry season. Twenty people voiced opinions on how the frequency of carnivore attacks on humans had changed, with 90% ($n = 18$) thinking they had decreased since they came to the area, and 10% ($n = 2$) thinking they had increased.

5.4.5.4 Reported human attacks on carnivores

Very few people (7.1%, $n = 19$) openly admitted killing a predator themselves or even knowing other people that had (1.1%, $n = 3$). Of those that said they had killed predators themselves, 47.4% ($n = 9$) reported killing hyaenas, 26.3% ($n = 5$) reported killing lions, 10.5% ($n = 2$) had killed both lions and hyaenas, while 15.8% ($n = 3$) had killed leopards. People who admitted killing carnivores reported no higher conflict with them than other people ($z = -0.36$, $P = 0.72$) and had not lost more stock to depredation, either in terms of numbers ($z = -1.07$, $P = 0.28$) or as a percentage of herd size ($z = -0.98$, $P = 0.38$). People from all ethnic groups apart from the Sukuma said they had killed predators, with the majority (52.6%, $n = 10$) being Maasai, followed by Hehe (31.6%, $n = 6$), Barabaig (10.5%, $n = 2$) and Bena (5.3%, $n = 1$). Overall, there was no significant difference between ethnic groups in terms of reported carnivore killings ($\chi^2 = 4.40$, $df = 4$, $P = 0.350$), although the power of this test was limited by the small sample size.

Only a tiny number of respondents (1.5%, $n = 4$) said they used poisons or traps to control carnivores. However, despite this apparently high tolerance towards carnivores, 62% of respondents said that they thought that predators needed to be controlled, and the reasons for not poisoning or trapping predators were usually practical rather than moral, with people either unable to procure the equipment or already employing other methods (Table 18). Less than 8% of respondents said that they felt that it was wrong or went against their traditional beliefs to trap or poison carnivores, while relatively few seemed put off by the possibility of getting into trouble from the authorities for taking such action.

Table 18. Reasons given by survey respondents for not trapping or poisoning carnivores

| Reason given for not trapping/poisoning carnivores | <i>n</i> | % |
|--|----------|------|
| Unable to get poisons or traps | 100 | 42.2 |
| Use other methods for control | 38 | 16.0 |
| Threat to stock/domestic animals or people | 26 | 11.0 |
| Not enough conflict | 26 | 11.0 |
| Don't know how to use poisons or traps | 19 | 8.0 |
| Think that it is wrong | 14 | 5.9 |
| Worried about getting into trouble | 7 | 3.0 |
| Not traditionally done | 4 | 1.7 |
| Too expensive | 3 | 1.3 |

Only two respondents (both Maasai) said that they had been on traditional lion hunts, killing an average of one lion on each hunt. Reasons for not hunting lions were given by 36 respondents, and most commonly involved fear or a scarcity of lions (Table 19).

Table 19. Reasons given by respondents for not engaging in traditional lion hunts

| Reason for not hunting lions | <i>n</i> | % |
|------------------------------|----------|------|
| Scared of hunting lions | 10 | 27.8 |
| Lions too rare or elusive | 10 | 27.8 |
| No suitable weapons | 6 | 16.7 |
| Out-dated tradition | 3 | 8.3 |
| No problem with lions | 3 | 8.3 |
| Too busy with other tasks | 2 | 5.6 |
| Think that it is wrong | 2 | 5.6 |

5.4.6 Robustness of attitudes towards focal carnivores

For all species apart from lions, reported conflict with focal carnivores had declined by the end of the long-term monitoring (Figure 36), although this drop was not significant when all species were considered together ($t = 1.61$, $df = 50$, $P = 0.113$). Individually, conflict declined significantly for cheetahs ($z = -2.45$, $P = 0.014$) and leopards ($z = -2.45$,

$P = 0.014$) but there was no significant change in attitudes towards lions ($z = -0.71$, $P = 0.477$), hyaenas ($z = -1.80$, $P = 0.072$) or wild dogs ($z = -1.05$, $P = 0.294$).

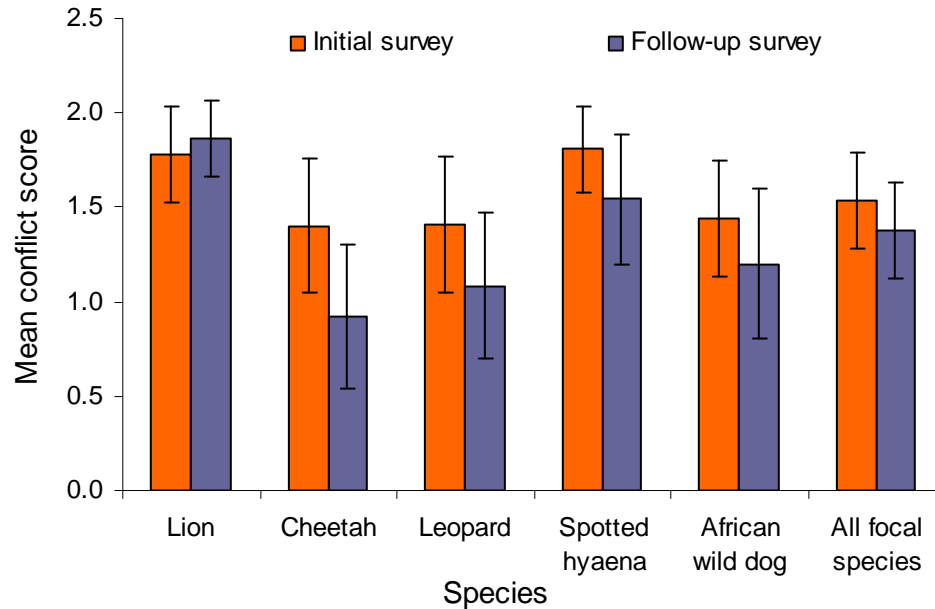


Figure 36. Mean conflict scores reported during initial interviews and during a follow-up after long-term monitoring of losses. Error bars denote the standard deviation

Of the 51 households where both long-term monitoring of losses and follow-up attitudinal surveys were conducted, 8 households (15.7%) reported lion depredation during the monitoring period, 3 (5.9%) reported leopard depredation, and 9 (17.6%) reported spotted hyaena depredation. No households reported depredation by cheetahs or wild dogs during the monitoring period.

Attitudes towards lions seemed to be robust, with no higher conflict reported by people who experienced lion depredation ($z = -0.47$, $P = 0.661$), or lower conflict for people who had gone 12 months without a lion attack ($z = -0.30$, $P = 0.762$). Similar robustness was seen for hyaenas, with people not changing attitudes significantly regardless of whether they had had a hyaena attack ($z = -1.73$, $P = 0.083$) or not ($z = -1.03$, $P = 0.301$). There were not enough cases to examine this for leopards, cheetahs or wild dogs. Moreover, the overall change in focal conflict score between the initial and follow-up surveys was not related to the level of reported depredation during the monitoring period, either in terms

of stock numbers ($r_s = -0.03$, $n = 51$, $P = 0.839$), or as a percentage of herd size ($r_s = -0.07$, $n = 51$, $P = 0.643$).

5.4.7 Key determinants of human-focal carnivore conflict

The level of reported conflict with focal carnivore species varied significantly between different respondents ($\chi^2 = 680$, $df = 21$, $P < 0.001$). Initial exploratory tests revealed that the magnitude of reported focal carnivore conflict varied significantly between people of different ethnic groups (KW $\chi^2 = 34.5$, $df = 4$, $P < 0.001$), with people from agro-pastoralist groups tending to be more tolerant than people from pastoralist groups ($z = -4.30$, $P < 0.001$). The level of carnivore conflict also varied between people from different villages ($\chi^2 = 31.3$, $df = 19$, $P = 0.038$), although there was no marked difference between districts ($z = -5.60$, $P = 0.560$) and no relationship with distance to the Park boundary ($r_s = -0.045$, $n = 249$, $P = 0.483$). Religious affiliation also seemed to affect the magnitude of reported conflict ($\chi^2 = 680$, $df = 21$, $P < 0.001$), with people who had retained their traditional beliefs apparently more tolerant of wildlife than those who had converted to external religions, even though they reported suffering more depredation. Unsurprisingly, people who reported losing more stock to predators, both in terms of numbers ($r_s = 0.207$, $n = 250$, $P = 0.001$) and percentage ($r_s = 0.212$, $n = 250$, $P = 0.001$) reported greater problems with the focal species. People who had directly observed a focal carnivore tended to be more antagonistic towards them than others ($z = -2.86$, $P = 0.004$), and people who rated focal carnivores as highly problematic also tended to give non-focal species high conflict scores as well ($r_s = 0.354$, $n = 250$, $P < 0.001$). Interviewees who reportedly owned more stock were no more tolerant than those with fewer stock ($r_s = 0.063$, $n = 250$, $P = 0.318$). Respondents with a greater knowledge of wildlife species ranked carnivores as more problematic than others did ($r_s = 0.283$, $n = 191$, $P < 0.001$), and people tended to report higher conflict if the PI was present at the interview than when only Tanzanians were present ($z = -2.68$, $P = 0.007$).

However, many of these characteristics are correlated with one another: for instance, people from traditional pastoralist groups tended to own more stock, but reported losing greater numbers to depredation. Therefore, to examine the main drivers of human-

carnivore conflict, a general linear mixed model (GLMM) procedure was employed, to determine which factors were still retained in the most parsimonious model with the lowest Akaike's Information Criterion (AIC) score. The relative importance of ethnic group, distance from the Park, district, number of onlookers, whether or not the PI was present at the interview, time lived in the area, age, gender, wildlife knowledge, number of stock owned, number of income sources, primary source of income, vulnerability score, adherence to an external religion, number and percentage of each stock type lost to predators, number and percentage of overall herd size lost to all causes, whether or not the respondent had directly observed a focal carnivore, and the conflict score for non-focal species were examined with relation to the mean focal carnivore conflict score. The original model had an AIC score of 351.8, while the final model had an AIC score of 304.1. This model retained the ethnicity of the respondent, adherence to an external religion, direct observation of a focal carnivore and the conflict score with non-focal species as the most important variables influencing intensity of conflict with focal carnivores (Table 20). Interestingly, although livestock depredation was the main cited reason for conflict with focal carnivores, and was a significant determinant of conflict when examined alone, the occurrence of depredation was not retained in the final model, with other factors appearing to be more important (Table 20).

Table 20. Final output from general linear modelling procedure used to examine conflict with focal carnivores, showing the variables which contribute to the model with the lowest AIC score

| Source | Numerator <i>df</i> | Denominator <i>df</i> | <i>F</i> | <i>P</i> |
|--------------------------------------|---------------------|-----------------------|----------|----------|
| Intercept | 1 | 215 | 58.70 | 0.000 |
| Ethnic group | 4 | 215 | 6.51 | 0.000 |
| Adherence to external religion | 1 | 215 | 7.67 | 0.006 |
| Direct sighting of focal carnivore | 1 | 215 | 16.03 | 0.000 |
| Conflict score for non-focal species | 1 | 215 | 17.52 | 0.000 |

Dependent Variable: Mean conflict score for focal carnivores.

According to this model (which only explains 26% of the overall variance in human-carnivore conflict), ethnic group was one of the most important determinants of human-

carnivore conflict. Examination of the data showed that the Bena and Sukuma were the most tolerant groups towards carnivores, while the Maasai were the group that reported the highest level of conflict with the focal species. Encountering a focal carnivore, even without it attacking livestock or people, was linked to higher conflict, while higher conflict with non-focal species was related to greater hostility towards carnivores themselves. Adherence to an ‘external’ religion, i.e. not one traditional to the respondent’s ethnic group, was also linked to increased carnivore conflict. However, the relatively small amount of variance in conflict scores explained by this model suggests that other factors aside from those discussed so far are also likely to have a substantial bearing on peoples’ attitudes towards large carnivores.

5.5 Discussion

There was a high level of perceived human-carnivore conflict in the study area, with focal carnivores subject to particular hostility, as has been observed in northern Tanzania (Maddox 2002). However, people appeared far more likely to think of threats when asked to describe focal carnivores here than in the Loliondo and Ngorongoro areas of northern Tanzania (Maddox 2002), perhaps indicating a deeper and more visceral perception of conflict. The majority of respondents disliked focal carnivores and considered them to be highly problematic, with the overwhelming reason provided being the risk that carnivores posed to livestock. However, despite this widespread concern and the importance of depredation when examined alone, neither the number nor percentage of livestock reportedly killed by carnivores emerged as significant determinants of conflict in the final model. Moreover, studies of households over a year-long period revealed that attitudes to carnivores remained relatively unchanged regardless of whether depredation had occurred during that time or not. These results are surprising, as depredation has often been assumed to be the single most important determinant of conflict, has been highlighted in numerous studies (Chardonnet 2006; Marker et al. 2003b; Oli et al. 1994), and was cited as the main driver of human-carnivore conflict in a global review (Sillero-Zubiri and Laurenson 2001). However, this robustness of attitudes towards carnivores regardless of actual depredation history has been noted previously for jaguars and pumas in Brazil (Conforti and de Azevedo 2003), and suggests that although it undoubtedly

affects local perceptions, reducing depredation alone will not be enough to produce a substantial change in peoples' attitudes towards large carnivores in this area.

Carnivore conflict scores were all highly correlated with one another, indicating that people tended to hold similar views for the group as a whole, as has been seen with carnivores elsewhere (Conforti and de Azevedo 2003). People also tended to want declines for all carnivores rather than judging individual species based on the problems that they caused. This is worrying for those species which actually cause relatively little conflict – for instance, wild dogs caused no reported attacks during the long-term monitoring, but people remained robustly negative towards them nonetheless, possibly due to general hostility towards carnivores as a whole. This response seemed species-specific, however, with people more willing to soften their attitudes towards cheetahs, another species which caused no reported losses during monitoring.

The potential risk to humans was also voiced as a common reason for antipathy towards carnivores, particularly lions. Relatively few attacks were reported in this area, with less than 4% reporting a predator attack on someone in their boma, compared with at least 13% of respondents in Ngorongoro and 21% in Loliondo (Maddox 2002). However, the attacks here seemed more likely to be fatal - four fatalities were recorded in this area, while only one was recorded by Maddox (2002). The perception of risk to human life was mentioned for all focal carnivores, and although such concerns may be justified in the case of lions, which attacked over 140 people in Tanzania in 2004 alone (Packer et al. 2005) and kill more than 65 people annually in the country (Baldus 2004), they are extended even to carnivores which have never been reported as killing anyone in the wild, such as cheetahs (Maddox 2002). This is similar to the situation with wolves, which are still commonly feared in North America despite them causing no predatory attacks on humans there during the 20th century, and Norway, where the last recorded fatal wolf attack was in 1800 (Linnell and Bjerke 2002; Loe 2002).

Unexpectedly, however, experiencing a carnivore-human attack at a household did not significantly influence reported carnivore conflict, possibly due to the small sample size concerned or because such fears are already widespread regardless of personal history

concerning actual attacks. Such fears of carnivores posing a threat to human life are extremely common (Sillero-Zubiri and Laurenson 2001), with hypotheses that they are instinctive anti-predator responses embedded deep within the human psyche (Kruuk 2002; Quammen 2003; Thirgood et al. 2005). Seligman (1971) proposed that certain fears are more likely to be acquired due to a evolutionary 'preparedness', and there is evidence that such 'preparedness' for fear of snakes is an inherited trait (Ohman et al. 1985; Ulrich 1993). Due to the considerable impact that carnivores have historically had on humans (Kruuk 2002; Quammen 2003), some heritability of fear of carnivores has also been proposed (Loe 2002), and may explain the widespread nature of such concerns, particularly in rural populations, and their relative lack of relatedness to actual experiences.

However, despite the widespread fear and hostility towards carnivores here, there was relatively little lethal control reported, with less than 10% of people admitting to killing focal carnivores; far fewer than in Loliondo and Ngorongoro, where around 60% of men interviewed reported killing predators (Maddox 2002). Similarly, less than 2% of respondents in this study said that they used poisons or traps, which was dwarfed by the 25-40% reported to use them in northern Tanzania (Maddox 2002). While the current reported level of retaliatory or preventative carnivore killing seems low, people may well be reticent about admitting the true scale of lethal control in the study area, particularly to someone that they probably perceive as closely linked to the conservation authorities. Considerable further work would be required in order to gain more reliable data on the true level of conflict-related threats to carnivores, either through long-term dedicated work in the area to build up local confidences, following the methods used by Hazzah (2006) while investigating lion killing by the Maasai in Kenya, or through direct monitoring of carnivore mortality to assess the true impact of anthropogenic killing. The fact that survey data relies upon truthful reporting and accurate recollection is always a cause for concern, as people are often unable to clearly recall exactly when an incident happened, or may be hesitant about revealing their true feelings and actions to an outsider, particularly one linked to conservation organisations and authorities. The data from studies such as these can nevertheless provide interesting insights into the

magnitude and causes of human-wildlife conflict, but this potential for bias should always be remembered, and highlights the need for gathering additional, independent data on factors such as the true impact of anthropogenic killing. Peoples' confusion over the difference between cheetahs and leopards, with only 60% of respondents in this study confident about distinguishing between them, is also a source of concern, as peoples' attitudes and experiences with one species may inadvertently be affecting their responses regarding the other. This was controlled for as much as possible in this study, as people were aware that they were two separate species, and pictures and explanations were used beforehand to ensure that the respondent was clear exactly which species was under discussion at any one time, but it is still likely to have some influence on the results and means that attitudes towards cheetahs and leopards must be treated with some caution.

Despite the low reported level of killing in this area, the majority of people clearly stated that carnivores did need to be controlled, and the current lack of lethal control appeared mainly circumstantial rather than due to innate tolerance, with people limited by a lack of access to materials or knowledge about how to use them. These limitations were the same ones cited by people in northern Tanzania who did not poison or snare carnivores (Maddox 2002), and may be a source of conservation concern in the future, as access to knowledge and materials spreads. The strong desire for carnivore populations to decline or be extirpated, despite the widespread perception that they had already declined over recent years, was another source of concern. Data on carnivore population dynamics are urgently needed in the study area, and if these reported population declines are true, it highlights the importance of ameliorating human-carnivore conflict in the study area as rapidly and effectively as possible.

The data here revealed that ethnic group of the respondent was one of the most important factors influencing the reported magnitude of human-carnivore conflict, with traditional pastoralist groups, particularly the Maasai, appearing to be least tolerant of focal carnivores. Pastoralists have a long tradition of coexisting with wildlife (Bourn and Blench 1999; Chardonnet 2006), but pastoralist-carnivore tensions are on the rise in East Africa (Frank et al. 2006a), and here at least traditional pastoralists suffered more attacks on their livestock than other groups. Moreover, traditional pastoralists are more

dependent than other people upon their livestock, especially cattle, for both social and economic worth (Hesse and MacGregor 2006; Ndembiwe 2006), so any such depredation is likely to have a greater impact on their livelihoods. This same pattern was observed in Indian pastoralist communities coexisting with snow leopards, where those who were most dependent upon livestock were most hostile towards the cats' presence (Bagchi and Mishra 2006). As with general human-wildlife conflict in the study area (see section 4.4.6), adherence to an 'external' organised religion was linked to higher carnivore conflict, mirroring the trend observed by Hazzah (2006) in Kenyan Maasailand. Having experienced a direct interaction with a conflict-causing species, by seeing it first-hand, was also a major driver of conflict, and this has been observed with species elsewhere: in Colorado, people with direct experience of prairie dogs were less willing than others to accept their presence, as such people were more likely to live in close proximity to them and personally suffer the effects of their presence (Lybecker et al. 2002; Zinn and Andelt 1999). Higher conflict with non-focal species was also linked to higher conflict with carnivores. This could be because the same people tend to be hostile towards all wildlife, due to economic or social reasons, or because damage caused by other animals such as elephants decreases the willingness of people to tolerate carnivore damage, as well as increasing their fear and hostility towards wildlife in general. Regardless of the exact mechanism, it is important to note that conflict with other species could have a 'knock-on' effect increasing human-carnivore conflict, which is an angle that has rarely been explored in the past and should be considered when hotspots of conflict with other species are identified.

These four factors (ethnic group, religion, direct sightings and conflict with other species) all appeared to be important drivers of conflict, yet still explained relatively little of the total variance in respondents' attitudes towards carnivores. As with wildlife in general (see section 4.4.6) a variety of more deep-seated factors are likely to influence peoples' views towards wild animals, such as attitudes towards the neighbouring Park, conservation authorities and tourism. It was interesting that although people reported high conflict with carnivores, they were actually relatively positive towards the species themselves, suggesting that some of their antagonism was actually directed at other

sources, such as the Park or Government authorities. This was openly mentioned by a few respondents here, with authorities criticised for ‘allowing’ wild animals to stray from the Park onto village land, and people feeling disempowered to deal with wildlife problems, and such issues will be examined in more detail in chapter 7. This relatively positive view of the animals themselves was not as true for hyaenas, however, which people disliked both due to the problems they caused and because they were ‘ugly’ and ‘scavengers’. This deep-seated dislike of hyaenas has been voiced by people for centuries, with Aristotle describing them as ‘cowardly’, and ‘exceedingly fond of putrefied flesh’, and by Hemingway in 1935 as the ‘hermaphroditic self-eating devourer of the dead...potential biter-off of your face at night as you slept’ (Glickman 1995). This highlights the fact that some antagonism towards animals derives from dislike of certain traits, appearance or behaviour, and this was mentioned by people here, with people more positive towards animals like the ‘beautiful’ leopard than the ‘ugly’ hyaena.

Overall, the issue of human-carnivore conflict is a complex one, with multiple inter-related drivers. However, the factors identified here allow us to start prioritising areas where efforts conflict resolution strategies should be initiated. Traditional pastoralist households, particularly in areas with strong evangelising missions, should be targeted as a priority, while studies on conflict with other species (such as hippo and elephant conflict studies, both of which have recently begun in the study area) could also inadvertently reveal hotspots of carnivore conflict. It may also be worthwhile initiating some work with the local missionaries and church groups, to investigate further why conversion to an external religion seems to be linked with higher conflict, and whether anything could be done to minimise this effect. The robustness of negative attitudes towards species such as wild dogs, despite little to no actual depredation, proves that effective conflict resolution needs long-term work and requires a broader strategy than just reducing the immediate costs of living alongside carnivores. As ever, conservation dollars for such long-term programmes are scarce, but effective prioritisation will allow conflict mitigation to be developed and directed in the most appropriate way, providing the best chance to ease human-carnivore coexistence in this diverse and significant landscape.

Chapter Six

Characteristics of reported focal carnivore attacks, and influence of livestock husbandry strategies and boma features upon the likelihood of focal carnivore depredation



CHAPTER 6: CHARACTERISTICS OF REPORTED FOCAL CARNIVORE ATTACKS, AND INFLUENCE OF LIVESTOCK HUSBANDRY STRATEGIES AND BOMA FEATURES UPON THE LIKELIHOOD OF FOCAL CARNIVORE DEPREDAATION

6.1 Chapter summary

This chapter aims to describe the characteristics of focal carnivore attacks reported during this study, investigate the veracity of reported attacks, and examine the livestock husbandry strategies and boma features that appeared to influence the likelihood of an attack occurring. Follow-ups on reported depredation incidents revealed that around a fifth of reported attacks were not due to focal carnivores, and there was evidence that householders exaggerated claims in order to garner interest into their livestock losses from researchers. Using this figure as a correction factor, losses to focal carnivores probably accounted for less than 0.3% of average herd size per month, indicating that depredation is probably not the main driver of the high conflict reported in this area. Good livestock husbandry was reported, with dogs, herders and night-time enclosures reportedly used by the vast majority of people, and no major effect of adhering to an external religion discernible on the reported level of husbandry. However, substantial numbers of attacks occurred on stock outside bomas at night, as well as on livestock unaccompanied by dogs or adult herders. The likelihood of depredation seemed more influenced by husbandry than habitat, with only ground cover emerging as a correlate of attacks. Although people felt economically limited in their ability to implement better husbandry, the data here suggest that strict adherence to traditional husbandry techniques, such as attentive herding, always enclosing stock at night, ensuring that they are accompanied by dogs, and making small adjustments to boma construction, could potentially help to lower the level of depredation even further. However, the decision processes, traditions and constraints of local people should be considered when suggesting changes to livestock husbandry methods, or they are very unlikely to be implemented. Developing truly effective conflict resolution strategies will depend upon working closely with local people and understanding all the issues that constrain them and drive decision-making, rather than just the risk of livestock depredation.

6.2 Introduction

Livestock depredation was the most commonly cited reason for antagonism towards carnivores in this study, as well as in a global review of human-carnivore conflict (Sillero-Zubiri and Laurenson 2001). Although no link was found here between the recent occurrence of depredation and intensity of conflict (see section 5.4.6), it is clear that carnivore attacks upon livestock were perceived as a major problem, with people who experienced greater levels of depredation being more hostile towards wildlife in general. In order to help lessen the high level of human-wildlife conflict observed here, it is important to understand where, when and how carnivore attacks upon livestock are reported to occur, and which livestock husbandry strategies seem most effective at preventing them. These data can then be used to advise local householders on how best to minimise the risks of attack by focal carnivores.

Work by Ogada et al. (2003) revealed that livestock husbandry had an important impact on the level of livestock depredation and, consequently, on the numbers of carnivores killed. Their study showed that depredation was influenced by physical characteristics of the boma, the presence of dogs and herding strategies when livestock were out grazing. All these factors, which were found to be important on commercial ranches in Kenya, will be examined here to see if the same patterns emerge for pastoralist and agro-pastoralist households in Tanzania. Other factors which may affect the likelihood of livestock depredation at a boma include the type of 'gate' used to close it, how easily predators can see through boma walls, how thornbushes are arranged in the walls and the number of external entrances (Frank et al. 2006a; Rasmussen 1999). However, Hemson (2003) found that physical characteristics of livestock enclosures proved less important than herding in terms of preventing depredation, while research on human-wildlife conflict in Kenya by Mwebi (2007) also stressed the importance of attentive herding for minimising attacks. Depredation events have also been linked to small-scale variation in habitat cover around livestock bomas (Mazzolli et al. 2002; Ogada et al. 2003), as well as to larger-scale effects such as the distance of stock enclosures from reserve boundaries (Hemson 2003).

A review by Thirgood et al. (2005) highlighted the lack of good, detailed information on livestock losses to predators, especially in the developing world, and this chapter will provide some of these much-needed data. Moreover, relatively few studies have attempted to conduct any independent investigation of reported depredation events, in order to examine whether or not the depredating species is correctly identified, and how many of the reported losses to carnivores are in fact likely to result from depredation. When reported attacks are examined, there seems to be a mismatch between perceived and ‘actual’ rates of loss (Marker et al. 2003c; Rasmussen 1999), with ‘actual’ rates much lower than the initially reported levels. However, the *perception* of severe conflict remains important, as negative attitudes are strongly linked to removal of the species concerned (Gittleman et al. 2001; Marker et al. 2003b), so this is still a critical factor to consider in terms of conflict mitigation.

This chapter will examine the characteristics of reported livestock depredation events in the study area, and assess which features appeared to be linked to a higher risk of attacks. The specific aims of the chapter are to:

- (i) Investigate the veracity of reported depredation incidents, by conducting follow-up research at households which reported attacks by focal carnivores;
- (ii) Examine which strategies respondents felt were most effective in terms of reducing depredation, how often these were used and reasons for not using them;
- (iii) Describe the reported characteristics of depredation events, particularly with regard to when and where they occurred, the species and demography of attacking carnivores, and which livestock types were attacked;
- (iv) Assess the levels of livestock husbandry reportedly employed at study households, examine any differences between respondents who adhered to external religions and those that retained traditional beliefs, and compare the reported husbandry practices to those in place when attacks occurred;
- (v) Explore how the characteristics of livestock bomas, both in terms of physical structure, location and surrounding habitat, are linked to patterns of livestock depredation.

6.3 Methods

6.3.1 Investigating the veracity of reported carnivore attacks

One or two local assistants were trained in each of the study villages, and they were the initial contact point for the 191 households that underwent long-term monitoring of livestock losses for 12 months (see section 3.2.4 for more explanation of the long-term monitoring methodology). Upon hearing of a reported attack by focal carnivores on livestock, the assistant would attempt to contact the project and arrange a visit to the household that experienced the attack. The PI and/or a trained research assistant would then visit the household and gather all possible information on the incident, including the livestock husbandry measures in place at the time, and such follow-up visits were made in order to investigate a total of 131 reported incidents of focal carnivore depredation. Attempts were always made to see the carcass or injured animal in order to inspect the bite marks and remains, and the reported attack site was examined for evidence such as scat, spoor and drag marks. Respondents were also shown picture cards of focal carnivores and their spoor, to examine whether or not they could correctly identify the predator thought to be responsible.

6.3.2. Assessing livestock husbandry and boma characteristics

The initial survey (Appendix I) was used to provide baseline data on the reported use of dogs, herders and enclosures to protect livestock, and this reported level of husbandry was compared to data on the livestock husbandry in place when attacks occurred. The same group of respondents described in chapter 4 was used, totalling 268 respondents, and their characteristics, in terms of ethnicity, age, gender, religious affiliation, demography, stock ownership and income sources are all detailed in section 4.4.1. The information for this chapter came from the section which dealt with livestock husbandry methods. The sampling frame and survey technique remain the same as described in Section 4.3.4.

At each household, data were also collected on the physical characteristics of the livestock boma complex, as described fully in section 3.2.2. These analyses were

restricted to traditional thornbush bomas, rather than the small mud huts that were occasionally used to enclose smallstock. The habitat surrounding the boma was investigated by examining four 6 x 6m vegetation plots, each 25m from the boma, as described in section 3.2.3. A GPS unit was used to record the exact location of the boma, so that distance from the National Park boundary could be ascertained and used in analyses. One obvious concern was that the characteristics of the boma may have changed during the time between an attack happening and the boma being surveyed. In order to investigate this, all bomas involved in the long-term monitoring ($n = 200$ at the start, $n = 191$ by the end) were examined every month to investigate how often substantial changes were made to the boma structure. Furthermore, boma characteristics were only examined in relation to attacks that had occurred within the last two years, and restricted to households where no significant changes to bomas had reportedly occurred since the attacks.

6.3.3 Characteristics of attacks

Data on reported carnivore attacks were collected both during the initial surveys ($n = 363$ focal carnivore attacks), and during follow-ups on conflict incidents reported during long-term monitoring ($n = 106$ focal carnivore attacks). During both the initial and follow-up surveys, detailed discussions were held with respondents who reported a focal carnivore attack, with questions regarding the circumstances surrounding the attack, and how the respondent determined which predator was responsible, using the survey photo cards (Appendix II), to ensure that focal species were identified correctly. If it emerged during these discussions that a non-focal species, such as a jackal, was actually responsible for the attack, or that there was no evidence of focal carnivore depredation, the incident was not recorded in the database of reported attacks. As much information as possible was recorded on the date, time and location of each reported focal attack, as well as on the species, age and sex of carnivores thought to be responsible, and the types and numbers of livestock attacked. Attacks which occurred between November and March inclusive were classified as happening in the rainy season, while the dry season was classified as lasting from April to October inclusive, and this difference in length between seasons was accounted for in statistical analyses of seasonality. Any attack data that was very likely to

have involved an incorrectly identified carnivore was not retained for analyses – this was the case for three leopard attacks, one of which involved 30 ‘leopards’ chasing stock in a pack, and two of which involved a pair of ‘leopards’ chasing stock very fast in the day. However, in many cases it was hard to ascertain whether or not the correct species was being described – for instance, a large cat seen jumping out of a boma at night could feasibly be a lion or leopard. To assist with this, respondents were shown picture cards of the focal species if they said they had seen the animal, spoor cards if they had based the identification on tracks, were played tracks of predator vocalisations if they had based the identification mainly upon that, or were asked to describe other signs (such as bite marks) in detail to determine whether the identification was likely to be accurate. These detailed investigations into how predators were identified were only conducted during the follow-up monitoring, but provide a good indication of how good the survey respondents here tended to be in terms of correctly identifying focal predator species.

6.3.4 Statistical analyses

All statistical analyses were conducted in SPSS 14.0 (SPSS Inc, Chicago). The one-sample Kolmogorov-Smirnov test was used to check assumptions of normality, and non-normal data were either transformed for parametric analysis or analysed using non-parametric statistics. Levene’s test was used to check equality of variances, while Bartlett’s test of sphericity (Bartlett 1954) and the Kaiser-Meyer-Olkin statistic (Kaiser 1974) were used to examine whether data violated the assumption of factorability of the correlation matrix, and therefore whether they were suitable for factor analysis. Analyses used in this chapter include Mann-Whitney U, chi-squared, Kruskal-Wallis H test, independent-samples t-test, Spearman’s correlation, principal components analysis and discriminant function analysis. All tests were two-tailed and significance was defined as $P < 0.05$, although P values of < 0.1 was considered to indicate trends that may be worthy of future investigation. Further details of the statistical approaches used are presented in chapter 3.

6.4 Results

6.4.1 *Veracity of reported carnivore attacks*

The follow-ups on carnivore attacks conducted during the long-term monitoring allowed the gathering of information on how often reported attacks were actually likely to be caused by focal carnivores. Overall, 131 reported incidences of carnivore depredation were investigated. Despite respondents clearly being asked to report specific depredation only by focal carnivores, these investigations revealed that 25 of the reports (19.1%) did not actually involve suspected depredation by focal species: in 12 of these 25 cases, they involved smallstock killed by jackals, in 7 cases the stock were killed by snakebites, in 5 cases the stock had just been lost in the bush with no evidence of depredation, and in one case a small goat was killed by a baboon. In all these cases, follow-up visits revealed that respondents had known that none of the focal species were involved, and they were very open about admitting that, but they said that had wanted the advice and input from researchers that resulted from investigating a focal carnivore conflict. Correcting reports of numbers of stock lost to depredation by this degree would lead to the estimation that carnivores are responsible for only 0.26% of livestock loss, compared to 0.32% reported during long-term monitoring (see section 4.4.1.9) and 1.21% reported in initial surveys (section 4.4.1.7), ratios of 1 : 1.2 and 1: 4.7 respectively.

Of the 106 follow-up cases where respondents were found to be actually describing attacks by focal carnivores, each species was not equally involved ($\chi^2 = 57.3$, $df = 3$, $P < 0.001$): around half (52, $n = 49.1\%$) were attributed to hyaenas, 39 (36.8%) to lions, 11 (10.4%) to leopards and 4 (3.8%) to wild dogs, with no attacks attributed to cheetahs. The signs used to identify which predator was reportedly responsible are shown in Table 21.

Table 21. Signs used by respondents to identify the species held responsible for reported attacks, from the 106 cases of focal carnivore attacks identified during follow-up monitoring

| Signs used to identify carnivore responsible | <i>n</i> | % |
|--|----------|------|
| Direct observation of carnivore | 54 | 50.9 |
| Direct observation and spoor | 7 | 6.6 |
| Spoor only | 33 | 31.1 |
| Spoor and calls | 7 | 6.6 |
| Spoor and bites/killing method | 2 | 1.9 |
| Spoor and scat | 1 | 0.9 |
| Bites/killing method | 1 | 0.9 |
| Calls and bites/killing method | 1 | 0.9 |

Due to issues with communication and access, only 23 (21.7%) of the 106 followed-up carnivore attacks could be investigated independently within 3 days of the incident. Carcasses could not be observed directly – even in cases where we arrived within an hour of the report, the carcass had already been cut up and was in the process of being eaten. In 12 of the cases, however, we could still make out fresh spoor around the attack site, and in all cases the spoor was of the reported focal carnivore. In another six cases, we directly observed livestock injured in the attack, and all evidence from bite marks supported the respondent’s conjecture in terms of which focal carnivore was responsible. All respondents that reported an attack by lions, hyaenas or wild dogs correctly identified the species and spoor concerned when shown identification cards, while 3 (27.3%) of the people reporting leopard attacks were unable to differentiate clearly between photos of cheetahs and leopards, although they could differentiate the spoor. Only one person relied mainly upon the predator’s calls for identification, which were correctly identified as a hyaena’s calls after using recorded vocalisations for verification. These results suggest that people are generally skilled at correctly identifying which focal predator was responsible for depredation, with the possible exception of attacks by leopards, which may actually involve cheetahs instead. People were also skilled at differentiating between livestock that were killed by predators and those that were scavenged, as they said that they would skin the carcass and would find bruise marks under bite marks, which

indicates that the animal was still alive when bitten by the predator. There was only one case where the respondent reported finding two different sets of predator prints (lion and hyaena) around a kill, but lion spoor around the boma itself led him to classify the kill as a lion kill, with hyaenas probably arriving to scavenge from the carcass once the lions had left.

6.4.2 Reported livestock husbandry strategies used

6.4.2.1 Reported use of herders, dogs and enclosures

All 268 interviewees said that their stock went out accompanied by a herder. Just under three-quarters of respondents with cattle claimed to have an adult herder (74.4%, $n = 180$) go out with the cattle, and the proportion was very similar for smallstock (74.1%, $n = 180$). The figure dropped slightly for donkeys, where 66.7% ($n = 50$) of respondents claimed to have adult herders. Overall, livestock was reportedly accompanied by adult herders in 73.2% of cases, with children herding the rest of the time. Contrary to the hypothesis that people adhering to an external religion might slacken their livestock husbandry practices, such respondents were actually more likely to report having adult herders, for smallstock ($\chi^2 = 4.36$, $df = 1$, $P = 0.037$) and donkeys ($\chi^2 = 4.48$, $df = 1$, $P = 0.034$), while the relationship was bordering on statistical significance for cattle ($\chi^2 = 3.80$, $df = 1$, $P = 0.051$).

People also commonly reported using dogs to protect their stock – 84.3% ($n = 204$) of respondents with cattle said they used a dog to protect their cattle, 86.1% ($n = 210$) said they used them to protect their smallstock, and 94.7% ($n = 71$) used them to safeguard their donkeys, with dogs present with a reported 86.5% of stock overall. The average household had 2.4 (± 1.8) dogs per boma, with a mean of 40 head of livestock owned per dog. People who adhered to an external religion were significantly less likely to have a dog protecting their cattle ($\chi^2 = 4.87$, $df = 1$, $P = 0.027$), with the relationship just at the level of statistical significance for smallstock ($\chi^2 = 3.80$, $df = 1$, $P = 0.051$). There was not sufficient sample size to accurately examine this for donkeys, but the same trend seemed to be apparent: 97.1% ($n = 33$) of people who had donkeys and had not converted

to an external religion kept a dog with their donkeys, but only 88.9% ($n = 24$) of people who had converted did so.

In terms of protecting livestock at night, all the cattle and donkeys were reportedly brought into thornbush bomas in the evening. For smallstock, in 94.3% ($n = 231$) of cases they were also brought into thornbush bomas, while the remaining 5.7% ($n = 14$) enclosed them in a hut at night. Overall, therefore, there was a high level of reported livestock husbandry in terms of the use of herders, dogs and protective enclosures at night, with no differences between respondents who adhered to external beliefs and those that did not.

6.4.2.2 Preferred livestock husbandry strategies

All 268 respondents were asked which strategies they considered to be the best for protecting livestock from predators, and the results are shown in Table 22. Using guard dogs was the most commonly mentioned strategy, followed by the construction of a strong boma and then by using spears and/or guns. The majority were strategies that householders could employ themselves, although 4.9% ($n = 13$) relied upon external input, such as fencing the National Park or having Park officials intervene to protect villagers' stock from dangerous animals (Table 22).

Table 22. Suggestions from 268 respondents regarding the most effective strategies for protecting livestock from carnivores

| Suggested method of livestock protection | <i>n</i> | % |
|--|----------|------|
| Use guard dogs | 90 | 29.1 |
| Construct strong boma | 84 | 27.2 |
| Use guns or spears | 41 | 13.3 |
| Have fires/torches around boma | 35 | 11.3 |
| Have attentive herding/guarding | 21 | 6.8 |
| Fence boma | 11 | 3.6 |
| Rely on Government/Park officials | 8 | 2.6 |
| Have outer boma | 6 | 1.9 |
| Fence National Park | 5 | 1.6 |
| Have good boma gate | 2 | 0.6 |
| Pray | 2 | 0.6 |
| Stay far from Park | 2 | 0.6 |
| Sleep outside boma | 1 | 0.3 |
| Bang tins at night | 1 | 0.3 |

*** People could suggest more than one strategy, so there are more suggestions than respondents**

When the respondents were asked if they used their suggested strategy, 78.4% ($n = 210$) of the 268 interviewees said that they did, while 21.6% ($n = 58$) did not. Cost was the main reason for not using their preferred strategies, while other limitations included needing Government action to fence the Park or bring in rangers to ‘control’ wild animals (Figure 37). People were also restricted by a lack of materials, such as strong timber for strengthening boma walls, and reported being forbidden by the Government to have firearms.

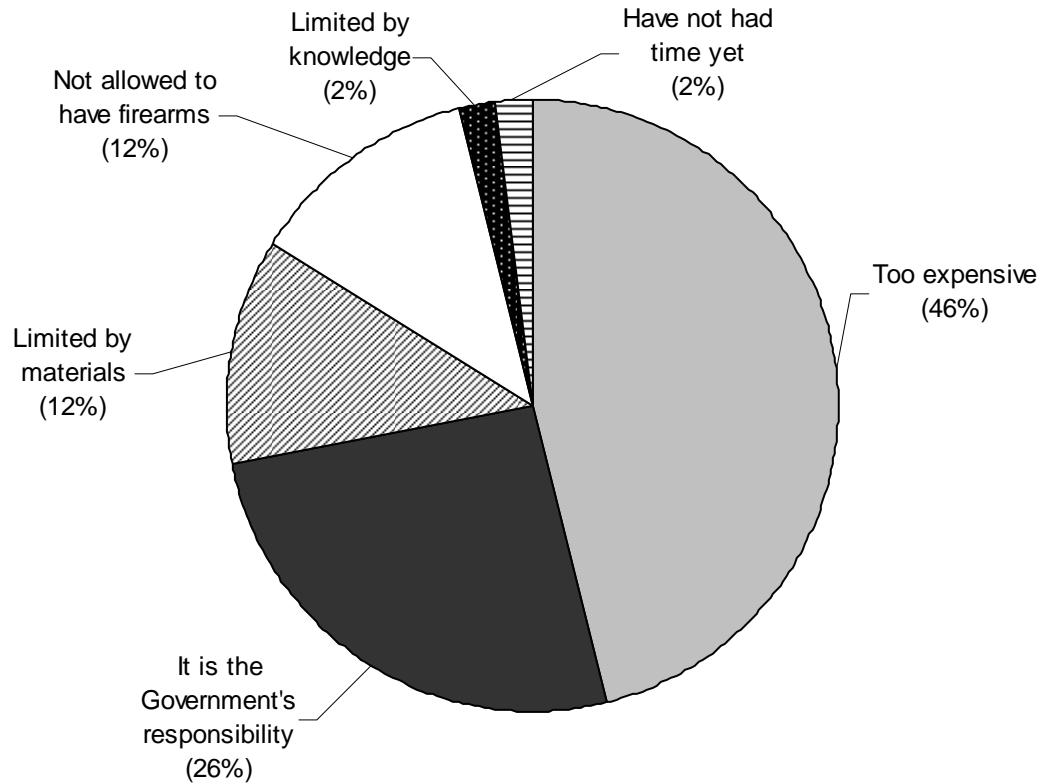


Figure 37. Reasons given by 210 respondents for why they did not employ the preferred strategies for livestock protection mentioned in Table 22, such as using guns or fencing their boma

6.4.3 Characteristics of reported attacks

Overall, through both the initial surveys and the follow-up reports, data were collected on 469 reported attacks by focal carnivores, 135 (28.8%) of which were attributed to lions, 44 (9.4%) to cheetahs, 71 (15.1%) to leopards, 165 (35.2%) to hyaenas and 54 (11.5%) to wild dogs. Examining the characteristics of these attacks allows us to learn about how and when each of these predators appears most likely to attack study households, thereby informing respondents about which strategies are most likely to help them protect their stock against these species. The amount of information gathered about the details of the attack, such as the month or season, depended upon how long ago it occurred, so data are not available on every characteristic for all 469 reported attacks.

6.4.3.1 Time of year

Information on the season of attack was available in 365 of the 469 total reported focal carnivore attacks. Over half of these (56.7%, $n = 207$) were reported to have occurred in the rainy season rather than in the dry season (Figure 38), a difference which was statistically significant ($\chi^2 = 7.13$, $df = 1$, $P = 0.008$).

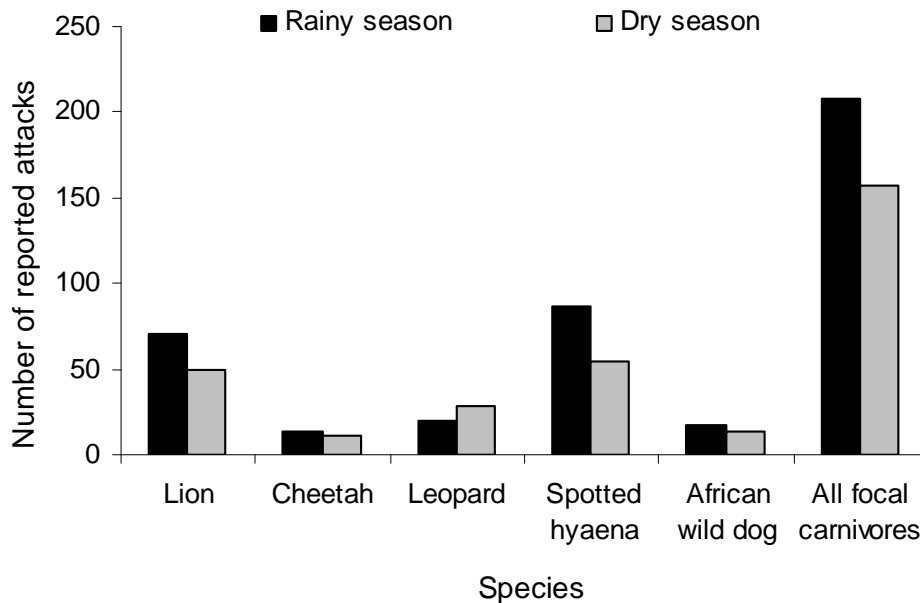


Figure 38. Frequency of reported attacks in the rainy and dry seasons, for each focal carnivore species and overall ($n = 365$ attacks)

This difference was driven primarily by spotted hyaena attacks, which were reported to occur much more often in the rainy season than the dry season ($\chi^2 = 7.72$, $df = 1$, $P = 0.005$). Lion attacks also appeared to be more common in the wet season, but this difference was just below the level of statistical significance ($\chi^2 = 3.33$, $df = 1$, $P = 0.068$). Cheetahs and wild dogs seemed to cause fractionally more depredation in the rainy season, but these differences were not significant (cheetahs: $\chi^2 = 0.36$, $df = 1$, $P = 0.549$; wild dogs: $\chi^2 = 0.53$, $df = 1$, $P = 0.469$). In contrast, leopards appeared slightly more likely to attack in the dry season, but again the difference was not significant ($\chi^2 = 1.28$, $df = 1$, $P = 0.258$).

Data on the month of attack were available for just over half (53.9%, $n = 253$) of the 469 total reported attacks: these included 86 reported attacks by lions, 14 by cheetahs, 34 by leopards, 102 by spotted hyaenas and 17 by African wild dogs. Patterns of reported attacks by month varied considerably between different species (Figure 39), although peaks in March/April (at the end of the rainy season) were seen for all species. A second, smaller peak in reported attacks between July and September, in the middle of the dry season, was also detectable overall, and for lions, cheetahs, hyaenas and wild dogs individually.

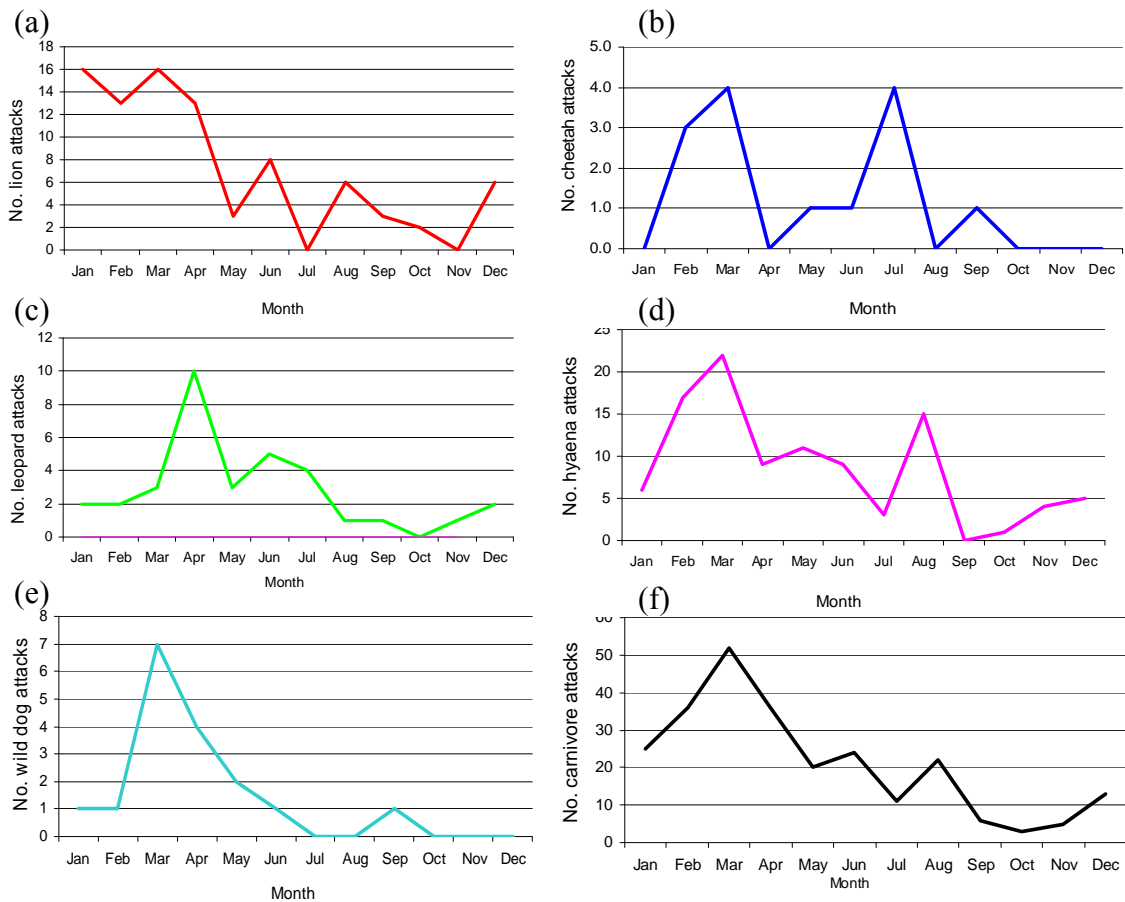


Figure 39. Patterns of reported attacks per month, for (a) lions, (b) cheetahs, (c) leopards, (d) hyaenas, (e) wild dogs and (f) all focal carnivore species

6.4.3.2 Time of day

Information on the time of day when attacks occurred was available for almost all (99.6%, $n = 467$) of the 469 focal carnivore attacks reported, with these data recorded for 134 reported attacks by lions, 44 by cheetahs, 71 by leopards, 164 by spotted hyaenas and 54 by African wild dogs. Overall, reported focal carnivore attacks were significantly more likely to occur at certain times ($\chi^2 = 440$, $df = 3$, $P < 0.001$), with the majority (59.1%) occurring at night-time (Figure 40). However, the timing of the attack depended heavily upon the species concerned – lions and hyaenas were significantly more likely to attack at night rather than during the day (lions: $\chi^2 = 25.9$, $df = 1$, $P < 0.001$; hyaenas: $\chi^2 = 127$, $df = 1$, $P < 0.001$), whereas cheetah attacks were reported as occurring far more often in the day than the night (cheetahs: $\chi^2 = 31.8$, $df = 1$, $P < 0.001$), and no wild dog attacks were reported at night. However, there was no significant difference in reported leopard attacks in terms of whether they were said to occur at night or during the day ($\chi^2 = 2.18$, $df = 1$, $P = 0.140$; Figure 40). This suggests that either leopards, which are usually a nocturnal predator (Bailey 1993), are behaving slightly unusually here, or that people are sometimes attributing diurnal cheetah kills to leopards.

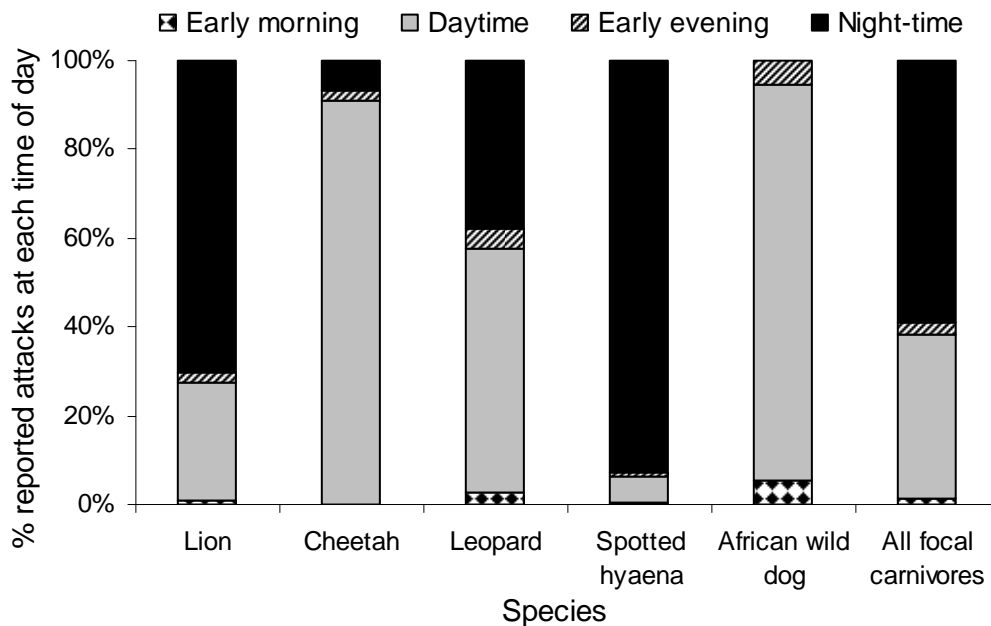


Figure 40. Time of the day that 467 reported attacks by focal carnivores occurred, for each species and overall

6.4.3.3 Location of reported attacks

Information on the location of attack was available for nearly all (99.8%, $n = 468$) of the 469 reported focal carnivore attacks. The number of reported focal carnivore attacks varied significantly according to location ($\chi^2 = 141$, $df = 2$, $P < 0.001$; Figure 41), with relatively few attacks close to the boma compared to elsewhere. However, there was no difference in the number of attacks that occurred in the bush and those that occurred within the boma ($\chi^2 = 141$, $df = 2$, $P < 0.001$). Both lions and hyaenas were much more likely to attack stock within a boma than out in the bush (lions: $\chi^2 = 18.0$, $df = 1$, $P < 0.001$; hyaenas: $\chi^2 = 26.3$, $df = 1$, $P < 0.001$), presumably because those species tend to attack at night. However, leopards were reportedly most likely to attack stock out in the bush ($\chi^2 = 10.9$, $df = 1$, $P = 0.001$), again possibly indicating a lack of differentiation with cheetah attacks. Both cheetahs ($\chi^2 = 29.5$, $df = 1$, $P < 0.001$) and wild dogs ($\chi^2 = 36.8$, $df = 1$, $P < 0.001$) were more likely to attack stock out in the bush than when enclosed within a boma.

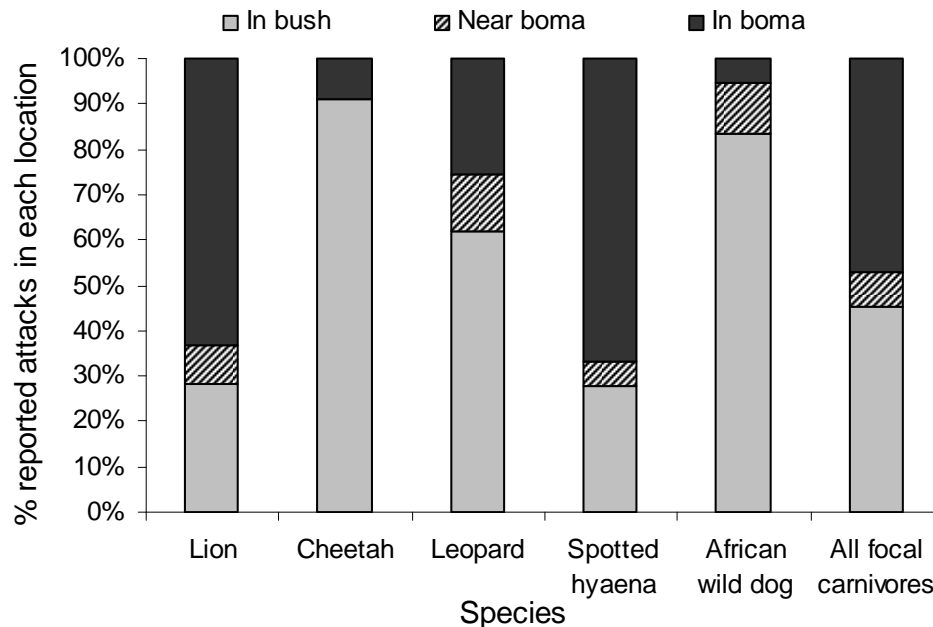


Figure 41. Reported locations of attacks by focal carnivores ($n = 468$), for each species and overall

6.4.3.4 Demography of attacking carnivores

Data on the demography of carnivores involved in each attack were reported in 79.5% ($n = 373$) of the 469 total reported attacks. The majority of these attacks (56.8%, $n = 212$) apparently involved a single predator, although no wild dog attacks were said to be conducted by a single animal. Reported leopard attacks involved a mean of 1.1 (± 0.3) predators, with the vast majority (89.1%, $n = 49$) involving only one. The remainder involved two animals, which may again be cheetah attacks due to the apparent confusion between attacks by the two species. The group size of predators reportedly conducting livestock attacks, for all focal species apart from leopards, is shown in Figure 42.

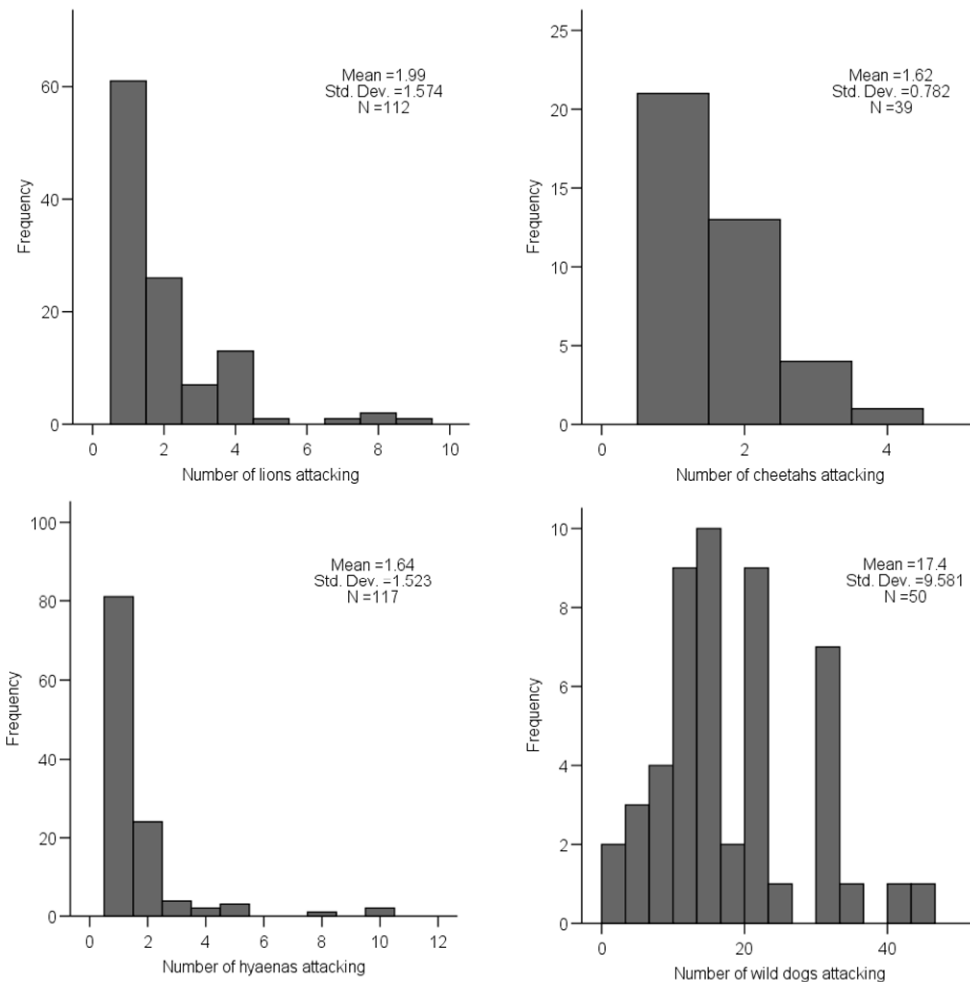


Figure 42. Reported numbers of focal carnivores involved in depredation events, for all species apart from leopards

Lions were the only focal species that could be readily identified by respondents as to sex, and people said they had noticed the sex of attacking lions in 58 cases (43.0% of all reported lion attacks). Of these, 29.3% ($n = 17$) said that the attacking lions were males, 27.6% ($n = 16$) said they were females, while 43.1% ($n = 25$) reported that they were in mixed sex groups. Information on the age of the attacking predators was available in 74.2% ($n = 348$) of reported focal carnivore attacks. In the vast majority of these cases (98.0%, $n = 341$), the carnivores attacking stock were thought to be fully-grown adults. Adults were reported as comprising 96.1% ($n = 99$) of attacking lions, 94.6% ($n = 35$) of attacking cheetahs, 98.1% ($n = 52$) of the leopards and all of the hyaenas and wild dogs.

6.4.3.5 Types and numbers of livestock attacked

Data on the livestock type attacked were available for all reported incidents. Overall, focal carnivores tended to attack smallstock more than would be expected based on their availability across study households, and seemed to avoid cattle or calves while preying upon donkeys in proportion to their availability ($\chi^2 = 50.9$, $df = 2$, $P < 0.001$; Figure 43).

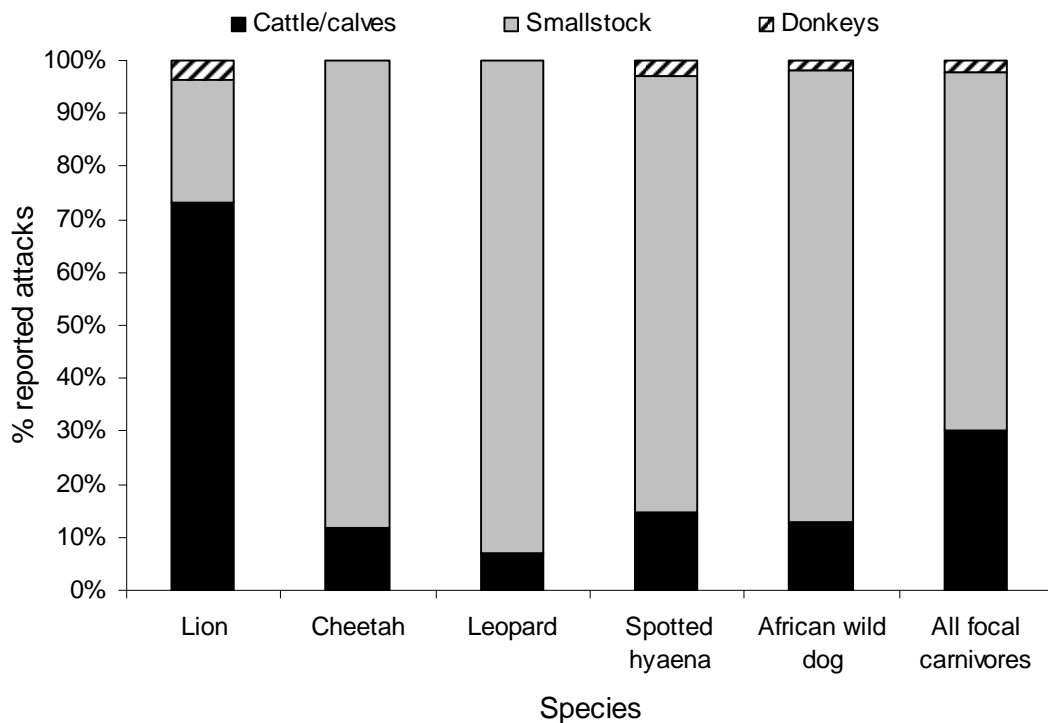


Figure 43. Percentage of reported focal carnivore attacks that involved different livestock types, for each species and overall ($n = 469$)

Again, data on the number of livestock killed or injured were available for all 469 reported focal carnivore attacks. When examined by species, reported lion attacks suggested that lions preferentially attacked cattle compared to the proportion of livestock types available, while attacking slightly more donkeys and fewer smallstock than expected ($\chi^2 = 171$, $df = 2$, $P < 0.001$). In contrast, cheetahs appeared to select for smallstock rather than cattle or donkeys ($\chi^2 = 21.8$, $df = 1$, $P < 0.001$), and the same was true for leopards ($\chi^2 = 44.3$, $df = 1$, $P < 0.001$). Hyaenas reportedly attacked smallstock more often and cattle less often than expected ($\chi^2 = 67.1$, $df = 2$, $P < 0.001$), while taking donkeys roughly in proportion to their availability, and wild dogs showed the same preferences ($\chi^2 = 25.5$, $df = 2$, $P < 0.001$).

The focal carnivore species varied significantly in terms of how many stock they killed per attack (KW $\chi^2 = 66.3$, $df = 4$, $P < 0.001$), but despite the high conflict they generate, lions actually killed fewest stock animals per attack, with wild dogs killing the most (Table 23). This suggests the reputation of lions as the most problematic predator is driven more by their selection for cattle rather than by how many stock they kill in a single attack.

Table 23. Numbers of livestock reportedly killed and injured per attack, detailed for each focal carnivore species

| Impact per attack | Lion | | Cheetah | | Leopard | | Spotted hyaena | | African wild dog | |
|--------------------------|------|------|---------|------|---------|------|----------------|------|------------------|------|
| | x | s | x | s | x | s | x | s | x | s |
| Total no. stock killed | 1.72 | 1.59 | 2.55 | 3.22 | 2.09 | 1.78 | 2.84 | 3.64 | 8.00 | 8.36 |
| No. cattle/calves killed | 1.23 | 1.50 | 0.07 | 0.26 | 0.20 | 0.93 | 0.23 | 0.82 | 0.75 | 4.14 |
| No. smallstock killed | 0.40 | 0.94 | 2.48 | 3.26 | 1.89 | 1.58 | 2.57 | 3.72 | 7.23 | 7.93 |
| No. donkeys killed | 0.08 | 0.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.22 | 0.02 | 0.14 |
| No. livestock injured | 0.37 | 0.79 | 0.26 | 0.66 | 0.24 | 1.06 | 0.45 | 1.38 | 1.13 | 5.56 |

6.4.4 Relationship between livestock husbandry and attacks

6.4.4.1 Use of dogs

Overall, dogs were reported to be present at focal carnivore attacks significantly less frequently than expected based on how often livestock was reportedly accompanied by dogs ($\chi^2 = 457$, $df = 1$, $P < 0.001$; Figure 44). This suggests that either focal carnivores are strongly selecting for livestock unaccompanied by dogs, or that dogs do not actually accompany livestock as commonly as initially reported. This trend was also observed for each focal carnivore species individually (lions: $\chi^2 = 54.3$, $df = 1$, $P < 0.001$; cheetahs: $\chi^2 = 112$, $df = 1$, $P < 0.001$; leopards: $\chi^2 = 128$, $df = 1$, $P < 0.001$; hyaenas: $\chi^2 = 70.9$, $df = 1$, $P < 0.001$; wild dogs: $\chi^2 = 191$, $df = 1$, $P < 0.001$).

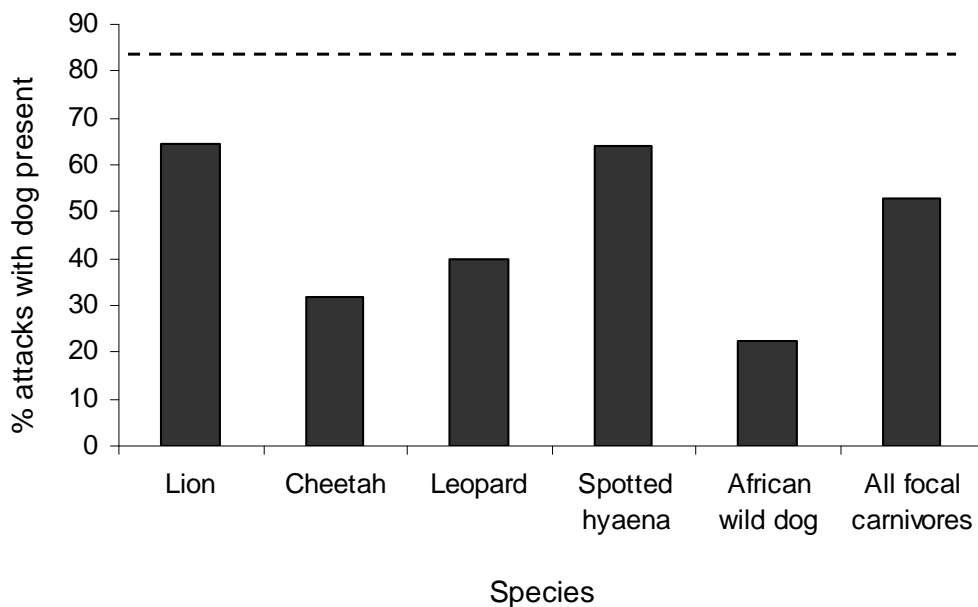


Figure 44. Percentage of attacks by focal carnivores that reportedly occurred when a dog was reported to be present, for each species and overall. The dotted line represents the percentage of livestock reportedly accompanied by dogs all the time

Not all carnivores showed equally strong tendencies to prey upon livestock unaccompanied by dogs, however ($\chi^2 = 36.0$, $df = 4$, $P < 0.001$), with wild dogs and

cheetahs taking most advantage of stock left unguarded by dogs, and lions and spotted hyaenas least deterred by the presence of a dog.

6.4.4.2 Presence and age of herders

Only 2.1% ($n = 4$) of day-time attacks by focal carnivores occurred without anyone present, suggesting that livestock were, as reported, usually herded. However, significantly more attacks occurred on livestock accompanied by children than would be expected given the reported percentage of stock herded by them ($\chi^2 = 259$, $df = 2$, $P < 0.001$; Figure 45). As with the dogs, this suggests that either carnivores are preferentially attacking those livestock herded by children rather than adults, or that stock are less commonly herded by adults than initially reported. This trend for selecting livestock herded by children rather than adults was evident for all focal species (lions: $\chi^2 = 19.2$, $df = 1$, $P < 0.001$; cheetahs: $\chi^2 = 57.7$, $df = 1$, $P < 0.001$; leopards: $\chi^2 = 67.6$, $df = 2$, $P < 0.001$; hyaenas: $\chi^2 = 338$, $df = 2$, $P < 0.001$; wild dogs: $\chi^2 = 72.7$, $df = 2$, $P < 0.001$).

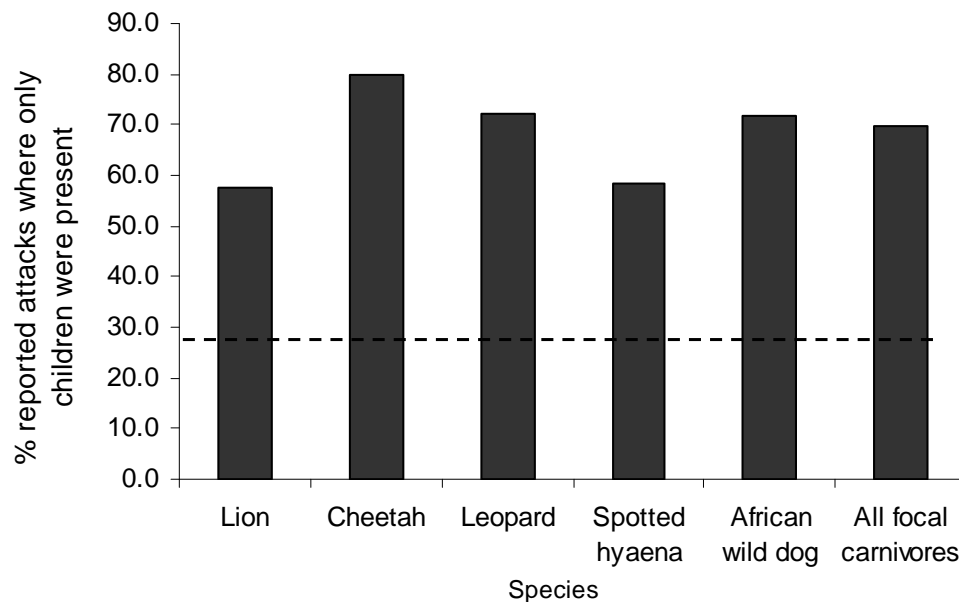


Figure 45. Percentage of reported focal carnivore attacks where only children were said to be herding livestock, for each species and overall. The dotted line indicates the reported percentage of occasions where children herd livestock

There was some indication of a species-specific response, where cheetahs were most likely to take advantage of herds attended by children rather than adults, and lions least affected by the age of the herder, but it was not quite statistically significant ($\chi^2 = 8.67$, $df = 4$, $P = 0.070$).

6.4.4.3 Use of enclosures at night

When just night-time attacks by focal carnivores were selected, it became apparent that despite the high levels of husbandry reported, with no stock theoretically left out at night, a considerable percentage of nocturnal attacks by lions, leopards, and hyaenas involved depredation on stock outside the boma (Figure 46). Nearly a quarter (24.2%, $n = 66$) of nocturnal attacks by these species involved livestock remaining in the bush at night, with leopards taking particular advantage of such stock.

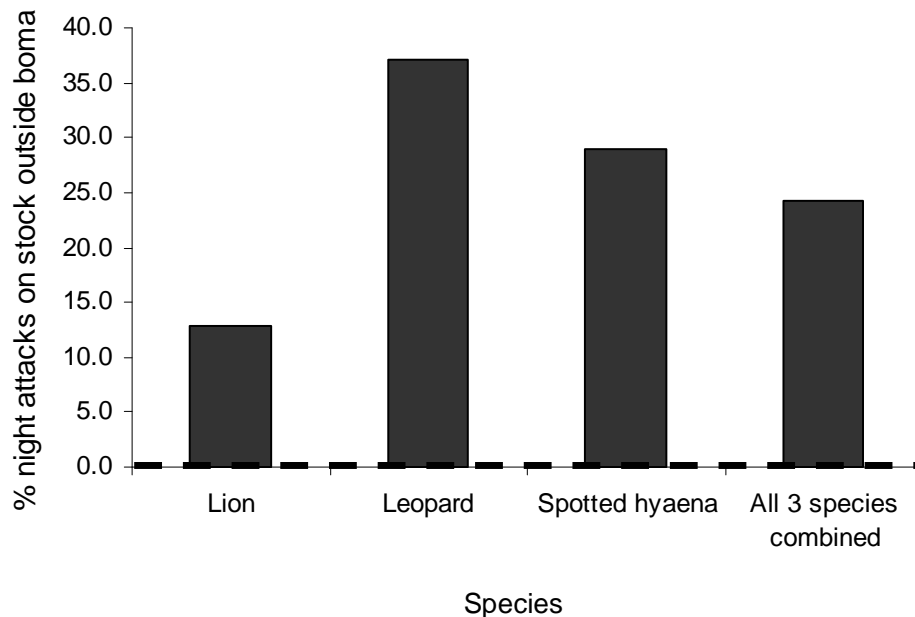


Figure 46. Percentage of reported nocturnal attacks by lions, leopards and hyaenas, and all three species combined, which involved attacking stock outside a boma. The dotted line shows the percentage of livestock reportedly not enclosed in a boma at night

6.4.5 Relationship between boma characteristics and reported attacks

Boma complexes involved between 1 and 5 individual stock bomas, with a mean of 2.0 (± 0.87) individual bomas within the complex. Nearly half of the 267 study respondents who were asked about attacks (44.6%, $n = 119$) had reportedly experienced a focal carnivore attack at their current livestock boma complex, rather than in the bush around it. Only two of these (1.7%) reported making changes to their boma complex following a predator attack, and this was supported by the long-term monitoring, where only one householder made substantial changes to his boma complex during the year. It can therefore be assumed that the characteristics of boma complexes when surveyed approximated those at the time of predator attacks.

Just over a third of the 267 households surveyed (34.1%, $n = 91$) reported suffering a depredation event by focal carnivores at their current boma complex in the past two years. Thirty-three households (12.4%) reported lion attacks at their boma complex during this time, two (0.7%) reported cheetah attacks, 12 (4.5%) reported leopard attacks, 64 (24%) reported hyaena attacks and one (0.4%) reported a wild dog attack. There was some correlation in attacks by different focal predators – a boma that had been attacked by hyaenas was more likely to also have been attacked by lions ($r_s = 0.136$, $n = 267$, $P = 0.027$) and leopards ($r_s = 0.132$, $n = 267$, $P = 0.031$).

Attacks on smallstock bomas were the most common, reported by 27% ($n = 72$) of people, while 9.7% ($n = 26$) reported attacks on their cattle boma, 1.9% ($n = 5$) on their calf boma and 0.7% ($n = 2$) on their donkey boma. There was some evidence that having one boma attacked was linked to a higher probability of another boma within the same household boma complex being attacked – this correlation was found for attacks on calf and donkey bomas, despite small sample sizes ($r_s = 0.308$, $n = 267$, $P < 0.001$) and there was a hint of a possible relationship between attacks on cattle and smallstock bomas ($r_s = 0.114$, $n = 267$, $P = 0.064$). Due to the relatively small sample size once separated by the carnivore species attacking and the particular stock type attacked, the following analyses examine which characteristics of a households' boma complex were linked to attacks by any focal carnivore species.

Eight characteristics of the study boma complexes (height, width, diameter, stem placement, number of weaknesses, number of external entrances, number of stock housed and number of internal ‘rooms’) were subjected to principal components analysis. The Kaiser-Meyer-Olkin value was 0.6, reaching the recommended level, and Bartlett’s test of sphericity reached statistical significance ($\chi^2 = 187, n = 28, P < 0.001$), revealing that factor analysis was appropriate for these data. The first component explained 24.8% of the variance in overall boma characteristics, while component 2 explained 19.1%, meaning that the first two factors explained nearly half (43.9%) of the overall variance, while component 3 explained a further 15.0% of the variance. Component 1 was influenced most heavily by the number of rooms in the boma, the number of stock enclosed and the width of boma walls, while component 2 was most influenced by the weaknesses in the boma and the height of the walls and component 3 was most influenced by stem placement (Table 24).

Table 24. Correlation between different boma characteristics and the three first principal components

| Boma characteristics | Component | | |
|---------------------------|-----------|--------|--------|
| | 1 | 2 | 3 |
| No. internal ‘rooms’ | 0.722 | -0.230 | 0.055 |
| No. stock housed | 0.639 | -0.465 | -0.239 |
| Width of boma walls | 0.557 | 0.307 | 0.491 |
| No. external entrances | 0.483 | -0.015 | 0.250 |
| Score for weaknesses | 0.317 | 0.755 | -0.049 |
| Height of boma walls | 0.453 | 0.596 | -0.333 |
| Boma diameter | 0.425 | -0.492 | 0.033 |
| Score for stems placement | -0.151 | 0.007 | 0.849 |

Extraction Method: Principal Components Analysis.

3 components extracted

Bomas that were reportedly attacked by focal carnivores differed significantly in terms of the regression factor scores derived from component 1 ($t = 4.41, df = 187, P < 0.001$), while they showed a slight difference (just at the level of statistical significance) between

factor scores derived from component 2 ($t = -1.96$, $df = 187$, $P = 0.051$). There was no difference between them in terms of the factor scores from component 3 ($t = -0.75$, $df = 187$, $P = 0.454$).

Discriminant function analysis revealed that bomas which had reportedly suffered an attack by a focal carnivore had significantly different characteristics from those which had not (Wilk's $\lambda = 0.84$; $\chi^2 = 32.6$, $df = 8$, $P < 0.001$). The single most important characteristic differentiating the two groups was the number of stock enclosed within the boma (Table 25).

Table 25. Structure matrix produced by discriminant function analysis, showing the degree of correlation between boma variables and the function differentiating between bomas that were reportedly attacked and those that were not

| Boma characteristics | Function 1 |
|--------------------------|------------|
| No. stock housed | 0.754 |
| No. external entrances | 0.529 |
| Boma diameter | 0.478 |
| No. internal 'rooms' | 0.365 |
| Score for stem placement | -0.272 |
| Width of boma walls | 0.230 |
| Score for weaknesses | 0.074 |
| Height of boma walls | 0.061 |

Bomas which were reportedly attacked held more livestock, had more external entrances, a greater diameter and more internal 'rooms' than those which were not. The characteristics of both groups of bomas are provided in Table 26.

Table 26. Characteristics of bomas that were reported to have suffered an attack by focal carnivores in the past 2 years, and those that were not

| Boma characteristics | Boma not attacked | | Boma attacked | |
|--------------------------|-------------------|-------|---------------|--------|
| | Mean | s | Mean | s |
| No. stock housed | 79.20 | 82.40 | 156.69 | 167.65 |
| No. external entrances | 1.20 | 0.47 | 1.42 | 0.52 |
| Boma diameter (m) | 14.64 | 6.48 | 18.96 | 12.86 |
| No. internal 'rooms' | 1.85 | 0.82 | 2.12 | 0.71 |
| Score for stem placement | 0.83 | 0.82 | 0.63 | 0.66 |
| Score for weaknesses | 1.25 | 0.68 | 1.30 | 0.64 |
| Width of boma walls (m) | 1.12 | 0.32 | 1.29 | 0.43 |
| Height of boma walls (m) | 1.54 | 0.60 | 1.53 | 0.41 |

Some additional boma characteristics were examined, but the sample size was not sufficient to include in the analyses above. These included the presence of an outer boma, which was actually linked to a higher likelihood of attacks ($\chi^2 = 13.1$, $df = 2$, $P < 0.001$), the boma gate material, which did not seem to be a key factor in attacks ($z = -1.62$, $P = 0.106$) and visibility through the boma wall, which did not prove significant either ($z = -1.20$, $P = 0.230$).

6.4.6 Relationship between boma habitat and reported attacks

Nine variables related to boma habitat and placement (distance to the Park boundary, percentage ground cover, percentage canopy cover, sighting visibility, the density of woody vegetation, distance to nearest dense vegetation, shrub height, tree height and tree diameter at breast height or DBH) were examined using principal components analysis. The Kaiser-Meyer-Olkin value (0.6) and the significance value of Bartlett's test of sphericity ($\chi^2 = 115$, $n = 36$, $P < 0.001$) confirmed the suitability of these data for factor analysis. The analysis resulted in three components being extracted, which together accounted for 59.6% of the variance: component 1 accounted for 26.7%, component 2 for 18.2% and component 3 for 14.7%. Component 1 was primarily driven by tree height, component 2 by ground cover, and component 3 by canopy cover (Table 27).

Table 27. Component matrix displaying the relative importance of different boma habitat characteristics to the three principal components extracted during factor analysis

| Boma habitat characteristics | Component | | |
|------------------------------|-----------|--------|--------|
| | 1 | 2 | 3 |
| Distance to Park boundary | -0.528 | 0.553 | 0.286 |
| % ground cover | -0.101 | 0.748 | 0.487 |
| % canopy cover | 0.155 | -0.247 | 0.680 |
| Sighting visibility | 0.590 | 0.332 | -0.305 |
| Woody stem density | -0.667 | 0.072 | 0.204 |
| Distance to dense vegetation | 0.362 | 0.714 | -0.213 |
| Mean shrub height | 0.460 | -0.227 | 0.433 |
| Mean tree height | 0.709 | -0.034 | 0.420 |
| Mean tree DBH | 0.670 | 0.190 | -0.014 |

Extraction Method: Principal Components Analysis.

3 components extracted.

Bomas that were reportedly attacked by focal carnivores did not differ significantly from those which were not attacked in terms of component 1 ($t = 0.12$, $df = 69$, $P = 0.906$) or component 3 ($t = -1.41$, $df = 69$, $P = 0.163$), but did differ in terms of component 2 ($t = -2.50$, $df = 69$, $P = 0.015$), suggesting that ground cover was the variable that differed most between the two groups. This was supported by a stepwise discriminant function analysis, which retained ground cover as the only variable in the final significant model (Wilk's $\lambda = 0.85$; $F = 12.3$, $df = 1$, $P = 0.001$; Table 28). Interestingly, bomas which suffered attacks actually had less ground cover (averaging $44.3 \pm 19.8\%$), whereas those without a reported attack averaged $62.3\% (\pm 20.9\%)$.

Table 28. Structure matrix produced by discriminant function analysis, showing the degree of correlation between habitat variables and the function differentiating between bomas that were reportedly attacked and those that were not

| Boma habitat characteristics | Function 1 |
|---|------------|
| % ground cover | 1.000 |
| ^a Distance to Park boundary | 0.413 |
| ^a Distance to dense vegetation | 0.286 |
| ^a Density of woody stems | 0.219 |
| ^a Mean tree height | 0.067 |
| ^a % canopy cover | 0.060 |
| ^a Mean tree DBH | 0.054 |
| ^a Sighting visibility | 0.021 |
| ^a Mean shrub height | -0.008 |

^a Variable not used in the final analysis.

However, it should be noted that of all the habitat characteristics, ground cover is probably one of the most likely to differ significantly with time, so it may not provide a good estimation of conditions as they were at the time of a focal carnivore attack. Given that this result should be treated with caution, it seems that habitat characteristics are relatively unimportant in affecting the likelihood of focal carnivore attacks here, and that other factors, such as the livestock husbandry and boma construction methods discussed above, are better guides to how stock should best be protected in order to lessen the risk of attacks on bomas by large carnivores.

6.5 Discussion

Long-term monitoring of study households allowed us to gather more information on the veracity and circumstances of reported carnivore attacks. As has been seen elsewhere (Rasmussen 1999), ground-truthing revealed that people commonly overestimate the impact of large carnivores on their livestock, and that depredation was actually responsible for a very low level of stock loss. In this case, it was clear that respondents

were indeed skilled at correctly identifying the agent behind their stock loss, but they would nevertheless exaggerate or over-report losses to focal carnivores in order to elicit external interest and input regarding their livestock losses. Such exaggeration is not uncommon, and has often been associated with a hope for financial compensation (Bulte and Rondeau 2005; Nyhus et al. 2003). Tanzania has no compensation programme for predator losses, and this has been assumed to mean that people have no reason to over-estimate depredation rates in this area (Holmern et al. 2007) but it is apparent here that researcher attention alone appeared to provide some incentive. Researchers should therefore bear in mind that seemingly innocuous inputs, such as visits to and discussions with households, can still encourage exaggeration of wildlife-related costs, particularly in marginalised communities where external positive interest has traditionally been lacking.

Repeated monitoring and ground-truthing efforts indicated that level of stock loss to focal carnivores was likely to be very low in this area, probably less than 0.3% of overall herd size. This is small compared to estimates of livestock depredation from other reserve-adjacent areas in East Africa: around Serengeti National Park, Holmern et al. (2007) reported that people lost 4.5% of their stock to predators, while around Tsavo National Park in Kenya the level was 2.6% (Patterson et al. 2004). It seems unlikely that this low level of attacks in reality actually drives the majority of the antagonism towards carnivores, and suggests that many other factors also play an important role: some of these possible factors will be assessed in the following chapter. However, livestock depredation was indeed cited as a major reason for the hostility towards carnivores in the study area, so reducing stock losses to predators still remains a worthwhile goal. The data presented here reveal that employing certain livestock husbandry strategies are likely to play an important role in achieving this aim. For instance, the majority of large carnivore attacks here occurred at night, as has been found elsewhere in East Africa (Frank 1998; Holmern et al. 2007; Ogada et al. 2003). Although high levels of livestock husbandry were reported here, with all stock reputedly enclosed in either a thornbush boma or hut at night, data on reported attacks revealed a different story, with nearly a quarter of nocturnal attacks by lions, leopards and hyaenas occurring when stock were still out in the bush after nightfall. This could be a result of poor husbandry, with herders failing to

bring stock back and enclose them at night, as has been seen in Botswana (Hemson 2003), or could be because people are using the cover of darkness to graze stock illegally within the borders of nearby protected areas. The importance of enclosing stock within good bomas has been stressed by several researchers (Mazzolli et al. 2002; Rasmussen 1999), and is likely to have a valuable impact on reducing depredation here, particularly by lions and hyaenas, if people ensure that they do secure all livestock within bomas at night. Differences in reported livestock husbandry practices were examined between people who adhered to external religions and those who did not, as it has been suggested that people who have converted to religious beliefs may reduce the quality of their livestock husbandry and abandon traditional practices, instead placing their faith in God to look after their stock (Hazzah 2006). There was no strong evidence for this here – people who adhered to external religions were less likely to keep a dog with their stock, but they were also more likely to have an adult herder, and still reportedly enclosed their stock at night, so seemed to retain traditional practices in these ways at least.

However, despite the widespread practice of enclosing livestock at night, thornbush bomas are evidently not impenetrable, with more than half all the lion and hyaena attacks taking place within them, having a particular impact on cattle losses. This may reflect the ecology of the species, as both lions and hyaenas are largely nocturnal, powerful carnivores which are able to break into bomas and kill large stock animals, something that engenders particular conflict here. However, certain boma characteristics appear to be important in reducing the likelihood of a carnivore attack – here, larger bomas which held more stock appeared more likely to be attacked, while having several external entrances was also a risk factor, as these tend to be the weakest points in the structure (Frank et al. 2006a). Bomas with more internal ‘rooms’ were also more likely to be attacked, contradicting the hypothesis of Ogada et al. (2003) that bomas with more internal walls should be stronger and therefore more resilient to attack. The height and width of boma walls had little effect on the likelihood of depredation, mirroring the findings of Ogada et al. (2003) in this respect. Both the gate material and visibility through the boma appeared unimportant here, despite other studies suggesting their

significance (Frank et al. 2006a; Rasmussen 1999), but the conclusions here for these two variables were based on relatively small sample sizes and deserve further investigation.

These aspects of boma construction appeared more important than the habitat around the boma or its location. Despite antagonism towards predators ‘coming out from the Park’, there was no evidence that distance to the Park boundary played an important role in the likelihood of depredation, which was similar to the finding by Holmern et al. (2007) around the Serengeti National Park. The only habitat variable that seemed to have any significant link with depredation risk was the amount of ground cover, with attacks apparently more likely in areas with less vegetative cover. This may be linked to the fact that certain predators need a clear ‘line of sight’ for hunting (Rasmussen 1999), but the extent of seasonal variation in ground cover means that this result should be treated with caution. However, even if a strong link was evident between the local habitat around bomas and depredation risk, people would probably be unwilling to make significant changes in site location, as boma locations are usually carefully selected in terms of what the habitat can offer both the livestock and the humans concerned (Western and Dunne 1979). For instance, deep, poorly-drained and light-coloured soils tend to be avoided because they make the area uncomfortable for people and they affect the milk production of cattle, hills with a gradient exceeding 0.08 are avoided due to the run-off of water, and long, high, hillslopes are avoided as they are arduous for cattle to climb when they are weak at the end of the dry season (Western and Dunne 1979). People do tend to avoid areas with dense vegetation due to the predation risk, but given the relatively small number of stock killed by predators, compared to the importance of human comfort, livestock health and productivity, it is unlikely that people would pay huge amounts of notice to the possible slightly increased risk of predation in areas with low vegetative cover, as seen here. However, it could be useful to feed this information back to local people, as small changes, such as not keeping the most vulnerable or important stock in the sections of the boma that have characteristics likely to predispose them to a higher risk of depredation, could help to reduce depredation further. It would be useful to extend this investigation in the future to include factors such as the distance to river beds or rocky outcrops which predators could use for cover, enabling them to get closer to bomas

undetected, the distance to other bomas, and the altitude and slope of the habitat around the boma, to see if other characteristics emerge as significant predictors of locations likely to be at high risk of focal carnivore depredation.

Regardless of the habitat surrounding their boma, the results here indicate that making adaptations to boma construction, such as having smaller, simpler bomas with fewer entrances, could play a role in lessening the chances of predator attack. However, pastoral lifestyles are notoriously labour-intensive already (Sieff 1997), and reconstructing or modifying bomas may simply be not worth the effort for many people in practice, given the very small percentage of stock that actually seem to be lost due to depredation from the bomas. Moreover, improving bomas would mainly reduce the likelihood of night-time attacks, whereas around 40% of the attacks happened in the day. This was a higher rate of diurnal attacks than has been noted in Botswana and Serengeti, where the proportion of daytime attacks were 22% and 25% respectively (Hemson 2003; Holmern et al. 2007) but less than in Cameroon, where the majority of lion attacks were diurnal (Bauer 1995). Reducing these daytime attacks will hinge upon the effective use of herding and guarding strategies: for instance, the apparent selection by predators for stock unaccompanied by dogs suggests that dogs can play an important role in reducing depredation, as has been shown elsewhere in East Africa (Ogada et al. 2003). Although these dogs are not the specific pedigree breeds of livestock guardians utilised in Europe and the United States (Sims and Dawydiak 1990), they have nevertheless usually been bred specifically to help protect livestock, and play an important role in livestock husbandry by acting as an 'early warning system' alerting people to the presence of predators. People are clearly aware of the value of these dogs, as it was the most commonly cited method of effective livestock protection, but many attacks occurred without dogs present, despite them apparently accompanying stock on over 85% of occasions. As they are not specifically bred to bond with stock, unlike specialised breeds of guarding dogs (Marker et al. 2005a), it may be worthwhile to have the herder ensure that the dog is present and close by while stock are grazing in the day. However, this would require a significant shift in terms of peoples' attitudes and practices towards dogs, which are generally left to their own devices, and this would probably be quite

difficult to implement given the long-standing characteristics of people-dog relations in rural African communities (Butler 1998). As has been noted elsewhere (Ogada et al. 2003), the presence of herders was a factor that seemed important in reducing the risk of depredation, with adults apparently acting as a particular deterrent to large carnivores. The high level of herding reported here contrasts with that reported from studies of traditional pastoralist communities in Namibia and Cameroon (Bauer 1995; Stander 1997), and ensuring that adult herders do accompany stock as often and closely as possible is likely to help reduce predator attacks even further in this area. Extra vigilance in terms of livestock husbandry will be particularly required in the wet season: most of the attacks occurred during the rains, mimicking the patterns noted elsewhere in East Africa, such as in Laikipia and Tsavo (Patterson et al. 2004; Woodroffe and Frank 2005), as well as with large carnivores elsewhere (Bhadauria and Singh 1994).

There was clearly some animosity on the part of householders that they were responsible for protecting their livestock when they were threatened by carnivores which were perceived as the Government's property – over a quarter of respondents felt that it was up to the Government to put in place better schemes to protect domestic stock. This was similar to the situation in Botswana, where people felt that the Government benefited most from wildlife presence and therefore should be responsible for investing in strategies to reduce livestock depredation (Hemson 2003), although the presence of compensation schemes in Botswana may increase the perception that the state is responsible for carnivore damage there. This perception of skewed costs and benefits of carnivore presence, where the state receives the benefits and local communities suffer the costs, is a common theme where people and predators cohabit, and is undoubtedly often justified (Maikhuri et al. 2001; Sekhar 1998; Walpole and Thouless 2005). However, the data here show that people do not need to rely on external input in order to reduce depredation: they could potentially make small changes themselves that could have valuable benefits in terms of reducing losses to predators. Strict adherence to certain facets of traditional livestock management and boma construction, such as the use of attentive adult herders, ensuring that dogs stay with livestock as frequently as possible, and minimising the number of external entrances to bomas, could be valuable in reducing

the likelihood of attack by focal carnivores. Importantly, such changes would not require significant inputs from householders in terms of material or money, which were often cited as limiting factors on their ability to improve livestock husbandry. Some people wanted external materials, such as wire, for fencing their bomas or constructing them entirely from wire, but work in Laikipia, Kenya showed that depredation was actually much worse in wire bomas than thornbush ones (Ogada et al. 2003), although some success with a small number of wire bomas has been noted elsewhere in East Africa (Kissui, pers. comm.). Overall, this study highlights the fact that new, expensive strategies are not required here, but that people can instead limit the risk of depredation by ensuring the best use of traditional, inexpensive, low-technology livestock husbandry strategies. Highlighting the value of and best-practices for these traditional methods, and encouraging their use as widely as possible, could save people from wasting their time and money on new strategies which may not be any better in terms of livestock protection. However, it should also be remembered that a complex variety of social and economic factors affect peoples' decisions regarding livestock enclosures and husbandry methods, rather than merely the threat of carnivore attack, so there is no use naively suggesting new or changed strategies that are impractical and unlikely ever to be implemented. Furthermore, if people remain resentful at the Government 'imposing' these risks related to wild animals upon them, they may be unwilling to invest in trying to reduce the problem, and may only be willing to do so if they benefit directly from local carnivore presence – otherwise, killing carnivores is still likely to be a more attractive strategy than investing time and money in changing long-standing husbandry practices. Overall, researchers working on conflict mitigation strategies should ensure that a more holistic approach is taken, working with local people and appreciating their traditions and constraints, in order to determine the most relevant and appropriate strategies for livestock protection, which could then assist in lowering depredation and conflict between humans and predators.

Chapter Seven

Local peoples' perceptions of the Pawaga-Idodi environment, including views on the presence, costs and benefits of both Ruaha National Park and wildlife



CHAPTER 7: LOCAL PEOPLES' PERCEPTIONS OF THE PAWAGA-IDODI ENVIRONMENT, INCLUDING VIEWS ON THE PRESENCE, COSTS AND BENEFITS OF BOTH RUAHA NATIONAL PARK AND WILDLIFE**7.1 Chapter summary**

The strategy of conserving biodiversity through creating 'no-go' protected areas has been strongly criticised for its potential impacts on the lives and livelihoods of local people, and protected areas can generate significant local hostility towards their presence over issues such as limited resource access and a lack of tangible returns to nearby communities. Human-wildlife conflict can often be intensified, and in some cases caused, by such underlying human-human conflict, for instance between local communities and disliked conservation authorities. In-depth discussions with villagers from the Pawaga-Idodi area revealed little evidence of marked hostility towards Ruaha National Park, although this may have been biased by the perception that the interviewers were linked to the Park authorities. However, there was greater dislike of MBOMIPA, who had been implicated in the death of a villager, and were the focus of disputes over boundary locations and access to grazing areas. Few people reported receiving any direct benefits from local tourist revenue, and people rarely linked the presence of wild animals, especially focal carnivores, to any benefits emerging from the Park. Carnivores in particular were seen to have little current value, and any benefits were predominantly linked to consumptive use. There was evidence of considerable conflict between different ethnic groups in the study area, and particularly between people engaging in agriculture and those still depending upon pastoralism. This inter-ethnic conflict was implicated directly in human-carnivore conflict, and continued pressures on pastoralists from immigration and increased agriculture are likely to diminish their tolerance for other forms of livestock loss, such as depredation. Effectively resolving all levels of the human-wildlife conflict observed here will depend not only upon improving the cost-benefit ratio of wild animal presence, but also by reducing tensions over land use and resource access between the disparate human groups in the Ruaha area.

7.2 Introduction

Attacks upon livestock were cited as the primary determinant of human-carnivore conflict in a worldwide review (Sillero-Zubiri and Laurenson 2001), and many conflict mitigation studies focus their attention solely or largely upon this factor (Landa et al. 1999; Mwebi 2007; Ogada et al. 2003). However, attitudes towards wildlife tend to be complex and multi-faceted, and are influenced by a broad range of social, cultural, political and economic factors as well as any personal experiences with wild animals (Graham et al. 2005; Knight 2000b; Sillero-Zubiri and Laurenson 2001). Interactions with and attitudes towards nearby protected areas can have significant impacts on how people view their local environment and the wildlife within it, especially if the needs of wild animals are perceived as being prioritised over those of local communities. Wildlife conservation, particularly within protected areas in developing countries, has been seen as a form of authoritarianism, termed ‘anti-humanism’, and has been attacked as being ‘premised on an antipathy towards human beings’ that leads to oppression and local conflict (Guha 1997). The ‘fortress conservation’ approach of protected areas has been strongly criticised for the effects it can have on local people, with people evicted, marginalised and even, such as with poachers in Kenya, killed in order to protect wildlife resources (Brockington 2002a; Brockington and Igoe 2006; Peluso 1993). The effects of such actions can persist long after protected areas are gazetted, with people finding that they have been disenfranchised, excluded from access to their traditional resources, left without alternative livelihood strategies and impoverished (Fairhead and Leach 1994; Geisler and Sousa 2001; Schmidt-Soltau 2003).

Ironically, the resultant conflict around the establishment of protected areas, or even perceived movement towards such establishment, can also have significant negative impacts on the very resources that they are intended to conserve. When the Maasai were evicted from Amboseli in Kenya in the 1970s, they vented their anger by spearing rhinos in the area (Kideghesho 2006; Western 1984). In Uganda, villagers reacted to plans to recreate Mbuoro National Park by killing as much of the local wildlife as possible (Hulme and Infield 2001), while in Norway a landowner responded to news that a forest he owned was due to be protected by cutting all the trees down (Svarstad 2004 cited in

Brockington and Igoe 2006). In the Mount Nimba nature reserve in eastern Guinea, villagers set fire to vegetation along chimpanzee habitat corridors, as they were resentful that wildlife was being prioritised above the needs of local people, with land and money dedicated to chimpanzees rather than humans (VOA 2003). In Tanzania, villagers were reported to have engaged in the systematic destruction of chimpanzees in their local forest after a visit by a Park official was mistakenly interpreted as signalling that the forest was to be protected (Murray 1992 cited in Walsh 1997).

Antagonism can also be directed towards specific authorities, rather than towards an entire area, although the resulting impacts are often similar. During 2007, seven endangered mountain gorillas (*Gorilla gorilla beringei*) were killed in the Virunga National Park in the Democratic Republic of Congo over a seven-month period, sparking international outrage and even a UN investigation (CNN 2007). It emerged later that the killings were apparently committed by charcoal traders who were angry at Park authorities for working to limit the exploitation of local timber resources for the trade (The Telegraph 2007). In Upper Guinea, the Toma people notoriously resisted French colonisation for ten years, and when the French finally occupied their local area they established forest reserves, which were viewed with particular hostility not only due to issues of resource exclusion, but also because of their association with their old enemies (Fairhead and Leach 1994). Evictions can result in significant anger and violence towards the authorities concerned: when efforts were made to evict local communities from the Virunga National Park in the Democratic Republic of Congo, the subsequent violence claimed the lives of 36 Park wardens (Machlis 1989). Such angry protests continue to the present day: in May 2005, around 150 people who were living illegally within the Parque Nacional Laguna del Tigre in Guatemala, drove into a Park camp established by WCS (Wildlife Conservation Society), armed with automatic weapons and machetes, and took hostages, saying that they would only release them once the state governor clarified their resource rights within the Park and prioritised their development needs over conservation aims (Redford et al. 2006).

Conflicts over wildlife can also be intensified if people feel that other groups' values or views are given precedence over their own – for instance, communities in North America

were deeply hostile towards grizzly bears, reflecting their anger at distant environmental groups, which were perceived as being elitist and arrogant (Primm 1996; Sillero-Zubiri and Laurenson 2001). In December 1995, Saami reindeer herders caused shock in Sweden when they dumped the corpses of reindeer (*Rangifer tarandus*) that had been killed by wolves in a Stockholm square: a protest that was driven by anger at the Government's legal protection of wolves, and reflected the dichotomy in how predators were viewed by urban Swedes and rural reindeer herders, who felt that their problems with carnivores were not understood or even acknowledged (Lindquist 2000). In 1990, Ovambo people who had previously been banned by the authorities from hunting within Namibia's Etosha National Park celebrated the country's independence, and their freedom from colonial authorities, by breaking down the Park's game fences and entering it with guns to kill the Park animals for meat (IIED 1994).

However, things are not always quite so bleak at the people-Park or people-wildlife interface. Some communities feel that nearby protected areas have enhanced their lives and livelihood options, with people apparently positive towards such reserves and their resultant economic benefits (Infield 1988; Walpole and Goodwin 2001). For instance, a tourism revenue-sharing programme around three Parks in western Uganda resulted in over US\$80 000 being invested in local schools, clinics and infrastructure, and a study revealed that nearly three-quarters of local people felt that this scheme had improved their attitudes towards the protected areas, with over half saying the revenue was greater than that from alternative non-timber forest products (Archabald and Naughton-Treves 2001). However, from a conservation standpoint, it would be ideal to see a link between local support for reserves and local support for the associated wildlife populations, and this is often lacking – people may appear positive towards tourism initiatives yet still want lethal control or consumptive use of the wildlife concerned (Walpole and Goodwin 2001). An example of this comes from Nepal, where people living in the Makalu-Barun National Park and Conservation Area strongly supported future tourism development in the area, but viewed protecting wildlife as a low priority, and pressed for more lethal control of wild animals (Mehta and Kellert 1998). The 'holy grail' for truly integrating conservation and development around protected areas is a situation where local people

receive tangible, valuable and equitably distributed benefits from reserves that outweigh the costs, and where no group ends up shouldering the majority of the costs without suitable commensurate benefits. This situation would ideally elicit local support both for protected areas and for their attendant wildlife populations, but this appears to be an elusive scenario at present.

The aim of this chapter is to investigate local peoples' views towards the Pawaga-Idodi environment, including the nearby Ruaha National Park and its authorities, and to examine if and how those views affect peoples' attitudes towards wildlife. Understanding the dynamics of the local area, including the influence of the Park and other protected areas, will help to determine whether or not the hostility seen towards wildlife here, particularly carnivores, is indeed driven simply by the actions of the animals themselves, or by more deep-seated attitudes towards protected areas, the people associated with wildlife conservation, or other local conflicts. The specific aims of the chapter are to:

- (i) Investigate the origins of people living in the study area, examine why they decided to settle in the Pawaga-Idodi area, how they feel the area has changed since they arrived, and how they view the area now;
- (ii) Learn about peoples' attitudes towards Ruaha National Park, particularly looking at the perceived costs and benefits of its presence, both at an individual and community level;
- (iii) Assess peoples' views towards the Park authorities and other wildlife-related local authorities;
- (iv) Examine people's attitudes towards wild animals in the Pawaga-Idodi area, and the perceived value, costs and benefits of wild animal presence, with a particular focus on the five focal carnivore species;
- (v) Relate these views and attitudes to the human-wildlife conflict observed in the study area, in order to identify possible avenues for conflict mitigation

7.3 Methods

The data for this chapter were collected during in-depth discussions with pastoralists and agro-pastoralists living in villages in Idodi and Pawaga. Thirty respondents were randomly selected from the ‘population’ of respondents used for the main survey described in chapter 4, and the PI, accompanied by two Tanzanian assistants (a translator and a socio-economist) visited each respondent at their household. The discussions took place after the PI and the study had been in the area for three years, so both were well-known and good relationships had been established with the local communities. This probably influenced the fact that all of the selected respondents were willing to talk, and they appeared willing to discuss even potentially sensitive subjects, such as their attitudes towards the authorities from the Park and MBOMIPA. As a caveat, it should be remembered the survey personnel were linked to WCS, who in turn have links with local and national conservation authorities, including the Park authorities, so it is possible that people were reticent about truthfully discussing some of these issues. However, these in-depth interviews were only conducted once long-term relationships had been established within the communities, and people often willingly shared information on other contentious topics such as poaching, snaring and spearing of wildlife, so it seemed as if they were relatively confident about discussing such issues without fear of negative consequences.

Following guidelines set out by Tuckman (1972), the discussions began by informing the participant of the general aims and purposes of the interview, and checking that they were comfortable with the data recording techniques. The names of the participants were not retained during data collection, with identification numbers assigned instead so that they could be confident that other people would not know who had said what. The discussions did not have a rigid structure, but were informal or unstructured interviews, as defined by Hitchcock and Hughes (1989). However, following Wenden (1982), a checklist was formulated and kept at hand to try to ensure that all relevant topics of interest for examining attitudes towards the Park and local wildlife populations were covered. These included:

- The background of the participant, in terms of whether or not they were born here, and if not, where they had come from, their reasons for settling in the Pawaga-Idodi area, and how long they had been settled here for. Respondents' ethnicities were already known from previous work at all the studied households, but this was checked again
- Any perceived changes in the local environment since they had arrived here, and their current attitudes towards the area
- Their knowledge of and attitudes towards Ruaha National Park, what they perceived its costs and benefits to be, how they viewed the Park authorities and other wildlife-related authorities, their personal experiences with the Park, how they thought the Park had affected their lives overall, and what they would like to see happen to the Park in the future
- Their attitudes towards wild animals in the Pawaga-Idodi area, the costs and benefits of wild animal presence, and how they thought the next generation might view wild animals
- The perceived value of having the five focal carnivore species (lion, leopard, cheetah, African wild dog and spotted hyaena) around the local area, and costs of their presence. Before discussions about the focal carnivores, a photo-sheet was used to check that participants knew exactly which species were being discussed.

Although a large number of topics were discussed, the method suggested by Patton (1987) was employed, where participants were only asked a single question at a time, to reduce the chance of confusion and misinterpretation. Discussions were translated as they were conducted, so that any confusing answers could be resolved and any novel or particularly interesting aspects followed up on, but they were also recorded onto a handheld MP3 player so that the translations could be double-checked later. Discussions generally took between one and two hours to complete. Chi-squared tests were used to compare proportions of people with different views; these analyses were conducted in SPSS version 14.0 (SPSS Inc., Chicago).

7.4 Results

7.4.1 Participant characteristics

7.4.1.1 Ethnicity, demography and location

Fifteen of the 30 participants were from traditionally pastoralist groups (12 Maasai and 3 Barabaig) while fifteen were from other ethnic groups (10 Bena, 4 Hehe and 1 Sukuma). As in the main surveys, the majority of participants (86.7%, $n = 26$) were male, while 4 (13.3%) were female. Ages ranged from 18 to 80, with a mean age of 41.4 (± 17.6) years old. Surveys were conducted in seven villages, namely Malinzanga ($n = 14$ participants), Idodi ($n = 5$), Tungamalenga ($n = 4$), Luganga ($n = 3$), Mafuluto ($n = 2$), Nyamahana ($n = 1$) and Itunundu ($n = 1$). The distance from participants' households to the Park boundary ranged from 10.6km to 30.1km, with a mean of 20.1 (± 5.6) km.

7.4.1.2 Origins and length of time in the Pawaga-Idodi area

A high level of immigration into the study area was evident, with only 33% of participants born in the Pawaga-Idodi area. Half of the Maasai participants immigrated here rather than being born here, while 67% of the Barabaig, 75% of the Hehe and 80% of the Bena participants were immigrants into this area. Only one Sukuma person was interviewed, who had also immigrated into the study area. Njombe was the most common location that people had moved from, with 40% ($n = 8$) of newcomers arriving from there. This movement from Njombe to Pawaga-Idodi was particularly common for Bena people – of the eight Bena immigrants, seven came into the area from Njombe. Twenty percent of immigrants came from Arusha ($n = 4$; 2 Maasai and 2 Barabaig), 10% came from Dodoma ($n = 2$; both Maasai) and 10% came from Iringa town ($n = 2$; 1 Hehe and 1 Bena). Length of time in the area varied considerably between incomers, with people first arriving in the study area between one and 55 years ago, with a mean of 33.0 (± 13.0) years since they first arrived. Not all these people arrived and stayed – 40% of immigrants ($n = 8$) moved to and from the study area seasonally before finally settling here, with people finally settling here an average of 30.1 (± 11.5) years ago.

The majority of participants (80%, $n = 24$) said that Ruaha National Park was already in existence by the time they settled here, although in two cases this was not actually true, and had not been formally designated as a National Park. The people who arrived prior to Park formation knew the area as '*Shamba la bibi*' (literal translation: 'the field of the lady'), an area that was known for its forests and which was still afforded protection as a Game Reserve even before the Park was gazetted. The National Park designation did change peoples' lives, with most people citing the prohibition of grazing and habitation within the Park. As one person who came to the area in 1940 explained:

“When I first came here the area that is now Ruaha National Park was known as '*shamba la bibi*', but it then eventually became a Park. The establishment of the National Park affected our lives, as originally we were able to graze in that area, but once it was a Park we were not able to graze there. It was also hard as we used to go there to the Ruaha river for water, but we are not able to do that now with the new protected areas, so we need to find new water sources.”

- Respondent 1, Maasai man

However, grazing and habitation was legally prohibited within the Game Reserve long before the National Park was gazetted, so these changes may be the result of increased enforcement of regulations following the Park establishment, rather than actual legal changes. People were clearly familiar with what 'Ruaha National Park' meant, with 80% ($n = 24$) referring to it as the area where wild animals were protected, with many also explaining its location. As one person explained, 'It is the area where wild animals remain as a deposit for future generations, like a grain storage'. People also mentioned the fact that the forests were conserved there, while three people described it as the area that they were not allowed to graze in. Two people (both Maasai men) referred to the economic benefits of National Parks when describing Ruaha, with one saying 'National Parks like Ruaha are emblems for our country, and the country can earn money from them'. However, discussions about the National Park frequently strayed to topics about MBOMIPA, the WMA or other forms of protected areas, so although people were clear about the distinctions between these things, attitudes towards them often appeared related to one another. No-one said that the Park had any cultural associations for them: as one of the Maasai participants explained:

“The Park is not important for our culture – we have no cultural areas in the area that is now the Park, as most of the Maasai originally come from far away. Our traditional ceremonies take place around the boma, so the Park is not an influence on that.”

- Respondent 1, Maasai man

7.4.1.3 Reasons for settling in the Pawaga-Idodi area

Cultivation was the main reason that people chose to move to this area, with over half of the incomers (56%, $n = 14$) saying that they had heard the soil was good for crops, and the rainfall was good for agriculture (Figure 47). The search for better grazing land drove the decision of 28% ($n = 7$) of the immigrants, while others were attracted by local facilities, predominantly access to the main road running from Iringa towards Ruaha National Park, and a small number followed relatives or were moved into villages here during the national process of *ujamaa* villagisation.

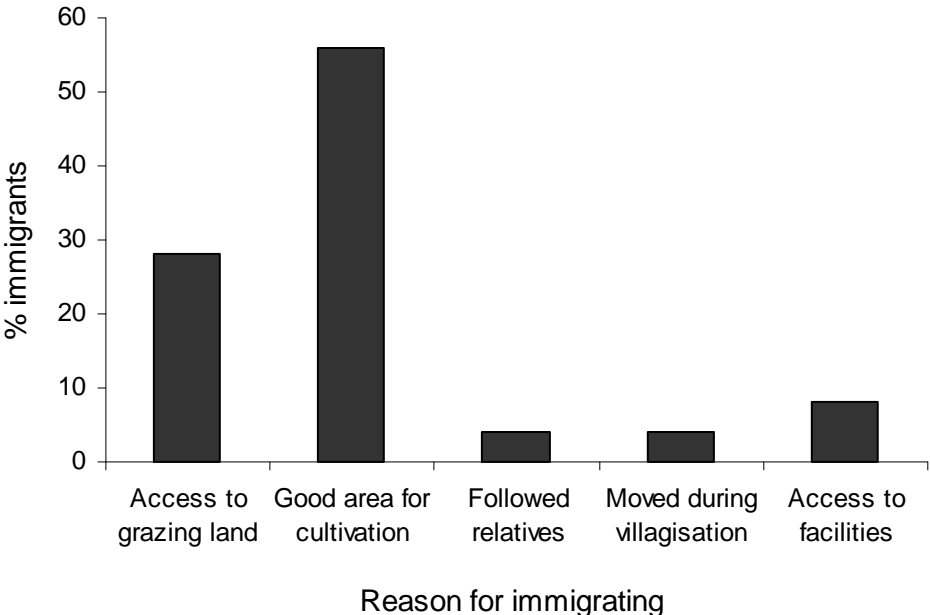


Figure 47. Reasons given by people who were not born in the Pawaga-Idodi area for coming to settle here

7.4.2 Participants' views towards the Pawaga-Idodi area

7.4.2.1 Perceived changes in the Pawaga-Idodi area since first settling here

The majority of participants (77%, $n = 23$), said that they had noticed changes to the local environment since they had first settled here. The change most commonly mentioned, by over half of those (52%, $n = 12$), was a decrease in the area of land available to graze livestock on, with the Maasai being the main group complaining about this. Several reasons were given for this perceived change, with blame partially attributed to increasing populations of humans and livestock, particularly as newcomers moved into the area. As one participant said:

“The grazing area here used to be good, but now it is not enough for all the new people coming here, like the Barabaig, so the grazing areas are now very limited”

- Respondent 91, Hehe man

It was notable that, as seen in the quote above, most people were not simply concerned with increasing populations, but were worried about the influx of people from certain other ethnic groups into the area (particularly the Barabaig and the Sukuma), with an assumption that the arrival of these other people would have particularly negative consequences. As stated by one Maasai man:

“There has been an increase in the number of people here, and the number of cattle, so now there is not as much land to live on or as much grazing land. If more people from other ethnic groups are allowed to come here in the future, then it will be very bad, as these other cultures bring more problems, especially the Barabaig and Sukuma, who are thieves. More Sukuma have been moving this way...and now more of them are coming from Usangu and Ihefu to here, so this is a big problem.”

- Respondent 1, Maasai man

Some people felt that this problem of more people arriving with lots of livestock was compounded by corruption of village officials, who could be bribed to allow people to graze too many livestock in a given area. The subdivision of land into different land use types was also mentioned by several people as intensifying the pressure on grazing areas: as explained by one participant, who had been in the area since the 1960s:

“In the past, you could go anywhere to graze your cattle, but now there are many boundaries everywhere. There are places where cattle are not allowed because they are now areas for farming, and there are other areas, like the Park and protected areas, that you are not even allowed to cross into”

- Respondent 244, Maasai man

People had also noted substantial environmental changes, with 43% ($n = 10$) of those who mentioned changes saying that there was now a problem with local rivers drying up. This was usually attributed to the impact of farms using up the river-water for their irrigation, which made people angry as less water remained for other people to use, and intensified the conflict between different ethnic groups, and particularly between farmers and pastoralists. As one participant said:

“A big change is that the rivers can sometimes now be dry, while before they flowed all the time. I think this is because now people have farms all around the river, especially the Hehe, and their irrigation is now causing changes to the rivers. In the future, I think there will be more problems fighting for water, and even more arguments between farmers and pastoralists.”

- Respondent 61, Maasai man

These issues over water were intensified by changes in land use, with the pastoralists in particular complaining that they could no longer access traditional water sources as the routes to rivers had been converted into farmlands or protected areas that they could not cross. There was resentment as people perceived that the areas with good water sources and good soil had been set aside for cultivation, while the pastoralists were ‘made to graze in areas that do not have enough water, and have tsetse flies and predators’. The conflict was not one-sided, however, with some of the farmers blaming pastoralists for degradation of the local environment. As one Bena participant said:

“Pastoralists who are nomads come here with their cattle and clear the area, and then move on, so they make lots of deforestation. In the future, I think the land will become a desert if too many pastoralists come here with their cattle.”

- Respondent 154, Bena woman

Other local changes noted were the decrease in large trees as people used them for charcoal, decreasing populations of elephants and large predators, lower rainfall and increased soil erosion. Various explanations were given for these changes, but the conflicts between different ethnic groups, and specifically the conflicts between farmers and pastoralists, were common themes throughout these discussions.

7.4.2.2 Current attitudes towards the Pawaga-Idodi area

All the participants claimed that, despite some of the problems mentioned above, they liked living in this area overall. When discussing what they liked in particular, the fact that the local weather conditions and soil fertility were good for growing crops was the most commonly perceived positive aspect, mentioned by over half the participants, with the good grazing land the next most commonly mentioned feature (Figure 48). People also said that the area had relatively low levels of both human and livestock diseases, that they appreciated being situated close to schools and the main road (which facilitated access to medical help), and that the irrigation schemes were useful to them. Only one person, a Maasai man who lived in Malinzanga, relatively close to both the Park and the main road, mentioned revenue from tourism as an advantage to living in the Pawaga-Idodi area, as sometimes visitors would stop at his boma and buy crafts from his wives.

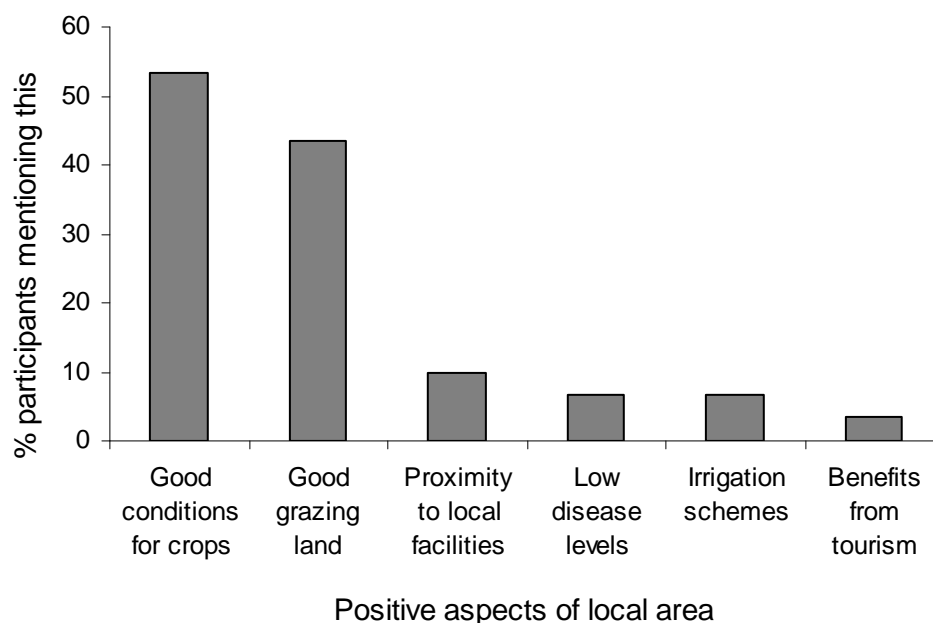


Figure 48. Reasons mentioned by participants for liking living in the Pawaga-Idodi area. People could mention more than one reason, so the total exceeds 100%

Although everyone said that they liked the area more than they disliked it, the majority (67%, $n = 20$) could think of negative aspects of the local area. Of these, 11 people complained about the presence of wild animals, with nine expressly saying they disliked having predators around, and lions, hyaenas and wild dogs all mentioned specifically (Figure 49). A lack of water was also mentioned, with people saying that rainfall levels could be low and erratic and that the local rivers now sometimes run dry: one person explained that he thought the drying rivers were due to local irrigation schemes for farms. Another problem was the influx of more immigrants into the area, particularly those with high numbers of cattle, like the Barabaig, which, combined with the allocation of land to the WMA, had reportedly resulted in people being sandwiched into a diminished area of land which was no longer sufficient for their grazing needs. There was clearly some hostility amongst the Maasai in particular towards their exclusion from land within the WMA, with two of them saying that this had caused them significant problems, both in terms of limiting grazing areas and reducing access to rivers. One explained that the situation, in terms of access to resources, was now so bad that they had to keep just a small number of cattle with them for milk, while their other cattle were kept up in the mountains where there was more forage available. This was also one of the determinants

of the farmer-pastoralist conflict seen in the study area: the enforced close proximity of pastoralists and farmers meant that it was hard for the pastoralists to prevent their cattle straying onto land demarcated for farms, and they were then forced to pay fines to farmers. This resulted in considerable hostility, particularly amongst the Maasai, with one of the Maasai men saying that the farmers were now ‘playing tricks’ to get the pastoralists into trouble. He said that this was even worse than the problem of depredation, explaining it as follows:

“It is better for a cow to be eaten by a lion than having to pay a fine when you pass through areas where there are problems between us and the farmers. You sometimes have to pay up to three cattle in fines if there is a problem – when a cow is killed by a predator then you can sometimes still eat meat from it, but here we lose all of the animal because of the fine, so it is worse.”

- Respondent 119, Maasai man

The only other problems mentioned were the occurrence of disease and the existence of village by-laws, which some people found confusing and said resulted in them being fined because they were not educated about these things.

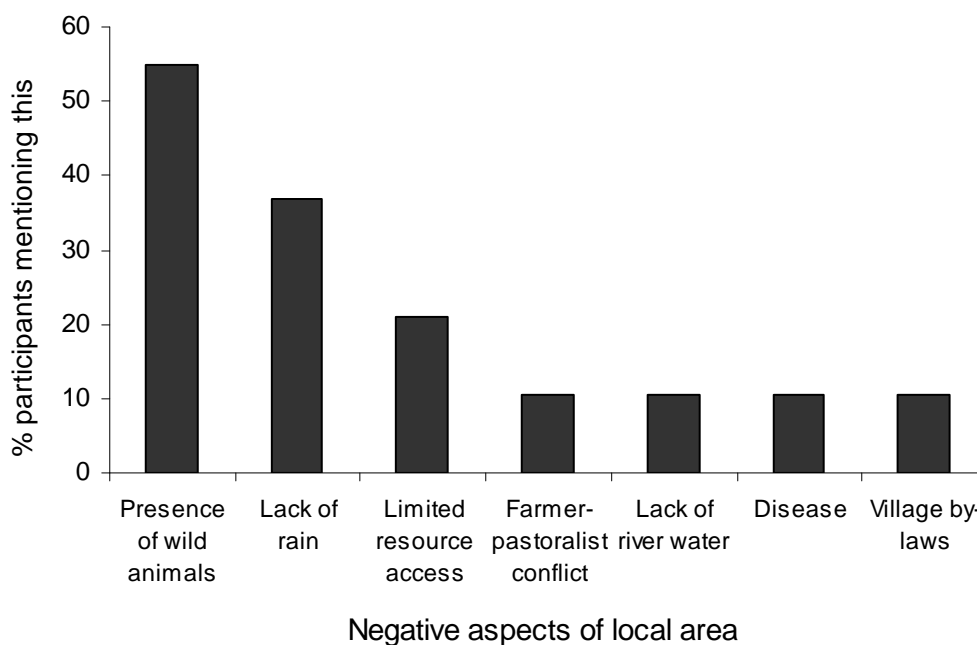


Figure 49. Reasons mentioned by participants for disliking living in the Pawaga-Idodi area. People could mention more than one reason so the total exceeds 100%

7.4.3 Participants' views towards Ruaha National Park

Just under a quarter of people (23%, $n = 7$) said that they did not have any particular opinions about the National Park, as it was a Government area that was 'just for the bush and animals', so it was not felt to be particularly relevant to their daily lives. Of the people who did voice opinions about it, just over half (52%, $n = 12$) said they liked the Park, two (9%) disliked it, and 39% ($n = 9$) had ambivalent views towards it.

7.4.3.1 Positive aspects of Ruaha National Park

Seven people (30% of those with opinions about the Park) said the Park authorities provided assistance to local people, particularly by helping them build schools and classrooms in the villages (Figure 50), although pastoralists complained that these did not benefit their children as much as other groups, as they were less likely to attend school. Other forms of assistance included the provision of temporary jobs, and the constructions of water bores and drinking troughs on village land. Despite the fact that the presence of wild animals was cited above as being negative, opinions on this were clearly mixed: seven people said that they liked the fact that the Park conserved these animals so that they could see them around, as they liked to see other animals around aside from domestic stock. As one man said, 'I think the Park is good as it protects wild animals...I don't think the wild animals would be here without the Park being here', while another complained that he had never even seen any of the big animals like giraffes and elephants, and would like to be able to see them himself. People also wanted their children to benefit from the Park, both in terms of being able to see and know about wild animals, protecting natural resources and gaining future revenue from tourism. Several people cited tourist revenue as a current benefit of the Park, whether at a local or national level, while one person said that the Park was beautiful and another said that he liked being able to get liver from wild animals from the Park, as he no longer had teeth and was able to eat that meat easily.

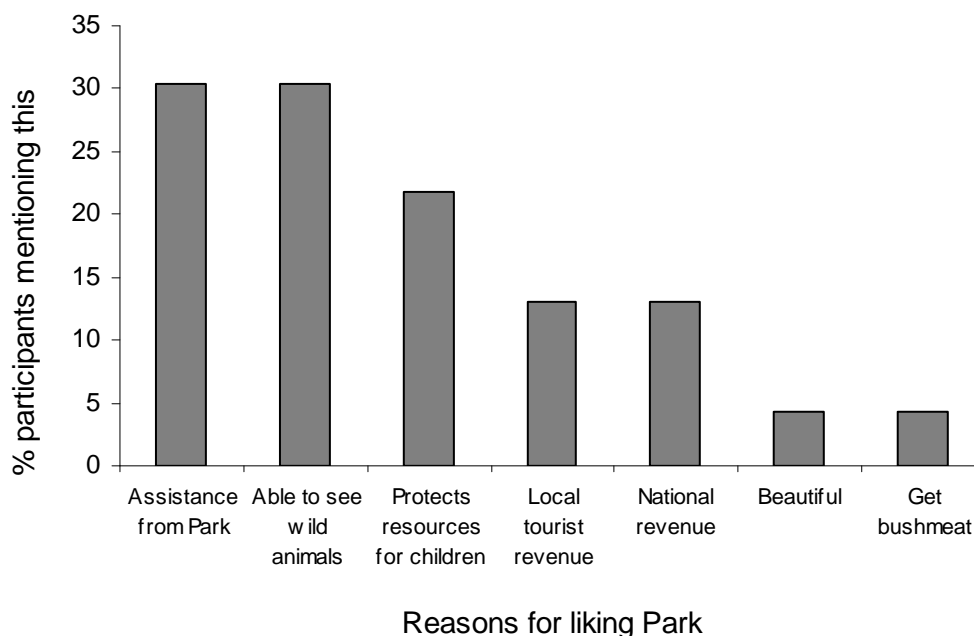


Figure 50. Reasons given by participants for liking Ruaha National Park. People could mention more than one reason, so the total exceeds 100%

7.4.3.2 Negative aspects of Ruaha National Park

Ten people (33% of all participants and 43% of those with opinions about the Park) cited problems with the National Park. Despite the positive attitude mentioned above towards seeing wild animals around, it was clear that only certain wild animals were welcomed, as the occurrence of ‘problem animals’ like predators and elephants around the Park was the most common negative factor associated with it, mentioned by half the people describing problems (Figure 51). The limitations on resource access imposed by the Park, particularly in terms of grazing land and access to water, were mentioned by several people, although one person defended this strategy, saying:

“People complain about not being able to graze in the Park, but if everyone was allowed to go everywhere then I think that everything could be destroyed.”

- Respondent 253, Sukuma man

The recent extension of the Park was also mentioned as a negative factor due to its impacts on evicted pastoralists, while people also disliked the segmentation of the area

into different land-use types, particularly as the boundaries were not clear to everyone. As one person explained:

“The park can also make people poor as well as bringing money into an area – during the extension of the Park towards Usangu, many people lost lots of cattle and money. I also don’t like all these boundaries around the Park – there are meant to be different zones, for instance for grazing cattle, but sometimes the officials catch you and say you are in the wrong place or in a protected area even before you cross the boundary.”

- Respondent 164, Maasai man

Hostile interactions with Park rangers were mentioned by two of the Maasai respondents: in both cases, the pastoralists had been chased away from areas close to the Park boundary while grazing their stock, although they both considered that they were still within designated grazing areas.

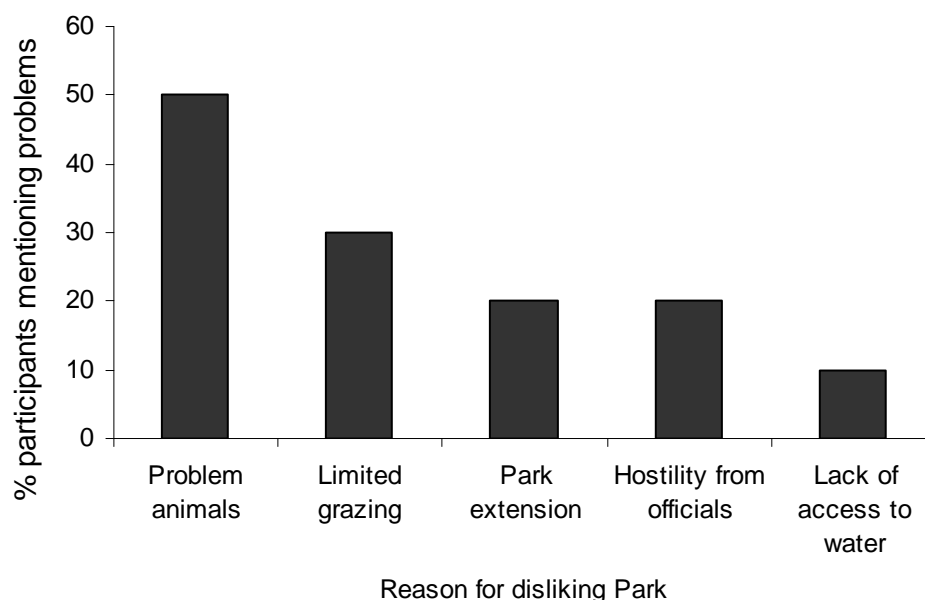


Figure 51. Reasons given by participants for disliking Ruaha National Park. People could mention more than one reason so the total exceeds 100%

7.4.3.3 Views towards Park authorities and other wildlife-related authorities

Twenty-two participants (73%) voiced opinions on the National Park authorities or MBOMIPA during discussions. People seemed generally happy with the Park authorities,

with one Sukuma participant saying ‘These authorities are good people as they are taking care of our things – it is like having people taking care of the things at your home’ and 73% of respondents ($n = 16$) saying that the Park rangers were doing a good job. The major fault found with the Park authorities, particularly by the Maasai, was that they did not involve local people enough in conserving wild animals. The situation of mixed land-use in the NCA was held up as by the Maasai as an example of how wildlife authorities could and should involve local people, as they said they were ‘good people, who like wild animals, and are not hunters’, so thought that this model should be used for Ruaha too.

The level of satisfaction was lower for MBOMIPA, as only 59% of respondents ($n = 13$) thought that the MBOMIPA scouts were doing a good job, but this difference in satisfaction compared to the Park authorities was not statistically significant ($\chi^2 = 2.16$, $df = 1$, $P = 0.142$). Although a couple of people did mention problems with Park rangers chasing them away from close to the Park borders, this was a much more common complaint about MBOMIPA scouts, who were said to be unclear about the boundaries of grazing areas within the WMA, and chased people away, or even caught them and fined them, when participants said they were certain they were within the allocated grazing areas. Although there was said to be confusion on both sides, such actions were often interpreted as direct hostility towards the pastoralists, although the situation was said to have improved recently, probably due to outside organisations bringing in new technology, such as GPS units and Geographic Information System (GIS) software, which allowed the accurate mapping of land use boundaries. As one man explained:

“The Park rangers are not usually bad, but the MBOMIPA scouts sometimes lie that you are entering a boundary even if you are not, so they can be bad people. If you cross the boundary then you get a fine, so that is difficult. Now that the *wazungu* [white people] have come here, more people know where the boundaries are so it is easier, but before that lots of people were unsure of the boundaries and people would get fined.”

- Respondent 90, Barabaig man

One major complaint lodged against MBOMIPA was that in December 2007, the scouts had killed a man in one of the villages in Idodi Division – they had apparently thought

that he was a poacher and had beaten him to death, although the other villagers were convinced that the victim was not in fact a poacher. Understandably, there was considerable anger directed towards MBOMIPA regarding this situation.

7.4.3.4 Interactions with and economic benefits from the Park

Over half the participants (57%, $n = 17$) had experienced personal interactions with the Park, whether positive, such as having been employed there or having visited the Park, or negative, such as having been chased away from the Park borders. Thirteen people (43%) had visited the Park, either through church seminars, visits organised by the local schools, going into the Park to sell meat to workers or visit relatives working there, while two others had not visited themselves but their children had, on school trips. Five people had been employed directly by the Park, three had relatives working for the Park, and an additional five had been employed in other wildlife-related activities, such as working for WCS or as Village Game Scouts. As described above, two of the Maasai respondents had been chased away from the Park boundaries by officials while grazing, but these were the only people to report direct negative interactions with the Park.

Interestingly, despite the stated happiness with the Park of the respondents as described in section 7.4.3.3, when the conflict scores of all the initial survey respondents were examined, it became evident that any direct contact with the National Park or its personnel was actually correlated with significantly higher conflict with wildlife ($t = 2.22$, $df = 35$, $P = 0.33$: Figure 52). Although some of this contact was intended to be positive and educational, such as when people visited the Park for seminars, conflict scores did not differ significantly between people who had experienced positive contact or negative contact, such as being chased away from grazing near Park boundaries ($t = 1.42$, $df = 21$, $P = 0.169$).

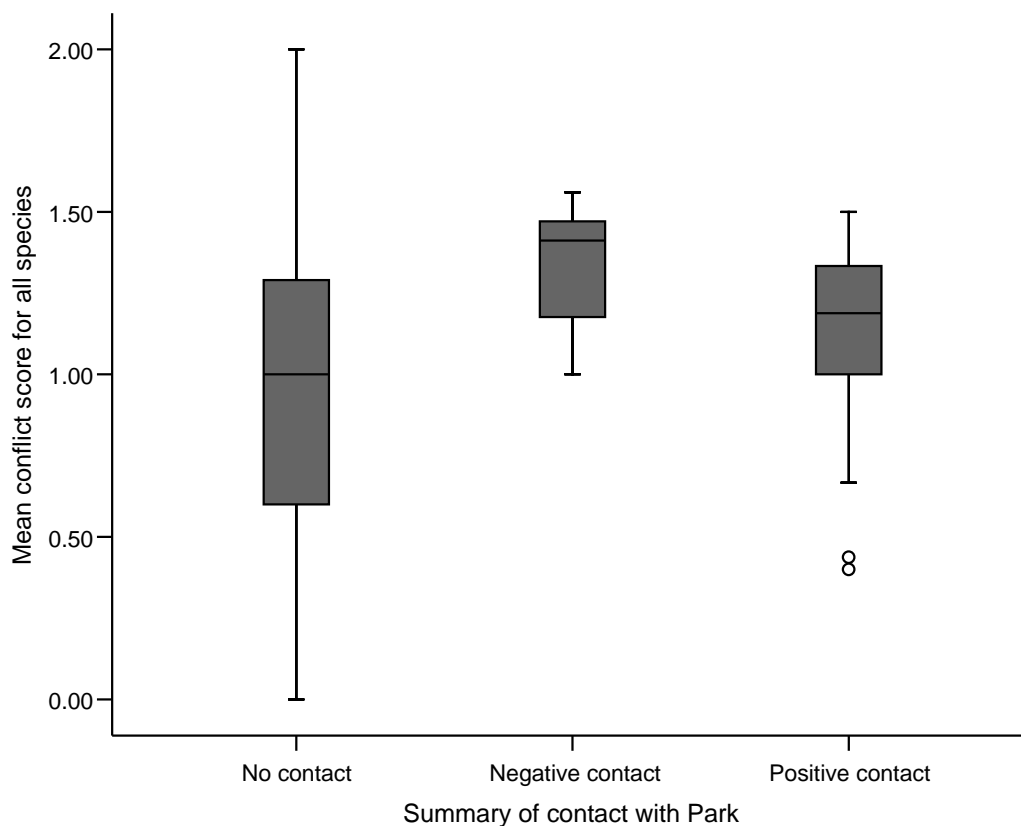


Figure 52. Mean conflict scores from initial survey respondents who had experienced positive contact, negative contact or no contact with Ruaha National Park or its staff

When benefits of the Park were discussed, two-thirds of respondents ($n = 20$) said they thought other people gained economic benefits from the Park, through activities such as having being employed there, not having to pay for building classrooms as the Park had provided money, or receiving revenue from tourists, while 11 (37%) said they had personally experienced such benefits. This revealed a significant mismatch between the perceptions of people in general benefiting from the Park's presence, and the level of participants that had actually experienced personal economic benefits ($\chi^2 = 12.2$, $df = 1$, $P < 0.001$). This often led to dissatisfaction being expressed, particularly by the pastoralists, that such benefits were not particularly relevant or important to their lives, with some hostility evident that they benefited other people but not the respondents concerned.

7.4.3.5 Overall perceived effect of Ruaha National Park on peoples' lives

When discussions were held about how the Park had affected peoples' lives overall, participants tended to distinguish between the effects it was perceived to have had on the community or on other people, and the effects it had on them personally. In terms of wider-level effects, 14 people (47% of respondents) said that they thought the presence of the Park had brought benefits to the community or other people, through revenue from tourism, local development, assistance from the Park in building schools and hospitals, assistance dealing with problem wild animals, local training of Village Game Scouts, employment opportunities and the provision of water bores.

Ten people (33%) said the presence of the Park had no significant effect at the community level, while four (13%) thought it had had negative effects for most people, because of the presence of dangerous animals, a lack of grazing animals, and limited access to bushmeat. In the words of one man:

“It has affected our lives as now we are living in an island, and on both sides of us we have problems. On one side there are many farms and we have to pay even if one cow goes into the farms, and on the other is the protected area where the officials are waiting for us. Due to these problems, I had to buy my own land, which has cost a lot of money and made my life worse. However, even the area that I have bought is not enough to graze my cattle in, so this is a problem.”

- Respondent 164, Maasai man

Again, the perceived impacts in terms of advantages and disadvantages at a personal level differed significantly from those imagined at a community level ($\chi^2 = 26.3$, $df = 2$, $P < 0.001$), with fewer people experiencing positive impacts, and more not experiencing any effects from the Park than would be expected based on the perceived community-level effects (Figure 53).

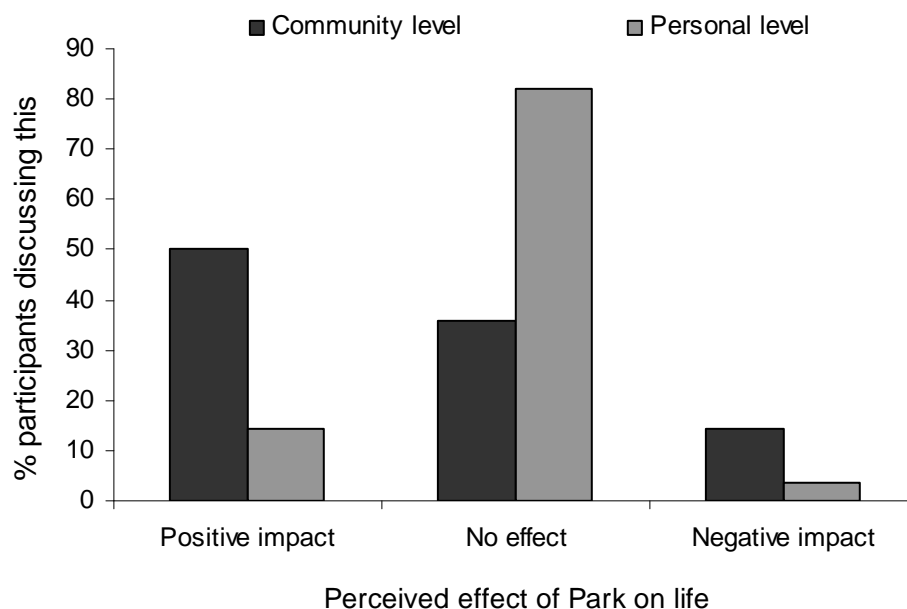


Figure 53. Perceived impacts of Ruaha National Park on local peoples' lives, both for the community in general and for that participant personally

7.4.3.6 Desired future changes for Park

During discussions about any changes people would like to see regarding the Park in the future, five people (17%) said that it should just remain as it is now, with another five saying that they did not know what changes should be made, as they did not know enough about the Park at present or felt that it was up to the Government rather than them. Amongst the people who did voice their thoughts on future changes, there was clearly a diverse array of opinions. Despite the common animosity towards certain wild animals in the area, five people (17% of all participants) wanted the Park to be developed more, or the numbers of wild animals within it to increase, so that more tourists would come to the Park and there would be more business in the local area. Two of these wanted the Park to expand and incorporate some of the land closer to their village in order to increase local revenues, but this was clearly a contentious subject as two others clearly stated that they were clearly against any further expansion of the Park. Five people said they wanted more assistance from the Park: two of these wanted more help with building schools and helping to pay for local children to attend school, but another complained that all the assistance so far had gone into schools, and that assistance should

be provided for a wider range of people. Others suggested that the Park should provide more help to local people in terms of controlling wild animals, and one suggested that a compensation scheme should be established to offset the costs of depredation.

Three people said they wanted more tangible benefits from the protected area: as one man explained:

“I would like it if we were able to harvest some animals in the Park, or have anything, like money, from the Park – that would be good. We are very close to the protected area here and yet we have no benefits, while we see others benefiting from tourism and from the wild animals. I think that other people also think this, especially the Maasai.”

- Respondent 61, Maasai man

Three others wanted to be able to get meat from wild animals in the Park, ‘rather than just looking at them’, and, as expected from the concerns cited above regarding resource access, three people mentioned wanting access into the protected area for grazing and to reach water sources. Linked to the issues over access, two other Maasai participants said they would like it if the Park authorities realised that the pastoralists could be good neighbours to them, and would allow them to live alongside them in peace, with the NCA cited as an example of what they would like to see happen in this area. Two people wanted more information about the Park, and one wanted local people to be able to visit the Park more cheaply and easily.

7.4.4 Participants’ views towards wild animals

People were split almost evenly on what they said they thought of wild animals in the Pawaga-Idodi area – 14 participants (47%) thought that wild animals were good to have around, with people saying that it was good for children to know these animals, that they helped attract tourists to the area, or that they just intrinsically liked wild animals, which was particularly true for those who had grown up alongside them. As one man explained:

“Wild animals are not a problem, and I like living next to them, and they are not harmful to us. In the past I have lived alongside all animals, including lions and hyaenas, and we all lived together. I have been educated through Hugo [van Lawick, who employed him as a driver] that wild animals have value and I know we can live next to them. There are

no problems with wild animals – bad things might happen but this is just normal: a hyaena might kill a goat, but this is the same as if you have children and one of them might die – it is just an ordinary thing in life. Wild animals have value for us so having them around is good, even if bad things sometimes happen accidentally.”

- Respondent 164, Maasai man

The remaining 53% had mixed views about wild animals in the local area, with people explaining that they could be destructive to both livestock and crops, while others were just generally fearful of wild animals, especially those who had moved here from towns – as one put it:

“I don’t know anything about wild animals, but I don’t like them as I am not used to living with them. I think they should live very far away, maybe as far as Iringa [around 60km away]”

- Respondent 113, Barabaig man

7.4.4.1 Positive aspects of having wild animals in the Pawaga-Idodi area

Half the participants ($n = 15$) cited various positive aspects of having wild animals in the local area, with the most common advantage being that children could understand what these animals really were, without just having to read about them or see pictures. People also valued their worth for tourism, liked them intrinsically, were used to having them around, or thought it was good to have wild animals around as it showed that an area was disease-free for livestock (Figure 54).

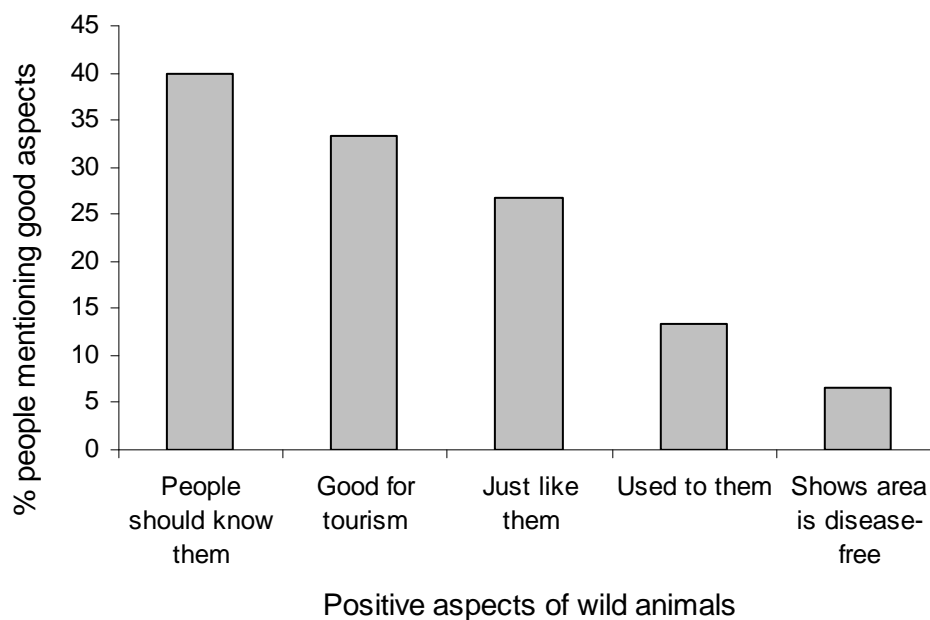


Figure 54. Perceived positive aspects of having wild animals around the Pawaga-Idodi area. People could mention more than one aspect so the total exceeds 100%

7.4.4.2 Negative aspects of having wild animals in the Pawaga-Idodi area

Over three-quarters of participants (77%, $n = 23$) cited particular negative aspects of having wild animals living in the local area, a significantly greater proportion than that mentioning any positive aspect ($\chi^2 = 8.53$, $df = 1$, $P = 0.003$). The threat that wild animals were perceived to pose to livestock was the main negative aspect cited (Figure 55), with people also saying that wild animals could damage crops, endanger humans or were simply intrinsically ‘bad’. One person also said that they caused substantial environmental damage, while another said that having wild animals around was bad as it attracted people to kill them, which then resulted in people going to jail.

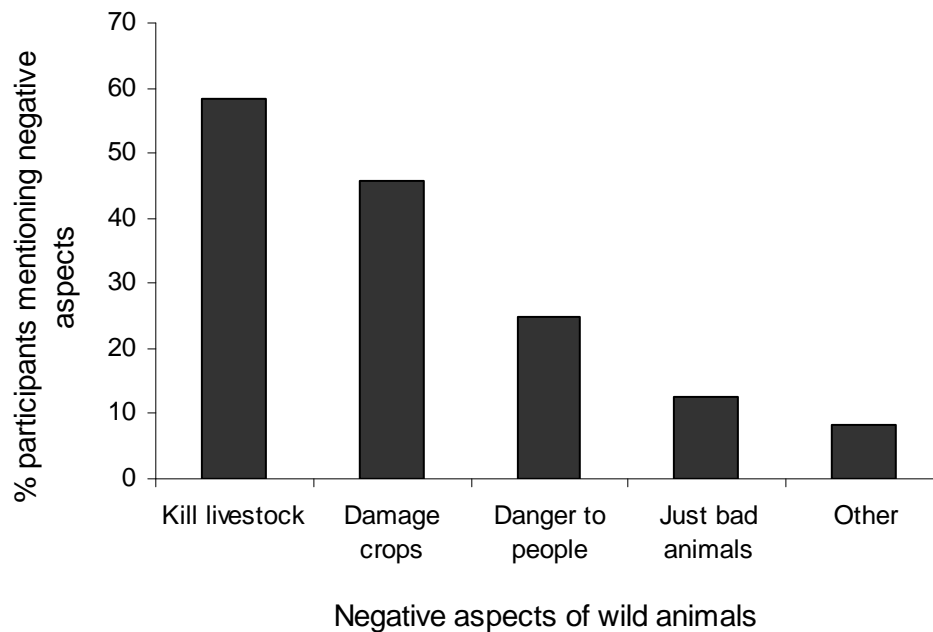


Figure 55. Perceived negative aspects of having wild animals around the Pawaga-Idodi area. People could mention more than one aspect, so totals exceed 100%

7.4.4.3 Perceived significance and value of focal carnivores

When discussing focal carnivores, 70% of the participants ($n = 21$) could not think of any personal value or benefit of having these animals around, although seven people (23%) said that they thought these species did benefit other people, with people from the Barabaig and Gogo ethnic groups in particular often perceived as benefiting. Two of the Maasai participants explained that if a Barabaig man killed a lion and made the skin into a shield, he could take it to all his relations and receive cattle from every one of their bomas, thereby becoming rich, so the presence of lions was seen by the Maasai to be advantageous to the Barabaig, while they themselves no longer received any such traditional benefits. Although the only Barabaig person who mentioned this said that it was an out-dated tradition that was no longer used, it clearly remained important in the minds of the Maasai. Some Hehe and Bena respondents explained that the Gogo people benefit from the presence of hyaenas, as they were believed to employ witchcraft in order to use hyaenas both as a mode of transport and to steal livestock from other people. As explained by one participant:

“These animals bring nothing good for us, but the WaGogo benefit from hyaenas as they use witchcraft so that they can travel with them – they use them like motorcycles. We call these animals [spotted hyaenas] ‘our neighbour’s car’. By using them to travel, if they want to go to Dodoma from Idodi [around 470km], they could go and come back in one night. They also use them by training them to go and kill livestock from other people who are not Gogo – in this way they can eat meat without killing their own animals. The Sukuma might also benefit from these animals, but I am not sure how.”

- Respondent 91, Hehe man

Although relatively few people thought that these species had any value now, seven people (mainly Maasai) said that they had in the past. They said that in the past, a young man had to kill a lion before he could marry, while people also won the respect of their community if they killed a lion, which was perceived as very important. One man explained:

“These predators are bad animals and we cannot value them. In the past, they had some value – if you killed a lion then the community would think that you were brave, but that is not true now. In the past, people got this respect for bravery rather than economic value from these animals, and now they have no value. Now, even if you kill a lion you get no respect for bravery, so they are useless to have around.”

- Respondent 1, Maasai man

People also said that in the past you could use the skins of these animals, particularly leopards, for decoration, but now they were not allowed to do that and they were afraid of being caught by MBOMIPA. Where people did recognise a current benefit of having focal species around, this was usually for medicines or amulets (Figure 56). The leopard’s skin was said to be used to keep medicines in, and used to cure fits in newborn babies, while leopard claws were also used for medicines. It was reported that leopard intestines could be boiled in water and the water then drunk to cure fits and confusion, while neck-ache could be soothed by placing lion skin around someone’s neck. People also said that if you boiled lion skin in water, the water could be drunk by women in labour to help them deliver their babies quickly, and lion fat was said to be good to cure illness in the elderly. Taking a piece of lion skin or lion claws into the bush was said to protect people from danger, even in very thick forest, while lion fat could be used to keep

bush pigs away from crops, by rubbing it onto cloths and then posting those cloths around crops.

Some people said that you could still get money from selling leopard skins, while, interestingly, two actually mentioned that having lions and leopards around could be good as depredation could sometimes be an advantage – they said that if a lion or leopard ate one of your cattle, then the number of newborn young would increase that year, so overall it was an advantage. However, both said that this was definitely not true for hyaenas, and that if a hyaena killed an animal it was very bad luck, and that your family might lose all their livestock. Two people (7%) also mentioned that these animals, with one specifying lions, leopards and cheetahs, helped bring tourists into the area, so they provided a local benefit in that way, while one person said that some people ate meat from lions, leopards and hyaenas.

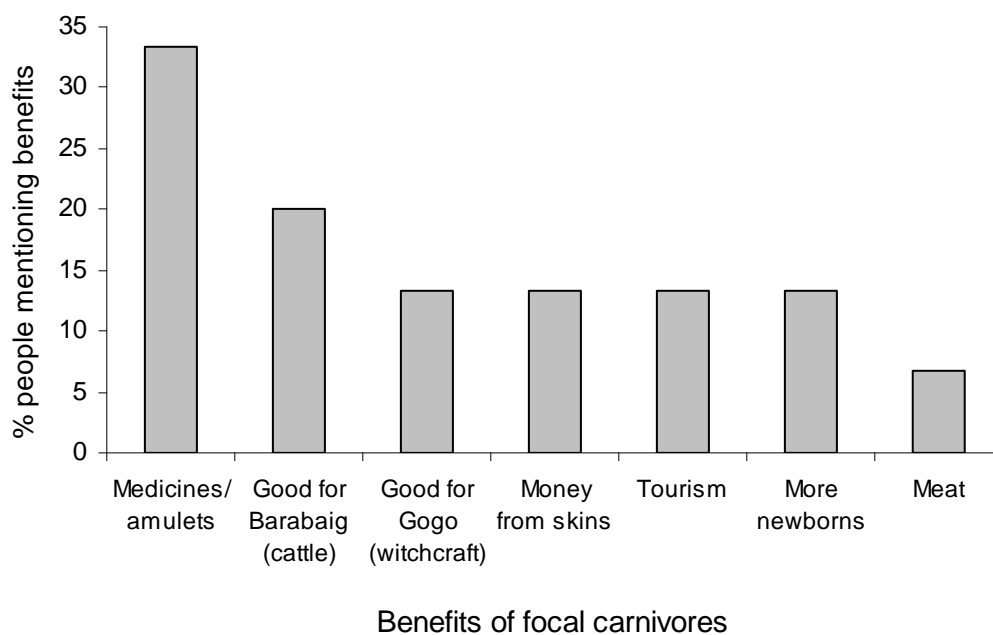


Figure 56. Benefits of focal carnivore presence, as explained by participants. People could mention more than one benefit so the total exceeds 100%

7.4.4.4 Overall costs and benefits of focal carnivore presence

Overall, 11 people (37%) could think of positive aspects of having focal carnivores above, with benefits to themselves or others. However, 23 (77%) cited costs of carnivore

presence, which was significantly higher than the proportion mentioning any benefits ($\chi^2 = 17.0$, $df = 1$, $P < 0.001$). These costs included attacks upon livestock and people, as well as having to invest money in protection strategies, such as bomas, night guards, buying torches and batteries, buying guns and bullets, and feeding dogs. People also said that they had to spend time guarding stock and constructing bomas when they could be doing other things, with others saying that it was hard to sleep at night as they worried about guarding their stock, and others said they were just scared by having these animals around (Figure 57).

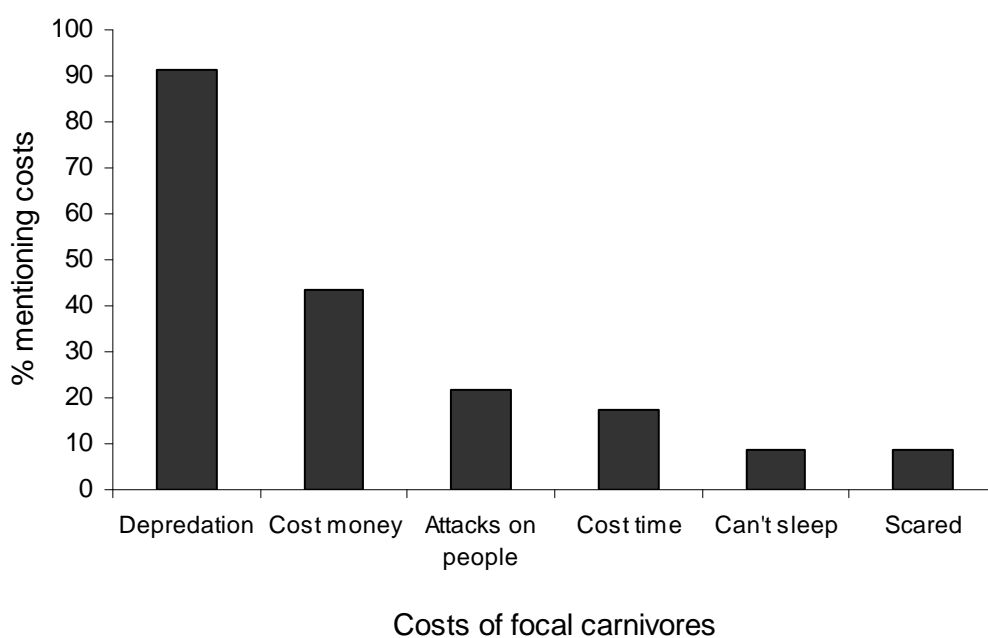


Figure 57. Costs of focal carnivore presence, as explained by participants. People could mention more than one cost, so the total exceeds 100%

Most people attributed these costs to the presence of these species, but one person did say:

“There are not costs that are just due to these animals – people have to build bomas to protect against thieves and to stop animals wandering off at night anyway, so it is not an additional cost that you can also use these things to protect against predators.”

- Respondent 78, Bena man

Overall, nearly three-quarters of respondents (73%, $n = 22$) felt that the costs of focal carnivore presence overwhelmed any benefits, 13% ($n = 4$) felt that there were no significant costs or benefits, while only two people (7%) felt that the benefits outweighed the costs. One of these said that this was due to tourism, while the other said that it was worth having carnivores around, as you could sell the skins and use body parts to protect crops.

7.4.4.5 Participants' opinions on how wild animals will be viewed in the future

Nearly half of the participants (43%, $n = 13$) felt that people of their children's generation would be more positive towards wild animals than they were themselves. The main reason given for this was that children now had the opportunity to visit the National Park on school trips, as well as being taught about wildlife in school, so they knew and liked the animals more than their parents' generation. Seven people said that children would also receive more economic benefits from wildlife in the future, and would therefore have a greater incentive to conserve them. As one man explained:

“I think there will be big changes in the future – children are now taken to Ruaha National Park and know the value of the Park and the wild animals there, so they know them more and like them more now. This is a change from their parents, who did not know any value from wild animals and thought that they could hunt them all. People now know the places where it is illegal to hunt, but their parents thought that the wildlife was given by God for everyone and that people could hunt everywhere. The Government should continue to take care of the wild animals and the new generation will see profits from these wild animals. If the wild animals are left alone, they will disappear, so they should be looked after. The children now know that these animals have value and they should be kept safe for them.”

- Respondent 114, Bena man

However, 10 people (33%) thought that the future generation would think much as they themselves did, six (20%) said they were not able to guess what people would think in the future, and one (3%) said that he thought that their children might want to do something else with the land in Ruaha rather than keep it as a National Park.

7.5 Discussion

The results of this study suggest that the levels of Park-people conflict reported here were considerably lower than has been observed in some other locations: less than 10% of participants here said that they disliked Ruaha National Park, which compares favourably to the 75% of local people found to dislike the Nandi Devi reserve in India (Maikhuri et al. 2001). However, this could conceivably be affected by the fact that the majority of participants had never known the area without the Park, so had nothing to compare the current situation with. Moreover, only around half of respondents actively liked the Park, which is poor compared to the 88% that reportedly liked the Maputo Elephant Reserve in Mozambique (De Boer and Baquete 1998). Before the establishment of Ruaha National Park, people recalled the area as '*shamba la bibi*', a term that has a colonial meaning, with the literal translation meaning 'the Queen's (Elizabeth II's) estate', seemingly in reference to the British control when Rungwa Game Reserve was expanded, prior to the gazetting of Ruaha National Park.

People who had been in the area to witness the designation of the Park said that it had affected their lives, and were resentful towards new restrictions on access to grazing and water access, as has been seen when reserves have been gazetted elsewhere (Blaustein 2007). However, it was clear that the concerns over limited grazing areas due to the Park's presence have been compounded by intense conflict over land rights amongst the villagers, particularly between farmers and pastoralists. Such disputes between pastoralists and cultivators has been seen elsewhere in Tanzania, particularly in the northern regions, and the resentment felt by pastoralists at the situation has been exacerbated by state authorities favouring agriculturalists over herders in terms of land allocation (Ojalammii 2006). The population in the Idodi and Pawaga districts grew by 42% in just four years between 1998 and 2002, with immigration a major component of this huge increase (Walsh 2007a) and the high level of immigration here was highlighted by the fact that two-thirds of the participants of this study were not born in Pawaga or Idodi. This is symptomatic of the growing trend for internal migration within Tanzania, with people often having to leave their natal areas because their original land has been alienated for protected areas or commercial agriculture (Odgaard 2002; Williams 2005).

Due to their relative political powerlessness and the view of their lifestyles as ‘primitive’ or ‘backwards’, pastoralist groups have often suffered the brunt of these land use changes, as exemplified by the Barabaig pastoralists forced out by the TCWP project in Hanang District (Lane 1996; Odgaard 2002; Williams 2005). Therefore, over the past 50 years in Tanzania, there has been an increased movement southwards of Maasai, Barabaig and Sukuma people, in search of better access to water, land and pasture (Brockington 2004; Williams 2005). Data are not available on the ethnic composition of immigrants into the Idodi-Pawaga area, but the high recent rates of influx are clearly heightening local conflicts, with people apparently particularly hostile to the impacts of immigrants from other ethnic groups and those who rely upon alternative livelihood strategies to their own. The arrival of Barabaig people, who have not traditionally lived in this area (Walsh 2007a) has been a particular source of concern due to their reputation among other ethnic groups of being thieves, despite the fact that cattle rustling is practiced by many of the other groups too (Brockington 2008; Redmayne 1968b).

Much of the immigration here was apparently driven by the desire for good arable and grazing land, supporting the findings of Williams (2005) that many people have moved into this area over the past few decades as they wanted to use the relatively fertile soils here for pasture and farming. However, this high recent rate of immigration clearly exacerbates the impact of land alienation for protected areas, as the establishment of farms further reduces the remaining grazing area available to pastoralists, which they then have to compete over with immigrating pastoralists. This situation is common in areas with sharply increasing populations and polyethnic societies, and the resultant increased demand for food crops heightens hostility between farmers and pastoralists, intensifying the ‘between-group’ tensions that already often exist between people of different ethnic groups and backgrounds (Gefu and Kolawole 2002). This increasing conflict and competition over land has been noted across much of sub-Saharan Africa, including Tanzania (Berry 2002; Odgaard 2002; Peters 2004; Williams 2005), and the problem is often driven by or magnified by land alienation and privatisation (Brockington 2002b; Shivji 1998; Williams 2005). Such increased tensions can be seen clearly in the Idodi-Pawaga area, which has undergone significant changes over the past 50 years, with

substantial areas demarcated for wildlife conservation and a rapid increase in both human and livestock populations (Williams 2005). These combined pressures have resulted in intense competition over remaining key resources such as fertile arable land, grazing land, and fresh water, which are in increasingly short supply (Walsh 2007a; Williams 2005). Consequently, many people have seen their living standards decline, and the situation has exacerbated conflicts between different groups, most notably between herders and farmers (Williams 2005). These increased pressures on pastoralist populations, especially if they lose cattle through fines to farmers, could well diminish their ability to tolerate any additional forms of stock loss, such as depredation, and may help explain their marked hostility to carnivores and depredation seen in this area.

However, the perceived negative effects of the Park are not just due to limitations on resource access. The impacts of wild animals were a source of conflict to both pastoralists and farmers, which is a common concern for reserve-adjacent communities (Hemson 2003; Naughton-Treves and Treves 2005). People were particularly negative towards the focal carnivore species, with twice as many people citing costs of their presence compared to benefits. The risk of depredation was apparently the main source of conflict, but here too, the situation is made more complex by the existence of underlying conflicts between different human groups rather than simply between humans and wildlife. Hyaenas were one of the most reviled species in the study area, but this hostility was influenced at least in part by the suspicion that they were associated with witchcraft practised by other ethnic groups in order to provide transport and steal other peoples' livestock. Rumours of similar practices have been documented elsewhere in Africa: in the Republic of Congo, certain '*mokila*' elephants are said to be morphologically indistinguishable from other elephants, yet harbour the body and life-force of a human being from the Baka ethnic group, and are said to kill hunters in revenge for them killing other '*mokila*' elephants (Kohler 2000). In Indonesia, the state attempted to solve Java's overpopulation issue by resettling 'surplus' Javanese farmers to Sumatra, but the new resettlement areas were ecologically unsuitable for farming, with the poor soil and the high population of wild pigs making crop-growing virtually impossible (Rye 2000). The conflict between the transmigrant farmers (most of whom were Muslim) and the wild

pigs was then intensified by the fact that they believed that their disliked neighbours in the forest, the indigenous Talang Mamak people, had the magic ability to turn themselves into pigs, so the people-pig conflict actually often represented a people-people conflict between the two groups (Rye 2000). Although the end-point, that of conflict between humans and certain species, may appear to be the same, it is important to understand these underlying dynamics, as solving the ‘real’ problem, such as reducing depredation here by hyaenas, may not significantly change peoples’ attitudes towards them if they are nevertheless still regarded as representing the hostile embodiment of a spirit sent by another ethnic group. The perceived threat of these ‘spirit animals’ can also be exacerbated by changes in peoples’ social circumstances, as was reported during a study into the concept of sorcery in Mozambique (West 2001). People of the Mueda region of Mozambique are believed to be able to make ‘people-lions’ (*vantumi va vanu*) from sticks of wood harvested from the *dimika* tree, or to transform themselves into lions, so that they could kill other people and gain from them (West 2001). Upon seeing a lion in the bush, locals often assume that it is a ‘people-lion’, so they set fire to the bush where the lion is and kill it, using a medicinal substance (*ntela*) to ensure that the lion does not harm anyone in the process (West 2001). Interestingly, although people said that there used to be many ‘bush- lions’ (*vantumi va ku mwitu*) and relatively few ‘people-lions’, this was said to have changed after the state-enforced villagisation process, similar to Tanzania’s, which forced many different people to live alongside one another (West 2001). This process was reported to have led to a situation where the feared ‘people-lions’ far outnumbered ‘bush-lions’, as everyone was thought to be using sorcery to create these lions for their own individual benefit (West 2001). The villagisation led to dramatic and rapid social change, and this was accompanied by an increase in the use of sorcery and witchcraft, probably as people attempted to conserve their indigenous norms when threatened by externally-imposed change (Marwick 1965; West 2001). This example highlights the complex interactions between traditional beliefs and social change, and shows that it can have direct impacts on human-wildlife conflict in an area.

However, in this area, the impacts of Ruaha National Park were certainly not all said to be negative, with more people reporting that it had had a positive local effect rather than

a negative one. There was no reported impact of the Park in terms of restricting access to cultural sites, which has been documented as a cost of conservation following the gazetting of protected areas elsewhere in Africa (Sandbrook 2006). The community assistance provided by the Park was clearly appreciated, with people also appreciating the existence value of wildlife that they connected with the Park, and the bequest value of conserving natural resources for future generations. However, relatively few people regarded the revenue from tourists as a benefit from the Park, indicating that the amount of foreign revenue trickling down to the local household level was low. In addition, there was a discrepancy between how often people thought that the Park was benefiting ‘other people’ compared to the number of people actually saying they received benefits, with fewer people than would be expected actually noticing a positive impact. This suggests that either people have an unrealistic view of how many people are benefiting from the Park’s presence, or that there is some form of ‘elite capture’ of any benefits that do emerge, with relatively few, high-level members of the village community receiving the majority of the profits, as has been seen elsewhere (Platteau and Gaspart 2003). The same trends have been observed around Tarangire National Park in northern Tanzania, while although people felt that the Park and wildlife did bring benefits to the area in general, very few people said that they actually noticed the impacts of such benefits at the household level (Sachedina 2006).

Despite the high levels of reported conflict with wildlife discussed in earlier chapters, people did recognise benefits of having wild animals around, and some, albeit a minority, saw some value in the presence of focal carnivores. However, here again there appeared to be some effect of inter-ethnic tensions heightening human-carnivore conflict, with people apparently resentful that other people and groups, such as the Barabaig, seemed to benefit from the presence of certain species, like lions, while they did not. Currently, the majority of people said that the costs of carnivore presence, both in terms of both direct and indirect costs, exceeded any benefits that they might provide. Furthermore, although their value in attracting local tourism was mentioned for wild animals in general, less than 10% of people mentioned it in relation to the focal carnivores. In reality, large carnivores and other dangerous animals are the ones that international tourists are often

most interested in: an online poll in 2006 revealed that lions were the species that Western tourists most wanted to see, with people also particularly excited by the possibility of seeing elephants, cheetahs and leopards (Zijlma 2006). Therefore, it is the relatively large populations of elephants and large carnivores, especially lions and African wild dogs, that tend to draw tourists to the Ruaha area in particular (Meadows 2000), but these are the very species that are most resented and feared by local people. The tourist value of these species is either currently not perceived by the local communities, or the benefits of tourism are so limited that they do not have a major impact on their lives at present. Carnivores were instead valued by local people predominantly for their consumptive uses, which is not unusual, as many wild animals are used by traditional healers for their curative properties (Ntiamoa-Baidu 1998). Numerous carnivore species are traditionally used in this way, with a study in Nigeria revealing that local people used leopard skin to treat snakebites, hyaena bones to invoke witches, civet (*Civetta civetta*) anuses to treat convulsions, and mongoose anuses to ward off evil spirits and witches (Adeola 1992; Ntiamoa-Baidu 1998). The use of carnivores for traditional medicines is undoubtedly an important aspect of their presence for local people, and was cited as the main benefit of focal carnivore existence here, but there were few evident linkages between the occurrence of these species in this area and either tourist revenue or assistance provided by the nearby Park. In order to start changing attitudes towards carnivores in the study area, there is a clear need to establish such linkages and demonstrate tangible benefits associated directly with their non-consumptive use, as has been done with other carnivore species, such as the Ethiopian wolf and the African wild dog (Williams and Sillero 2005).

Despite the problems with the Park mentioned above, there was no evidence of marked antagonism towards Park authorities, with the majority of people saying they thought they were doing a good job. However, this survey work was done under the auspices of the WCS, which works closely with the local and national wildlife authorities, so it is possible that people were hesitant about criticising the Park authorities too openly. There were some complaints that local people were sidelined in terms of conservation in the local area, with participants, especially the Maasai, espousing the mixed-use landscape in

NCA as a role model that should be followed in the Ruaha area. This resentment by local people at their lack of voice or involvement in conservation issues is a widespread concern (Kallonga et al. 2003), but the NCA model is by no means a panacea, with substantial conflicts still remaining over access to resources and land (Lissu 2000). There was some antipathy reported towards the MBOMIPA scouts, however, particularly over the issue of boundary locations, which has been a source of conflict around the NCA as well (Lissu 2000). The reported incident of a villager being killed by MBOMIPA scouts has also clearly created significant anger and distrust towards the organisation. Violence committed by conservation authorities against pastoralists who were thought to be rule-breaking has been documented previously in Tanzania (Lissu 2000; Sachedina 2006), and such incidents can result in significant and long-lasting hostility towards those authorities (Sachedina 2006). While people here clearly differentiated between MBOMIPA and the Park authorities, such conflict can result in people resenting and sometimes retaliating against the species and resources that the disliked authority represents (Kideghesho 2006) and this could therefore contribute towards human-wildlife conflict.

Interestingly, despite the generally negative views on how the local environment had changed over recent years, and the relative lack of tangible benefits currently emerging to household level from the Park, people seemed largely optimistic about the benefits that the next generation would receive from wild animals. The recent development of the WMA, which should ideally help resolve some of the issues over pastoralist-farmer conflicts, pastoral land tenure rights, border disputes and a lack of tangible benefits from wildlife presence, may contribute towards this positive view, although it remains to be seen how effective the WMA development will be in achieving these. At present, although there is no intense people-park conflict apparent in this area, people do not strongly associate the presence of wild animals, particularly focal carnivores, with benefits from the Park, while human-wildlife conflicts also appear to be affected by underlying tensions between people from different backgrounds and ethnic groups. It is clear that although efforts to diminish the costs of coexisting with wildlife, for instance by implementing strategies to reduce the likelihood of depredation, would be well received by communities and are clearly important for targeting the 'dispute level' of

human-wildlife conflict, such action alone would not truly solve the problem. Effective conflict mitigation will depend upon a two-pronged approach, with efforts to increase the cost-benefit ratio of wildlife presence on one side, and work to ease social and political tensions on the other. This will require much more investment, time and understanding than simply attempting to resolve conflict by reducing wildlife attacks, but is vitally necessary if easier human-wildlife coexistence is to be achieved long-term in the Ruaha landscape.

Chapter Eight

General Discussion



CHAPTER 8: GENERAL DISCUSSION

Human-wildlife conflict is an increasingly important issue in our crowded modern world, and its resultant impacts upon wildlife populations means that it has received widespread attention from zoologists, ecologists and conservation biologists (Graham et al. 2005; Hoare 1999; Sillero-Zubiri and Laurenson 2001; Woodroffe et al. 2005b). However, despite its often significant impacts upon humans, it is a topic that has so far attracted relatively little attention from an anthropological perspective (Knight 2000b). While a wealth of information has been generated on the biological drivers of conflict, such as risk factors associated with predator attacks on humans or livestock (Hemson 2003; Herrero 1985; Loe 2002; Ogada et al. 2003), the need for a deeper understanding of the anthropological dimension has often been overlooked, despite its importance, particularly in situations where the culture of the people involved differs from that of the researcher (Knight 2000b). Fundamentally, effective resolution of conflicts between people and wildlife will depend upon understanding both ecological and human aspects of the problem, but conservation managers are rarely trained in the necessary human disciplines, such as history, politics or anthropology (Schmidt and Beach 1994), whereas social scientists tend to lack knowledge on the animal behaviour and ecology relevant to the issue. Incorporating both of these dimensions will strengthen our ability to reduce conflicts, by not only examining ecological drivers and studying wildlife behaviour to suggest ways of avoiding problems, but also by teasing out any deeper anthropological aspects of conflict, working with indigenous knowledge and practices in the local area, and ensuring that any suggested mitigation techniques are relevant, appropriate and culturally sensitive (Breitenmoser 1998; Knight 2000b; Parrish 1995).

The aim of this thesis was to examine the magnitude of reported conflict with wildlife, particularly large carnivores, in the Rungwa-Ruaha area, and to assess the key drivers of any such conflict, including a consideration of both ecological and anthropological factors. The main results of the study, and their potential relevance to the wider field of human-wildlife conflict, are discussed in more detail below.

8.1 Reported magnitude and causes of human-wildlife conflict

8.1.1 Reported level of conflict and the impact of depredation

People were relatively antagonistic towards wildlife in this study, with less than a third saying that they were happy with the current suite of wild animals living around their village, and 10% were unhappy with the presence of any wild animals at all. A comparison of conflict scores from respondents here and those studied in northern Tanzania (Maddox 2002) revealed higher conflict in this study area, especially when only Maasai participants were considered. Particular hostility was shown towards carnivores, especially lions, but also towards hyaenas, leopards, cheetahs and wild dogs. As found during the review by Sillero-Zubiri and Laurenson (2001), the main reason given for considering focal carnivores problematic was the perceived risk to livestock, which was mentioned by virtually all respondents as a cause of conflict. The perceived impact of depredation was also the main reason given for why people disliked predators, and was the primary explanation for why people wanted large carnivores to decline in number or disappear entirely from the study area, so clearly this had a major impact on peoples' views.

However, despite the clear and widespread perception that focal carnivores posed a significant risk to stock, there was relatively little evidence of a large numbers of stock regularly being killed by predators. People reported losing around 1.2% of their livestock to predators every month, with depredation reportedly accounting for 10.4% of all stock losses, which was equivalent to around 10% of the stock used per month. Although this undoubtedly has marked impacts on the households concerned, the reported level of depredation here is far less than has been seen in some other studies – in Nepal, villagers estimated that predators accounted for over 60% of stock losses (Jackson et al. 1996), while ranchers in Brazil reported that pumas killed up to 84% of their sheep and 16% of their cattle (Mazzolli et al. 2002). However, it is on a par with many of the African studies – research by Bauer (1995) found that Fulbe pastoralists in Sifna, Cameroon, reported losing around 1.4% of their stock to predators, ranchers in Zimbabwe said that they lost 2% of their stock to depredation (Rasmussen 1999), reserve-adjacent people in

Botswana reported a depredation rate of 2.2% (Schiess-Meier et al. 2007), while Maasai pastoralists in northern Tanzania reported losing around 1% of their livestock to depredation every month (Maddox 2002).

Reported losses revealed that theft was responsible for twice as many losses as depredation, while disease accounted for eight times as many and was apparently responsible for over 60% of all stock losses. This pattern has also been observed in other studies, where despite intense perceived conflict with carnivores, other factors such as theft and disease actually account for more losses than depredation (Bauer 1995; Mizutani 1993; Rasmussen 1999). Moreover, long-term monitoring involving monthly re-visits suggested that initial estimates of stock losses were exaggerated, with people losing only around a quarter of the number of stock they initially estimated to carnivores, bringing the depredation level down to 0.32% of herd size monthly. Although losses to other causes were also over-estimated, the same pattern remained, with losses to theft and disease reportedly far outweighing those to large carnivores. However, even this small level of depredation was likely to be an overestimate, as follow-up visits to households revealed that a fifth of reported depredation events here were false reports, apparently made intentionally in order to elicit attention from researchers, leading to a final estimate of 0.26% stock lost due to depredation by large carnivores. Therefore, the initial estimates of depredation provided during the initial surveys were nearly five times higher than the final calculations following long-term monitoring and conflict investigations. This was similar to the results of Rasmussen (1999), who ground-truthed reported wild dog kills in Zimbabwe and found that people overestimated their impact on livestock by nearly six times. Such over-exaggeration of losses to predators has been noted in studies across the globe, with people tending to over-estimate the damage caused by large, conspicuous species and under-estimate that by smaller animals (Knight 2000b; Naughton-Treves 1997). There are several potential reasons for this, including a desire for compensation, or because of the lasting impact that dangerous wild animal attacks can have, meaning that they tend to be recalled as occurring more recently than was actually the case (Naughton-Treves and Treves 2005; Nyhus et al. 2003). The reasons for over-estimation here are likely to have varied through the study – initial reports probably over-

estimated monthly losses due to problems with accurate recall over a set time period (Maddox 2002), while the ability to call a survey team out to the household probably contributed to the over-estimations during the follow-up surveys. Regardless of the reason, the discrepancy between initially reported rates and eventual calculations shows that researchers should treat initial estimates with caution, and need to invest in longer-term monitoring to better gauge the actual impact of predators upon livestock.

However, a broad-scale review of human-wildlife conflict, Treves and Wallace (2006) warned about scepticism regarding the ‘actual’ damage caused by problematic species, as it is more important to accept local peoples’ perceptions of conflict and use those as the baseline for investigating and addressing any antagonism towards wildlife. Furthermore, even if levels of depredation are relatively low across a study area, this may mask important variation between households, with some experiencing devastating losses while others suffer few or no attacks, and even if nothing has happened yet, the fear alone of the consequences of a possible attack can substantially influence general attitudes (Sillero-Zubiri and Laurenson 2001). Moreover, even a numerically low level of depredation can still have important impacts on local people, particularly in poor, rural households, and therefore still generate substantial hostility towards the carnivores concerned (Oli et al. 1994; Stander 1997). This is particularly true if the household income is largely or entirely reliant upon livestock, with no other sources of income to fall back on after an attack (Bagchi and Mishra 2006), or if the livestock lost has particular social or cultural value, as is the case with both Maasai and Barabaig societies (Klima 1970; Spear and Waller 1993). For instance, Klima (1970) reported that cattle with a black head, a black tail and a white body were particularly prized by the Barabaig, while a bull with one horn pointing forwards and one pointing backwards was an especially cherished animal. This marked variation in value between different animals is likely to exacerbate the impact of losses, especially for people with small herds: such people are likely to have few valuable animals, so the loss of one would be especially damaging and create more intense antagonism towards carnivores. The huge cultural and economic significance of cattle is probably one of the key reasons why lions were viewed as being so problematic: despite killing fewest animals on average per attack, they

predominantly killed cattle, unlike the other predators, which mainly attacked smallstock. The importance of such specific cultural values has been seen in conflict studies elsewhere – timber trees are an important sign of family unity in rural Japan, and are fastidiously maintained over generations, so when such trees are damaged by bears it has a huge impact, as it is perceived to counteract the work done by previous generations to preserve family ties (Knight 2000b).

One of the behaviours that elicited particularly intense hostility towards predators was surplus killing, defined as where a carnivore kills more than is required for immediate consumption (Kruuk 1972). This behaviour has been documented across a wide range of species, with accounts of polar bears (*Ursus maritimus*) surplus killing narwhals (*Monodon monoceros*), snow leopards killing up to 100 goats in a single attack, and red foxes killing over 200 gulls at one time (Jackson 2000; Kruuk 2002). Such behaviour is resented as it is perceived as greedy or wasteful (Jackson 2000; Oli 1994), and this is of particular importance for certain groups, such as Muslims, who are unable to eat the meat from depredated animals as it is not *halal*, so can salvage nothing at all from such situations (Bauer 1995). Surplus killing was mentioned as an issue with all focal carnivores discussed here, but especially with regard to wild dogs and spotted hyaenas, and was likely to be an important driver of the antagonism towards those species in particular.

It was interesting to note that although recent personal experiences of depredation were linked to increased human-wildlife conflict in general, it was not one of the most important factors driving cited hostility towards large carnivores specifically. This suggests that views towards carnivores are influenced by other social and cultural experiences, rather than the level of depredation suffered personally. Awareness of the danger posed by wild animals and the actions needed to control them is often culturally institutionalised, through avenues such as rituals, ceremonies and games – in rural Japan, ‘deer-dances’ and ‘monkey-chasing festivals’ ritually demonstrate the threat posed by wildlife and the antagonism of the villagers towards such a threat, while children in livestock-centric Spanish communities often play games re-enacting the hunting of wolves to protect their stock (Fernandez 1986; Knight 2000b; Moon 1989). Therefore,

people often experience human-wildlife conflict in two ways, through direct personal experience as well as through cultural traditions, and both can be important in shaping peoples' views and attitudes towards wild animals (Knight 2000b). It did appear that higher levels of reported depredation increased conflict with wildlife in general, possibly because losing stock (and therefore income or security) to predators may heighten fears over the possible additional impact of other animals, such as elephants that may destroy crops as well. However, these results should always be interpreted with caution as they are based on initially reported levels of livestock depredation, which are often subject to personal biases and misrepresentations, whether intentional or not. For instance, people who are generally hostile towards or fearful of wildlife may be the ones most likely to over-exaggerate the level of carnivore impact, which was demonstrated to be a concern during follow-up monitoring. The antagonism towards carnivores following depredation may also be influenced by various other factors, such as how long ago the last depredation incident occurred, and how many stock were killed or injured. Further long-term and detailed research will be required to tease out the actual impact of verified predator attacks on peoples' perceptions towards carnivores and other wildlife, to assess the likely true importance of this factor compared to the many others that combine to affect peoples' attitudes towards wild animals.

8.1.2 Reported impact and fear of human attacks

Lions were cited by the vast majority of people as the most problematic species, despite the fact that they actually killed the fewest livestock per attack. As discussed above, this discrepancy between attack level and conflict is likely to be due in part to their predilection for attacking cattle, the stock type with the highest cultural and economic worth, but it is also likely to be due to their feared impact on humans themselves. The power of large carnivores to elicit fear in humans should not be underestimated: it is likely to have evolved as an anti-predator response (Kruuk 2002) and has persisted for millennia, with mythology and culture awash with terrifying representations of predators: for instance the famously bloodthirsty Egyptian goddess Sekhmet, who was associated with war, disease and death, was represented by the shape of a lion (Quammen 2003). Greek mythology described the lion of Nemea, which was said to have a hide that was

impenetrable to weapons, and was invincible until eventually strangled by the hero Heracles; the Sphinx was a lion with the face of a human woman, who sadistically tricked and ate people; and the Babylonian monster, thought to be 630 miles in length and adept at devouring people, was named 'Labbu', meaning 'lion' (Quammen 2003). The concepts of these terrifying carnivorous monsters all came from societies living alongside lions and other top predators, and fear remains widespread today where people still live with predators, even if the real risk of carnivore attack is low. In Japan, bears are often intensely feared for their ability to attack and kill people, and, even though actual attacks are rare, the animals still engender very strong emotions – when an image of a bear was used on a road billboard to warn people of wild animals crossing the highway, it was so frightening to drivers that it became a cause of accidents, and consequently had to be replaced with the image of a raccoon-dog instead (Azumane, 1997, cited in Knight 2000a). Moreover, in some communities that retain traditional spiritual beliefs, the risk of being consumed by a man-eating predator is particularly dreaded, as dying in this way means that you are consumed by evil and will not attain immortality, with your soul instead being possessed forever by Satan (Quammen 2003).

In Tanzania, the fear of species such as lions is well-founded in reality, as it remains a hotspot for lion attacks upon humans, with at least 815 reported attacks between 1990 and 2004, and with the rate increasing markedly over time (Packer et al. 2005). More than a fifth of respondents here cited the threat to human life as a reason for being hostile towards lions, with little evidence that this was affected by actual attacks in the vicinity, as there was no higher perception of a risk of human attacks in villages where such attacks had been reported than those where they had not. This is probably due to the fact that news and fear of such attacks spreads quickly, far beyond the actual villages where they took place, and the effects can persist for a very long time – for instance, the infamous 'Tomamae Incident' in Hokkaido, where a bear killed seven people during an attack in a single village in 1915, is thought to be a very important contributor to the widespread perception of bears as bloodthirsty killers, which still persists across Japan to this day (Knight 2000a). People in this study were also fearful of the risk to humans posed by other focal carnivores apart from lions, but although both leopards and hyenas

have been documented as attacking people relatively often (Balestra 1962; Corbett 1948; Daniel 1996; Kruuk 2002), there is no evidence suggesting that wild cheetahs and wild dogs pose a risk to human life. Although ‘conservation education’ is unlikely to alleviate many of the issues contributing to conflict here, this is one area where improving awareness about the realistic levels of risks posed by different species, and what can be done to lessen the chance of an attack, could be a useful step in helping people to understand and deal with one of the main cited causes of conflict.

It was interesting to note that merely having directly observed a large carnivore, even if it did nothing overtly aggressive, was linked to higher animosity towards them. This is similar to the situation in Japan, where just seeing a bear was linked to increased hostility towards them, as they were said to inflict ‘spiritual damage’ on people by frightening them (Knight 2000a). Sightings of carnivores can create fear and anxiety about remaining in an area, as well as having tangible effects: the presence of bears around fields in Japan led to crops being ruined as people were unwilling to remain there to continue harvesting (Knight 2000a). Such actions are not necessarily an accurate response to the level of threat posed, as it is estimated that for every bear attack in Japan, there are another 1000 perfectly harmless encounters with bears, but this intense level of fear nevertheless remains widespread (Knight 2000a).

8.1.3 Reported impact of humans on carnivores

Despite the relatively high level of animosity towards wildlife, particularly carnivores, noted during this study, the level of reported carnivore killing was very low, with only 7% of people admitting to having killed a predator, far less than the 60% and 59% reported by men in Loliondo and Ngorongoro respectively (Maddox 2002). One obvious reason for this could be a lack of openness, with people unwilling to admit to behaviour that was illegal or that they feel would be disapproved of, as has been seen with discussions regarding wildlife poaching (Weladji and Tchamba 2003), especially given the survey team’s links with conservation agencies. However, people appeared willing to openly discuss predator control and were happy to provide body parts and detail killings where they had occurred, so this does not appear to have had a major effect. However, in-

depth research into the causes of carnivore mortality would be needed to assess whether or not people are indeed obscuring the true magnitude of human-caused carnivore mortality. Over half of the people who said they had not killed carnivores nevertheless said that they would be willing to, but were constrained by money, knowledge and access to the necessary resources, which may be of potential conservation concern as people gain access to those things, if conflict is not mitigated. Very few people appeared to be deterred by the possibility of getting into trouble, or by an intrinsic or traditional belief that it was wrong. While traditional lion hunting was clearly still, or had recently been, a part of life in northern Tanzania, with 85% of men in Loliondo and 74% of men in Ngorongoro having participated in at least one (Maddox 2002), there was a striking difference here, with only two people (1% of all the male interviewees and 2.5% of Maasai male interviewees) reporting having engaged in such a hunt. Again, people may have been unwilling to share such details if they feared they would get into trouble, but they were happy to show the skins of lions that they had snared and speared due to conflict, so this seemed a relatively unlikely explanation. The negative impact of traditional killings on lion populations has been highlighted elsewhere (Frank et al. 2006b) but, paradoxically, the lack of traditional hunts seems to have had a negative effect in terms of lion conservation here, as pastoralists often commented that lions used to have value in the area, by enabling young men to prove their bravery during hunts, but as this no longer occurred, there was little or no reason now for still having lions around. This value of predators in enabling people to acquire prestige has been noted worldwide: the Amerindians traditionally killed jaguars to gain and reinforce social status (Knight 2000b; Saunders 1994), African kings were relied upon to protect their subjects from predators (Simonse 1992) and bear-cullers are still viewed as courageous heroes in Japan today (Knight 2000a).

Overall, it appears that there was relatively low rate of retaliatory killing here, but given the possibility that people biased their responses based on our allegiances to conservation agencies, there is a need to gather independent data to investigate this further. The ideal next step would be to initiate a project examining the levels and causes of carnivore mortality in the area, to examine whether people here are unusually tolerant in the face of

depredation here, or whether anthropogenic killing actually poses a risk to carnivores living on village land around Ruaha National Park.

8.2 Underlying and deep-rooted drivers of conflict

Despite the threats of attacks on humans and damage to resources being cited as the main reasons for conflict with wildlife here, it was very clear that a variety of other factors played a very important role in shaping peoples' attitudes towards wild animals, and these are discussed in more detail below.

8.2.1 Ethnicity and inter-ethnic conflict

Ethnic group emerged as one of the most significant determinants of conflict with carnivores, with people from traditional pastoralist groups voicing more negative opinions than those from agro-pastoralist groups. This importance of social or ethnic group has been noted in previous studies of carnivore conflict: in a study in Wisconsin, social group was found to be a stronger determinant of tolerance to wolves than personal experiences of depredation (Naughton-Treves et al. 2003). This is probably to be expected, as people from different social and cultural backgrounds often have a very different set of beliefs and expectations about what the world 'should be like' (Boholm 1998; Williams 2005). It was also evident here that respondents from different ethnic groups varied in important ways, such as the type and number of stock holdings, variation in levels and causes of reported stock loss, and differing proximity to the Park, but the fact that ethnicity itself was a strong predictor of the intensity of carnivore conflict suggests that it is a complex mix of factors related to ethnicity that drive this trend, rather than one single important driver such as the degree of stock loss. Respondents from traditional pastoralist groups did report suffering more depredation, but the number of stock lost did not seem to be the main cause of variation between ethnic groups in terms of their attitudes towards focal carnivores. One important factor that is hard to quantify is the fact that the number of stock does not in itself truly represent the impact of depredation upon ethnic groups with a strong social and cultural attachment to their livestock, as discussed above, and certain groups here, particularly the Maasai and

Barabaig, exhibit this far more than others (Klima 1970; Shorter 1974). People from these groups are likely to view stock-killing predators with more antagonism than people without such strong emotional and societal connections with their livestock, resulting in more intense conflict with carnivores even if losses are numerically similar to those experienced by people from other ethnic groups.

Another of the key differences between ethnic groups was the level of income diversification from livestock, with people from traditional pastoralist groups relying on fewer sources of income than others. Having limited livelihood strategies has been linked to increased conflict with wildlife before, as it is thought to diminish the capabilities of people to withstand environmental changes and resource losses (Naughton-Treves and Treves 2005). The lack of any other income sources apart from livestock has been linked to greater hostility towards predators elsewhere (Bagchi and Mishra 2006; Hazzah 2006), but the fact that dependence upon livestock was linked more strongly to general wildlife conflict rather than specific carnivore conflict suggests that the fear of depredation was not the sole driver here, but that other factors were also important. One likely contender was the commonly-cited antagonism between pastoralists and farmers, based upon competition over land and resources, which is an important flashpoint between groups in the study area (Williams 2005). Insecurity of land tenure and resource access is an increasingly important issue in the Pawaga-Idodi area, particularly for relative newcomers, such as the pastoralists, who are often viewed by the Hehe and other farming groups as little more than squatters on village land (Williams 2005). Agro-pastoralists and pastoralists often have fundamentally different perceptions of what are acceptable rights over and uses of village land, and people who have diversified into farming and other forms of land use are now ensnared in an ongoing battle with people who still rely solely or heavily upon pastoralism (Williams 2005).

The population in Pawaga-Idodi has soared over the past few decades, and the degree of agriculture in the area has risen greatly with the advent of irrigation schemes, which were developed through the 1980s and 1990s to encourage rice cultivation (Walsh 2007a; Williams 2005). As the Hehe, Bena and other groups diversified into various forms of agriculture, the Maasai and Barabaig pastoralists found themselves increasingly hemmed

in by farmland, with the land available for them to graze on substantially diminished (Williams 2005). The twin encroachments of farmland and protected areas into their traditional grazing lands have driven pastoralists into substantial conflict with their farming neighbours, and have intensified hostility and competition over resources (Williams 2005). Pastoralists are fined if their cattle stray onto farmland, and there were numerous complaints during this study that such fines were considered excessive, and even that farmers were employing underhand means to extract fines from pastoralists. The pressures now exerted on people who remain heavily reliant upon livestock in this area are considerable, with limited access to resources and increased economic costs of grazing in the patches of land between the farmlands and the Park. It is likely that this scenario influences peoples' views towards local wildlife, partly as the economic impacts resulting from poorer grazing and fines after incursions onto farmland mean that any additional wildlife-related damage or further competition is particularly hard to bear. The importance of such factors has been seen in the Transmara district of Kenya, where insecurity over land tenure, issues of disease transmission from wild animals to livestock, competition over remaining forage and water sources with wild animals, and problems with resource access as a result of protected land, have all been major drivers of intense pastoralist-wildlife and pastoralist-park conflicts (Nyamwaro et al. 2006). This conflict between different ethnic groups in this area is not surprising, as inequalities in political and economic power, constitutional differences and demographic instability (all of which occur within Tanzania, with pastoralists particularly marginalised) have been linked to high conflict within multi-ethnic societies, while the requirements for peaceful coexistence of different ethnic groups include economic parity between groups, adequate political representation of minority groups, and effective decentralisation of political power (Hewitt 1977). Despite all the efforts to reduce the ethnic divisions between groups in Tanzania, it is clear that much work remains to be done in terms of sharing political power and economic wealth with currently marginalised ethnic groups, and major changes are needed in order to substantially reduce the existing inter-ethnic conflict.

Overall, numerous differences exist between people of different ethnic groups and livelihood strategies in terms of how they view wildlife and resource use, and these issues also permeate many of the other factors affecting conflict that are discussed below.

8.2.2 Discrepancies in costs and benefits of wildlife presence

The resentment felt by pastoralists at their increasingly restricted access to local resources as land was allocated to wildlife or farming, was likely to have been amplified by the widespread perception that while wild animals used to have value to them, they no longer do so. The Maasai in particular mentioned the long-standing cultural value attached to carnivores, with lions traditionally valued due to the respect that hunting them garnered for young men, but said that this was not applicable any more. Some inter-ethnic conflict was also reflected here in comments about any current utility of wild animals, with people commonly feeling that other people benefited from their presence while they themselves incurred only costs. The Maasai felt that although they no longer received benefits from carnivore presence, the Barabaig still profited by killing lions and being rewarded with cattle from other community members, although the Barabaig said that this was no longer the case. Similarly, the Hehe felt that the Gogo, a neighbouring ethnic group, benefited from the presence of hyaenas as they employed witchcraft to use them for transport and stock theft, enabling the Gogo to eat meat without killing their own livestock. Hyaenas have been associated with carrying witches on their backs (Mills and Hofer 1998), apparently due to their sloping backs, while, interestingly, research showed that people in north-western Zimbabwe thought that witches relied upon wild dogs instead as a mode of transport there (Davies and du Toit 2004). In Mozambique, lions are increasingly viewed as representing ‘people-lions’ rather than ‘bush-lions’, with locals saying that they have been sent by sorcerers to jealously kill other people (West 2001). This association of animals with witchcraft, or with damage actually plotted by a rival ethnic group, can be an important factor intensifying dislike and distrust of the animal concerned, and this has been documented in various studies worldwide (Richards 2000; Rye 2000).

In some instances, though, wild animals can still provide benefits to local people, often through consumptive use, such as for amulets and medicines or through the value of their skins. The traditional use of carnivore body parts has been documented for millennia, with Pliny the Elder dedicating at least five pages of his *Natural History* tome to the potential pharmacological uses of just one carnivore, the spotted hyaena: he writes that “barrenness in women is cured by an eye taken in food with liquorice and dill, conception being guaranteed in three days”, with various other parts of hyaenas recommended for treating headaches, toothaches, eye complaints and low libido (Glickman 1995). More recently, Mills and Hofer (1998) described numerous traditional uses of hyaenas across Africa, while Adeola (1992) recorded how a variety of carnivore body parts were used in traditional Nigerian rituals and medicines. Davies and du Toit (2004) also detailed a multitude of medicinal uses for wild dog body parts in Zimbabwe, including using their faeces and fat to treat tetanus, their skin to treat cuts, and their teeth to promote strong tooth growth in children. Here, most of the cited medicinal uses involved lions and leopards, but many carnivore body parts are considered significant in traditional medicine in Tanzania (Mills and Hofer 1998; Msuha in prep; TAWIRI 2007b).

Some non-consumptive uses of carnivores were cited as benefits, and these often also referred to traditional beliefs, such as thinking that a small level of carnivore depredation would lead to an increase in the number of newborn stock that year, and similar superstitions have been documented elsewhere (Davies and du Toit 2004). Interestingly, people made it clear that this was only true for certain carnivores, with hyaena depredation in particular always considered unlucky. This reveals the deep-seated discrepancy in attitudes towards different carnivores, even if they do exactly the same thing, with hyaenas often tending to be particularly disliked.

It was very clear that although tourism was occasionally referred to as one of the non-consumptive benefits associated with wild animals in general, very few people mentioned this as one of the benefits of having carnivores around, despite these animals being the ones that are particularly important in drawing tourists to the Park. This is likely to be due to the fact that people currently receive too few relevant benefits from tourism to have a significant impact on their attitudes towards dangerous wild animals. There was

clearly a discrepancy in the cost-benefit ratio of wild animal presence to local communities here, with significantly more negative aspects of their presence mentioned compared to positive aspects, and nearly three-quarters of people saying that the costs of focal carnivores in particular outweighed any benefits. Moreover, many of the benefits were recognised as being advantageous for the community in general or for other people, for instance with pastoralists complaining that building classrooms was not important for them, as their children rarely attended school, and just helped more settled farming families. As has been seen above, this perception that other groups are benefiting while the respondent themselves is not, can actually intensify conflict, so these apparently skewed benefits can become a significant source of antagonism. The failure of wildlife-related revenue to reach many people at the individual household level has been demonstrated elsewhere in Tanzania, with the vast majority of people interviewed around Tarangire National Park in northern Tanzania saying that they had no benefits to their households from wildlife revenue, despite the large sums being generated locally (Sachedina 2006). This lack of tangible, widespread and relevant benefits, which are equitable for all groups of people and which outweigh any costs, is something that must be addressed urgently for effective conservation, as people are clearly only likely to genuinely want to invest in maintaining a resource if it is advantageous for them personally to do so. The development of possible appropriate schemes to derive such benefits is discussed further in section 8.3.2.

8.2.3 The influence of external religion

Having converted to an external religion, rather than retaining traditional beliefs, was linked to more intense conflict, both for wildlife in general and carnivores in particular. This trend has been noted before, with Hazzah (2006) identifying religious affiliation as a key determinant of intense conflict, with pastoralists who had been converted by missionary groups to evangelical churches apparently the most likely to kill lions. Religion has long been criticised as having negative repercussions for conservation, with the Bible chapter of Genesis often blamed for proclaiming humankind's dominion over wild animals, planting an idea of dominance over other creatures and a lack of respect for nature among Judeo-Christian followers (White 1967). Western Christianity has been

denounced as the most anthropocentric form of religion ever known, espousing the duality of man and nature, highlighting the mastery of man over the environment, and suggesting that it is God's will for humans to exploit nature for their own ends (White 1967). This is in marked contrast to traditional pagan animist beliefs, where every natural construct – every hill, spring and tree – is considered to have its own spirit that must be placated and honoured before natural objects can be changed or destroyed (White 1967). The theological conversion to western Christian beliefs was therefore blamed for inducing a significant shift in peoples' perceptions, allowing and even encouraging them to exploit nature without being inhibited by the idea of spirit guardians protecting the natural world, a concept that Christians regarded as idolatrous (White 1967). This condemnation of the ecological implications of religious beliefs has continued apace, with evangelical Christians criticised for believing that current anthropogenically-driven environmental destruction is merely the fulfillment of prophecies stated in the Book of Revelations, heralding the imminent Second Coming of Christ, and therefore having no incentive to prevent it, and even a reason to advance it (Orr 2005).

Religious advocates have sprung to the defence of their beliefs, strongly denying these accusations of complacency and even complicity in the face of environmental degradation. Henderson (2005) cited excerpts from a National Association of Evangelicals (NAE) report, which stated that 'dominion' entailed responsible stewardship over nature, rather than a licence to destroy it. There is even an Evangelical Environmental Network, which worked to prevent the dismantling of the Endangered Species Act (Barcott 2001; Henderson 2005; Johns 2005), as well as a Judeo-Christian Stewardship Conservation Ethic, developed by people who interpret biblical stories such as Noah's Ark as showing that God intended the Earth to be filled with all kinds of animals (Borgerhoff Mulder and Coppolillo 2005; Callicott 1994). Moreover, many religions still maintain a strong environmental ethic, with faiths such as Islam, Hinduism, Jainism, Buddhism, Taoism and Confucianism all highlighting the interconnectedness between all living beings, and entailing obligations of stewardship of man towards nature, rather than domination (Borgerhoff Mulder and Coppolillo 2005; Callicott 1994), although Harris (2006) considers that people often credit Eastern philosophies with more of a pro-environmental

meaning than they deserve. However, even people belonging to the same broad church are likely to vary markedly in their personal beliefs and practices, a fact recognised even by strong critics of religion's effects on the relationship between humans and nature (White 1967).

Importantly, however, traditional animist beliefs often incorporate spiritual messages and practices to help deal with the threat of wild animals, which seem to be missing from the teachings of Western Christianity. Many traditional societies believe that problems caused by wild animals are some kind of spiritual punishment for human actions, and that such problems can be avoided by practising certain rituals and actions. For instance, Nuer pastoralists reportedly believed that 'lions should refrain from killing the cattle of those who respect them', so by showing sufficient respect, they were confident that such problems could be avoided (Evans-Pritchard 1956). Similarly, the Turkana people living around Lake Turkana in north-western Kenya believed in a God who used crocodiles to punish bad people, so you had nothing to fear from crocodiles if your conscience was clear (Quammen 2003). Traditional practices are often used to guard against any wildlife threat – this is seen with the Udege people, who are traditional hunters living in south-eastern Russia, and consider the Siberian tiger (known locally as Amba) to be an important spiritual being, and do not fear it as long as certain practices are adhered to (Quammen 2003). Udege hunters will pause in the forest and offer prayers, acknowledging the presence of Amba, while some people carry cloth strips with them, and if a tiger is encountered then they tie the cloth around a tree, bow and retreat, which shows respect to Amba and is thought to bring luck to the hunter (Quammen 2003). Although such practices may seem archaic in the modern world, such rituals and beliefs help people retain some sense of control and power, and as noted previously, people tend to be far less fearful of a risk of they perceive that they personally exert some control over it (Langer 1975; McKenna 1993). Missionaries and evangelicals converting people to western Christianity encourage people to abandon their traditional cultural practices and beliefs, as seen with the Maasai in Kenya (Hazzah 2006), so the cessation of traditional rituals intended to prevent wildlife damage, and the resultant lack of control,

may well be an important contributor to why converted people are more hostile towards wildlife than people who have retained their traditional beliefs and practices.

Despite the occasional impassioned debates that have occurred about the relevance of religion, the possible importance of people's religious and spiritual beliefs has often been overlooked in human-wildlife conflict and other environmental studies, with even the World Conservation Strategy criticised for 'markedly avoiding dealing with the great moral and spiritual backcloth of mankind' (Boyd 1984). Although many other factors are clearly important in affecting peoples' attitudes towards wildlife and the environment, adherence to western Christian beliefs does seem to play a role in intensifying human-wildlife conflict, and this is something that should be considered and investigated further in future studies. The need for such consideration is highlighted by the large-scale 'conversion' in Africa over recent decades from traditional beliefs to Christian ones: during the first decade of the twentieth century it was estimated that around 10 million people, or 9.2% of the population, were Christians, but by the 1990s that had increased to 237 million, and was estimated to reach 50% of the population by 2000: a trend described as 'the missionary success story of all time' (Kirby 1994). Although this pattern of decreased tolerance towards wildlife amongst converted Christians has now been observed in various sites across East Africa, it would be extremely valuable to examine the process by which this seems to occur. Missionaries have been accused of having very little cultural sensitivity towards the societies that they are working in, and have long worked to suppress traditional rituals and practices, with missionaries reported as regarding traditional African belief systems as 'a morass of bizarre beliefs and practices' (Clarke 1986; Kirby 1994). Given this keenness to alter traditional practices, it would be particularly interesting to investigate if and how peoples' livestock management strategies change as their religious convictions do, and if and how their attitudes to predators change as well. The need for a study to investigate the correlations between husbandry practices and religious affiliation was highlighted by Hazzah (2006), as there is currently very little information available on this topic. The data gathered here did not point to a marked difference in livestock husbandry strategies reportedly being employed by people who had retained traditional beliefs and those who had converted to an external

religion, suggesting that an alternative mechanism is responsible for changes in attitudes. The results presented in this thesis provide a snapshot of the situation, indicating that there is some link between conversion to an external religion and increased conflict with wildlife, but did not permit the longitudinal study of attitudes and practices as people underwent conversion – a study that would be well worth undertaking in order to examine and understand this relationship in much more detail.

8.2.4 Attitudes towards protected areas and related authorities

Even the model including reported experiences of depredation, ethnic group and religious affiliation – all demonstrated as playing an important role in influencing peoples' views of wildlife – only explained a minority of the variation in reported conflict between respondents, suggesting that other drivers are also significant. This could include factors that have appeared as important in conflict studies before but were not included here, such as the density of people or wildlife around the villages (Newmark et al. 1994; Patterson et al. 2004), and these will hopefully be investigated in follow-up research in order to examine their apparent relevance in terms of influencing conflict. However, other factors that are harder to quantify are also likely to play an important role, such as peoples' attitudes towards the nearby network of protected areas and their authorities, as studies have often revealed a strong link between attitudes to protected areas and views of the wildlife that they protect and therefore represent (Kideghesho 2006; Naughton-Treves and Treves 2005; Nyamwaro et al. 2006). This is particularly true if there is a perception that the needs of wildlife are being prioritised above those of local people. An example of this came from a critic of the integrated conservation and development project around Ranomafana National Park in Madagascar, which was initiated to assist in lemur conservation, when he said 'The next time you come to Madagascar there'll be no more Malagasy. All the people will have starved to death, and a lemur will have to meet you at the airport' (Kottak 1999, cited in Borgerhoff Mulder and Coppolillo 2005).

There was little immediately evident hostility towards Ruaha National Park here, with more than half the respondents claiming that they liked the Park, and nearly three-quarters saying that they liked the Park authorities. It must be remembered, however, that

this study was conducted under the auspices of the Wildlife Conservation Society, which has worked with the Park, and may be viewed as a closely allied organisation by local people, thereby making them less willing to discuss negative views. However, the converse could also be true – people seemed to most strongly emphasise their problems with wildlife when a foreigner was present, so they could also use the survey as a chance to vent frustrations about the Park in the hope of more assistance in the future. The suggestion that there may be some underlying hostility towards the Park was strengthened by the evidence that people who had direct experience with the Park or its personnel were more negative about wildlife, even if that experience was intended to be positive. It was clear that people were happy about the idea of more contact with the Park, especially in the form of visits by schoolchildren, but any contact that people had experienced so far appears not to have resulted in more positive views about wildlife and conservation. This is likely to be because the presence of the Park and its associated wildlife populations has had few positive impacts on local peoples' lives, and any such impacts would have to be very marked in order to overcome the long history of dispossession and ill-treatment that many rural Tanzanians have suffered in the name of wildlife conservation. Although people seemed genuinely interested in the opportunity of visiting the Park and knowing more about it, seminars and other forms of outreach are highly unlikely to change very ingrained attitudes regarding the negative impacts of living alongside wild animals and protected areas. It is unclear why such contact should actually make attitudes towards wildlife more negative, although it is conceivable that if people see the amount of resources being channelled into wildlife conservation and the Park infrastructure, it would make them more hostile about the fact that similar efforts are not being made by the state in the rural villages, thereby increasing antagonism towards the wildlife populations receiving such unfair benefits. Indeed, few people actually reported a personal benefit from the Park or tourism, although more considered that it had benefited others or the community at large, through assistance such as building classrooms and providing water boreholes in the villages. This lack of conservation-related benefits reaching the household level, despite considerable revenue passing to other people, has been noted in other communities living close to conservation areas in

East Africa (Homewood and Trench 2008; Thompson and Homewood 2002), and must be addressed as a matter of urgency.

Pastoralists in particular were negative about the limitations on resource access imposed by nearby protected areas, however, as well as the costs imposed by dangerous animals straying out of the Park and onto village land. They also resented the fact that they were viewed as a threat by the Park authorities, and several stressed that they were ‘good neighbours’ instead of hunters of wildlife, which they felt they were perceived to be by the authorities. Several of the Maasai viewed the multiple land use strategy employed within the NCA, where pastoralists are allowed to graze and use resources within the protected area, as a very good approach, and said that they would like a similar scheme to be utilised in this study area. Given the marked inter-ethnic tensions in the area, the idea of an area designated specifically for the Maasai may have also made it seem like a particularly attractive scenario to the Maasai here. However, while the Maasai around Ruaha may view this as an ideal solution to problems with grazing and resource access, the experiences of pastoralists actually within the NCA show that it has been far from an idyllic scenario. For instance, the original Ngorongoro Conservation Ordinance in 1959 originally decreed that the NCA would encompass more than half the Serengeti plains, all the Ngorongoro highlands, and the Endelun Game Controlled Area (Thompson 1997b). Within this area, pastoralists were entitled to retain rights of permanent habitation, cultivation and socio-economic development, and due to their loss of traditional water sources within what became the Serengeti National Park, they were to be provided with water development projects and other social services (MLNRT 1990; Perkin 1997). Moreover, the Governor of Tanganyika proclaimed in a speech in 1959 that ‘should there be any preference between the interests of the game and the human inhabitants, those of the latter should take precedence’ (MLNRT 1990; Perkin 1997). However, significant conflicts had already arisen by the 1960s, with the Ministry of Agriculture and other powers supporting the degazetting of 85% of the NCA, to allow commercial ranching and wheat farming, which caused huge and acrimonious debate (Homewood and Rodgers 1991). Finally, the President intervened and placed the NCA under the control of the new Ministry of Natural Resources and Tourism, an arrangement that prioritised conservation

over human interests, reversing the original scenario (MLNRT 1990). By 1975, restrictions on pastoralist land use were already being imposed, with permanent bomas on the Crater floor prohibited by 1974, and the Ngorongoro Ordinance revised in 1975 to ban all cultivation within the NCA, although this ban was temporarily lifted in 1992 (MLNRT 1990; Perkin 1997). There have been issues with in-migration of people from other groups, difficulties over establishing who exactly is entitled to live within the NCA, problems with the provision and costs of social services, insufficient access to water resources, and resentment over the lack of Maasai involvement in NCA management (Aikman and Cobb 1997; Perkin 1997). Additionally, although the NCA is an internationally famed tourist destination and generates substantial economic revenue, these benefits have consistently failed to reach indigenous residents, with tour companies usually employing outsiders on the grounds that local people are often untrained and unqualified for the majority of jobs in the tourist industry (Perkin 1997). These conflicts have only intensified over recent years, as fluctuating human, wildlife and livestock populations within the NCA make balancing land-use and conservation aims ever more difficult (Perkin 1997).

Despite the lack of personal benefits currently reported as resulting from the presence of wildlife or the Park, people claimed to be hopeful about the future, with many people feeling that their children would increasingly benefit from the local protected area system and wild animals, and only a very small minority saying that they thought their children would want to change the status quo in terms of protected areas. This optimism may stem in part from enthusiasm for the new Pawaga-Idodi Wildlife Management Area, which was finally gazetted in 2007, with hopes that it would increase the revenue from wildlife to local people, thereby redressing the local cost-benefit ratio of wild animal presence, and provide incentives for better wildlife management and conservation. Importantly, such revenue should go directly to the villages, rather than into central government coffers (MNRT 1998). Economic schemes designed to incentivise conservation have worked well elsewhere in reducing human-wildlife conflict (Bagchi and Mishra 2006), while economic models have suggested that increased ecotourism would be an effective method for offsetting most or all of the costs of maintaining wild dogs outside reserves in

South Africa (Lindsey et al. 2005a), so the income from the WMA could have a very positive effect here. There have been marked problems with WMAs established elsewhere, however, and these are discussed in more detail below.

There have been some criticisms of the likely impact of WMAs, with concern that as the Director of Wildlife retains final authority they might become another form of state control over wildlife resources, and whether returns spread across multiple villages will actually have a household-level impact (Sachedina 2006). Around Tarangire National Park, proposals to establish WMAs were met with suspicion and hostility, driven by concern that local people would only end up further marginalised by new initiatives in the name of conservation, and many pastoralists engaged instead in ‘defensive farming’ to cement their current land tenure and obstruct any further land alienation (Sachedina 2006). So far, no significant problems have emerged from the recent formation of the PI-WMA, with much work done to involve all the relevant stakeholders, but only time will tell whether its establishment will really produce household-level benefits to local people, and whether it will have a marked impact on reducing conflict with wildlife and increasing incentives for conservation in the Pawaga-Idodi area.

8.3 Moving forwards: strategies for protecting both people and the pests

Resolving conflict is particularly challenging when the central antagonism revolves around species that are locally problematic yet internationally valued – species that have been termed ‘internationally protected local pests’ (Knight 2000b). However, it is considerably more difficult when numerous different factors influence the level of antagonism, which not only include the actual risk posed by conflict-causing species, but also the fear of potential risks, innate dislike of certain species, and additional stressors relating to problems with resource access, the ramifications of past conservation interventions, resentment of wildlife-related authorities, and hostility and suspicion between people of different ethnic groups or lifestyles. Importantly, as this study shows, even an apparently simple conflict centring around the threat of wildlife damage often involves many of these factors, making its resolution more complicated than would initially be expected. This is not to say that such conflict cannot be eased, but that it must

involve a far wider and more complex approach than simply dealing with the ‘dispute level’ of conflict, i.e. the issue of problems caused by wild animals to people and their resources. Some of the components likely to be necessary for achieving effective, long-term conflict mitigation are discussed in the following sections.

8.3.1 Reducing the costs of wildlife presence

Investigating measures to reduce the level and impact of depredation should be part of any conflict mitigation strategy in this area, as although the level of stock loss to predators appeared to be very low, this was cited by local people as the main reason behind hostility towards carnivores. Happily, much of the ability to reduce livestock loss rests with local people themselves, with the results here indicating that strict adherence to traditional livestock protection methods, such as the use of dogs, enclosing stock within good bomas at night, and having adult herders, is effective at reducing the chances of depredation. Using dogs was particularly effective at deterring wild dogs, which were reported to be the primary culprits causing surplus killing, an action that resulted in particularly intense conflict. After talking to many different livestock owners and herders across the study area, guides have been produced and distributed widely to local people, demonstrating some of the simple techniques that local people have found to be most effective at repelling predators, such as using an old, broken jerry can by placing it on top of a pole within a stock boma, which makes a loud noise when stock crowd together in the boma as a predator approaches, and therefore scares away the predator (Dickman and Msigwa 2007). As many people in the study area are illiterate, the details of such techniques, as well as information on the behaviour of different predators to help people best protect against certain species, and suggestions on how to best guard against attacks upon humans, are also explained during video nights and talks in the villages, which have so far proved very popular, although their effects upon conflict are yet to be investigated.

However, implementing effective livestock husbandry techniques can clearly still entail significant costs, both in terms of money and time, and these costs can be prohibitive for the poorest families, which are also those which would be hit hardest by any depredation incident. Moreover, the pastoralist way of life is already very labour-intensive, with

people's time and energy stretched by the demands of herding, digging wells, milking livestock, looking after children, fetching and carrying water, building houses, preparing food, travelling to markets, and cultivating crops (Sieff 1997), so investing further in livestock protection may simply be impossible given these existing constraints. Therefore, in reality it would be easier for people to just kill predators in an effort to reduce the chances of stock loss, as this means that they can be pro-active in attempting to reduce the problems they face with wild animals, while also being able to vent their hostility by killing the predators that are endangering their stock. This is undoubtedly a common approach wherever people live alongside problematic carnivores, and has been reported in Namibia, where farmers often elected to kill cheetahs as a retaliatory or preventative measure, even if they were not currently experiencing problems with them (Marker 2002), as well as in the United States, where ranchers who are antagonistic to legally protected wolves deal with the issue by using the 'shoot, shovel and shut up' approach (Eriksson et al. 2002).

Therefore, instead of just aiming to mitigate the costs of wildlife presence, the only long-term solution will be to develop initiatives that actually make having conflict-causing animals around worthwhile. One possible solution would be for external agencies interested in mitigating conflict to assist in reducing livestock losses to other causes such as disease, which is clearly a huge problem for local people, and thereby increase the ability to withstand any stock loss as a result of depredation. The results here indicate that if losses to disease were cut by even a quarter, this improvement would then completely cancel out the current reported level of loss to predators. Numerous householders complained that they did not have access to or money for necessary veterinary medicines or treatments such as cattle dips, while those who did manage to obtain them often used them incorrectly, resulting in livestock becoming ill or even dying. The establishment of a scheme such as the Snow Leopard Trust's livestock vaccination programme, where the Snow Leopard Trust (SLT) and local partners have enabled local herders to obtain vaccinations and thereby reduce livestock disease deaths, which, as here, had a far greater impact on stock numbers than deaths to carnivore depredation, could be an important model for this area (SLT 2008). Access to the vaccinations is clearly linked to the SLT,

and is similar to programmes initiated by other wildlife conservation organisations, such as the Ethiopian Wolf Conservation Programme where help given to local communities is clearly advertised as resulting from the presence of certain species, with the intention that people will recognise that maintaining those species also results in the maintenance of such benefits (Sillero-Zubiri and Laurenson 2001). Boosting household income through animal health schemes has been suggested elsewhere in Africa where conflict with predators is high, such as in reserve-adjacent areas in Zimbabwe (Butler 2000). The presence of the WCS-linked Health for Animals and Livelihood Improvement (HALI) project in this study area, which has already harnessed considerable local and international veterinary expertise, and is already working to investigate the impact of zoonotic diseases on local pastoralist and agro-pastoralist communities, means that a partnership working with the HALI project to see whether livestock vaccination to reduce stock loss to disease resulted in a discernible impact on easing wildlife conflict could be a very realistic and valuable future initiative.

However, in many cases the assistance from such programmes comes with conditions attached – for instance, the SLT provides vaccinations on the proviso that local people do not kill snow leopards or their prey, and that people do not increase their herd size beyond certain limits, with the SLT helping people to sell stock above that limit (SLT 2008). It could be argued that, despite their immediate benefits, such initiatives are encouraging a form of ‘enforced primitivism’, where people are only assisted if they eschew certain practices and do not achieve the levels of wealth and stock ownership that they may otherwise aspire to. This has been a problem in many places where conservationists have formed alliances with local people, as external help is often conditional upon indigenous people surrendering some of their rights (Borgerhoff Mulder and Coppolillo 2005). There are obvious problems with this, such as increasing innate resentment of local people to conservation agencies due to the restrictions imposed, and that it does not necessarily lead to a long-term change in behaviour, as once people have sufficient resources to buy things such as vaccines themselves, they are likely to do so without still adhering to external rules such as not killing predators. Moreover, there is a risk that by reducing losses to disease, predation would appear as a relatively larger

problem, so this may not result in people feeling more tolerant towards the carnivores concerned, and attitudes towards carnivores appeared robustly negative here even if people had not suffered depredation in a year. Nevertheless, such schemes have proved useful in assisting local people and helping to reduce predator offtake in the short-term elsewhere (Sillero-Zubiri and Laurenson 2001), and it would be a worthwhile scheme to investigate developing in this area. The existence of information on peoples' attitudes and reported rates of stock loss before the development of such a project, as presented here, will be very useful in examining the effects of any such scheme, both in terms of reducing stock loss and in terms of changing peoples' attitudes towards wildlife. However, effective, long-term conflict resolution will really hinge upon local people being centrally involved in deciding upon the best schemes to profit from wildlife presence in their area, and managing those profits to provide tangible, relevant, long-term and clearly commensurate benefits to the households that traditionally bear most of the wildlife-related costs. Possible strategies for increasing benefits from wild animal presence are discussed in the next section.

8.3.2 Increasing the tangible benefits of wildlife presence

Having local people take charge of schemes enabling them to receive direct, relevant benefits of conservation, that outweigh any costs, will be the only way that they are actually likely to want to keep dangerous wild animals living on their land. In the Pawaga-Idodi Area, the recent establishment of the WMA could help to provide these kinds of benefits, although lessons learned from other places show that establishment alone is clearly not enough. Economic modelling has suggested that, in theory at least, WMA formation can generate substantial benefits from wildlife, which can be used to fund community development projects, or simply distributed to villagers as cash benefits, something that several villagers in this area mentioned as an ideal scenario, as this would enable them to receive tangible rewards from the WMA that they could use as they individually wished to (Christophersen et al. 2000). Such rewards from wildlife areas have been linked to increased support for conservation, tourism and the existence and maintenance of protected areas elsewhere (Sekhar 2003), which would be the desired scenario here from a conservation viewpoint. Importantly, another local benefit is that the

development of the land use plan associated with the formation of the PI-WMA clearly demarcates certain land use zones, including traditional grazing areas, which is intended to help strengthen land tenure rights for local pastoralists (Coppolillo and Dickman 2007), so should in turn help to reduce the people-people conflicts that are evident in the study area. The development of WMAs has specifically been mentioned as a positive step for the conservation of Tanzania's large carnivores, as theoretically it should improve the cost-benefit ratio of large carnivore presence outside protected areas and finally provide some rewards from their presence to local people (TAWIRI 2007b, 2007c).

However, despite the potential benefits of WMA formation, the ones that have been implemented so far prove that there are also many pitfalls. In both Simanjiro and Loliondo districts of northern Tanzania, proposals to develop WMAs were greeted with suspicion, hostility, and, in some cases, violence, as people feared that the new designation was merely another way for the government to alienate village land under the guise of conservation (Gardner et al. 2004; Sachedina 2008). There have been significant conflicts between villages involved in WMA formation, and it was alleged that during the creation of Burunge WMA, the District Game Officer (DGO) utilised his powers to evict families from the proposed WMA area, organised the placement of beacons demarcating different land use zones without the agreement of the relevant Village Assemblies, and bribed village leaders (Igoe and Croucher 2007). Moreover, the villagers concerned complained that Burunge WMA had been formed 'behind their backs and against their will' (Igoe and Croucher 2007). In the Enduimet WMA in northern Tanzania's Longido District, villagers complained that the DGO had forced them to go along with WMA creation, and they consequently rebelled by defacing the beacons marking the WMA boundaries and calling for villages to withdraw from the WMA concerned (Nelson et al. 2006; Sachedina 2008). The formation of WMAs has also threatened some existing revenue on village land: for instance, around Tarangire, the creation of a WMA led to a hunting company suing the owners of a photographic tourism camp on village land that was generating around US\$26 000 for the village concerned (Nelson et al. 2006; Sachedina 2008). As a result, the camp stopped operating, and the villagers were so irate at losing their revenue stream and control over their local resource use that they

threatened the clients of the hunting company concerned with spears, which almost caused an international incident as one of the hunters happened to be the Ambassador of the US to Tanzania (Sachedina 2008). The main criticisms levelled at WMAs include the bureaucracy involved in establishing them, the fact that the Director of Wildlife still retains final authority in WMAs rather than truly devolving power to the local level, and the fact that economic returns are unlikely to have a significant impact on livelihoods at the household level (Nelson 2007; Sachedina 2008). The villagers whose land is under discussion are often illiterate and unaware of all the relevant legislation and conditions involved, so they are forced to rely upon other people to interpret these for them (Igoe and Croucher 2007). Furthermore, while tourist hunting is the activity likely to provide most revenue at a WMA level, the management and rights to such revenue are not devolved to local people (Nelson 2007; Sachedina 2008). Another problem is that although WMAs are based on a multi-village unit, agreements regarding photographic tourism are usually made at the single village level, which can create conflicts when villages with such initiatives have to share them with other villages in the WMA who do not have them, as stated in the WMA Regulations (Sachedina 2008). Moreover, the power and control over what to do with land is divested from individual villagers once land is placed within a WMA, while wildlife-related revenues rarely appear to flow back into the communities as promised, and usually benefit only a few well-placed village elites if they do so (Igoe and Croucher 2007).

The formation of the PI-WMA in this study area appears to have avoided at least some of these problems, as every village was involved in the land use planning and WMA establishment process, and there has been no evidence of corruption yet, but many of the other problems are inherent to the WMA legislation and structure, so will be harder to overcome. Dealing with these issues of conflicting legislation and policies, and the state's unwillingness to truly devolve power and control to local people, will require a dramatic overhaul and harmonisation of Tanzania's land and wildlife regulations, which are unlikely to be forthcoming in the near future. Nevertheless, it will be interesting to see what happens in the Pawaga-Idodi area once the WMA is fully operational, and the existence of these data on attitudes prior to its formation means that its effects on

peoples' views towards wildlife, its perceived costs and benefits, and its overall impacts on their livelihoods can be investigated and used to suggest how the situation could be improved further.

However, there are other possibilities for generating benefits from wildlife without relying entirely upon revenue from the WMA. In Kenya's Amboseli-Tsavo region, where conflict between pastoralists and lions is a significant and growing conservation issue, a scheme called 'Lion Guardians' has been established, where young Maasai men are trained to track lions, provide advice to villagers in terms of where the tracked lions are, provide practical help in strengthening bomas, and talk to people about their problems and issues with large carnivores (Hazzah and Dolrenry 2007). This was developed after a study into the anthropological causes of conflict in the area, revealing much the same drivers as in this study, with people no longer receiving traditional benefits from lions and other carnivores, less opportunity for young men to prove themselves within the community, and little involvement of local people in conservation enterprises (Hazzah and Dolrenry 2007). This initiative is based on existing community institutions, encourages the Maasai to share their comprehensive knowledge of effective livestock husbandry with other livestock owners, engages local people themselves with conservation, and gives young men jobs and training, providing them both with employment and with prestige within their communities (Hazzah and Dolrenry 2007). The project has so far been very successful, and no lions have been killed on land where the scheme is active, compared to 12 on neighbouring land (Hazzah and Dolrenry 2007). It would be very useful to develop a project based on this same template in this area, as it is likely to help address some of the problems experienced by traditional pastoralists in this area, who are those reporting highest conflict and who have often been excluded from conservation initiatives. Ultimately, it will take working with the local communities to better understand the causes of their problems before effective resolution strategies can be put in place. This takes substantial time and effort, and any solutions must be appropriate, culturally sensitive, provide commensurate benefits and be driven by the needs of local people themselves, but the Kenya example shows that such solutions, when developed, can be effective in reducing conflicts between humans and wildlife.

8.3.3 Dealing with the underlying and deep-rooted drivers of conflict

It was very clear from the results of this study that a wide variety of different social, cultural, economic and political factors interact to create human-wildlife conflict, and therefore no single scheme is likely to be the ‘silver bullet’ that will resolve all the underlying problems. However, it is very important that conservationists in particular should be aware of this, as effectively resolving conflict will depend on far more than simply reducing the issue of wildlife damage.

Many of these factors appear so ingrained and deep-rooted that they appear virtually impossible to solve, such as the anger and continued fear over the alienation of land, but they must nevertheless be confronted as they are likely to be very important drivers of local hostility towards both wildlife and conservationists. On a local scale, this is important for researchers to bear in mind when conducting fieldwork – for instance, it was evident during the first year of this study that people became worried when the team started measuring the vegetation, and it only became apparent during the second year that they had been concerned that the study in fact involved some scheme to turn more land into conservation areas. Similarly, Williams (2005) found that farmers and herders in Idodi met his questions about their land use with suspicion, and he later discovered that it was because he was rumoured to be in Idodi in order to steal land off the local people. Such fears, if not understood and sensitively addressed, are not only likely to distort the results of the studies concerned, but also increase hostility towards external researchers and conservationists, who have long been associated with negative changes in local peoples’ livelihoods. On a larger scale, it is very important for conservation professionals in particular to face up to the social implications of conservation-related initiatives, and not blindly extol the virtues of such schemes without also considering all the possible implications for the people most affected by them. Although many researchers would instinctively shy away from ‘meddling’ in their host country’s affairs, the fact remains that pressure from conservation organisations and their donors has had, and continues to have, important effects on Tanzania’s land and wildlife policies (Igoe and Brockington 1999; Neumann 1998; Sachedina 2008), and equal pressure should be applied in order to resolve the current problems. There is a clear need to harmonise the laws regulating

Tanzania's land use and wildlife utilisation in order to reduce existing conflicts and insecurities over land tenure, control over resource use and access to revenues, and although this is clearly a matter for the Tanzanians themselves, international conservation NGOs and similar agencies should use their considerable power to press for reform in order to create more equitable alternatives to the current situation (Chambers 1997; Igoe and Croucher 2007).

In the meantime, however, smaller positive actions can be taken in an attempt to start mitigating some of the factors heightening human-wildlife conflict. Just learning about local peoples' viewpoints and their individual reasons for antagonism can be an important step, as conflict can be lessened simply by listening to the complaints of local people and demonstrating a willingness to respond to them. Evidence for this was seen in Ethiopia, where persecution of Ethiopian wolves and mountain nyala (*Tragelaphus buxtoni*) was linked to frustration with distant Government officials, and the simple recognition that local peoples' problems were legitimate was enough to reduce their simmering resentment and diminish the level of wild animal persecution (Gottelli and Sillero-Zubiri 1992; Sillero-Zubiri and Laurenson 2001). A similar situation was seen in North America, where hostility to distant environmentalists was taken out on grizzly bears, but this antagonism eased when a legitimate forum for the peoples' complaints was established (Primm 1996). Acknowledging peoples' complaints and frustrations is likely to be particularly important within communities such as pastoralists, which have traditionally been marginalised and disempowered, so recognising their problems as real and legitimate, and taking action to address them, is likely to be a powerful component of conflict resolution.

There is also a clear need in this area to start investigating the apparent link between conversion to an external religion and the increase in reported conflict with wildlife. This correlation between religious beliefs and conflict levels has also been noted in pastoralist societies in Kenya, where Hazzah (2006) suggested that it was due to people who adhered to an external religion being less conscientious about livestock husbandry, as they trusted God to look after their stock. There was no clear evidence for that here, but the relationship remained marked, so it would be very informative to conduct further

work on the changes in peoples' lifestyles, beliefs and practices following conversion to an external religion.

Although some factors found to be important here are clearly beyond any external control, such as someone's ethnic group, that does not mean that they should be ignored, but rather that different conflict mitigation strategies might need to be developed and adapted depending on the ethnicities or lifestyles of the people affected. For instance, the development of a scheme to reduce livestock deaths to disease, as discussed above, is most likely to benefit pastoralists, who have most livestock and regard them as being particularly valuable, both culturally and economically, and who also report most conflict with wildlife. However, the antagonism seen here over benefits which were perceived to preferentially help some people rather than others highlights the importance of developing schemes so that everyone perceives that they are receiving equitable benefits. This does not necessarily mean that a single scheme has to be developed for all villagers, but that appropriate conflict resolution strategies are identified and implemented for each group – for example, for people who are most dependent upon farming for their income, it may be better to focus on reducing their crop losses rather than reducing their stock losses to disease. One such programme has already been initiated by WCS in the study area, where people are encouraged to plant chilli plants as a barrier crop around their farm (Coppolillo pers. comm.) Following the use of this strategy elsewhere in Africa, the scheme has been adopted here as it provides farmers with another source of income through selling the chillies, and lessens the risk of elephant damage to farmers' main crops, as elephants tend to be deterred by the presence of the chilli (Osborn and Anstey 2002).

Overall, only by understanding the wide variety of factors, whether historical, ecological, social or cultural, which contribute to the development and continuation of conflict, will it be possible to develop the most locally appropriate strategies for successful, sustained conflict resolution. Helping local people to implement the most effective livestock husbandry strategies will undoubtedly play an important role in this, but it is clear that successful conflict mitigation will require a far more complex approach than simply dealing with this one aspect. Rather than just ameliorating the costs of wildlife presence,

people must be helped to develop and control schemes which generate enough relevant and tangible benefits from wildlife that they outweigh any remaining costs. However, for this to occur, and for long-term conflict resolution to be effective – in terms of both people-wildlife and people-people conflict – a fundamental shift will be required in terms of Tanzania’s land laws, legislation regarding wildlife utilisation, and the degree of power handed over to local people. This is a situation where the people who bear the majority of the costs and dangers of wildlife presence are also those least empowered to bring about such change, and where international NGOs, including conservation ones, should work to support them in developing a more equitable system, where all local people receive valuable, commensurate benefits for their continued coexistence with wildlife. This kind of multi-faceted, interdisciplinary approach to conflict resolution will require far more time, energy, understanding and collaborations than a simple attempt to resolve human-wildlife conflict by mitigating wildlife damage, but is probably the only hope for eventually creating the more hopeful future, with increased benefits from wildlife, that people here said that they envisaged for their children.

Chapter Nine

References



CHAPTER 9: REFERENCES

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*Note if also have stock at another location or not

Attitudes and knowledge

20. Please tell me all of the wild animals that live in the area around this household (within 1 day's walk) that you can think of:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

26. What do you think about wild animals living in the area around this household (within 1 day's walk)?

Can you sort these pictures into animals that are a big problem, small problem or no problem around this household, and explain why? (show picture cards):

| | Identification | | Problem? | | | Don't know animal | Doesn't occur here (within 1 day's walk) | Why is it a problem? |
|----------------------|----------------|--------------------|----------|-------|---------|-------------------|--|----------------------|
| | Right Y/N | Spp conf used with | Big | Small | No prob | | | |
| 27. Giraffe | | | | | | | | |
| 28. Elephant | | | | | | | | |
| 29. Hippo | | | | | | | | |
| 30. Lion | | | | | | | | |
| 31. Leopard | | | | | | | | |
| 32. Cheetah | | | | | | | | |
| 33. African wild dog | | | | | | | | |
| 34. Spotted hyaena | | | | | | | | |
| 35. Striped hyaena | | | | | | | | |
| 36. Impala | | | | | | | | |
| 29. Tiger | | | | | | | | |
| 30. Serval | | | | | | | | |
| 31. Rhino | | | | | | | | |
| 32. Crocodile | | | | | | | | |
| 33. Snake | | | | | | | | |
| 34. Buffalo | | | | | | | | |
| 35. Jackal | | | | | | | | |
| 36. Wildebeest | | | | | | | | |

| | | | | | | | |
|-------------|--|--|--|--|--|--|--|
| 37. Warthog | | | | | | | |
| 38. Zebra | | | | | | | |

39. Which animal (even if it has not been mentioned so far) causes the biggest problems in the area around this household (within 1 day's walk)? Why (if it hasn't been explained above)?

40. Have you had any experience with the National Park or with people related to it? (Briefly describe encounter)

41. What do you think has happened to the numbers of the following animals in this area, in the time period since you came to this household?

| | Increased | Decreased | Stayed the same | Don't know |
|----------------------|-----------|-----------|-----------------|------------|
| 42. Lion | | | | |
| 43. Cheetah | | | | |
| 44. Leopard | | | | |
| 45. Spotted hyaena | | | | |
| 46. African wild dog | | | | |

47. What would you like to see happen to the numbers of the following animals in this area, and why?

| | Increase | Decrease | Disappear completely | Stay the same | Don't know | Why? |
|----------------------|----------|----------|----------------------|---------------|------------|------|
| 48. Lion | | | | | | |
| 49. Cheetah | | | | | | |
| 50. Leopard | | | | | | |
| 51. Spotted hyaena | | | | | | |
| 52. African wild dog | | | | | | |

Frequency of sightings and attacks

| When was the last attack on your livestock by.....? | Lion | Cheetah | Leopard | Spotted hyaena | African wild dog |
|---|------|---------|---------|----------------|------------------|
| 53. When (year and month if possible) | | | | | |
| 54. Season of attack (dry/wet) | | | | | |
| 55. Location of attack | | | | | |
| 56. At/around this boma or elsewhere? | | | | | |
| 57. Time of day of attack | | | | | |
| 58. Livestock type attacked | | | | | |
| 59. No livestock killed in attack | | | | | |
| 60. No. injured but not killed | | | | | |
| 61. Who was with the livestock? | | | | | |
| 62. Was there a dog with the stock at the time of the attack? | | | | | |
| 63. Were any adults present at the time of the attack? | | | | | |
| 64. Did anyone actually see the | | | | | |

| | | | | | |
|---|--|--|--|--|--|
| attack? (If not, find out how it was identified as a predator attack) | | | | | |
| 65. Number of predators involved | | | | | |
| 66. Sex/age of predators involved | | | | | |
| 67. What happened to the predator | | | | | |

| When was the last time you saw..... around this household? | Lion | Cheetah | Leopard | Spotted hyaena | African wild dog |
|---|------|---------|---------|----------------|------------------|
| 68. Was it the same as attack above? | | | | | |
| If not..... | | | | | |
| 69. When (year and month if possible) | | | | | |
| 70. Season of sighting (dry/wet) | | | | | |
| 71. Location of sighting | | | | | |
| 72. Time of day | | | | | |
| 73. How many, and sex/age if known | | | | | |
| 74. What were they doing? | | | | | |

| Has anyone in this boma been attacked by.....? | Lion | Cheetah | Leopard | Spotted hyaena | African wild dog |
|---|------|---------|---------|----------------|------------------|
| 75. Age when attacked (years) | | | | | |
| 76. Location of attack | | | | | |
| 77. Date (year and month if possible) | | | | | |
| 78. Season of attack (dry/wet) | | | | | |
| 79. What was the person doing? | | | | | |
| 80. Was the person injured or /killed? | | | | | |
| 81. What happened to the predator? | | | | | |

Actions

| | Yes/No | If yes, how? Poison, traps? | If no, why not? |
|---|--------|---|-----------------|
| 82. Do people in the area around this boma use poisons or traps to control the numbers of predators here? | | | |
| | Yes/No | If yes, what kinds, how many, and when? | |
| 83. Have you ever killed a predator? | | | |

84. What do you think are the most effective ways of protecting livestock from predators?

85. Do you use these methods? If not, why not?

Thank you for your participation!

Appendix II: Photographs used to identify survey species



Buffalo



Spotted hyaena



Crocodile



Serval



Hippopotamus



Zebra



Striped hyaena



Warthog



Wildebeest



Lion



Puff adder



Elephant



Leopard



Jackal



Black rhino



Tiger



African wild dog



Giraffe



Impala



Cheetah