



# Large carnivores and conflict: Lion conservation in context

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People & Wildlife  
A Wildlife Conservation Research Unit  
Born Free Foundation partnership



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**This essay was completed as part of DWM's work under the Mitsubishi Fund of Europe and Africa's sponsorship of the WildCRU's African big cat project and as part of CSZ's work under the Born Free Foundation's sponsorship of the WildCRU's People & Wildlife Initiative. It first appeared in a volume on lion conservation research (Loveridge et al. 2002)**

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**Recommended citation:** Macdonald, DW and Sillero-Zubiri, C. (2002). Large carnivores and conflict: Lion conservation in context. Pp. 1-8 in A.J. Loveridge, T. Lynam and D.W. Macdonald (Eds.) *Lion conservation research. Workshop 2: modelling conflict*. Wildlife Conservation Research Unit, Oxford University. [www.peopleandwildlife.org.uk/crmanuals/CarnivoreConflictP&WManual](http://www.peopleandwildlife.org.uk/crmanuals/CarnivoreConflictP&WManual)

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## Introduction

From polar bear to least weasel, carnivores around the world evoke from people a paradoxical blend of enchantment and irritation. While, by their nature they can be problematic, costly or even dangerous, it is also obvious that they can be assets. The splendour of lions - the species that is the focus of our workshops - makes it obvious that they have high existence value. That is, they are worthwhile in themselves. More tangibly, however, any problems they may pose to people can be offset against their capacity to generate revenue. The balance of pros and cons attributable to carnivores varies from species to species, and with time and place. In the particular case of lions, the principal factors in the balance are, on the deficit side, risk to people and losses to livestock and game ranchers, and on the asset side, a stimulus to tourism. The African lion is regarded as the kingpin tourist attraction of Africa, whether for photo-tourism or trophy hunting – uses which are very different in both their biological and moral attributes.

Throughout most of Africa, lions are becoming increasingly rare outside protected areas, and are listed by the IUCN as Vulnerable. The African lion population has recently been estimated at 18,000 to 27,000 with the majority located in East and Southern Africa (Bauer & van der Merwe 2002). They are protected from trade under Appendix II of CITES (which lists

species that are not necessarily now threatened with extinction but that may become so unless trade is closely controlled).

Our purpose in this short essay is to provide an introduction to the generally ambivalent relationships between people and predators (particularly big ones), as a backcloth to the workshop's deliberations on the particular case of lions in Africa.

It is clear that there is no single approach that will guarantee the coexistence of large carnivores with people throughout Africa or elsewhere. Circumstances vary, and thus so must solutions: there is variation in habitats, availability of prey, patterns of land-use and animal husbandry, and people's attitudes towards large carnivores. Additionally, some large carnivore populations are abundant and continuous with other populations, while others may be critically small, fragmented and endangered. In this complex spectrum a variety of real or perceived conflicts with humans can arise. These may include concerns for personal safety, predation on livestock (especially when their natural prey has been depleted by illegal and legal hunting) and game farms, and competition with hunters for wild ungulates. Livestock owners and others respond by killing carnivores, using guns, traps and poison.

## Predisposition to conflict

When it comes to the conservation or control of large carnivores, two fundamental aspects of their biology are crucial. Notwithstanding a few vegetarian anomalies, such as the bamboo-eating pandas and fruit-eating kinkajous, most of the Carnivora are carnivorous, and this puts them somewhere in the mid to upper stories of the food pyramid and in direct competition with people. This is because, first, predators are always rarer than their prey (on one recent estimate, a generalisation is that 10,000 kg of prey may sustain only 90 kg of predators - (Carbone & Gittleman 2002) and therefore need disproportionately large amounts of space. Second,

being equipped to kill and eat prey they have the weaponry that can make them dangerous to people, eat their livestock and compete for the same prey.

A fundamental problem is that large carnivores require extensive home ranges and large prey populations; to be viable, their populations need space, and nowadays space is a scarce commodity (critical reserve size linearly related to female range size - Woodroffe 2001). Furthermore, what space does exist tends to be fragmented and either to adjoin human neighbours or to be increasingly intensively used by them.

## The threat to human life

Man-killing by tigers, lions, leopards, pumas, hyaenas and bears account for hundreds of people being killed annually worldwide (Linnell & al 2002). There have been some exceptional events in the past. Eight man-eating tigers and one leopard shot by Jim Corbett in the early 1900's had killed and eaten nearly 1,100 people (Corbett 1991). In the US there have been over a hundred human deaths from grizzlies and black bears in the 20<sup>th</sup> century (Herrero 1985). Today, Californian joggers are occasionally attacked by pumas, but tigers are probably the greatest direct threat to human life where the two species share habitat. In the Sundarbans mangrove forests in eastern India between 36

and 100 people are killed each year; one perspective is that this is a relatively low rate considering some 35,000 people move through this area annually (Chakrabarty 1992).

Although the data are incomplete, lions appear to be less dangerous, with only a few people being killed each year (eg. (Yamazaki & Bwalya 1999). A renowned exception was that of the man-eaters of Tsavo, who killed 130 workers on a railway line in Kenya at the turn of last century (Patterson 1907). Lion attacks have been attributed to diverse triggers, including the defence of their kills from thieves (Treves & Naughton 1999).

## Competition for prey

Because humans are also carnivorous, we are in competition with carnivores for prey – consider the impact of bush meat extraction on carnivores: an estimated 3.4 million metric tonnes of game meat is extracted from Central Africa annually (Fa et al. 2002). This is probably catastrophic for many of these prey species, but a secondary devastating consequence is that removal of this much prey removes food that would, one estimate has it have fed around 2.5 million individual carnivores throughout the region (Ginsberg 2001, pg 503). Potential competition between people and wolves for prey has led to the controversial efforts of moose and caribou hunters in Canada and Alaska to kill wolves in an attempt to increase the numbers of their quarry (killing wolves appears to lead to increases in the survival of calf, yearling and adult moose (Gasaway et al. 1992). In Europe,

while many might rejoice at the reintroduction of lynx in the Alps, roe deer hunters complain that their quarry populations have declined as a result (Breitenmoser et al. 1999).

Humans and big cats have notably similar diets. Take Jorgensen & Redford's (1993) ranking of the prevalent prey of puma, jaguar and human subsistence hunters in the Neotropics. Although people had much the broadest diversity of diet (mean 39.2 prey taxa taken per site), followed by jaguars (14.7 per site) and pumas (mean 5.3 per site) the least, all three got more than 50% of their diet from mammals. Seven out of the jaguar's eight principal mammalian prey were also eaten by pumas or humans. The lesson is simple; people have probably always been in competition with big cats.

## The threat to livestock and game

However, worldwide, the big issue with carnivores is livestock raiding. In passing, this is also the big issue for smaller carnivores (for example, bounty schemes record, in 1964-65, payments for over 10,000 foxes in Scotland and 52,000 coyotes in Kansas). The lesson from studies of these smaller carnivores is that accounts of livestock losses appear often to be based more on perception than fact (Macdonald et al. 2000) and to involve only partial accounting (e.g. by killing rabbits, foxes may save British farmers a total of c. £30-150 million worth of crops a year (Macdonald et al. In press). Although farmers

and ranchers in North America consistently express the most negative attitudes toward large carnivores (e.g. Kellert 1985), large carnivores often constitute a minor problem compared with smaller carnivores such as jackals, coyotes or feral dogs. Worldwide, carnivores are in trouble with stockmen – whether it is lap herders objecting to wolverine killing their reindeer (Landa et al. 2000) and African bee-keepers feel no better about honey badgers wrecking their hives than do American ones about brown bears wrecking theirs. The awkward blend of perception and fact is universal in these cases, and ex-

emplified by the work of (Frank & Woodroffe 2001) on commercial ranches in Kenya. There, spotted hyaenas have the smallest per capita impact on livestock of any large predator (and damage by hyaenas is largely preventable) whereas big cats kill more stock and these depredations are more difficult to control. However, most white ranchers admire the big cats and while they tend to shoot hyaenas on sight most would like to see greater populations of lions, leopards and cheetahs.

In contrast, consider the furore associated with the reintroduction of wolves to Yellowstone, revealing the deep loathing that seems still to characterise the attitude of most North American farmers and ranchers to big predators. Similarly, gun shots were the most common cause of death amongst Mexican wolves reintroduced to Arizona in first year following release (Paquet et al. 2001). Illegal killing of protected species because of perceived threats to livestock is also common practice in Europe - in Norway the sole remaining wolf pack is persecuted, while the last two dozen bears in Spain are threatened by illegal hunting.

There is an unbecoming imbalance in the failure of wealthy societies to bear the relatively small costs of conserving large carnivores, while exhorting poor countries to rejoice in carnivores that bring heavier burdens - in the Gir Forest Sanctuary, India, 1,900-2,000 domestic animals have been killed annually by lions in recent years ((Singh & Kamboj 1996). Reported losses to snow leopards in Nepal's Annapurna amounted to only 2.6% of the total livestock held by farmers every year, but represented in monetary terms almost a quarter of the average annual Nepali national per capita income (Oli et al. 1994). Elsewhere in Nepal, Mishra (1997) found losses of 18% of the stock holding in an 18 month period, attributed (rightly or wrongly) to wolves and snow leopards, amounting to a loss of half the average annual per capita income. Unsurprisingly, herdsmen retaliate by killing snow leopards, and prevailing local opinion was that total extermination of leopards was the only solution to the predation problem (Oli et al. 1994).

Predation on livestock is seldom distributed evenly; it tends to be associated with certain landscape features, such as distance to human habitation, plant cover and distribution of natural prey. Consider the revealing case of Eurasian lynx depredation on sheep in France. In recent decades, the lynx has re-colonized the French Jura, a 10,000km<sup>2</sup> area that the recovering lynx

now share with 36,000 ewes that graze unguarded from spring to autumn. Stahl & Vandell (2001) analysed 15 years of data to show that, across the region, lynx killed less than 0.5 % of the available stock. However, each year, there were 2-6 "hot spots" of killing. These spots, 1,835-4,061km<sup>2</sup> in size, remained the same over several years even where 'problem' lynx had been removed. Sheep were attacked by lynx in only 5.1% of 98 pastures more than 250m from a forest, but in 39.1% of the 228 pastures adjacent or connected to large forests by cover. In an analysis of the risk factors affecting pastures, a logistic regression showed a positive effect of their proximity to major forested areas, absence of human dwellings, local abundance of roe deer and presence of attacked pastures in their vicinity. This last factor might indicate the presence of a sheep-killing lynx. In short, analysis revealed a predictable set of habitat features that constitute risk factors, a situation complicated by an unpredictable rare event - the occurrence of a habitual sheep-killer.

Wherever there is livestock, big cats have a terrible reputation. For example, livestock ranchers in La Rioja, Argentina, reckon that almost a quarter of their goats are lost annually due to puma and in Santa Cruz, puma are blamed for an estimated 23% perinatal lamb mortality (Johnson et al. 2001). However, while there's no shortage of farmers' opinions, data to verify them are harder to come by. In the middle latitudes of Kenya, Mizutani (1993) showed that annually the average farmer lost 2% of his sheep and 0.8% of his cattle to predators. Some 24% of these sheep losses and c.12% of the cattle losses were due to leopards, and most leopard kills were attributable to poor husbandry - the victims were animals left outside of a protective boma (enclosure) at night.

However, even one cow in a hundred would be one too many if it happened to be your cow, and the loss of livestock can have severe emotional, political and financial costs. Indeed, farmers in many parts of South America have a shoot on sight policy towards jaguars. Rabinowitz (1986) argues that the 'shoot on sight' policy, which all too often leads to maiming, creates more cattle-killers than it removes. In this case, deforestation has left the jaguars with inadequate wild prey, and the proximity of ranches all around that habitat which remains creates temptation (Hoogesteijn et al. 1993) - temptation made all the more irresistible when high stocking rates and associated diseased animals create alluring bait.

What might be termed the “Paradox of Protection” is illustrated by the Torres del Paine National Park in southern Chile, created in 1959 to protect guanacos. Numbers of guanacos had increased from c.100 to 1300 by 1988 (Johnson et al. 2001). The local pumas, too, increased in density to 1/17 km<sup>2</sup>. Many of the puma ranges, however, spilled beyond the park’s borders, onto sheep farms, and some radio-tracked individual pumas were recorded to kill sheep almost nightly. Meanwhile, enjoying their new-found protection, the pumas became less shy and more visible, so while the farmers became increasingly irritated by the more frequent sight of pumas, tourist businesses prospered accordingly – although this expansion faltered in 1998 when a puma killed a tourist.

The problem of poor husbandry is illustrated by the 15 settlements within Ladakh’s Hemis National Park in Ladakh (Jackson et al. 2001). Residents reckoned they lost 492 animals to predators during just over a year – and blamed snow leopards on 58% of occasions (the rest they attributed to wolves). One household claimed to have lost 12% of its livestock that year. Closer scrutiny revealed that nearly half of all losses occurred on just 29 occasions when a snow leopard entered a poorly constructed night corral and killed several animals in one hit. Further, 54% of all losses were sustained by just three settlements (31 households), raising doubts about their standards of day-time guarding and night-time housing.

In the last 25 years the world population of cheetahs has halved, and about 20% of the survivors live on the commercial livestock and game farmland in north-central Namibia. These ranchlands are economically important; about 70% of Namibians are dependent on agriculture as a livelihood, and trophy hunting contributes just

under US\$5 million per annum to the Namibian economy. Cheetah kill small stock and calves up to six months of age, and during the 1980s killing by farmers more than half the Namibian cheetah population. Although records of causes of cheetah deaths are incomplete, Marker et al. (2003a) estimated that in one sample 47.6% were shot as prophylactic predator control, and 11% by trophy hunters. However, of 98 cheetahs trapped as perceived threats to livestock only six (3.0%) were associated with even circumstantial evidence that the individual had indeed been taking livestock. Of these six, five had physical or behavioural problems - injured paws, broken teeth and so on.

Questionnaire surveys revealed that throughout the 1990s 22% of Namibian farmers believed they had a cheetah problem, and 84% of them said they removed cheetahs (Marker et al. 2003b). However, of the 78% who said they didn’t have a cheetah problem, 59% also confessed to removing cheetahs – probably they did so ‘just to be on the safe side’. Excitingly, the renaissance of a traditional method of stock protection – sheep-guarding dogs – has resulted in a large majority of farmers reporting a decline in losses due to cheetah. The aforementioned questionnaire survey indicates that whereas the proportion of livestock farmers perceiving cheetahs as problematic has worsened (from 16% to 58%) as the 1990s progressed, the proportion removing them has marginally reduced. While the trends for game farmers are in the same directions, they have stuck much more firmly to their intolerant guns and 80% of them still remove cheetahs. However, while the proportion of farmers removing cheetahs may or may not have changed, the numbers they own up to removing certainly have. The average across all types of farmers in the early 1990s was 19, but later in the decade it dropped to 2.9.

## Competition for space

Turning to competition for land, Nath (2000) studied tigers in central India’s Bandhavgarh National Park, where 34 villages (each averaging 427 people and 466 cattle) lie within and on periphery of the 105 km<sup>2</sup> park. Ranking the problems they endured due to the park, 9% of villages took the collective view that tigers killing cattle was their worst problem, 20% ranked this as their second worst problem (88% ranked their worst problem as crop damage by wild boar and chital). Most villages claimed to lose 1-2 cows a year but two villages claimed they lost

50-60 per year; villagers valued cows at more than £21- £71 and buffalo at more, and claim the compensation ranged between £4- £23. However, their main objection to the tiger was that it had brought the park, which they regarded as a blight. Three quarters of villagers said the park had not benefited them at all (26% thought it a mixed blessing). They complained of crop damage and lost access rights for grazing and gathering natural products. Worse, against an initial expectation of economic gain, of 12,409 people interviewed, only 39 (0.3%) had

received employment. The park staff had been recruited from different castes to the villagers, and had a different perspective: they perceived their work to be bedevilled by the inhabitants of the 14 villages still within the park, along with their lose dogs and 7,000 malnourished cattle carrying foot-and-mouth disease.

Our remarks are intended to provide a backcloth against which to set the context of the following specialist accounts of lions in conflict with people in Africa. To conclude, it is noteworthy that many of the sources of conflict between people and big cats are encapsulated by the woeful circumstances of Asiatic lions. Only about 250 Asiatic lions survive, all within the Gir forest

Reserve, around whose borders live 400,000 people. Local enthusiasm for the lions is diminished by an average of 14.8 attacks and 2.2 human deaths annually (Saberwal et al. 1994). Of 73 villagers interviewed, 61% expressed hostility towards the lions (one can only marvel at the tolerance of the remaining 39%) – and most villages report losses of about five cows annually to lions. Livestock is estimated to comprise about a third of the lions' kills, giving a total annual tally of 1,900-2,000 domestic animals killed by lions in recent years. However, the one ingredient that is crucially different between lions in Africa and most big cat issues elsewhere is their value for photo-tourism and trophy hunting.

## Non-consumptive use

Broadly speaking, the asset values of wildlife can be categorised as either consumptive or non-consumptive. The most obvious expression of the latter is as recreational use, notably photo-tourism. Of course, this may not, strictly speaking, be entirely non-consumptive insofar as the activities of the tourists may disturb the species or degrade its habitat. While data on the non-consumptive recreational use of wildlife has hitherto been somewhat fragmentary, it is obviously high-value (Eagles 1997). For example, in 1991 18.7% of Canadians took a trip to view or photograph wildlife - these people devoted 84,300,000 days to this activity and spent US \$2.4 billion during the trips. The United States has 10 national parks which each receive visits from over two million people per year. The most visited of all, Great Smoky Mountains National Park, had 8,600,000 visitors in 1994, and the primary reason for people enjoying this park was the opportunity to see a big carnivore – bears. On the other side of the world, the financial value of tourism in five Australian World Heritage Areas during 1991/92 totalled \$1,372,000,000.

Turning to Africa, on one estimate an average African private reserve creates 457 months of employment annually. Since 1987 tourism in Kenya has surpassed tea and coffee as a source of foreign expenditure, and in 1997 750,000 tourists spent US\$502 million in Kenya (Eagles 1997). Virtually all visitors to Kenya travel there with the primary aim of seeing the big five (elephant, rhino, buffalo, lion and leopard), with lions arguably at the top of the list. It is probably self-evident that big predators are the main lure to the general tourist, but if proof is needed it can be gleaned from the enthusiasms of visitors to zoos: at London Zoo 7,961 members of the public have paid to adopt animals, of which 5,811 adopted a mammal, of which 2,682 adopt carnivores and 2,132 nominated the Sumatran tiger!. Thresher (1982) calculated the value of a maned male lion to photographic tourism in a Kenyan National Park as US\$ 515,000 over a ten-year period.

## Consumptive use and the perturbation hypothesis

Carnivores have also had high-value for consumptive use (Johnson et al. 2001). Historically, this has been most obvious for small carnivores through the value of their fur. For example, from 1976–79 c. 3,600,000 Patagonian grey fox pelts were exported from Buenos Aires, Argentina, with a total value of over US\$80 million. The racoon is the most economically important furbearer in US: records began in 1934, when 400,000 animals were traded – numbers fluctu-

ated and reached over 5 million per year in the early 1980s. Although protective legislation, and changes in fashion, has constrained trade in big cat pelts, in 1960s over 15,000 jaguar pelts were removed from the Amazon region yearly. The international market in small cat pelts averaged 250,000 to 600,000 pelts/yr in 1960s and 70s. As a consumptive use, the pursuit of carnivores for their fur blends into recreational hunting. One case study in the UK, of traditional foxhunting,

suggested that 6,000 to 8,000 jobs were involved and that total direct income derived from hunting was £15.6 million (Burns et al. 2001).

Hunting of large carnivores has been a tradition in many parts of the globe, whether the goal is to make a display of bravery, to deal with a nuisance or to indulging in a testing sport and quest for a trophy. While it is not obvious that there is a straightforward biological, or even ethical, distinction between hunting carnivores rather than, say, ungulates or rodents, the killing of large carnivores, whether for hunting or lethal control is particularly emotive. It is not, however, necessarily incompatible with conservation. An important issue, therefore, is what are the consequences of trophy hunting for the conservation (including the welfare) of large carnivores, and this is a major topic of our workshop because lions are economically important to the hunting industry, and sport hunters increasingly seek them.

The seemingly increasing demand for trophy hunting makes it a priority to ascertain its impact on lions in the context of their apparently accelerating decline (Bauer and van de Merwe 2002). In addition to any straightforward demographic impact, the nature of lion sociality makes it plausible that mortality due to hunting will cause a cascade of perturbation effects (Tuytens & Macdonald 2000). Testing this hypothesis is a core purpose of the Hwange Project (Loveridge et al. 2002). Pride males, with attractive manes, may be over-utilised, and their reproductive potential curtailed. In the process new males take over the prides and this can result in an increased risk infanticide associated with the removal of resident males. A possible outcome could be shifts in the social system, including spatial organisation, with associated changes in the mortality pressures and accessibility to hunters of the remaining males. Furthermore, the demand created by trophy hunting has the potential to interact with claims about livestock losses, where a system of problem animal control might be subverted by financial pressure to make available more targets for trophy hunters. This last concern is alleged to apply (<http://www.african-lion.org/news1.htm>, 21 May

2002) in one central/west African country where livestock owners are said to conspire with the owners of hunting lodges to distort the number of livestock raiding incidents in order to get more hunting permits issued. While it is a priority to quantify the hypothesised drawbacks of lion hunting, it is also important to evaluate postulated benefits. For example, the flow of revenue to rural areas (and associated motivation to co-exist with large carnivores), an associated sense of local empowerment, providing an incentive to tolerate a species otherwise judged pestilential and helping to maintain shyness among large carnivores towards people thus reducing potential conflicts.

Much remains to be done to quantify the biological and socio-economic processes relevant to lion hunting. Current evidence gathered by the Hwange Project suggests that in Zimbabwe a male lion commands a trophy fee of US\$3,000 (and up to US\$15,000 elsewhere in Africa); this makes them the most expensive trophy after bull elephant and cheetah. In addition, hunting clients usually buy a 'hunt' of at least 14 – 21 days when hunting 'big game' (paying at least US\$ 500 per day). During their visit they stay in hotels, fly with local airlines or charter companies and visit tourist attractions. Lion hunting in Botswana has been estimated to be worth \$4.5 million a year, but most of the profits go to hunting operators ((McGreal 2001). The Botswana government gets just \$2,250 for each lion, a fraction of what is paid by the hunters. Concern about declining populations and the disproportionate killing of mature males has led the government of Botswana to place a moratorium on lion hunting in 2001 (for both trophy hunting and control of 'problem' animals). Currently, different range states take alternative views on the balance of arguments for and against hunting lions. Kenya, where tourism is the mainstay of its conservation programmes, has adopted a non-consumptive policy for its wildlife. Government banned hunting at a time when poaching was out of control (1977). Tanzania and South Africa, on the other hand, have successfully used limited game hunting to generate sizeable funds to help pay the heavy cost of maintaining wildlife.

## Respectful engagement – the science of compromise

It does not diminish the splendour of large carnivores, nor the crucial imperative to conserve them and foster their well-being, to acknowledge the reality that their biology provokes conflict with people. Most landscapes are now

dominated by humans, and where carnivores and people coexist the best we can hope for may be an uneasy tolerance (Sillero-Zubiri & Laurenson 2001). Innovation and imagination are required to find solutions to carnivore-human

conflict outside protected areas, and these will most likely require a mixture of strategies. Similar conflict occurs throughout the world between the competing interests for environmental management; (Macdonald et al. 2001, p264-266) argue that the only workable solution will need compromise and strategies that do not involve sealing people off from nature but, on the contrary involving a respectful engagement with wildlife. One thing is certain, these strategies will have to be based on the integration of many disciplines – biology alone is not enough. From the cornerstone of biological understanding the

edifice of the new conservation science must be built of strong bricks from the social and political sciences too. The eventual mix is certain to involve compromises, and likely to blend protectionism, lethal control, consumptive and non-consumptive uses. Crucially, the lesson from conservation elsewhere (for example the case of mountain gorillas, Weber & Vedder - 2002) is that a prerequisite to success is an involvement of the local community in the decision-making process and the sharing of any revenues accruing from wild carnivores.

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