

Managing Human-Lion Conflicts

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Introduction

Of all the continents on earth, Africa contains the poorest countries, the least urbanized human population, and the most rapid human population growth. Of all conflicts between humans and large carnivores, the most challenging involves the African lion. No major wildlife African ecosystem is completely fenced, lions attack thousands of livestock throughout the continent each year and lions kill over a hundred people a year in southern Tanzania and northern Mozambique. Of the less than 50,000 lions still in Africa, about a quarter are found in four large well-protected ecosystems (Serengeti, Selous, Okavango/Chobe, Kruger); the rest are exposed to varying degrees of human contact and may not survive until the 22nd Century without intensive management.

Recent studies of human-lion conflict in eastern and southern Africa have shown three consistent patterns:

1. Humans directly retaliate against lions for killing livestock and people.
2. Traditional practices of livestock husbandry reduce but do not eliminate the risk of lion attacks.

3. Far fewer livestock are lost to lions than to disease or drought.

While these findings suggest that human-lion conflict might be managed to produce an acceptable level of risk to local communities, it is clearly urgent to identify effective low-loss mitigation strategies. Highly invasive responses such as erecting fences are not only infeasible (e.g. the Selous is the size of Switzerland) but ecologically unacceptable (e.g. trapping migratory ungulates inside fenced reserves), whereas translocating people or problem lions would be politically unacceptable.

For the past five years, my research group has conducted intensive field research on the ecology of human-lion conflict across three geographical regions of Tanzania:

1. The Tarangire/Manyara ecosystem is typical of many migratory systems where only a core dry season refuge was gazetted as a National Park, while the wet season dispersal area has become increasingly occupied by agriculturalists and pastoralist Maasai over the past 20+ yrs.

2. The Ngorongoro Conservation Area was the world's first multiple land-use area, where pastoralist Maasai were allowed to remain inside the equivalent of a national park, provided that they retained their traditional way of life. Livestock predation is a way of life in the NCA, and the Maasai rely entirely on traditional husbandry practices.

3. Two southern coastal districts, Rufiji and Lindi, suffer the highest rates of lion attacks on humans in Africa. Rufiji District is adjacent to the Selous Game Reserve, but Lindi has no obvious source for its lion population.

In this paper I briefly outline the highlights of our group's work so far and outline possible mitigation strategies, first focusing on cattle-killing and then on man-eating. Our research is still at a formative stage of development, so any conclusions must be considered tentative.

Cattle-killing

Tarangire. Bernard Kissui's research in the greater Tarangire ecosystem has shown that lions, leopards and spotted hyenas are the three major predators on livestock, but the lion is most vulnerable to retaliatory killing (Figure 1). Lions are exceptionally vulnerable to retributive killing by pastoralists compared to hyenas and leopards for several reasons (Kissui, in review). First, lions are more likely to defend a livestock carcass against humans, exposing them to frequent confrontations which they inevitably lose. In contrast, hyenas are shy of people, moving well beyond the reach of humans after a livestock attack, whereas leopards can successfully hide themselves. Second, lions engender more human resentment by mostly killing cattle, which have more value to pastoralists than the sheep and goats typically attacked by hyenas and leopards. Third, in contrast to the nocturnal attacks of leopards and hyenas, most lion attacks occur during the day, when people are armed and prepared to defend their stock, and searching for predators is far easier during the day. Fourth, Maasai culture contributes to the vulnerability of lions to retaliatory killing through the practice of *Ala-mayo* where a young warrior can prove his courage by killing a lion (see below). But over the past few years, almost every lion hunt in Tarangire has been in retaliation for cattle killings.

Ngorongoro Conservation Area. Dennis Ikanda's research in the NCA has revealed two factors that greatly increase the risk of lion attack on Maasai grazing cattle (Figure 2). Lions can apparently distinguish warriors from children and monitor how well herds are

tended (Ikanda and Packer, in review), because attack rates were over five times higher when cattle herds were tended solely by children than by warriors (*Morani*) and nearly four times higher when over 150 cattle were tended by each herder. But in contrast to studies elsewhere (e.g. Woodroffe and Frank, 2005), we were largely unable to explain why some bomas suffered higher predation at the kraals than others. The risk of attack was not deterred by the presence or number of domestic dogs or by the type of building materials used to construct the kraals. Perhaps the average level of defense against nocturnal depredation is so high in the NCA that livestock attacks at the kraals are essentially random, and some families are merely unlucky.

Also in contrast to Tarangire, the Maasai in the NCA do not strictly kill lions in retaliation for cattle depredation. Although there is a broad correlation across the major regions of the NCA in the number of lions killed vs. cattle killed by lions, far more lions were killed in one area (known locally as Angata Kiti) compared to cattle predations (Figure 3a). This is the same area that is most commonly visited by nomadic lions from the Serengeti following the annual wildebeest migration each wet season (Figure 3b), and most lions are killed during the wet season in Angata Kiti whereas there is no seasonal pattern to livestock depredation in this area. Interviews with Maasai revealed that young *Morani* would come to Angata Kiti each year just for the opportunity to participate in an *Ala-mayo*, or ritual lion hunt.

Mitigation strategies for Maasai-lion conflict. Results from the NCA project suggest that the incidence of lion attack on cattle could be greatly reduced by simply encouraging the Maasai to send their children to school (consistent with Tanzanian Government policy of attaining universal literacy) and to break their herds into smaller units so as to maintain a more favourable number of livestock per herder (also consistent with Tanzanian Government policy of reducing the

environmental impact from overgrazing). Although lions are less likely to attack the kraals at night when compared to other predators, nocturnal lion attacks are sufficiently common to fuel widespread resentment by the Maasai. Bernard Kissui has found that many of the bomas around Tarangire are so flimsy that a nocturnal predator merely has to provoke a stampede to get the livestock to break out of their kraals, whereupon they can be easily caught. Kissui has successfully convinced five Maasai families to reinforce their kraals with chain-link fencing, which has so far prevented any nocturnal losses to predation. Most importantly, each family paid for the fencing themselves – in most cases by selling off a large cow and using the money to buy the fencing and a small calf – effectively maintaining a constant herd size. More and more families are expressing interest in the program, and it remains to be seen whether the strategy will remain effective as reinforced kraals become more common and spread through the region.

Man-eating

The Problem. Figure 4 shows the number of lion attacks on humans reported across Tanzania between 1990 and 2004. The incidence of attacks increased from an average of about 30 cases per year in the early 1990s to over 100 in 2004. Most cases were concentrated in the coastal districts in the southern part of the country, and reports suggest that the problem extends a similar distance across the border into northern Mozambique (C. & K. Begg, pers. comm.). The most striking aspect of this problem is the remarkable boldness and persistence of these man-eaters, attacking people in the middle of a village, pulling people out of their thatched houses, snatching children out of their parents' arms. The repeated emergence of man-eating lions in this southern coastal area stems from two primary ecological factors: a low density of "normal" lion prey (e.g. wildebeest, zebra, buffalo, gazelle) and a high abundance of bush pigs (Figure 5).

The role of bush pigs can hardly be overstated. People in this part of the country are agriculturalists who mostly grow rice, maize and cassava, as well as cashews and coconuts. The coastal climate promotes the growth of thick vegetation, and cashew trees also provide excellent cover for lions. Although plains ungulates have largely been extirpated by the agricultural communities, the omnivorous bush pigs thrive in disturbed habitats and are serious nocturnal crop pests. The impact of the nocturnal pigs is so great that a farmer and his family will often sleep in a temporary structure (*dungu*) in the middle of their field so as to be able to chase away any pigs during the night. The lions here appear to live primarily on bush pigs, so they often follow the marauding pigs into the farmers' fields where they eventually encounter easy prey in a *dungu*. Lions mostly attack humans at the same time of night when they catch their normal prey, and most human victims are alone at the time of the attack.

Mitigation strategies for man-eating lions. Our research has suggested several possibilities for reducing the villagers' risks of attack. First, in other parts of Tanzania, agriculturalists dig trenches around their fields specifically to exclude bush pigs. This technique is not employed in the southern part of the country, perhaps because the population is mostly Muslim with an aversion to pigs and pork. Even if a pig-exclusion project did not greatly reduce the long-term risk of lion attack, it would at least reduce crop losses to the bush pigs – generating more revenue that villagers could apply to other strategies. A corollary to this approach would be to encourage trophy hunting or meat consumption of bush pigs. Pigs are impossible to eradicate, but systematic harvest of the pig population could have positive consequences for humans and reduce their conflict with lions.

Second, a surprising number of people are attacked while going to their outhouses during the night. Most villagers lack any sort of fence around their houses, and although chain-link fencing would be prohibitively expensive for these communities, any sort of visual barrier (bamboo or woven sticks) between themselves and the lions might lower their risks of attack.

Third, local people are ill-equipped to respond to man-eating lions themselves, and lions in these areas appear to be extremely secretive. A well-trained team might be able to eradicate a man-eater before it could kill again. Slow government responses to man-eating outbreaks in the past have often led people to fight back with fishing nets, sticks and spears, resulting in further human fatalities. Recently, though, people have discovered that rat poison is a simple way to kill a lion, and they have taken to lacing the carcasses of half-eaten people, livestock and bush pigs, so perhaps lions will simply be exterminated in many of these areas in the next few years. But some proportion of man-eating lions presumably originate from the Selous Game Reserve (and in Niassa Reserve in northern Mozambique), so the problem will never go away entirely.

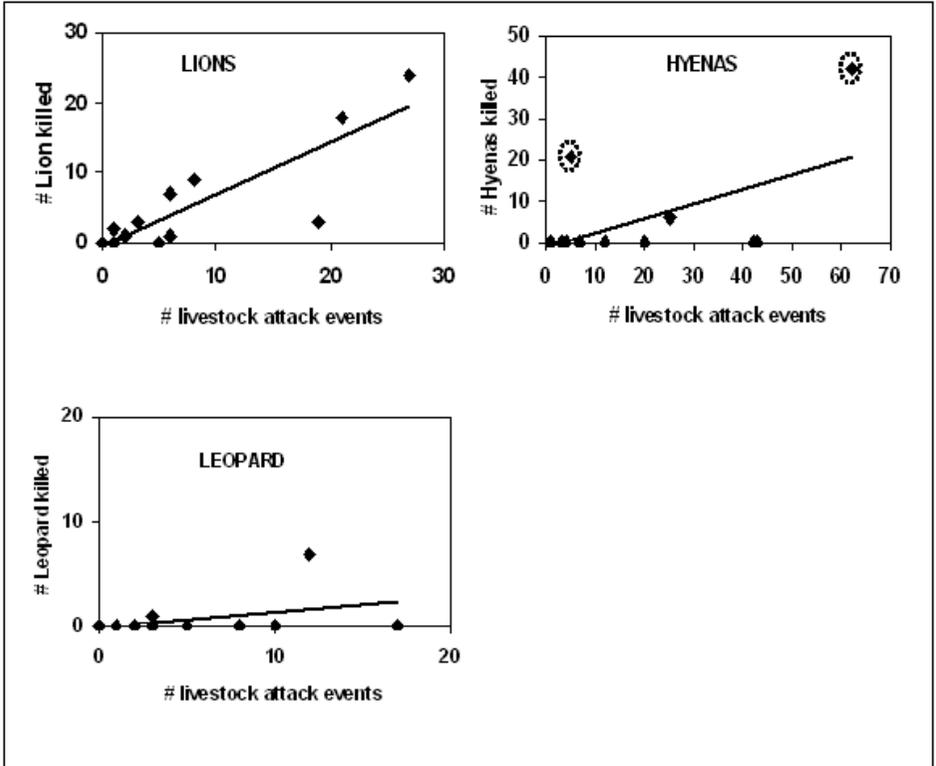


Figure 1. Relationship between the number of lions, hyenas and leopards killed by pastoralists in each village and the associated number of attack events by each species. Dotted circles indicate two villages that reported frequent use of poison against hyenas. Taken from Kissui (in review).

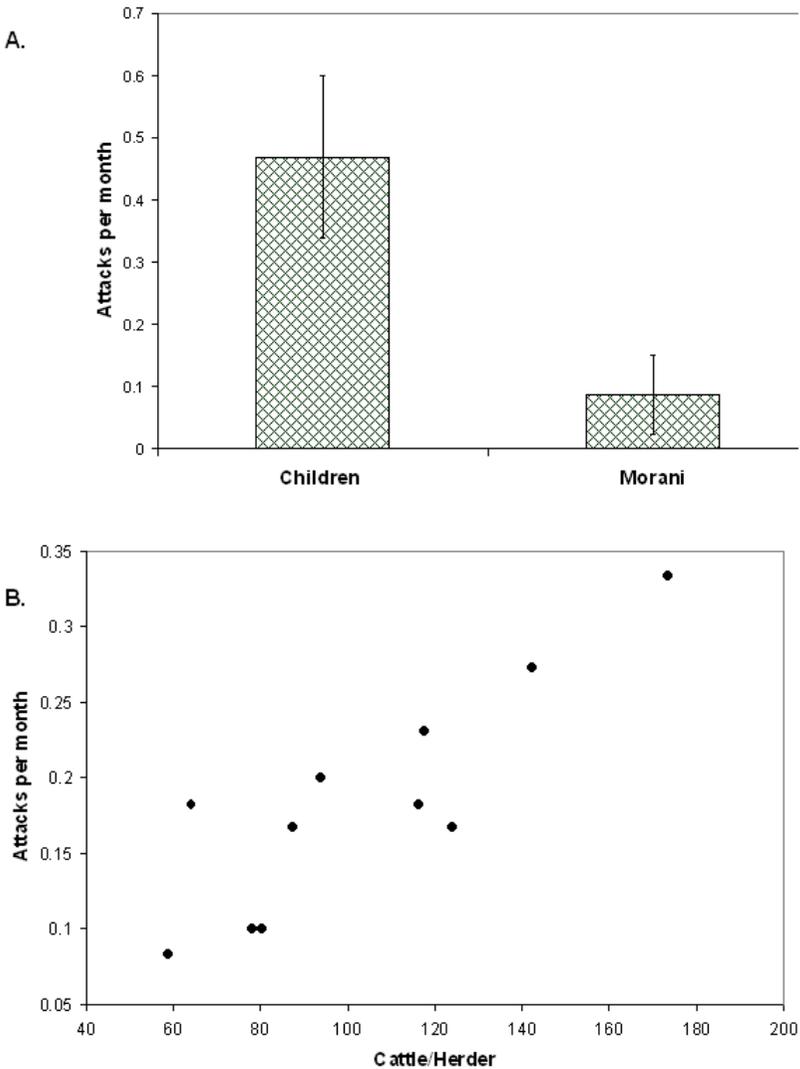


Figure 2. Monthly risk of depredation on grazing herds of cattle in the NCA. (A) Herds tended solely by herdboys suffered higher rates of

depredation than herds tended solely by *Moranis* ($p = 0.05$); vertical bars indicate standard errors. **(B)** Risk of attack increased with the average number of cattle tended per herdsman ($p = 0.0006$). Taken from Ikanda & Packer (in review).

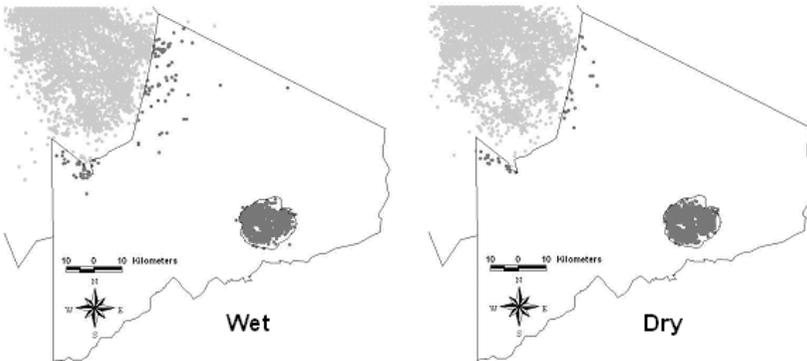
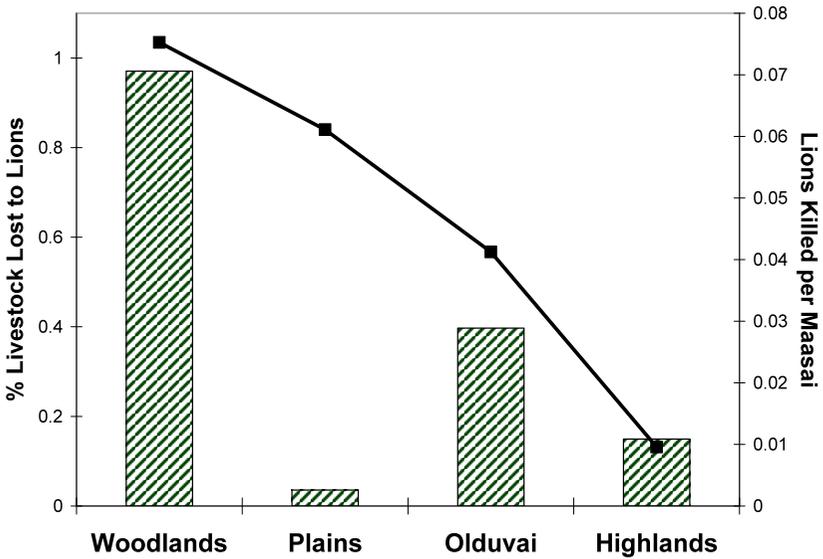


Figure 3. Spatial pattern of lion attacks and lion sightings in the NCA. **A.** Percentage of livestock lost to lions (hatched bars) vs. lions killed per Maasai (black line) across four broad geographical areas in the

NCA. **B.** Lion sightings by the Serengeti lion project 1984-2004 inside Serengeti National Park (grey) and in the NCA (black), as well as of Ngorongoro Crater lions (also black; all of which were in/near the Crater) during the Wet and Dry seasons. The northern-most part of the NCA includes Angata Kiti. Taken from Ikanda & Packer (in review).

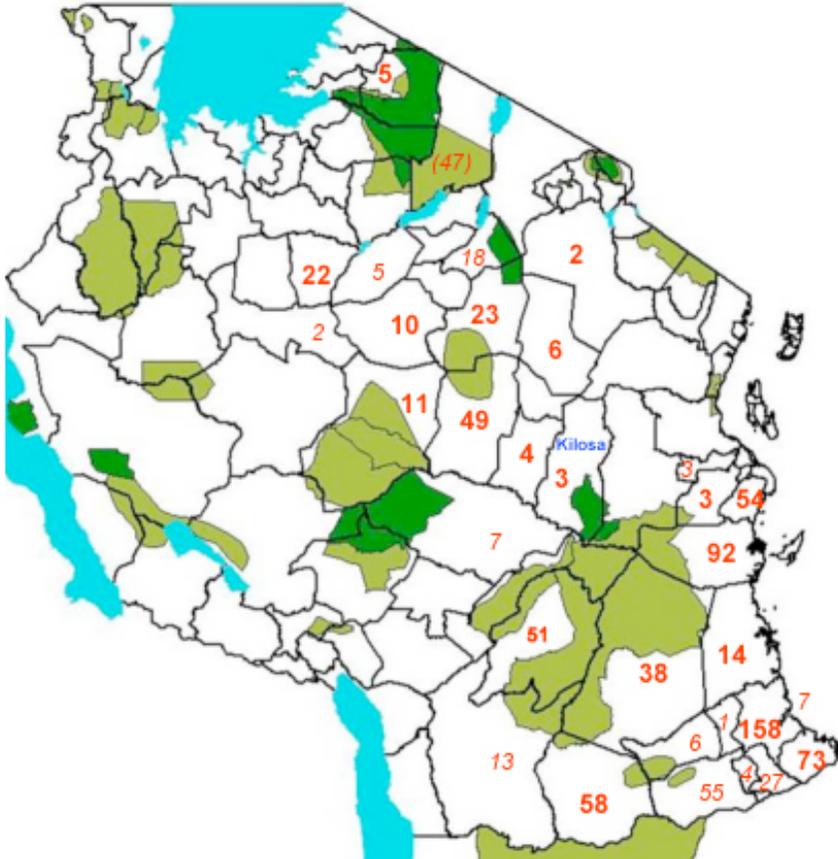
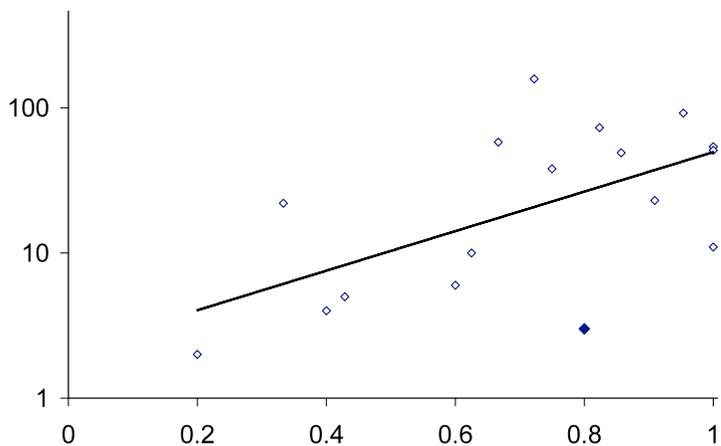
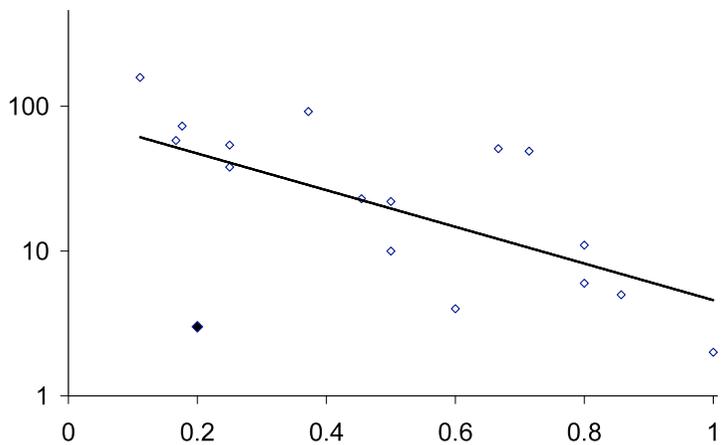


Figure 4. Map of Tanzania showing the number of lion attacks on humans Jan. 1990 - Sep. 2004. Bold numbers show districts surveyed directly; italicized numbers rely solely on reports to the Wildlife Division. Number in brackets indicates data collected by D.I. Dark green areas are National Parks; light green areas are Game Reserves. Taken from Packer et al. 2007.



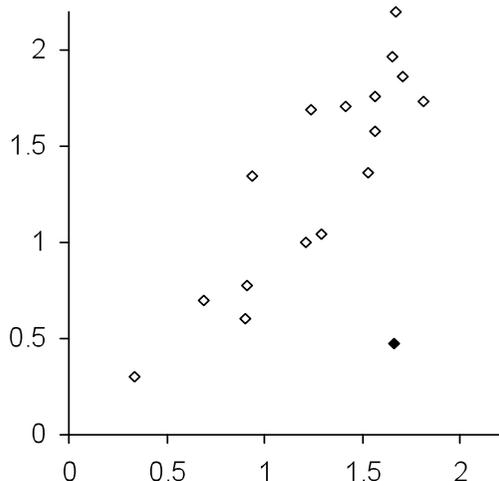


Figure 6: Ecological factors influencing number of lion attacks in 17 districts. **A.** Abundance of mid-sized prey, $P=0.0091$, $n=17$. **B.** Abundance of bush pigs, $P=0.0129$. **C.** Predicted number of attacks from multivariate regression model including both factors, adjusted $r^2=0.45$, $P=0.0059$, $n=17$. Solid diamond refers to Kilosa district where villagers were relocated out of problem-animal areas in 1992. Taken from Packer et al. 2007.