A lion population under threat : understanding lion (Panthera leo Linnaeus, 1758) ecology and human-lion interactions related to livestock predation in Waza National Park, Cameroon

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Summary

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Understanding lion (*Panthera leo L*, 1758) ecology and human-lion interactions related to livestock predation in Waza National Park, Cameroon

Keywords

Lion (*Panthera leo),* population status, spatial ecology, lion diet, human-lion interactions, lion predation mitigation, Cameroon

The lion was historically one of the most widely distributed terrestrial mammals on the globe. Currently, the lion exists only in a few range countries in Sub-Sahara Africa and a small population in the Gir forest in India. In Cameroon, the lion's range is currently limited to the Guinea-Sudan and Sahel savannahs in the northern region, south of Lake Chad. Lion populations in West and Central Africa are increasingly becoming threatened throughout their remaining range. The threats impacting lion populations are generally anthropogenic in nature, including habitat destruction, prey depletion, conflicts with livestock owners, diseases (zoonoses), inbreeding depression due to fragmentation and isolation, and illegal trade. In order to cope with these threats and to conserve the remaining lion populations, continuous research and monitoring of the lion populations is required. However, lion conservation in West and Central Africa suffers from a general lack of data within and across lion populations. My research aims to provide scientific data needed to support a better management and conservation of lions in the Central African region with a focus on Waza National Park in Cameroon. Investigations focus on lion ecology and the human-lion conflicts due to livestock predation in this park.

Reliable population estimates are indispensible for wildlife management and conservation. The lion population in Waza National Park appears to experience a striking decrease. The number of adult lions has declined from 40-60 in 2002 to 14-21 in 2008, which represents a reduction of about 65% in 6 years. Furthermore the population age structure is

skewed towards adults, producing an inverted pyramid. The sex ratio is 1 male to 3 females and the mean lion group size is only 1.6 lions. All these characteristics point to a population under high pressure. And indeed, the human-livestock pressure on the park is enormous, 31% of photographs captured by camera traps, set to count lions in this study in 2008, were of humans and livestock in the park. The estimated mortality rate of approximately six lions dying per year mainly as a result of retaliatory killing for livestock predation and poaching is alarming. The retaliatory killing is done by herders, as the lions increasingly predate on cattle due to the strong decline of their natural prey. All in all, the lion population is expected to be extirpated in 10 years' time, if nothing is done to reverse the situation.

The low natural prey density now available in Waza National Park is also reflected by the large lion home range sizes observed in this study. The home ranges of the lions, expressed as 95% minimum convex polygon (MCP), have increased from a mean of 630 km^2 in 2000 to 1015 km^2 in 2008. These home ranges are the largest reported so far in the region of West and Central Africa. Many of these ranges presently extend to areas outside the park, causing lions to spend on average 21% of their time outside the park. This results especially in larger wet season and cold dry season home ranges. In the hot dry season, home ranges are smallest and the lions largely remain in the park close to the water holes, where they still find prey during this period. Time spent outside of the park coincides with increased livestock predation. The seasonal variation observed in home range size appears to be mainly due to the availability of water, of natural prey, and of migrating livestock as alternative prey.

While lions stay in the park during the hot dry season, they surprisingly move over longer distances than during other seasons, which indicate that even during this season prey has become scarce. Males cover longer distances than females. Lions in Waza National Park are nocturnal in their activities with crepuscular peaks at sunrise and sunset. The lions are generally more active inside than outside the park and move outside mostly at night. The lion's diet in Waza National Park shows a niche breadth of 14 different prey species. However the bulk of the diet consists of five prey species, of mainly medium-sized (50-200 kg) and large-sized (> 200 kg). The western kob (*Kobus kob kob*) is the most common wild prey of lions, but livestock (predominantly cattle) presently constitutes as much as 21.6% of the diet (on a number basis), resulting in conflicts with livestock owners. In fact, all observed characteristics of the diet and

movements of the lion reflect a survival strategy of lions under highly disturbed conditions.

The conservation problem of lion mortality by retaliatory killing by pastoralists is exacerbated by ongoing livestock intrusions into the park. Even inside the park, cattle constitute 18% of the lion's diet. Wild prey species are also consumed outside the park (6.7% of prey consumed outside the park), suggesting excursions of the natural prey species beyond the park boundary. Despite the much higher abundance of livestock over natural prey, lions appear to prefer wild prey over livestock, which becomes clear when applying the Jacobs' index of relative abundance. This finding is important as a basis for practical recommendations for conflict mitigation in and around Waza National Park.

Conflicts between humans and lions due to livestock predation is a key factor driving population decline of lions in Africa, especially on the edges of small protected areas without transitional buffer zones. Pastoralists around Waza National Park suffer high levels of livestock depredation, with most attacks occurring at night. Economically, lions are a substantial threat, accounting in the Waza area for total losses of €100,000 per annum (price level 2010). Per household, resident pastoralists lose one head of cattle whereas nomadic pastoralists lose two per annum, equating to about €260 and €520, respectively (price level 2010). The pastoralists make some efforts to reduce losses to lion attacks, mostly consisting of keeping livestock in enclosures at night and herding during pasture. However, these measures appear not to be sufficiently effective. Application of the best practices which are already being used now by a percentage of the pastoralists, proved useful in reducing total livestock depredation by 25% and cattle depredation even by 50%. A further improvement of these methods is possible; therefore the human-lion conflicts around Waza National Park could theoretically be largely prevented. It has become clear however, that different methods will have to be adopted by the resident and nomadic pastoralists in order to effectively mitigate livestock predation by lions, as nomadic pastoralists have few easy options. These herders therefore pose the greatest challenge. Another point is that substantial prevention of cattle predation, as is recommended here, will further limit food availability for the lion. Prevention of predation must therefore go hand in hand with a better protection of the natural prey so that prey populations can increase again and lions will no longer rely on livestock for survival.

Although the Waza lion population, one of the most viewed lion populations in the region of Central Africa, now seems to be most threatened, concerted conservation efforts could still save this population from local extinction. Studies in the Ngorongoro crater in Tanzania show that the lion is in fact quite resilient; its population can bounce back and increase rapidly after a positive change in conditions, given its rapid reproductive rate. For the Waza lion population to increase and to regain its former status, the government must greatly improve park protection through the park management authority and law enforcement, as well as providing financial and human resources for the park. During my study, funds to open the roads of the park for game viewing (tourism) never arrived in time. Furthermore, local communities living close to the park must receive direct benefits from park revenues, which after all the years of existence of the park is still not the case. Such measures, particularly including economic benefits from the park by the local population, may then lead to a positive attitude and support for conservation efforts by the local human population, thus forming a "social buffer" along the periphery of the park against intruding strangers.