Perceptions and Solutions to Human-wildlife Conflict in and Around Murchison Falls National Park, Uganda

Tutilo Mudumba

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Abstract

A questionnaire survey was conducted aimed at describing human carnivore conflict and factors that influence it in and around Murchison Falls National Park and suggest recommendations to the stakeholders on how to minimise the impacts of the conflict. There were reported cases of depredation of both livestock and people in the study area, and predation on livestock occurred mainly in house-holds that kraaled their stock. Distribution of incentives to individual house-holds, history of depredation of livestock and people in the area, and carnivore sighting history were found to predict attitude of respondents to carnivores. Poverty level was not a good predictor of attitude and it was found that the community around the park is of new settlers who had just returned from the internally displaced people's camp (mean duration of stay in village ca 3.6 years).

It was recommended from the findings that: local communities improve on the livestock husbandry techniques, that an insurance and compensation scheme be established to pay for losses caused by wildlife, that incentive programs be put in place to offset losses and increase tolerance of carnivores, that environmental education and community training sessions be conducted to raise awareness among locals, and that a carnivore problem animal response and assessment team be constituted to handle local incidences of predation. It was also suggested a study to quantify conflict and other factors that influence attitude be conducted in future

Keywords: Wildlife attitude, Poverty and conservation, Wildlife conflict, Socio-economic surveys

Introduction

Large carnivores are presumed to be a primary source of human-wildlife conflict (HWC) in regions where they occur, due to predation of livestock and competition for wild game with humans (Mcdonald & Sillero-Zubiri, 2002). Increasing human and livestock populations, and land use changes are anthropogenic factors that can directly aggravate this conflict, while climatic factors, abundance and distribution of wild prey, and stochastic events influence it indirectly (Distefano, 2005). HWC is often detrimental to the survival of carnivores leading to local and global extinctions (Cardillo et al., 2004). In the developing world - including Africa, the effects of this pressure on carnivores are more pronounced as the relative cost of coexistence with carnivores for low income communities is higher than in developed areas, leading to low public tolerance and frequent lethal control of problem animals (O'Connell-Rodwell et al., 2000).

This pattern is true in Uganda where all of the country's ten national parks are located in rural areas. In Murchison Fall National Park (MFNP), the largest protected area in Uganda, HWC is especially pronounced (Rogers et al., 2006). The area has been less developed than other parts of the country due to the 1988-2007 civil war which required local population to live within internally displaced people's camps. The absence of direct human pressure on the park's resources during that time led to an increase in wildlife and reduced incidences of predation and persecution of wildlife (Rwetsiba & Nuwamanya, 2010). With the return of relative peace to the area in 2008, people started rebuilding and resettling in areas often close to the park, making themselves and their livestock vulnerable to attacks from predators and crop raiding from grazing animals. This trend has been further exacerbated by an overall increase in human population in Uganda (Mugisha, 2002).

A recent survey of lions (*Panthera leo*) and spotted hyenas (*Crocuta crocuta*) in Uganda by the Wildlife Conservation Society (WCS) in partnership with the Uganda Wildlife Authority (UWA) identified MFNP as the site with the second highest lion population in the country (~130; 26% of national total), despite it having experienced the sharpest national decline (40%; from ~324) in its lion population since the previous estimate in 2002 (Mudumba et al., 2009). Commercially viable quantities of oil have been discovered under MFNP, and the process of further exploration and production will increase significantly over the next two years. This development has the potential to cause further disturbance to the carnivore population and their prey base.

Although understanding the nature of conflict and its drivers is key to drafting effective mitigation strategies, the MFNP management has not studied HWC in or around MFNP since 2000 – before the end of the civil war and the return of rural people in the area (Driciru, 2005). The aim of this

study was to: (1) describe public perceptions of human carnivore conflict around MFNP and identify important factors that influence these opinions, (2) suggest recommendations based on the factors to mitigate the conflict for consideration by MFNP managers and local stakeholders. The data used for this analysis were collected during a questionnaire survey of households living near the MFNP boundary in 2011.

Methods

Study Area

Murchison Falls National Park (MFNP) is located in the north western part of Uganda (02°15ʼN 31°48ʼE) and is managed by the Uganda Wildlife Authority. Established in 1952, the 3,840 km^2 park was a popular tourist destination in the 1960s, having the highest number of visitors per year in Eastern and Central Africa (Rwetsiba & Nuwamanya, 2010). It is bisected by the Nile River from east to west, which forms the 7 m wide, 43 m high falls that are the namesake of the park (Figure 1). Two wildlife reserves are contiguous with MFNP; Karuma Wildlife Reserve to the southeast and Bugungu Wildlife Reserve to the southwest. Together, the three protected areas extend over 5,308 km^2 and are collectively referred to as Murchison Falls Conservation Area (MFCA).

There are two rain seasons in the region: the main rain season from April to June and a minor one from September to October. Mean annual precipitation is 1000-1250 mm. The dry season runs from mid-December to mid-February with temperature reaching up to 40 ^{o}C. The Park's topography is mostly level grassland fields interspersed with whistling acacia (*Acacia drepanolobium*) and borassus palm (*Palmyra palm*) on the northern bank, and closed-canopy moist forest dominated by Cynometra (*Cynometra alexandri*) in the south. The mean elevation of MFNP is 800 m. See Nangendo et al (2005) for a more detailed description of the vegetation of the area.
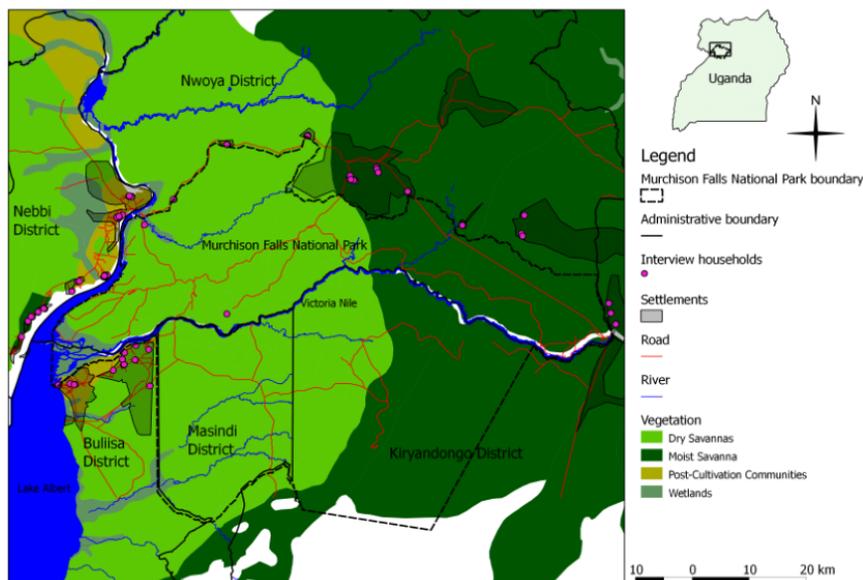
Figure 1: Locations of households interviewed in the survey, administrative units, drainage and roads of Murchison Falls National Park and surrounding area in 2011.

MFNP historically had a rich large carnivore community consisting of lions (*Panthera leo*), leopards (*Panthera pardus*), spotted hyenas (*Crocuta crocuta*), cheetahs (*Acinonyx jubatus*) and wild dogs (*Lycaon pictus*), but the latter two have not been sighted in the last two decades (Driciru, 2005; Mudumba et al., 2009).

The communities near MFNP are of a diverse group of ethnic groups, many of which are closely related (Acholi, Alur, Bagungu, Madi, Bachope, Jonam, and Banyoro). The region is administered under the Districts of Nwoya, Kiryandongo, Masindi, Buliisa and Nebbi. Masindi, situated 15 km south of the park's southern entrance, is the region's nearest big town, while capital Kampala is located 300 km to the southeast. Apart from a recent surge in number of pastoralist communities in the Buliisa District, the communities in the vicinity of the park are dominated by subsistence crop-farmers (Figure1).

Data collection

Information on the locals' perceptions and attitudes towards carnivores, livestock losses to predators, and demographic and socio-economic status of households was collected using a survey questionnaire. The survey was conducted during January and February 2011 by five trained research assistants familiar with the research area and fluent in the local dialects. Each questionnaire consisted of 49 closed and 11 open-ended questions (Appendix 2). Only one person per household was surveyed, and households were randomly selected using a fixed interval (every fifth house) from a landmark point in the

community (e.g. the village clinic, school or a main junction). A minimum of 15 households at each community were surveyed. Participation was voluntary and the aim, likely output, and anonymous nature of the survey was clearly explained to all involved, in order to avoid data biases due to wrong expectations among the participants of rewards or compensations which could exaggerate the reported losses to carnivores (Romanach et al., 2007).

The questionnaire consisted of sections focusing on: demographics of the household, socio-economic status, perceived problem animals, livestock and husbandry practices, resources collected from the park, land tenure systems, relationship between household and park management, large carnivore sightings, and predation incidences and proposed solutions. Also, a section proposing an insurance scheme was included (see Appendix 2). Prior to administering it in the study area, the questionnaire was tested with a team of WCS researchers familiar with human-wildlife conflict in the region, and edited for clarity and simplicity.

Data analysis

Responses from all questionnaires were digitally collated into a spreadsheet and eventually into the statistical analysis software R (version 2.12). General linear models were used to examine relationships between attitude and welfare, benefits from park, carnivore sightings, participants' ethnicity, gender, and occupation, resource use and husbandry practices, and carnivore attacks on wildlife and people; others parameters where: distance to nearest police and ranger stations, distance to park boundary and health centre 4.

The cultural beliefs in the area regarding large carnivores were also recorded and divided in two groups; those that promoted conservation and those that did not. Using the responses from a specific subset of questions, a welfare (Questions; 3, 12, 13, 14, 23, 24, 25 & 37) and attitude (Questions; 7, 10, 42, 43, 47, 48, 49, 53, 54, 56, 57 & 59) index was developed for each participant (Appendix 1).

A geographic information system software (Quantum GIS 1.7.0) was used to extract geographic parameters: distance to the park boundary, distance to the nearest police or ranger station, and distance to the nearest health centre.

Statistical tests, unless otherwise described, were two-tailed with the level of significance set at 0.05.

Results

Socio economic information of participants

A total of 160 participants were included in the survey, mostly male (80%) and from the Acholi (39%) and Alur (36%) ethnic groups (Table 1). There was a significant difference in mean household size of different ethnic groups (*mean = 7.2±1.08 SD, df = 7, F=0.96, P= 0.45*) Most interviewees moved into the area after the 2007 peace treaty that brought an end to the long civil war (*mean 3.7 ± 1.1 SD years ago*). There was a significant difference between households of different ethnic groups in the mean number of years since they settled in the village (*mean=3.7, df =7, F=10.22, p<0.05*).

Table 1: Ethnicity of house-holds interviewed

Gender	Acholi	Alur	Other*	Total
Female	11	13	8	32
Male	52	45	31	128
Total	63	58	39	160

*Other contains participants of the Amachole (1), Jonam (7), Langi (7), Mudama (1) and Mugungu (22) ethnic groups.

Two thirds (66.9%) of the interviewees were subsistence farmers. The remaining participants were fishermen (16.9%), salaried employees (5%), business owners (5%), students (3.1%), wage labourers (2.5%), and a pastor. There was no significant difference between annual household income of interviewees engaged in the main economic activities of the area: charcoal burning, farming, fishing and skilled labourer. ($X^2 = 5.09, df =6, P= 0.52$; *Figure 2*).
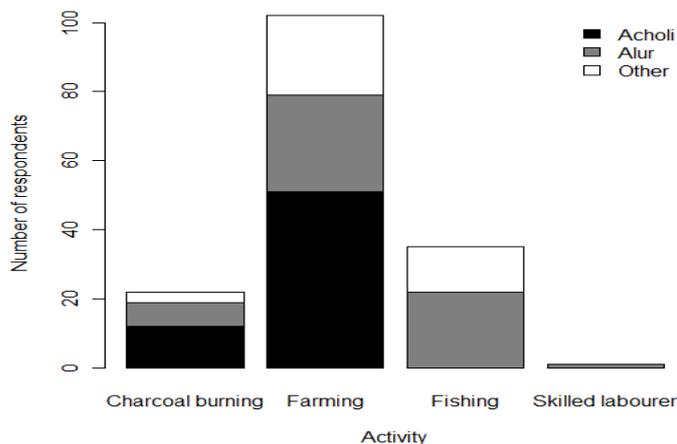

Figure 2: Main income generating activities of the interviewed house-holds around Murchison Falls National park.

Although the study area has many rivers and an open water body, more than half (55%) of the interviewees said that they considered their drinking water to be contaminated. Moreover, 8.7% did not own the land they lived on. The majority of landowners (30.6%) owned land less than 5 acres and estimated their land's value typically at less than one million Uganda shillings. There was no significant difference between ethnic groups' value of land (X^2 = 3.26, df = 4, P = 0.51). Most (59.4%) of the interviewees valued their land at less than one million shillings, 17.5% between one to five million shillings, and 23.1% at more than five million shillings. Seventy one percent of the interviewees did not own a woodlot (n=114). Most (55.9%) owned a bicycle and/or television and 3 households had a motorcycle (Table 2).

Table 2: Assets owned by the house-holds interviewed

Asset	Number of interviewees
Generator and/or car	4
Bicycle and/or television	90
Motorcycle	3
Radio	32
None	32

The occupation generating most income was salaried/wage earner with 75% of the interviewees employed earning more than two hundred fifty thousand Ugandan shillings per annum and the least earners were students, business owners and pastors, half of them reported an annual income of less than two hundred fifty thousand Ugandan shillings (Figure 3).

Housing of interviewees was grouped into three; Most interviewees (82%) lived in mud and thatch houses, 7% in pole and thatch and 11 % in brick and corrugated iron roofed houses. Most (65%; Figure 4) of the respondents owned fowl, in contrast to only 1% who owned cattle. One percent of the interviewees were employed by the park with no significant difference in ethnicity (*mean 26.6 ±30.1 SD; X^2 = 3.12, df = 2, P = 0.20*).
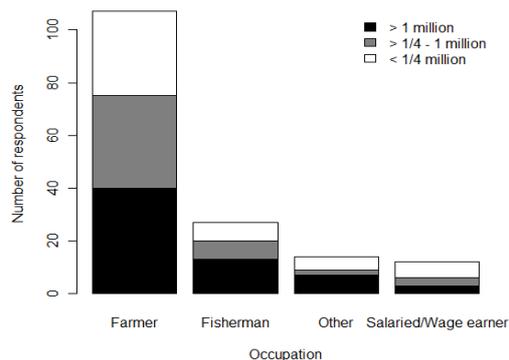
Figure 3: Annual incomes of house-holds from their occupations.

*Other: Student, Pastor and businessman
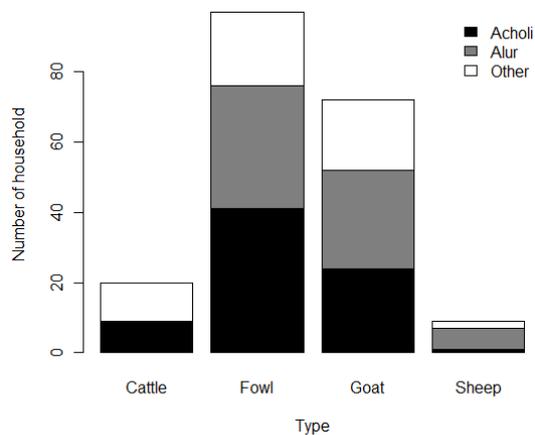
Figure 4: Domesticate animals and fowl of the interviewees by ethnic group.

3 b. Human-carnivore conflict levels

A total of 51 people (reported by 26% of interviewees) were reported as having been killed by predators in the area over the last year. Predator attacks on people were mostly (3.7%; Table 3) among the farmers.

Table 3: Number of predator attacks per occupation, number in parentheses shows the percentage of the total occupation.

Occupation	Number attacked (%)
Farmer	6 (3.7)
Fisherman	3 (1.9)
Salaried/Wage earner	1 (0.6)
Other	1 (0.6)

Most (72.3%) of the 64 dogs owned by the survey participants were used for guarding livestock, while the rest were kept for cultural reasons. There was no significant difference between dog ownership among the different ethnic groups ($X^2 = 2.21$, $df = 2$, $P = 0.33$).

About one in three (n=25) of the interviewees reported having lost livestock to predators in the last year. Most (56%) of the losses were reported by households that kraaled their livestock for the night, 36% by those who neither kraaled nor guarded them, and 8% of those guarded them with dogs only. There was no loss reported by 5 (3%) of households using fire rings around livestock shades at night. There was no significant difference in numbers of livestock lost to carnivores between herds kept communally and those managed privately ($X^2 = 1.84$, $df = 1$, $P = 0.17$).

Thirty (48%) interviewees were aware of wildlife poaching taking place in the region, with no significant difference in awareness (or admittance of awareness) among ethnic groups ($X^2 = 1.74$, $df = 2$, $P = 0.41$). Nineteen percent of the respondents said that they try to trap problem animals.

All the tribes of the region use wildife parts and/or products. Predator skins were reported to be valued as symbols of royalty, while elephant waste is locally used in the preparation of the house floor (Table 4). Twenty six percent of the interviewees were aware of a fellow villager who had been killed by carnivores (9%) or other wildlife (17%). The respondents said they react differently to predator attacks on humans than those on livestock ($X^2 = 5.05$, $df = 1$, $P = 0.02$), and this was also affected the way they responded; whether they reported to UWA, local police, local leader or killed the animal ($X^2 = 55.22$, $df = 4$, $P < 0.05$) (Figure 5).

Table 4: Uses of wild animals and their parts by the ethnic groups living around Murchison Falls National Park

Animal part used	Function	Acholi	Alur	Other
Leopard skin	Symbol of royalty	Yes	Yes	Yes
Hyena liver	Poison	No	Yes	No
Hyena nose	Fetish	Yes	No	Yes
Lion skin	Symbol of royalty	Yes	Yes	Yes
Lion oil	Medicine	No	Yes	No
Elephant waste	Building material	Yes	Yes	Yes

Lions and leopards rank highly among locals as dangerous problematic animals (Figure 6). The hippopotamus (*Hippopotamus amphibius*) (33.3%) was the animal most frequently mentioned as being problematic (33%), followed by the elephant (*Loxodonta africana*) (22.4%). There was a significant

difference among ethnic groups in which animal were deemed problematic (X^2 = 118.82, df = 36, P < 0.05).

Most (54.4%) respondents said they eat the problem animal if caught. This was common in all ethnic groups. Killing of predators in retaliation for predation on humans (7%) livestock (12%) was reported by 19% of the respondents.

The establishment of an insurance scheme for losses to predators would be welcomed by 70% of the interviewees (Table 5), with no significant difference among occupations (X^2 = 3.05, df = 3, P = 0.38) and ethnicity (X^2 = 2.93, df = 2, P = 0.23).
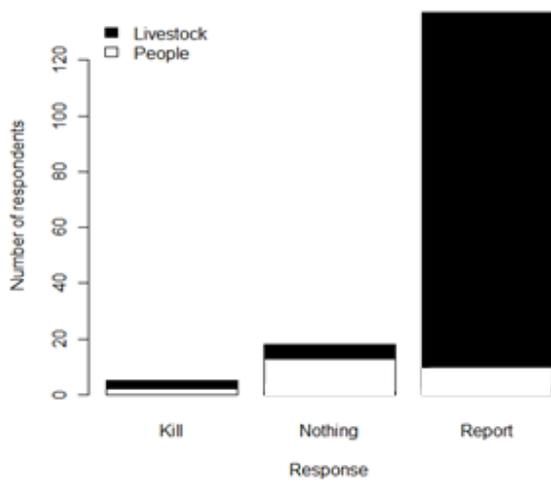
Figure 5: Response of house-holds to predator attacks.
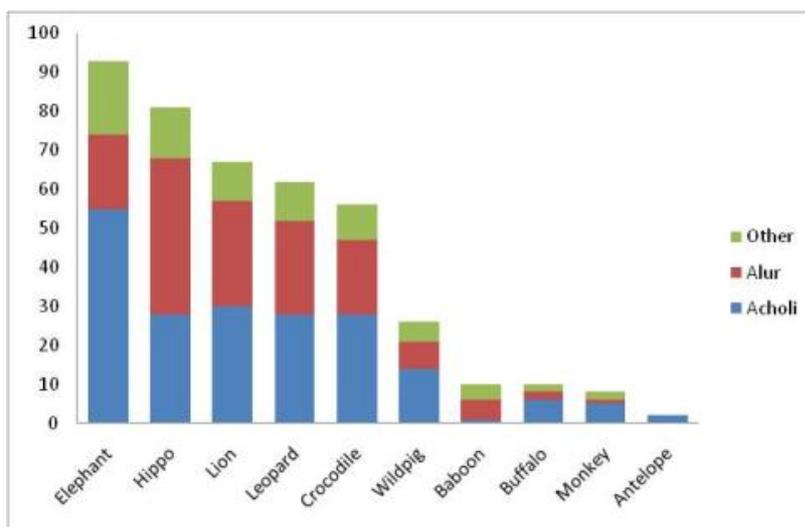
Figure 6: Cumulative problem animal list per ethnicity for the house-holds interviewed around Murchison Falls National Park.

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Table 5: Support of an insurance scheme among the occupations of the respondents, parentheses show the percentage within occupation

Occupation	Agree (%)
Farmer	76(48)
Fisherman	18(11)
Salaried/Wage earner	11(7)
Other	9(6)

Perceptions of conflict with carnivores and attitudes towards conservation

The locals' relationship with the park authorities differed significantly among respondents (Figure 8; $X^2 = 138.75, df = 3, P <0.05$), with 44.3% (n=71) reporting as having a bad relationship.
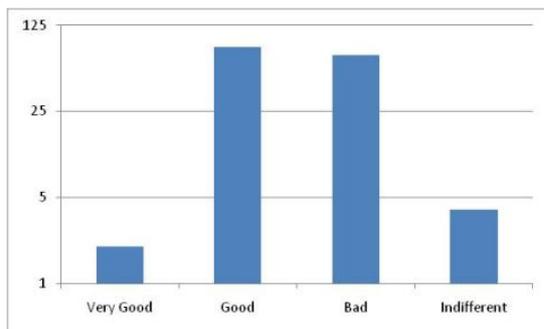
Figure 7: Relationship of interviewed house-holds and Murchison Falls National Park management.

The interviewees proposed seven solutions to the human wildlife conflict (Table 6). Increase in ranger force was the most frequent proposal (39.6%), with a few (2.4%) people proposing lethal control.

Table 6: Interviewee proposed solutions to predation by large carnivores.

Solution to predation by carnivore	Number (%)
Deploy more ranger patrols	17 (39.6)
Fence the park	15 (34.9)
Kill the predators	1 (2.4)
Translocate the predators	1 (2.4)
Dig wildlife trench around park	6 (14.3)
People should stop using the park	1 (2.4)
Train local people to manage problem animals	1 (2.4)

The vast majority (80%) of the respondents felt that predators should be conserved in the park. There was no difference among ethnic groups($X^2 = 0.47$, df = 2, P = 0.79).

Most of the study subjects were agreed to fencing of the park as solution to predation (Figure 8): 25%of all other ethnic groups, 31.6% and 34.2% Alur and Acholi respectively agreed to fence the park. There was no significant difference in ethnicity or occupation ($X^2 = 5.44$, df = 2, P = 0.06 and $X^2 = 0.83$, df = 3, P = 0.84 respectively).
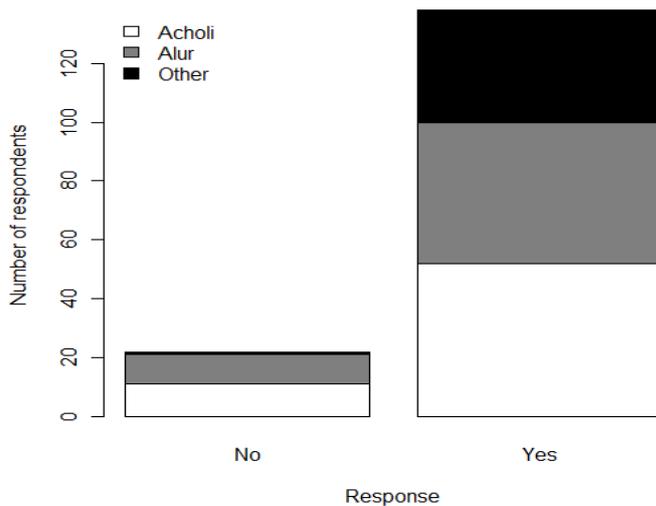
Figure 8: Response of respondents to proposal to fence the park as remedy for predation by large carnivores.

Exploring causes/relationships of current attitudes

The mean attitude score of respondents towards carnivore conflict and other wildlife was 9.9 ± 2.14 SD and there was no significant difference between attitudes towards carnivores and conservation per ethnic group (*mean 9.86±4.28 SD, df = 3, P = 0.09*) or occupation (*mean = 12.62±5.18 SD, df = 3, P = 0.06, Figure 9*).
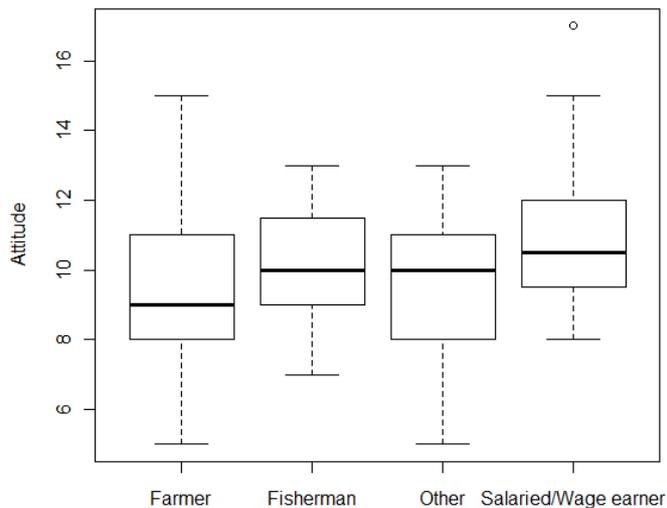
Figure 9: Mean attitude score of the interviewees per occupation

Among the variables whose data was collected (see questionnaire Appendix 2), distribution of incentives by the park management to locals, predator attacks on livestock, carnivores killing of village member in last year, and sighting of lion and/or leopard in last year had a significant difference in the mean attitude score of people with different responses (Table 7).

Respondents, who had received incentives from the park management in the past, did not report a village member killed by carnivores over the last year, did not see a lion or leopard in the last year, and whose livestock had not been attacked by predators in the last year generally had a more positive attitude towards conservation of what carnivores.

Table 7: Mean attitude scores of respondents for the variables with significant differences in means. The degrees of freedom = 1.

Parameter	Response	Mean	SD	Estimate	SE	P
House hold received incentives	No	9.5	2	0.77	0.33	<0.02
	Yes	10.3	2.2			
Village member	No	10.3	1.9	-1.60	0.36	<0.00

killed by carnivores	Yes	8.7	2.3			
Carnivores attacked livestock	No	10.2	1.9	-0.89	0.34	<0.01
	Yes	9.4	2.5			
Respondent seen lions in last year	No	10.7	2.1	-1.20	0.33	<0.00
	Yes	9.4	2			
Respondent seen leopard in last year	No	10.3	2.2	-0.77	0.33	<0.02
	Yes	9.5	2			

Seeing lions, seeing leopards and receiving incentives from the park were correlated. A hierarchical multi-variant method was used and correlated parameters were entered as first ANOVA factors to minimise their effect. Reported death of a village member contributed most (28.6%) to the explained variation in attitude scores of respondents in the model (Table 8).

Table 8: A multi-variant linear model output of the attributes that predict attitude of respondents towards carnivore conservation around Murchison Falls National Park

Parameter	Df	Sum Sq	Mean Sq	F value	P
Incentives	1	23.74	23.74	6.05	0.015
Seen Leopard	1	18.52	18.52	4.72	0.031
Seen lion	1	32.66	32.66	8.33	0.004
Livestock attack	1	15.41	15.41	3.93	0.049
Village death	1	36.13	36.12	9.21	0.003
Residuals	154	603.93	3.922		

The poverty index was not a predictor of the interviewee's attitude towards carnivore conservation. The same applies to respondents: gender, tribe, house-hold size, occupation, duration of stay in the village, husbandry practice and livestock owned, resource harvesting from the park; and distance to: park to boundary, police or ranger station, and health centre.

Discussion

The study sheds light on local public perceptions and attitudes towards wildlife and carnivores in particular. Although there are multiple tribes in the area - in almost all cases there was no difference in attitudes/perceptions between tribes, suggesting that a universal-landscape level conservation strategy would work.

Poverty level was not a good predictor of local people's attitude towards carnivores and other wildlife. It was found that attitude was affected by past experiences with respondents having a negative or positive attitude depending on their previous interaction with carnivores. Respondents for instance who had received incentives directly from the park authorities had a more positive attitude when compared to those who had not.

Local attitudes to wildlife

Although communities neighbouring the park are experiencing losses to carnivores and other problem animals, most (80%) of the respondents still want them conserved in the park. The majority prefer to report incidences of problem animals to the park management, local leaders or nearest police rather than kill them. This could be due to the relatively low reported losses of livestock and people to carnivores in the area, compared to other areas in Uganda like Queen Elizabeth National Park which have a considerably higher figures per annum (Moghari, 2009). This is promising for conservation, which suggests that the ability of these authorities to address the reported problem should be strengthened, in order to ensure that this non-lethal/better report trend is maintained. In Ngorongoro Conservation Area in Tanzania, the Maasai were found to kill lions in retaliation of predation of their livestock due to absence of structures for dealing with the problem animals (Kissui, 2008).

Large animals, such as the hippopotamus and the elephant feature - not surprisingly - high in the local people's list of problem/dangerous animals for their size but also due to their ability to destroy comparatively larger crop fields even in single raids (Hoare, 2000; Weladji & Tchamba, 2003). The two largest carnivores, the lion and the leopard, in the area also rank high (3rd and 4th respectively), which shows that human-carnivore conflict is an existing or perceived problem. There is therefore need to address it before it gets worse – as human population expands in the area.

It is encouraging to see that only a small percentage of people proposed lethal control of predators as the best solution to problem animals regardless of occupation or ethnicity. However, it should be taken into account that people may have not been straight forward with their response – fearing to admit that they would support a currently illegal management scheme. Also, it contradicts with the much higher percentage (19%) who said that they trap problem animals. The study method did

not include quantitative measures of conflict which would show just how much harvesting of carnivores and other wildlife is going on. A further investigation is hence necessary in order to be able to clearly explain the level of tolerance to large carnivores in the area.

In order for the conservation efforts in the area to work, a positive attitude towards local wildlife is not sufficient in itself. The management of the park is also need to be viewed positively, in order for any campaign/strategy that necessitates the involvement of local communities to succeed and be positively received (Naughton-Treves, 1999). A disliked doctor cannot be trusted to give a good medicine. Currently, half of the people have a negative or indifferent attitude towards the park. May be because they do not benefit? Employed by the park? May be because they are not aware of the laws, and therefore do not understand/misunderstand the management's decisions? May be because they do not see the rangers often enough? UWA currently runs community conservation clinics in the villages neighbouring the park, emphasis should be put in ensuring not only teaching the locals wildlife conservation but the role of UWA staff so as to encourage collaboration. Recruitment off locals in park management ranks has been shown to encourage local participation in conservation initiatives and ultimately increased tolerance of carnivores (Mcdonald & Sillero-Zubiri, 2002).

It is suggested from the study that all the locally extant large carnivores are part of the culture and beliefs of the ethnic groups. There are small differences between ethnic groups and it is important to explore more closely to find any potentially positive taboos than can be used to increase local respect for the carnivores. Although the study did not explore whether any of these traditional uses are actually sources of conflict, carnivores were admittedly being killed for parts and it is also worth following further. The area has experienced the sharpest national decline in lion numbers in a decade potentially illegally harvested as parts. However, lion and leopard parts take significant roles as symbols of royalty and are also used as medicine among the Acholi and Alur. Harnessing these attributes for conservation purposes is beneficial to local conservation of species. This can be achieved through identifying locally revered species, linking them to carnivores and presenting them to locals as flagship species and hence complement existing conservation efforts (Williams et al., 2000).

From the data collected, the model did not identify important parameters influencing local people's attitude towards carnivore and therefore, no conclusive arguments can be with the available evidence. A study quantifying conflict would perhaps account for more variability in attitude and be able to qualify the conclusions. However, the strong significance of predicators in explaining attitudes has led to the following: death of individuals due to wildlife especially to a community which receives very little direct benefit from the park is an important aspect influencing attitude. Deaths from predators

have been demonstrated to influence levels of tolerance among communities living in predator infested areas (Bauer & Van Der Merwe, 2004; Romanach et al., 2007).

The attitude of the local communities towards conservation was affected by sighting carnivores. It was a general trend for individuals who had seen lions or leopards in the last year to have a comparatively more negative attitude to those who had not. Since sighting carnivores correlates with attacks to livestock, the data suggests that local people often see carnivores in conflict situations and develop a negative attitude towards them; this highlights the need to expose locals to less dangerous encounters with carnivores, and more crucially, the extent of conflict that is high enough to affect local tolerance to carnivores. This cannot wholly be divorced from the weaknesses of husbandry techniques employed in the area. Poorly made kraals or unattended livestock provide easy prey for carnivores and lure predators to human settlements (Woodroffe et al., 2007).

Carnivore conservation recommendations

Based on the findings of this study, the following recommendations proposed to guide stakeholders in dealing with the current levels of HWC.

- Improve livestock management among the communities vulnerable to depredation
- Consider compensation and an insurance scheme for victims of carnivore and other wildlife depredation or crop raiding
- Start incentive programs to offset costs of depredation by carnivores
- Run environmental education and community involvement in carnivore conservation programs
- Establish carnivore management teams to respond to individual conflicts resulting from local attacks

Use of predator proof kraals and good livestock husbandry for vulnerable communities is has been found to highly reduce incidences of depredation (Lagendijk & Gusset, 2008). The study showed that Predation of livestock occurred mainly in households that had kraals (56%) and also in those that let their livestock roam without any form of protection (36%). The kraals therefore are not offering the desired protection and need to be improved upon to minimise breach by predators. The reduction of attacks from predators has been shown to increase local acceptance of carnivores there by reducing incidences of retaliatory killing (Goodrich, 2010). Also, although predator proof Kraals are relatively expensive to build, use of locally sourced materials keeps the costs low and the associated reduction in depredation ensures a good return on investment.

Compensation of losses to carnivores and other wildlife although difficult to manage increase increases tolerance of carnivore and benefits their conservation and is often practiced together with an insurance scheme with contribution from locals or funded by resource manager with assistance from conservation organisations (Mcdonald & Sillero-Zubiri, 2002; Karanth et al., 2005). From the study, the majority of respondents (70%) are willing to contribute towards an insurance scheme to compensate for losses to wildlife; this was irrespective of ethnicity, occupation or level of income. The pitfalls of compensation schemes have been: government corruption, high levels of depredation which cannot be sustainably paid off, poor regulation with no proper verification system due to hard to reach areas, and the ethical issue of putting a price to human life (Boitani et al., 2010; Goodrich, 2010). However, MFNP's surrounding communities are easy to reach given that a proper communication system is in place in order for verification of attacks to take place. This is particular relevant to attacks to humans that are easy to verify and known to greatly improve local tolerance of predators (Maclennan et al., 2009; Goodrich, 2010).

Incentives to local community's from this study had a positive correlation with attitude towards conservation of carnivores and other wildlife. The policy in Uganda currently sees 20% of gate collections given to the districts in which the park entrance is located. This money often does not reach the most affected members of community who bear the cost of depredation as they live furthest away from the administrative headquarters, and also, it is never explicitly clear to the people that the service or benefit is a result of conservation of wildlife in their areas (Hazzah et al., 2009). Local communities show benefit from conservation through direct employment, sale of services to tourism industry or payment for tolerating carnivores in order to encourage conservation in the areas where humans live with predators.

Environmental education and community involvement in conservation programs enables local communities to more ably and willingly contribute to conservation of locally extant species as they feel they own wildlife in the area (Naughton-Treves, 1999; Mugisha, 2002). Feeling ownership of species in their areas is pro-conservation because it lowers the cost of monitoring wildlife by the wildlife managers and also reduces illegal harvesting of species due to community policing (Distefano, 2005). MFNP is serviced by many radio stations on which environmental programs can be aired and given that most of the populace has got radio sets, it is a relatively cheap and efficient way of sensitizing the locals.

Problem animal management and response teams should perhaps be synonymous with areas with wildlife and people. Carnivores even in intensively managed areas with well maintained fences such as southern Africa still predate (Lagendijk & Gusset, 2008; Hunter et al., 2009), and as such, a team

composed of local leaders and park authority should always be in place to respond and evaluate cases of suspected problem animals. This will necessitate training of locals in post-mortem of livestock with specific emphasis on predator kills which can be arranged as workshops to involve carnivore experts.

Overall, this study highlights the need for the park management to involve the local community more in conservation of carnivores around MFNP. It emphasizes the potential negative effect of depredation of livestock and people that reduces local tolerance for wildlife leading to revenge killings of carnivores, and also hampers conservation efforts in general. It is recommended that a study to quantify conflict is done in the future so as to better gauge local peoples' attitude towards carnivores and its drivers, and that measures to reduce conflict as suggested in this study are taken by local management

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Appendix 1

Welfare scale

Question number	Parameter	Response alternatives	Score	Total
3	Nature of housing	Plastic or mad wall + thatch or plastic roof	0	2
		Poles wall + thatch or plastic roof	1	
		brick wall + iron roof	2	
12	Annual income	<100,000 - 250,000 UShs	0	2
		>250,000 - 1000,000 UShs	1	

		>100,000 UShs	2	
13	Household items	None of the items listed	0	4
		Radio	1	
		Bicycle & television	2	
		Motorcycle	3	
		Generator & car	4	
14	Livestock owned	None of the items listed	0	3
		Only fowl	1	
		<10, sheep, goats or pigs	2	
		At least 1 cow or >10; sheep, goats or pigs	3	
23	Land size	No land owned	0	3
		<5 acres	1	
		5 - 9 acres	2	
		>10 acres	3	
24 (a)	Land tenure	Do not own land	0	1
		Own or rent	1	
24 (b)	Land valuation (cost per acre)	< 1000,000 UShs	0	3
		>1000,000 - 5000,000 UShs	1	
		>5000,000 - 10,000,000 UShs	2	
		>10,000,000 UShs	3	
25	Fuel availability	Do not own a woodlot	0	1
		Own a woodlot	1	
37	Quality of drinking water	Contaminated	0	1
		Safe	1	
		Total		20

Attitude scale

7	Poaching	Trap animals	0	1
		Do not trap animal	1	
10	Employment benefit from park	Not employed in tourism sector	0	1
		Employed in tourism sector	1	
42	Cultural beliefs related with conservation	Mentions anti-conservation belief	0	1
		Mentions pro-conservation belief	1	
43	Utilisation of carnivore parts	Does not use parts	1	3
		Mentions at least 1 traditional use	2	
		Mentions > 1 traditional use	3	
45	Carnivore attacks	Attacked in last year	0	1
		Not attacked in last year	1	
47	Carnivore deaths	Village member killed in last year	0	2
		No village member killed in last year by predators	1	
48	Response to carnivore attacks to people	Kill	0	2
		nothing	1	
		report to authorities	2	
49	Response to carnivore attacks to livestock	Kill	0	2
		nothing	1	
		report to authorities	2	
53	Retaliatory killing of wildlife	Participates	0	1
		Does not participate	1	
54	Relationship with park management	Bad	0	3
		Indifferent	1	

		Good	2	
		Very good	3	
56	Solution to predation	Solution entails removal or fencing wildlife area	0	1
		Solution does not involve removal of wildlife	1	
57	Conservation of large predator	Do not support conservation	0	1
		Support conservation	1	
59	Fencing of the park	Supports fencing	0	1
		Do not support fencing	1	
		Total		20

Appendix 2

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WILDLIFE CONSERVATION SOCIETY

WILDLIFE CONSERVATION SOCIETY,
PLOT 802, KIWAFU RD, KANSANGA
PO BOX 7487, KAMPALA
www.wcs.org

WILD

PROGRAMME

Sheet No. ..D.12........

Distance from park: ...05........km

Introduction and explanation of Survey

Wildlife Conservation Society Uganda (WCS) under its WILD program (Activity 1.2.2) large carnivores: lions, hyenas, wild dogs and cheetah) carried out a national census of lions and hyenas in the three largest carnivore habitats; Queen Elizabeth National Park, Kidepo Valley National Park and Murchison Falls National Park between November 2008 and November 2009. The results of the survey show that the population of lions in Uganda has declined by at least 30% in less than 10 years with the largest decrease of 40% registered in Murchison Falls National Park (MFNP).

This study seeks to explore further the status of carnivores in Murchison falls national park and the human-wildlife conflict that may exist with communities living around the park. We explicitly want to emphasize that this study is significant, and we want to contribute to the mitigation of conflict by generating ideas, highlighting and proposing recommendations to the policy and decision makers at the local and national levels; Environment Officers and other stakeholders for improved conservation and management of these vital animals.

Your answers will be kept strictly confidential and used only for proposing policy actions for the lions and other large predators and your well-being. Unauthorised official or government institutions will not gain access to the data. The data will only be accessed by WCS officials; all based in Uganda who are actively involved in managing and implementing nature conservation programmes including lion monitoring in 2 national parks of Uganda and other conservation activities. The data will also be stored anonymously, so there will not be any reference to your household data.

Date of interview...19|2|2011.....Interviewer.........Sophia.........GPS Point. 0316135 /0213947
Village. Kaligonzi.......Parish. Uwuje.............Sex of respondent. M. Tribe .....Alur....................
Please Cross (X) on the alternative that best represents your view or write clearly in the space provided

1. How many people are in the household?

Status	Description	Age	Sex	Education level	Occupation
Head of Household	1	54	m	Primary 7	1
Spouse	2		F	P 2	
Member 1			F	0	
Member 2					
Member 3	17 Children		2m		
Member 4			9F		
Member 5				high level primary 7.	
Member 6					

Description – 1)husband, 2)Wife, 3)Child 4)Relative 5)Orphan 6) Visiting worker 7)Dependent 8) Female head
Education Level – 0) no formal education, 2) Primary, 3) Secondary 4) College/University education
Occupation – 0) no work 1) Farming-including subsistence 2) student 3) Own business 4) wage labour 6) Salaried employee 7) Infant 8) Fisherman 9) Other – specify

1

2. How many years has your family been in this village or location.............?
   1) Less than 1 year   2) 1-5 years   3)5-10years   ④10years or more

3. House Materials for Main Dwelling (try to make discreet observations on approach)
   Walls;
   ①Timber/poles   2) Brick   ③Mud   4) Iron   5) Plastic Sheeting

   Roof;
   ①Thatch   2) Tiles   3) Iron Sheets   4) Plastic Sheeting

4. Do you have any problems with crop raiding animals from the park?① Yes   2)No

5. Which Species?
   1)Buffalo 2)Antelopes 3)Lion 4)Monkeys 5)Baboons 6)Elephants 7)Wild pigs   ℅ Hippos   ⑧ Crocodiles

   8) Other (Specify).....Hippos.....

6. Which species is most problematic?
   Hippos

7. Do you ever trap some of these problem animals? 1) Yes   ② No

8. Do you eat them?① Yes   2) No
   ....Hippos..........

9. Does your community receive any income or benefit from the park (contributions from UWA/concessionaires
   to any local development)?① Yes   2) No
   ......Constructed apmeat school Boats to local people.
10. Do you get any form of employment or income from tourists (services or sales)? 1) Yes ② No

11. What is the main source of income for the house-holds? (Tick only one option)
    1. Fishing ( )   2. Charcoal burning ( )   3. Cultivation (x)   4. Selling firewood ( )
    Other.............................

12. How much money does your household earn per year (after taxes)? (Once again I would like to remind you
    that this a confidential survey only to be used for research purposes; no one will gain access to the data)
    Annual household income ....720.000.................UG.Shs

13. Do you own any of the other things below?
    ①Radio   2) Television   3) Bicycle   4) Motorcycle
    5) Pickup truck or car   6) Generator

14. Do you have any animals amongst your household assets?

Livestock Item		Number
Goats/	x	7
Sheep		
Pigs	x	10
Chickens /ducks/ pigeons		
Rabbits		
Cows	x	2
Dogs		

15. Why do you keep livestock?

Economic benefits (specify)	
Cultural value	x
Prestige	
Draught power/animal traction	
Meat	x
Milk	x
Other	

2

16. In the last month how many days did you graze your animals on;
    a) Your own land?.................................×..
    b) Neighbours land? ....
    c) Communal land? ....
    d) Park land? ....
    e) Other *specify*...

17. Where do you keep the livestock at night?

Privately		on verander
Communally		

18. What is the nature/ structure of livestock housing?

1. Housed (specify)		
2. Fenced		not tied .
3. Tied with rope outside		
Combination (*choose any two or all*)		

19. How do you herd your livestock?

Herder	×
Rope at home	
Rope in the bush	
Free to roam (free ranging)	
Housed / zero grazing	
Combination of above	

20. What are the methods/ systems you use to protect your livestock against wildlife?

Method	Day	Night	Effectiveness
Herders/ guarding	×		
Dogs			
Fire			
Enclosure (specify)			
Nothing		×	0

Effectiveness scale: 0- not effective   1-slightly effective; 2-Effective 3-very effective

21. How could the safety of your livestock be improved?
    ....construction....of....shed.....................
    ....
    ....

22. Why don't you improve on the safety of your livestock?
    ....Poverty..

23. Land Resources - How much land do you have? What do you use it for?

Land Type	Area (Local Unit)	Land ownership e.g. leasehold, freehold, customary, others----------- -----
× 5	2.3 ha	

Land Type – *1) Natural forest/woodland, 2) Woodlot, 3) Arable, 4)Wetland, 5) Grassland Pasture 6)Woodland/forest pasture 7)Cash crop plantation*

3

24. Land ownership/land tenure?
(1) – Own   2) rent/Hire   3) Do not own land
If at all you are to sell your land, how much would it cost? UShs/ha....23.millions

25. Do you own a woodlot? 1) Yes (2)No
If woodlot is owned:

Species of tree	Area (Ha)	Purpose

26. Do people use the park? (1) Yes 2) No
How long does it take to walk there...?

27. Which months of the year do you use the park most?

Month	Reason

28. Which months is food scarce or expensive?

Month	Reason
Jun - July	Drought.

29. Which fuels do you use each week and how much?

Source	Use	Volume (unit)	Share of fuels provided by park
Wood	Cooking	180 per day.	
Charcoal	Cooking	1 bah np day	
Grass			
Paraffin	1 Liter	a week	
Gas			
Electricity			
Other?			

Use- 1) Cooking 2) Lighting 3) Heating
Share – 1) None   2) A quarter   3) Half 4) Three quarters   5) All

30. How far on average do you travel each day to collect firewood? Time...7.hrs..... Distance.....3.kms
Is it from the park? 1) Yes 2) No

31. How has this changed in the last 5 years? 1) No change (go to 35) (2) travel further 3) travel shorter

32. What is the reason for the change (if any)?
..............population.........Increase..
....
....
....

4

33. What is the source of water for domestic use and for watering animals, and where is it located?

| Source | Location (In approximate Kms from homestead or kraal) | |
	Domestic	Livestock
River/stream	X 20m	
Bore hole	X	
Protected spring		
Shallow well	X 17m.	
Dam		
Other Specify		

Record distance of one way trip

34. Does your water come from the park? ①)Yes 2)No

35. How many 20ltr jerry cans do you use each day for domestic purposes?
...........7. jerry cans........

36. What type of treatment do you use to purify water for drinking?

Nothing	X
Boiling	
Boiling and Filtering	
Chemicals	

37. What is the quality of your drinking water?
1. Excellent   ②Good   3.Fair   4.Poor

38. Do you collect medicinal plants from the park? 1) Yes ②) No

39. What is the main reason you collect medicinal plants?
1) Own Consumption   2) Sale

40. Do you harvest or sell anything from the park? 1) Yes 2) No

Item	Local Unit	Own harvested units Sold Annually	Own Harvested Units Consumed Weekly	Price Per unit
Yams	Heap			
Mushrooms	Basket			
Wild honey	Litre			
Others....................				
Small wild animals:				
Rats	Piece			
Rabbits	Piece			
Duiker	Piece			
Porcupine	Piece	N/A		
Guinea fowl	Piece			
Francolin	Piece			
Other				
Large wild animals:				
Big Antelope	Piece			
Giraffe				
Large predators	Piece			
Buffalo	Piece			
Other products:				
Building Poles from forest	Piece			
Timber from forest				
Grass for thatching	Bundle			
Rattan	Bundle			

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Sand	Heap			
Clay	Heap			
Stones				
Handicrafts/panniers	Item			
Firewood	Bundle			
Charcoal	Sac			
Mineral........................	Gram			

41. How often do you see these animals? *Please put a cross(×) appropriately*

	Never	Rarely	Few times	Most of the time
Lions	×			
Leopards	×			
Hyaenas	×			
Jackals	×			
Other.....................				

42. What cultural beliefs are associated with lions, leopards, hyaenas or jackals in your community? *Please specify the animal and then write its use*

....Nothing...

43. What lion or other large predator parts do you use in your culture or community and what are they used for?

....Nothing...

44. Have you seen a lion, leopard, hyaena or jackal in the last one year?
Yes ( ) What was it?.................................... How many?.... Where did you see it?.......................
No (×)

45. Have you ever been attacked by lions or other predator?
Yes ( ) Activity when attacked................................Time of day...........................
No ( )

46. Has anyone in your village ever been attacked by lions other large predator? Hippo
Yes ( ) Activity when attacked..Time of day...........................
No ( )

47. How many people in your village have been killed by lions and other large predators in the last one year?
...........Hippo......killed......Some....one......fishing..........(C People).........................

48. What do you do when lions and other large predators attack people? Hippo
Nothing (×) Go to park authorities ( ) Go to police ( ) Local leaders ( ) Kill the animal ( )
Other...

49. What do you do when lions and other large predators attack livestock?
Nothing ( ) Go to park authorities ( ) Go to police ( ) Local leaders ( ) Kill the animal ( )
Other...

50. What tools/methods are used for hunting animals in the area? *Please tick all those that you know*
1.Wire snare (×) 2.Spear (×) 3.Nets (×) 4.Wheel trap (×) 5.Guns ( )
Others...

51. Have you lost livestock in the last one year to Lions and other large predators, or disease?

Livestock	Number	When	Disease	Wild animal
Cattle				
Goats				
Sheep		None		
Other (s)				

6

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52. Where did you lose the livestock and at what time of the day? (tick appropriately)

Activity	Day	Night
While grazing on communal land		
While grazing in the park		
At home		

53. Do animals in the park get killed in retaliation for livestock/crop losses in your village?
    1) Yes (x); 2) No ( )
    a) If Yes how?
    .... Hippos eat at night.
    ....

    If No, why?
    ....
    ....

54. How are your relations with the park authorities?
    1) Very good ( ), 2) Good (x), 3) Bad ( ) 4) indifferent ( )

    If bad, what kind of actions will help to improve it?
    ....
    ....

55. What should be done for livestock, killed by lions and other large predators from the park in your opinion?
    .... Compensation
    .... Chase the animals from community land

56. What do you think could be done to stop lions and other large predators from attacking livestock?
    ....
    .... - Fencing.

57. Do you think lions and other large predators should be conserved in parks? Yes (x) No ( )
    Why?.......... - for future generation to see
    .... - Bring Income.

58. How can people with livestock live along side lions and other large predators more easily?
    .... There is no way people can live along side
    .... predators.

59. Would you like the park to be fenced against lions and other large predators leaving the park?
    Yes (x) No ( )
    If No – why not...

    Would you contribute to the maintenance of a fence or other barrier? Yes (x) No (x)

60. Would you be interested in contributing to some form of insurance scheme where you contribute reasonably each year and if an animal was killed you would be compensated from the scheme?
    Yes (x) What kind of contribution and how much?
    No ( ) If No why not?
    ....
    ....
    ....
    ....

Thank you very much

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