

Carnivores and Pastoralism in Termit and Tin-Toumma

Predation on livestock and pastoralists' attitudes towards wild carnivores in Termit and Tin-Toumma, East Niger



A relaxed interview with local pastoralists.

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Abstract

The newly created Termit and Tin-Toumma National Nature Reserve in east Niger harbours a rich Sahara carnivore guild, including four canids, two small cats, the striped hyaena and the Saharan race of cheetah, one of the most specialized and threatened carnivores in Africa. This study examined the impact of livestock predation by carnivores and how this affected the locals' attitudes towards these animals, in order to understand human-carnivore conflict in the region and thus identify ways of resolving it. We conducted a baseline survey of 77 pastoralists and 30 members of the general public in the region. Most people interviewed had a negative attitude towards carnivores, to the extent that retaliatory killing was considered an acceptable option to reduce livestock losses. Golden jackals were most frequently thought to cause damage. Negative attitudes were strongly associated with younger people, and to some extent

to the level of education and reliance on local myths. Livestock husbandry practices did not significantly influence the level of livestock losses to carnivores. Despite the negative attitudes unveiled, the survey indicated a general willingness to accept the need for carnivore conservation education and research interventions in the region. A better understanding of the impact of carnivore predation on livestock in the reserve will enable the Sahara Conservation Fund and its partners in Termit and Tin-Toumma to mitigate human-carnivore conflict in East Niger. Effective conservation education measures in the new protected area should seek a reduction of the negative attitudes towards wild carnivores, and build the capacity of pastoralists to mitigate livestock losses to predation.

Keywords: Animal husbandry, Carnivore conservation, Livestock loss, Pastoralists, Termit Tin-Toumma, Niger.

Introduction

Growing human populations, increased demand for resources, and continued expansion of agricultural and pastoral lands has led to a rise in human-wildlife encounters (e.g. Sillero-Zubiri et al., 2007; Karanth et al., 2013). Unfortunately, during these encounters wildlife can damage crops, kill livestock, transmit diseases and in some cases lead to the loss of human life. Whenever wildlife proves to be detrimental to humans, the species responsible are generally persecuted, either legally or illegally, reducing drastically their numbers and even leading to their local or global extinction (Woodroffe et al., 2005). The extent and frequency of such human-wildlife conflicts is of major concern in conservation (Gittleman et al., 2001; Conover, 2002; Woodroffe et al., 2005), and reconciling the needs between species conservation and people's livelihoods a serious challenge (Messmer, 2000; Woodroffe et al., 2005).

Livestock depredation by wild carnivores is one of the most common forms of human-wildlife conflict and can potentially result in significant economic losses (Macdonald & Sillero-Zubiri, 2004; Woodroffe et al., 2005). Nonetheless, there is a lack of detailed research on the extent and drivers of depredation, particularly in developing countries. As a result, strategies for mitigating human-carnivore conflict are based on a limited understanding of either the magnitude or the causes of the problem (Messmer, 2000).

Understanding the public's perception and local attitudes towards such conflicts is crucial for identifying management options that will improve tolerance to wildlife and that will ultimately help generate long-term coexistence (Messmer, 2000; Conover, 2002; Jackson et al., 2003; Kaczensky et al., 2004; Sillero-Zubiri et al., 2006). Proposed solutions to reduce both livestock losses and the associated persecution of the culprit species (e.g. public education initiatives, improved husbandry techniques, compensation schemes) have all directly



Golden jackals caught by camera traps.



or indirectly involved local people (Macdonald & Sillero-Zubiri, 2004; Woodroffe et al., 2005).

The human dominated desert landscapes of the Termit massif in East Niger is mainly occupied by pastoralist communities (Anderson & Sprundel, 2009). The reported presence of a rich Sahara carnivore guild, including the striped hyaena (*Hyaena hyaena*), at least four canid species, two small and three large felid species, including the endangered desert cheetah (*Acinonyx jubatus*), and several mustelids makes it an important site for carnivore conservation (Wacher et al., 2004b). Many of these carnivores occur in close proximity to people and their livestock, and not surprisingly livestock losses to predators have often been reported from the pastoralists living in the region

(Wacher et al., 2004a; Wacher et al., 2004b). As human-wildlife conflicts are perceived to be of concern in such a landscape, and may even escalate, developing effective mitigation measures will be crucial in order to protect the carnivores of the area.

The Sahara Carnivores Project (SCP) started in August 2009 to study the rich carnivore guild in the deserts of eastern Niger. The project is a collaboration between the Wildlife Conservation Research Unit (WildCRU) at the University of Oxford, the Sahara Conservation Fund, the St Louis Zoo and the Marwell Wildlife, under the aegis of the IUCN/SSC Cat, Canid and Hyaena Specialist Groups.

In 2010, in collaboration with the Sahara Conservation Fund (SCF), we conducted a survey of households in the Termit & Tin-Toumma National Nature and Cultural Reserve in East Niger to understand the impact of carnivore predation on livestock in the area and the attitudes of local people towards carnivores. Here we analyze the survey responses to examine:

- The drivers and extent of perceived livestock losses to carnivores and human-wildlife conflict in the area.
- The efficiency of different livestock husbandry techniques to reduce livestock losses.
- The factors that influence public attitudes, perception and the level of acceptance of carnivores in the area.

Based on the findings of this survey we propose possible conflict mitigation measures, in order to reduce livestock depredation and improve the tolerance of the local pastoralist community on wild carnivores and other Saharan wildlife.

Materials and Methods

Study Area

The Termit and Tin-Toumma landscape is located in south-eastern Niger in the mountainous region south of the Ténéré desert (Fig.1). On 6th March 2012 Niger's Council of Ministers decreed the

formal establishment of the Termit & Tin Toumma National Nature Reserve. At 97,000km² the reserve is the largest terrestrial protected area in Africa. The reserve extends into the Algadez, Zinda and Diffa regions.

Sand dunes dominate the landscape, with sparse grasses and shrubs (at < 5% cover) around patches of grass, shrubs and thinly scattered trees the Tin-Toumma area (Wacher et al., 2004a) and dominated by *Acacia* (i.e. *Acacia raddiana*) in the Termit massif (Wacher et al., 2004a). The massif itself, located in the centre of the reserve, is a volcanic outcrop characterised by broad valleys of sand, gravel, stone and large boulders. Elevation ranges from about 300m a.s.l., where human settlements occur, up to 700 m.a.s.l., at the peak of the Termit massif (Servant, 1973).

Mean annual precipitation is less than 200mm (Daget and Godron 1995) and temperatures means range from 12 oC to greater than 40 oC (Hijmans et al. 2005 and SCP, unpublished data). There are four seasons in the area: rainy (July-August), hot dry (March-June), cold dry (October-February) and the transitional rainy cold (September-October) (Anderson & Sprundel, 2009). Seasonality plays an important role in water availability and therefore determines the movement patterns of the nomadic and pastoral tribes. In the drier seasons, water wells dictate the location of the campements, small tented settlements. The Termit region is home to four species of antelopes, including the Critically Endangered addax antelope (*Addax nasomaculatus*) and Dama Gazelle (*Nanger dama*) (Wacher et al., 2004a; IUCN, 2011). The wild ungulates compete with a larger number of livestock (camels, donkeys, sheep, goats, few horses and cattle) for the limited grazing vegetation available (Wacher et al., 2004b). The carnivore community consists of the golden jackal, the striped hyaena, three fox species (*fennec Vulpes zerda*, Rüppell's fox *V. ruePELLII* and pale fox *V. pallida*), three cat species (Saharan cheetah, sand cat *Felis margarita* and African wildcat *F. sylvestris*)

Location of the Termit & Tin Toumma National Nature Reserve, Niger

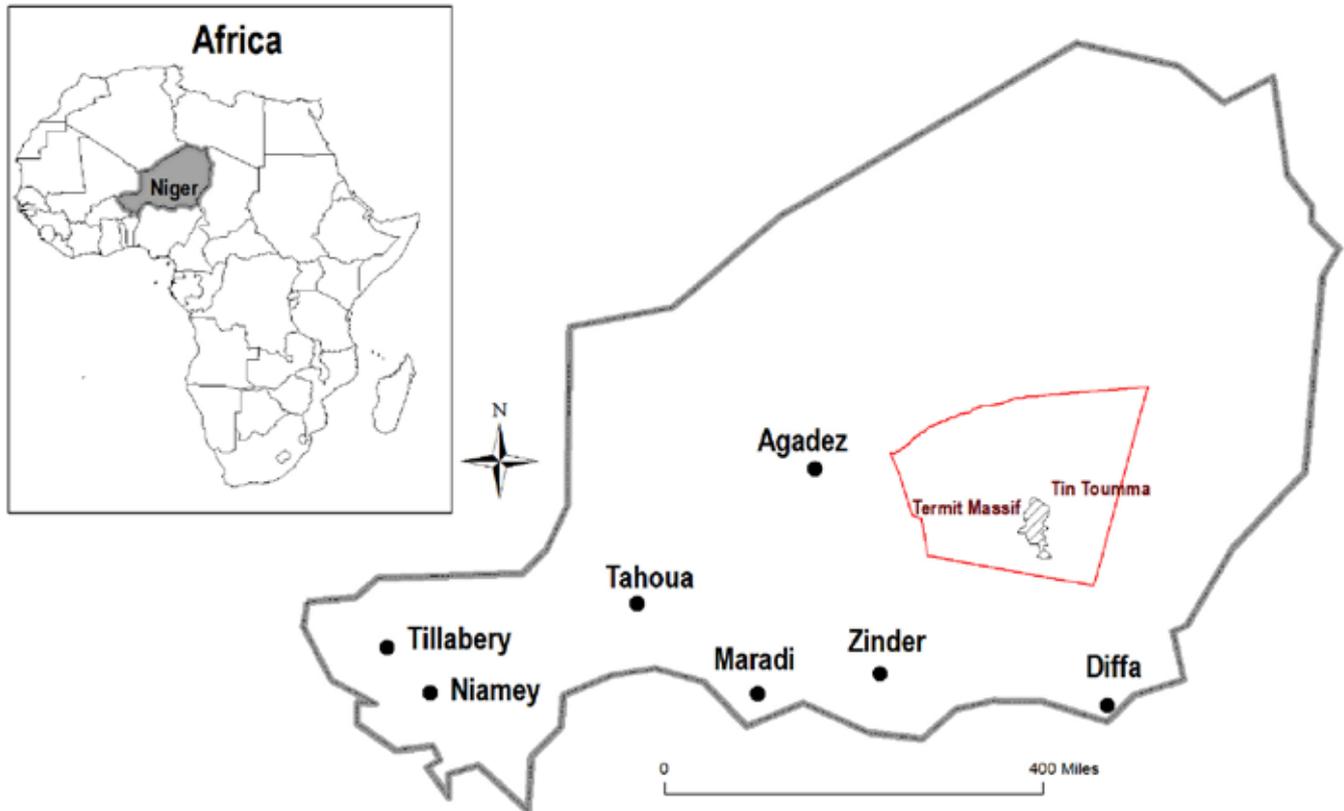


Figure 1. Map of Termit and Tin Toumma Reserve. The inset on the right shows the location of the study area within Niger.

(Wacher et al., 2004a; Rabeil et al., 2008) and mustelids (honey badger *Mellivora capensis* and Lybian striped weasel *Ictonyx libyca*) and viveridae comon genet *Genetta genetta*. Illegal hunting of wildlife has been reported in the past, with military personnel stationed in the area often responsible (Rabeil et al., 2008).

Over 48,000 people live in more than 95 small settlements throughout two communes, Tesker and Ngourti which harbour more than half of the reserve, with the settlements always located close to water wells (Anderson & Sprundel, 2009). These small settlements or “campements” are a small collection of households living in make-shift huts. Five Muslim ethnic groups make up the local population: the Arab, Tuareg and Peulh, who historically occupied the region, and the Toubou Teda and Toubou Daza who are the most numerous of the indigenous tribes. All tribes are primarily nomadic pastoralist communities,

typically raising at least one species of livestock (Anderson & Sprundel, 2009). Although French, the national language of Niger, is widely understood, tribal languages are primarily spoken (Anderson & Sprundel, 2009). The nearest towns to the study area are Tesker, in the southwest of Termit massif, and Ngourti in the east Tim-Toumma area.

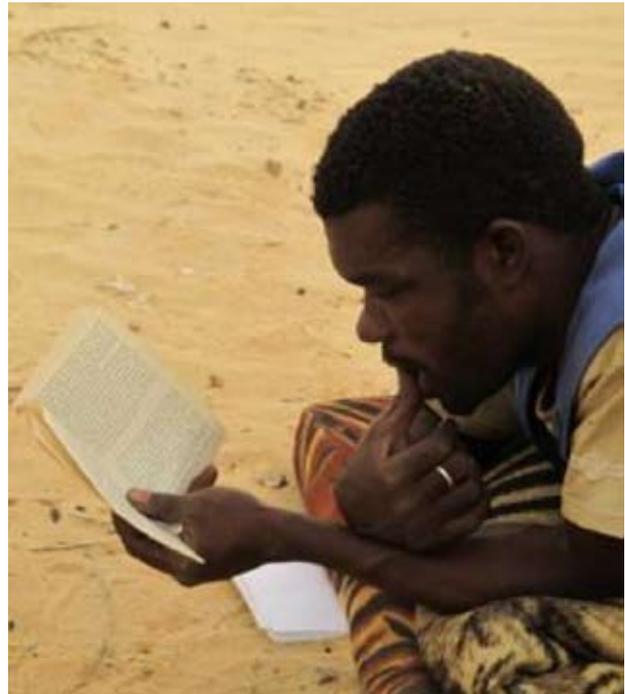
Data Collection

The interview surveys focused on households around 38 settlements in the Tesker area (Fig. 1), and comprised two questionnaires: 1) the livestock survey, which examined levels of livestock losses and husbandry methods used by locals, and 2) the attitudes survey, which explored the locals’ attitudes and perceptions towards carnivores and human-wildlife conflict (Annex 1).

The first questionnaire was administered only to pastoralists, whereas the latter was administered to both pastoralists and members of the public

(e.g. armed forces, community workers). Both questionnaires were administered as semi-structured interviews by four locally recruited assistants trained by the SCP for the purpose. There was a special emphasis on developing a rapport between the participants and the surveyors, and scientific jargon or leading questions were avoided (Leech, 2002). All questionnaires were written in French and responses recorded both in French and the local languages.

Between May and July 2010, the survey team made unannounced visits to households in the 38 studied settlements, and interviews with heads of households conducted. At least one household was surveyed in each settlement. Participants completed both questionnaires, with the attitudes survey always being administered before the livestock survey. Non-pastoralist members of the public were interviewed opportunistically, either when present in a pastoralist's household or in their own household.



A Team member taking a break.

An introductory statement on the purpose of the study and on the confidentiality of the responses was read to the participants beforehand. Both questionnaires recorded socio-economic and



Dylan Burruss, Alkabouss Matchano and a colleague in the Termit massif.

demographic information of the participants. Most of the questions in the attitudes survey used a 5-point Likert scale (Rigg & Sillero-Zubiri, 2010)(Rigg & Sillero-Zubiri, 2010)(Rigg & Sillero-Zubiri, 2010) (Rigg & Sillero-Zubiri, 2010) , while some questions were open ended. Photographs of carnivores were shown to participants to verify their knowledge of wildlife in the area (Dickman 2005).

Data analysis

The questionnaire responses were transferred to an Excel spreadsheet in French, as well as in the local languages. These data were standardized and translated to English with the assistance of the SCP team based in Niger. Coordinates were recorded for each household, and the distance to the nearest water well and vegetation cover within a 5km radius were calculated using Quantum GIS (version 1.6) and GRASS (version 6.4.1). Vegetation (percentage) cover data was extracted from the 300 m grid resolution GlobCover 2009 dataset generated by the European Space Agency (ESA), and the land cover types reclassified in three categories (Table 1). Population statistics obtained from the GIS layers of villages were used for testing the representativeness of the interviewed settlements population compared to that of non-surveyed settlements in the wider Termit massif. Using descriptive statistics, the socioeconomic background of the surveyed participants was described in terms of ethnic group, age, education, and occupation.

General Linear Models (GLMs) were used to test whether certain parameters were good predictors of the livestock depredation levels of each

household. Similarly, GLMs were used to evaluate the possible factors influencing the respondent's attitude towards carnivores. Information regarding the respondents' background (i.e. age, ethnic group), household location (i.e. distance to water well, vegetation cover within 5km)and animal husbandry techniques used (i.e. enclosures, day and/or night vigilance, use of dogs, and scaring devices) was included and tested in the model of possible explanatory variables of the levels of livestock losses. Seasonality could not be tested as a potential predictor of the frequency of livestock losses since information on specific attack dates was not always available.

The responses to the attitudes' survey to 13 Likert-scale questions were used to calculate an index of the respondents' attitude towards carnivores and then tested against the following potential predictor variables: age of respondent, tribe, level of education, occupation, proportion of livestock lost to predators (i.e. percentage of pastoralist's existing livestock), time spent in areas with carnivores, and experience with wild carnivores. The index of experience was calculated from yes or no responses (Ericsson & Heberlein, 2003) to four questions (No. 39 – 42 of the attitude survey, Annex1).

Results

Socio-demographic characteristics of respondents

Eighty percent of the 77 pastoralists who participated in the livestock survey were of the Toubou Teda tribe (Table 2). The Hausa, who are not residents of the Termit landscape but are present in urban centres and dominate the armed

Vegetation category used	Globcover classification values*
1. Grassland	110, 120, 130, 140
2. Bare desert and urban settlements	190, 200
3. All other land cover categories	11-100, 150–180 and 210–230

*Land cover classification categories refer to Globcover 2009 dataset by ESA

Table 1. Land cover categories used to reclassify and extract vegetation cover for the study area.

forces, represented 37% of the 30 participants to the second questionnaire. Almost half (i.e. 47%) of the respondents were between 30-50 years old, 36% were over 50 years old and 16% between 20-30 years old. Only 1% of the respondents were younger than 20 years old. The mean household size in the survey area was five persons, of which 55% were unmarried offspring.

The interviewed households and settlements were characteristic of the wider Termit massif faunal reserve area, with no significant difference between the mean population of the surveyed and non-surveyed households ($t = 1.5$, d.f. = 28, $P > 0.05$). With the exception of people from other tribes who moved into the area (20%), most of the participants were natives of the Termit Tin Tourma. About two thirds of the respondents had never attended school (Figure 2), being the Toubou (i.e. Teda and Daza) 88% of the respondents ($N = 107$) without any level of education, whereas the Hausa represented the most educated respondents. Of the 30 non-pastoralists who took the attitude's survey, most (83%) were members of the security forces (i.e.



Golden jackal.

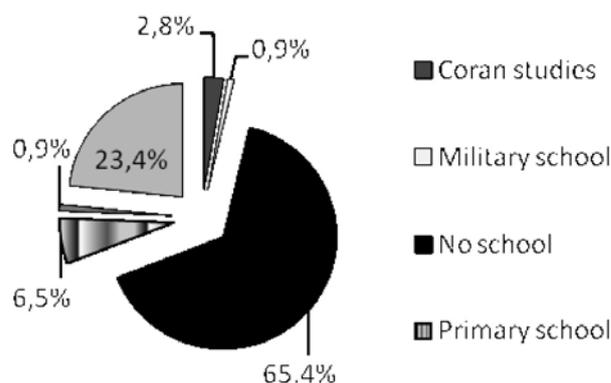


Figure 2. Proportional representation of the different levels of education amongst the surveyed individuals in the study area ($N = 107$)

gendarmarie and game guards), two were teachers and the remaining three included a retired public service worker, a SCF agent, and an administrator.

Livestock and husbandry methods

Livestock ownership

Sheep and goats accounted for 63% of the livestock owned by the surveyed pastoralists. Mean herd size was 47 ± 40 SD per household, with no significant differences between Ethnic groups ($t_3, 74 = 9.6$, $P > 0.05$). Nonetheless, the Toubou teda pastoralists tend to disproportionately own more of all livestock types, with most having cattle (74%), horses (84%) and donkeys (88%). Only 7% of respondents kept a small number of poultry, and 18 respondents owned domestic dogs. Older interviewees (i.e. > 30 years) tended to have larger herds ($\chi^2 = 1034$, d.f. = 3, $P < 0.01$).

Livestock losses

There was a reported high annual loss of livestock too predators, both in terms of total livestock killed and proportion of herd lost per household, with a mean annual loss of 17 ± 15 SD animals per household, equivalent to $36\% \pm 31$ SD of the household's total herd size. Goats and sheep accounted for most of the livestock reportedly lost to predators (i.e. 52% and 47% respectively). Only 5% of the respondents did not suffer livestock losses in the past 12 months. Reported losses did

not differ significantly between ethnic groups, and 85% of respondents attributed their losses to carnivore predation, while 10% attributed losses to disease. Most of the livestock losses (94%) were apportioned to golden jackal attacks, with the rest ascribed to hyenas.

Eighty eight percent of the pastoralists considered that attacks increased during the rainy season. Most recent losses reported varied significantly between seasons ($\chi^2 = 55$, d.f. = 3, $P < 0.001$), however, contrary to the pastoralist's perception, most of the attacks occurred during the hot dry season.

Most of the attacks on livestock (61%) were reported within 5 km from households and during sunset. Neither the distance from the household to a water well or vegetation cover in the surrounding area were good predictors of livestock losses ($F_{1, 73} = 0.018$, $P > 0.05$; $F_{1, 73} = 0.18$, $P > 0.05$ respectively). Herd size was a good predictor of the reported livestock loss to predators ($F_{1, 61} = 90531$, $P < 0.0001$, $N = 63$). However, the proportion of livestock lost and herd size was found to be significantly correlated ($r^2 = 0.999$ d.f. = 63, $P < 0.0001$). Thus, we chose to use the proportion of livestock loss to herd size instead of herd size alone as an indicator of conflict level, since this measurement provides an unbiased representation of the relative impact of the predation events experienced by pastoralist.

that livestock losses to predation were becoming more common, 10% considered there had been



Students in a local elementary school.



Pale foxes in the study area.

no change, 7% thought that losses had slightly declined whereas 3% considered they had increased slightly. When asked what mitigation measure could be used to curb livestock losses to predators, 57% of respondents proposed improved husbandry methods, 36% retaliatory killing and 6% a compensation scheme.

Tribe	Population estimates	Number surveyed	Percentage in sample (%)
Arab	58	8	10.4
Peulh & Touareg	2	2	2.6
Toubou dazza	43	7	9.1
Toubou teda	263	60	77.9
Total	366	77	100

Table 2. Information of the 77 pastoralist respondents to the livestock survey

Livestock husbandry method	% use by pastoralists
Day vigilance during grazing	89.6
Use of scary devises ¹	53.0
Use of guarding dogs	32.5
Night vigilance of livestock	23.4
Use of nocturnal enclosures	18.4

1 Scary devises includes the use of scare crows and night lighting around the herd.

Table 3. Reported use of common livestock husbandry methods by surveyed pastoralists (N=77)

Perception and attitudes towards carnivores

On average, the participants scored 35 points ± 12 SD, in the attitude's index (of a maximum 65 points). Attitudes towards carnivores were not significantly related to occupation, ethnic group, level of education, experience with carnivores, proportion of the herd lost to predators or herd size. However, attitudes towards carnivores were significantly related to age ($F_{2,47} = 4.39$, $P = 0.0179$). Differences in attitudes towards carnivores within age groups were identified post hoc. Generally, respondents 30 years of age or older scored higher on the attitude's index than younger interviewees. Although non-significant, respondents who had received some level of education generally had higher index scores.

In general, attitudes towards focal carnivores were negative, particularly towards jackals and hyenas (Fig. 3). When asked to explain their negative perceptions of carnivores, 74% of respondents claimed that hyenas attacked people and dug out human corpses, while 12% claimed that jackals and cheetahs attacked people. Only 16% of respondents attributed their negative perception to livestock losses. Cheetahs and foxes were generally positively perceived by respondents.

Interactions with Wildlife

Pastoralists tended to frequent areas with wildlife while tending their herds, with 89% doing so on a daily bases, 8% at least weekly and 3% monthly. Only 10% of the non-pastoralist interviewees visited wild areas on a daily bases, 7% did so on a

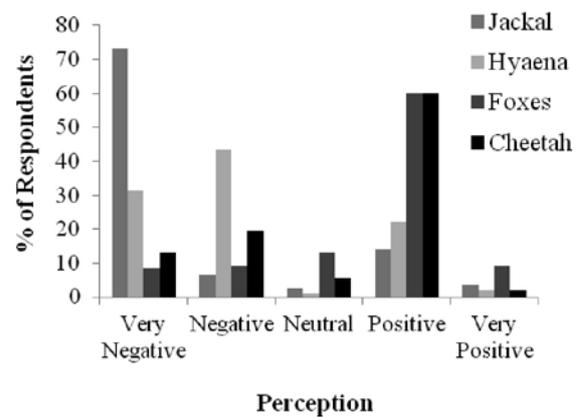


Figure 3. Respondents' perceptions towards focal carnivores of the study area. Few respondents had a positive attitude toward jackals or hyenas while cheetahs and foxes were more highly regarded.

weekly basis, 23% made at least monthly visits and 60% reported to make at least a yearly visit.

Impact of childhood stories

Eighty percent of respondents felt that the folklore tales heard during childhood typically depicted carnivores in a negative light, with jackals being portrayed slightly more negatively than the other carnivores.

Perceived Carnivore Population Trends

Sixty percent of respondents felt that the population of cheetahs and hyenas in the study area were declining, particularly cheetahs.

Conservation Education

Most of the respondents (95%) expressed an interest in learning more about wildlife conservation, preferably from a conservation education officer (63%). Television, radio, excursions, internet, books and newspaper were preferred 30% of the time, whereas 7% preferred leaflets.

Discussion

Livestock losses to wild carnivores represent an important problem in the Termit & Tin-Touma landscape. Golden jackals were thought to be the main culprit species, responsible for most of the attacks in the area (Jackals predation on young livestock was witnessed during the study).

Golden jackals are particularly tolerant of the rocky mountainous and dry habitat (Sillero-Zubiri & Macdonald, 2004) predominant in the study area. Anecdotal data from remote infrared camera traps indicates jackals are common throughout the Termit massif and Sahelian grasslands in the southern portion of the reserve (SCP unpublished data; Fig 4).

Watcher (2004b) reported more sightings of golden jackals than of hyenas and cheetahs in the area. Thus, local perception of the jackal's role in livestock losses may reflect jackal's abundance, particularly since these animals are known to approach human settlements, hunt ungulates 4-5 times their size, and do it during dusk (Kingdon, 1977) – a period where most losses occurred. Nonetheless, more detailed information on the carcasses and the level of respondents' knowledge on wildlife is required to confirm that jackals are indeed responsible for all the attacks that locals ascribe to them. After all, attacks on goats and sheep by cheetahs and hyenas – though rare – have been observed in other areas (Leakey et al., 1999; Marker, 2002). There are also a large number of pastoralists who either do not corral their animals at night or do not supervise them at all during the day. Therefore, it is likely that at least some of the attacks may not have been witnessed, and wrongly attributed to jackals when they were found scavenging at the remains.



Mother camel defending her calf's carcass, killed by two golden jackals.

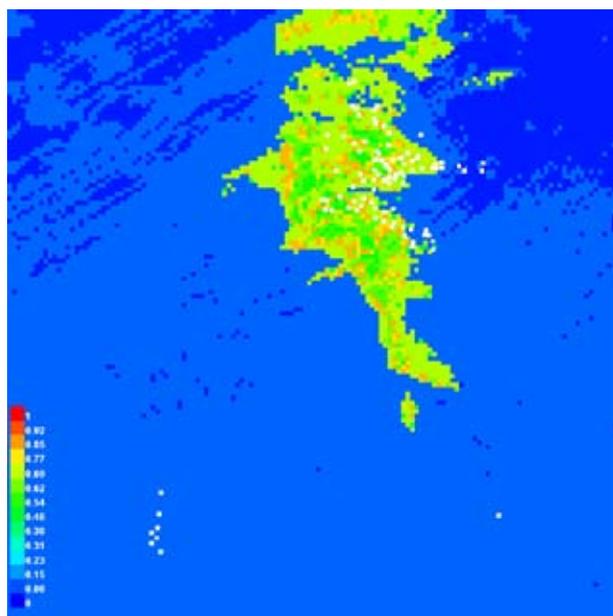


Figure 4. *Maxent output depicting the probability that the groundcover is suitable habitat for golden jackals. Jackal presence in each ground cover class was recorded using passive infrared cameras and are depicted as white dots.*

The abundance of wild prey would also need to be examined as a possible predictor of livestock losses. Decreases or seasonal changes in the availability of wild prey populations have been reported to cause increased dependence on livestock by predators, leading thus to conflicts (Macdonald & Sillero-Zubiri, 2004). Thus, finding on the feeding ecology of the carnivores in the area would be useful to gain an insight on the main prey species taken.

Improvement of animal husbandry practices

Poor livestock husbandry methods have a tendency to increase vulnerability of livestock to predators (Sillero-Zubiri et al., 2006) and lead to an increase in livestock losses. Husbandry methods, such as the use of guarding dogs, are known to be effective measures against predation in other areas (Dickman, 2005; Rigg et al., 2009).

Enclosures or 'bomas' have been widely used and successful in protecting livestock from predators (Sillero-Zubiri et al., 2006; Rigg et al., 2009). In a study of other pastoralist communities

in Niger, night vigilance, though laborious, was reported as advantageous as it improved grazing while reducing mortality of livestock due to predators (Ayantude et al., 2000). Although this



Local pastoralists at a well with their herds

does not seem to be the case in Termit, as the overall consensus is that livestock losses have been increasing over time, pastoralists using enclosures and practising night vigilance did report lower livestock losses than others. Therefore, even though husbandry methods were not clear predictors of livestock vulnerability to predators, these reported reductions in livestock losses indicate the need to consider improvements in the husbandry practices currently used.

Similarly, the way in which the husbandry methods are practiced has not yet been examined. There is thus a need to further examine the husbandry methods like the use of guarding dogs, scaring devices, and livestock fences, in order to find ways of improving them. In addition, the feasibility of each method should be assessed since their effectiveness may be compromised by the extreme nature of the region. Encouraging the wider and better use of husbandry practices, particularly of fences (recommended by 32% pastoralist as a non-retaliatory option of reducing carnivore predation), is also of great importance.

Improving public attitudes

Although 26% of the respondents thought it was 'not bad' to have carnivore species in their locality, there is an alarming negative attitude among pastoralist and the general public alike towards these species. Though livestock predation could be the major cause of negative attitudes, livestock losses, as well as previous experiences with carnivores, did not seem to affect people's attitudes towards carnivores as it would be expected (Ericsson & Heberlein, 2003). Post hoc comparisons of age classes suggested that attitudes of young (below 30 years) pastoralists were more negative than older individuals. Perhaps this strong negative opinion reflects the fact that young pastoralists have smaller herd sizes and tend to lose a greater proportion of their herd when a predator attack occurs.

The future of the Termit massif protected area, like most others, depend on the extent to which the concerns and needs of the local people are addressed (Jackson et al., 2003). Though no reasons were given as to why, most respondents thought that some carnivore populations were decreasing. Previous research have reported the existence of illegal hunting of wildlife in the area (Wacher et al., 2004b). This, together with the fact that up to 36% of the respondents proposed retaliatory killing as a solution for decreasing current rates of livestock losses to carnivores, may explain the respondents' perception. There is therefore an urgent need for interventions that will help change the current negative attitudes towards carnivores in order to mitigate the human-carnivore conflict in the area (Rigg & Sillero-Zubiri, 2010).

Education can and has been used to raise awareness levels and change attitudes of local communities towards carnivores in the long term (Jackson et al., 2003; Macdonald & Sillero-Zubiri, 2004; Sillero-Zubiri et al., 2006). Post-hoc comparisons of respondent's education and attitude index scores suggest that education can

improve opinions of local carnivores within the region. Positive opinions towards cheetahs and foxes may indicate these species have some level of cultural importance and could provide a foothold on which to mount an educational campaign.

An effective carnivore education programme will have to take into consideration the high level of illiteracy in the area, the nomadic lifestyle of the local pastoralists (Anderson & Sprundel, 2009), and the expressed willingness of the populations. Though local knowledge of carnivores has not been measured in this analysis due to data translation limitations, increasing knowledge on wildlife through education, particularly targeted at the younger generation, can change attitudes and possibly increase tolerance levels of wild carnivores (Ericsson & Heberlein, 2003; Jackson et al., 2003; Sillero-Zubiri et al., 2006). These efforts must be accompanied by effective anti-poaching strategies, that will help reduce the actual hunting pressure on carnivores and their wild ungulate prey, and the active participation of the beneficiary local communities for proper ownership and stewardship of interventions (Jackson et al., 2003). Compensation schemes have also been used to reduce the impacts of livestock losses to predators and to increase tolerance towards problem species (Woodroffe et al., 2005). Such interventions may help improve the local attitudes towards carnivores around the study area. However, compensation schemes can be difficult to implement in areas where there is corruption or no clear wildlife legislation (Woodroffe et al., 2005; Rigg et al., 2009). Moreover, caution is needed when using compensation schemes as in some areas they have failed or have not achieved the desired effect on peoples' attitudes (Rigg et al., 2009).

Next steps

It is evident that the Sahara Carnivore Project in the region needs to consider the possible drivers of both the apparent high levels of carnivore predation and the negative attitudes towards

carnivores. This can be achieved through an improvement of the current husbandry practices and educational levels, crucial steps to increase peoples' tolerance and thus to achieve carnivore conservation in the area.

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Saharan cheetah caught in a camera trap on 19 August 2010.



Dorcas gazelle caught in a camera trap.

Annex I

The livestock survey (Component 1)

This survey is conducted by the Sahara Carnivore Conservation Project in order to understand the nature and extent of livestock predation by carnivores in the Termit and Tin Tourma area. Your response as a pastoralist in the area shall be used to assess the impact of depredation and thus plan effective strategies to mitigate human wildlife conflicts. Your response shall not be used for any other purpose than this survey and shall be kept confidential. Please feel free to express yourself as much as possible.

Read out to respondents before the interview begins. This should explain the organisation the interviewers represent, the aim of the survey, and should carefully state confidentiality. Possibly a printed version could be given to the respondents, with a thank-you at the end.

Items marked * may be assessed/recorded directly by the surveyor

1. *Date [date]
2. *Time of interview begin [time]
3. *Time of interview finish [time]
4. *Name of surveyor 1
5. *Name of surveyor 2
6. *Name of surveyor 3
7. *Name of surveyor 4
8. *Name of nearest well or hamou or campement
9. *Household GPS_X
10. *Household GPS_Y
11. *Dominant habitat visible from respondent's household (Use SCF Habitat code).
[Match habitat visible to sample images].

Household and livestock demographics

12. Name of the head of family
13. *Age [<20; 20-30; 31-50; >50]
14. *Sex [Male/Female]
15. Ethnicity of respondent [Toubou/Hausa/Touareg/etc]
16. How many people lives at this household including children? [#]
17. How many unmarried children live at this household? [#]
18. How long have you lived at this same location? [# years]
19. *House type [natt/grass/adobe/concrete/other:]
20. *Night-time enclosure (enclose, encirclement) for livestock present? [Y/N]
21. Does the respondent's family use night-time enclosure(s)? [Y/N]

Predator Knowledge

Provide laminated cards, each one bearing a clear photograph of a predator known to be present in Termit. Images should be in true colour and scaled as closely as possible to relative sizes (i.e. larger animals' images should look larger relative to other images). Each card should have a reference number on the back. Include two "red herrings" (predators definitely not found in the area). Present the images in a different order for each interview.

Predators to be represented are:

- Fennec
- Rüppell's fox
- Golden jackal
- Sand cat
- Cheetah
- Caracal
- Striped hyaena
- Honey badger
- Bat-eared fox (red herring)

22. Please identify this animal – 1
23. Have you seen this animal? – 1
24. Please identify this animal – 2
25. Have you seen this animal? – 2
26. Please identify this animal – 3
27. Have you seen this animal? – 3
28. Please identify this animal – 4
29. Have you seen this animal? – 4
30. Please identify this animal – 5
31. Have you seen this animal? – 5
32. Please identify this animal – 6
33. Have you seen this animal? – 6
34. Where did you see this animal? - 6
35. Please identify this animal – 7
36. Have you seen this animal? – 7
37. Please identify this animal – 8
38. Have you seen this animal? – 8
39. Where did you see this animal? - 8
40. Please identify this animal – 9
41. Have you seen this animal? – 9
42. Which predator do you see the most?

Livestock in household

- 43. Number of sheep in household [#]
- 44. # goats [#]
- 45. # camels [#]
- 46. # cattle [#]
- 47. # horses [#]
- 48. # donkeys [#]
- 49. # dogs (juvenile, less than 1 year) [#]
- 50. # dogs (adult, more than 1 year) [#]
- 51. Poultry? [Y/N]

Losses to predators

- 52. Do predators cause problems for you? [Y/N]
- 53. What do you lose more animals to, a) predators or b) disease? [a,b]
- 54. Which is the worst time of year for predator problems for you? [season codes]
- 55. Which causes you the most loss of money, a) predators or b) livestock diseases? [a,b]

Please choose (from these pictures) which predator causes you the most problems [top 5].
[interviewer to build a rank through discussion with respondent]

- 56. picture1
- 57. picture2
- 58. picture3
- 59. picture4
- 60. picture5
- 61. If you consider the last 5 years, have problems with predators been: a) getting less common, b) staying the same or c) getting more common?[a,b,c]

Details of attacks

- 62. Have you had any problems with predators in the last 12 months? [Y/N]
- 63. How many attacks have you endured in the last 12 months? [#]
How many of your animals have been killed or injured by predators in the last 12 months?
- 64. # chickens [#]
- 65. # goats [#]
- 66. # sheep [#]
- 67. # camels [#]
- 68. # Other [cattle, horse, donkey]

Now ask the interviewee to provide details of the most recent attack.

- 69. When was the last attack on your livestock? [date]
- 70. What time was the livestock attacked? [dawn/am/pm/dusk/night]
- 71. Location of attack? (description of where place is)
- 72. Distance from household?

73. Which predator was responsible for the attack? [caracal/cheetah/fox/hyaena/jackal]

74. Did anyone see the predator? [Y/N]

How many animals were killed in this particular incident?

75. # chickens [#]

76. # goats [#]

77. # sheep [#]

78. # camels [#]

79. # others [specify]

80. Were there any dogs nearby when the attack happened? [Y/N]

81. What did the dog do? [no reaction/bark/chase/bite/other (specify ____)]

82. Was there someone nearby? [Y/N]

83. What did the person do? [nothing/shout/chase/other (specify ____)]

Now ask for the next previous attack and if you think respondent is willing repeat data questions.

Preventive measures/ Animal health

How do you protect your livestock from predators?

(listen to explanation and tick those categories that apply)

84. Keep dogs

85. Killing the predator

86. What method of killing predator? [options?]

87. Daytime vigilance

88. Sleeping with flock

89. Avoiding high-risk areas

90. Which areas are high-risk areas?

91. Putting flock in enclosure

92. Removing dead livestock

93. Scaring devices

94. What kind of scaring devices?

95. Other methods? [describe]

96. Do you think these measures are effective? [Y/N/Doesn't know]

97. What would happen if you didn't protect your flock?

98. Would you like help to protect your flock? [Y/N]

99. What kind of help do you want?

100. Where is the nearest veterinary help for your animals?

101. Are you satisfied with the veterinary assistance you received?

102. What veterinary services you need most?

Remarks

Do you have any questions? Anything else you would like to share with us?

The Attitudes survey (Component 2)

Dear respondent,

Thank you for answering to/filling in this questionnaire about your feelings towards carnivores living in Niger, such as cheetah, hyaenas, jackals, caracal and foxes.

Your opinions towards these animals are important and we greatly appreciate your time answering these questions thoughtfully. Whether positive, neutral or negative your views are very valuable to us, as we are trying to document the range of people's attitudes towards wild carnivores.

Your answers should represent your real opinions, not those of others. We encourage you to voice your opinion. Your individual answers will be treated confidentially.

Please answer all the questions, but do not take too long over this: it is not an exam!

With regards,

Sahara Carnivores Project Team

I. We would like to ask about your attitude towards carnivores such as cheetah, jackals, hyaenas and foxes. Please circle the number that best describes your opinion.

Which answer best describes your feelings towards these animals?

	Very negative	Negative	Neutral	Positive	Very positive
1. Cheetah	1	2	3	4	5
2. Hyaena	1	2	3	4	5
3. Jackal	1	2	3	4	5
4. Foxes	1	2	3	4	5

	Very bad	bad	Neither good nor bad	Good	Very Good
5. That in Zinder Region there are cheetahs is:	1	2	3	4	5
6. That in Zinder Region there are hyaenas is:	1	2	3	4	5
7. That in Zinder Region there are jackals is:	1	2	3	4	5

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
8. Cheetahs belong in the wild in Termit	1	2	3	4	5
9. Hyaenas belong in the wild in Termit	1	2	3	4	5
10. Jackals belong in the wild in Termit	1	2	3	4	5
11. A lot of sheep/goats/camels are killed by cheetahs	1	2	3	4	5
12. A lot of sheep are killed by hyenas	1	2	3	4	5
13. I would be afraid to go to places with wild carnivores	1	2	3	4	5

Which of the following animals do you think are dangerous to humans?

	Very dangerous	Dangerous	Mostly harmless	Always harmless	Don't know
14. Cheetah	1	2	3	4	5
15. Hyaena	1	2	3	4	5
16. Jackal	1	2	3	4	5
17. Foxes	1	2	3	4	5

18. If you answered very dangerous or dangerous, in which situations are they dangerous?

19/20. What do you think the main food of **cheetahs and hyenas** in Termit-Toumma is?

Please mark with an X in the squares the option that best describes your opinion

	19. Cheetah	20. Hyena
Fruit, leaves and insects		
Mice and rabbits		
Antelopes		
Camels, or Sheep		
Other (please specify)		
I don't know		

II. What is your opinion about carnivore conservation in Zinder Region?

Please circle the response that best describes your opinion.

Do you think the numbers of these animals is changing or staying the same?

21. Cheetah	Increasing	decreasing	staying the same	I don't know
22. Hyaenas	increasing	decreasing	staying the same	I don't know

23. In your opinion, what is the most important issue concerning **carnivores** of the Zinder Region?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
24. In the Zinder Region there are too many cheetahs	1	2	3	4	5
25. In the Zinder Region there are too many hyaenas	1	2	3	4	5
26. In the Zinder Region there are too many jackals	1	2	3	4	5
27. Cheetahs, hyaenas and jackals should only live in some parts of the Zinder Region		2	3	4	5
28. Money should be paid to people whose livestock is killed by cheetahs/hyaenas/ jackals	1	2	3	4	5
29. Money should only be paid to people who tried to protect their livestock	1	2	3	4	5
30. Carnivores should be eliminated from areas where they kill livestock	1	2	3	4	5
31. People need more information about carnivores	1	2	3	4	5
32. More research is needed on carnivores	1	2	3	4	5

III. Please mark all that apply concerning your knowledge of carnivores.

33. Where have you learnt about wild carnivores? (*Tick all that apply*)

Newspapers / magazines	Books/leaflets	Conservationists	Fairy tales / legends
Family	Hunters	Pastoralists	Radio
School	Television	Other	

34. Are you interested in learning more about wild carnivores?

Yes	No	A little
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35. If yes, in what form would you like to obtain information?

Television/radio	Internet	Excursions	Newspapers	Books	Leaflets	Other
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IV. We would like to learn about your experience with carnivores

Please tick or circle the answer that best describes your opinion.

36. How often do you go to places with wild animals?

Almost daily	At least once a week	Once a month	Once per year	Never
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37. What was the name of the place you went? (What is the nearest town?)

38. Which of the following activities do you usually pursue?

Sheep/camel/cattle herding	Hunting	Wildlife watching	Other
Food gathering	Fishing	Hiking	

	Yes	No
39. Have you ever seen a wild cheetah ?	1	2
40. Have you ever seen a wild hyaena ?	1	2
41. Have you ever seen other wild carnivores ?	1	2
42. Have you or your family ever lost livestock to wild carnivores ?	1	2

43. How would you react if you saw a **cheetah**?

44. How would you react if you saw a **hyaena**?

If in childhood you were told stories about these animals, how were they described?

	Mostly good	Mostly bad	Various	I wasn't told	I don't remember
45. Cheetah					
46. Hyaenas					
47. Jackals					

V. This final section will help us to learn more about the respondents of this survey. Your answers will be grouped together with those of others and will not be individually identifiable. All information is confidential.

Please circle or fill in the correct information.

48. How old are you? _____

49. Are you female or male? _____

50. What tribe are you? _____

51. Your occupation is (circle the correct category):

Livestock owner	Shepherd	PA staff
Tourism industry	Teacher	Student
Hunter	Other (specify):	

52. If your family keeps animals, what kind of animals do you have? Indicate how many.

Sheep	Goats	Cows	Camels	Horses	Poultry	Other
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53. What education have you completed?

None	Primary	Secondary	University
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Thank you for your cooperation.