

The background of the cover is a close-up photograph of a yellow and black beetle, possibly a leaf beetle, perched on a brown, spiky plant stem. The beetle's body is primarily yellow with black markings on its elytra and thorax. The plant stem is covered in small, pointed, brownish structures. The background is a soft, out-of-focus green.

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ABOUT IJBC

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ARTICLE

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Full Length Research Paper

Human carnivores conflict in Wamba District, Samburu County, Kenya

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Human-livestock-carnivores conflict is a unifying theme on a complex problem of a shared environment. The study was conducted to determine the levels and nature of human wildlife conflict in Samburu County, Kenya. The data was collected from 2006 to 2009, in three community areas. A total of 266 homesteads were randomly selected for interviews and characterization. The survey was carried out using semi-structured questionnaires, direct field observations and physical measurements. Data obtained was analyzed using Genstat® Discovery (3rd Edition University of Reading), and levels of association established using chi-square. Carnivores within the ecosystem were identified using motion sensor cameras which included lion (*Panthera leo*), leopard (*Panthera pardus*), hyena (*Crocuta crocuta* and *Hyaena hyena*), jackal (*Canis mesomelas*), and wild-dog (*Lycaon pictus*). Livestock predation occurred at different sites notably homestead, water-point and grazing field. A total of 435 cattle, 801 sheep, 1138 goats, 189 donkeys, and 92 camels were killed by carnivores during the study period. The magnitude of depredation was mainly influenced by animal husbandry practices, including poorly constructed animals' sheds and animals left in the field without headers or under the care of minors unable to scare the carnivores away. The dynamics of both wild and domestic ungulates at different seasons are considered to be possible influencing factors on carnivore diet composition, hence presenting as increased conflict during droughts.

Key words: Human-carnivore-conflict, ungulates, homestead, denning site, depredation.

INTRODUCTION

Integrated ecosystem

Human-Carnivore interface is complex and takes different forms, definitions and levels. Finite competition for

resources between wild ungulates and livestock for pastures create opportunities for carnivores to capitalize

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on easily accessible prey. This makes the interfacing more prominent resulting in increased depredation and cross-species disease transmission with a negative economic impact to involved communities (Koch, 2005; Treves and Karanth, 2003). Shared ecosystems have resulted in transmission and resurgence of diseases that were previously under control (Pedersen and Davies, 2010).

Large carnivores population has been on the decline globally, a fact attributed to livestock depredation and human development (Kolowski, 2005). In Kenya, killing of six lions (*Panthera pardus*) in a single encounter with pastoralists was witnessed at the outskirts of the Nairobi National Park. The big cats strode out of the park to the neighboring farms in search of domestic prey (KWS, 2012). Livestock attacks by carnivores have been directly related to drought seasons as well as decreased numbers of wild ungulates. A growing human population and new settlements have increased encroachment on wildlife areas additionally increasing human-carnivore conflict (Kolowski, 2005; Naughton-Treves et al., 2003).

Cultural and social habits

The Samburu pastoralists have a philosophy of keeping large herds of cattle. The cattle have more social than economic value. Cattle symbolize prestige and power such that the more herds of cattle one owns, the more recognition, prestige and power one is accorded (Spencer, 1965). Livestock plays a big role in achieving and sustaining social fabric and social capital within the community. A lot of social benefits are accrued with this recognition, for instance, marrying many wives. In this regard livestock is used to pay bride price during marriage and also slaughtered during such festivities, strong relations and kinships. Cattle are also used as compensation for collateral damages and for other goods or services rendered (Sobania, 1988). The aspect of cattle keeping is intertwined with peoples' social and economic livelihoods.

The current Samburu way of life has a direct negative impact on environment and natural resources. The many herds of cattle that the community owns deplete the pasture and vegetation, hence enhancing the biophysical impacts such as soil erosion, land degradation and dwindling of water resources (Lamprey, 1983). The community gets into conflicts with their neighboring tribes over sharing of limited pasture and water resources. The conflicts also involve wild animals that share these limited resources and community attitudes towards wildlife are rapidly changing. There are emerging, managed community conservancies and open community grazing lands that constitute carnivore dispersal areas where human and carnivores interface (Hardin, 1968; Lamprey, 1983).

The objective of this study was to determine the levels and nature of human wildlife conflict in Samburu County, Kenya. The scope of the study included grazing sites, homesteads and carnivore denning sites. The study investigated the nature and levels of conflict as well as the carnivores involved at the different interfaces.

MATERIALS AND METHODS

Study area

The study was carried out in Samburu County, 400 km north of Nairobi, in community grazing area and sanctuaries of Lodungogwe, Nkaroni, Ngilai west, Namunyak and west Gate (Figure 1). The main economic activity of the Samburu people is pastoralism with livestock depredation being a major economic constrain (Ogara et al., 2011).

Homestead characterization

Livestock bomas (stockades) within the study area were mapped individually and dimensions taken using a tape measure. The following information was recorded: GPS position, date and time, wall height and thickness, construction material, number of compartments in the boma, number and type of stock in the boma, number of people living at the boma, number of dogs present at the boma, number of fires near the boma at night, presence of families living at the boma, duration of time the boma is used, type of habitat surrounding the boma, position of livestock sleeping area in relation to human shelter(s) (Figure 3). This helped in making determinations on how the homesteads' dynamics influenced depredation particularly at home.

Survey of predation incidences (Livestock kills at homesteads, grazing fields, watering points)

We documented the details of predator attacks at each boma. It was necessary to do this for every attack, because circumstances surrounding an attack could vary depending on the habitat, normal practice of the particular group ranch and habits of the herders. Because of the large size of the study area, much of the predation information was obtained from community groups and livestock owners at specific intervals for four years.

Boma kills

To establish the magnitude of depredation occurring at home and the problem carnivore (s), the head of the family or the elder present at the time was interviewed at the randomly selected homesteads. For incidents where the predator involved in an attack was not seen, its identity was established by the presence of spoor (tracks) and mode of attack as follows:

Lions' general mode of attack is to roar, stampede cattle and kill outside the boma with a bite at the neck. Identity confirmed by tracks and distance between canine teeth on the bite mark. A lion cannot scale boma walls more than 2 m high. Lions usually move in prides.

Leopards are solitary hunters and rely on stealth to catch their prey. Leopard usually prey on animals of a size that they can easily climb a tree with or drug into a thicket after capture.

Subsequently shoats, young calves and dogs form a greater part

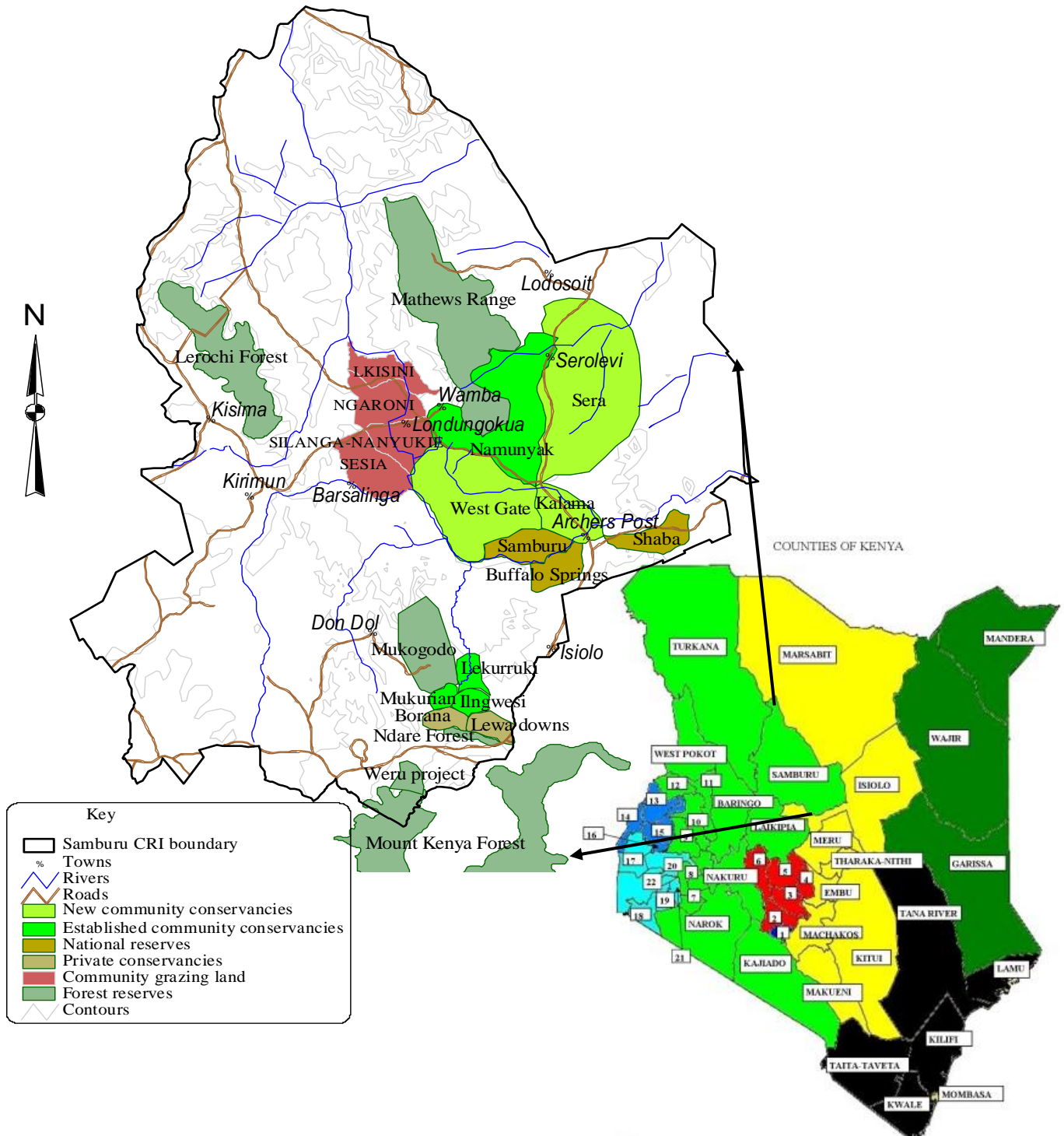


Figure 1. Map of study area showing the community grazing land, community conservancies and national reserves.

of their prey.

Hyenas usually force their way under or through perimeter fence. Their tracks are easy to identify because of a distinctive pad shape (Personal communication; Samburu elders).

Field kills

Livestock attacked and killed while grazing were considered separately as another form of wildlife livestock interaction. This was



Figure 2. A typical Samburu homestead as observed in the study area.

because such attacks had a strong component of vigilance problem, and consequently, factors such as stock to herder ratio and presence of dogs assume increased importance. Such attacks also involved other species such as cheetahs (*Acinonyx jubatus*), jackal (*Canis mesomelas*), and wild-dog (*Lycaon pictus*), which rarely attack at bomas. The following information was recorded for field kills: herd size, number of predators involved in the attack, number of herders present during the attack, type of habitat, number of dogs, location and time of the incident, distance between herder and livestock. This information was obtained from interviews with the herders in charge of the attacked herd. Animals killed because of being left out in the field at night were recorded separately to measure the impact of herding practices and overall loss.

Motion sensor cameras studies

Motion sensor cameras were placed near human settlements, livestock stockades, dens, at kills and left-over carcasses, commonly used watering points and places where locals often spot carnivores. The cameras recorded times of day or night when pictures were taken. Motion sensor cameras provided added accuracy to the identification of individual animals for instance differentiating between striped and spotted hyenas which was not possible using spoors and feeding style.

RESULTS

Homestead characterization

Two hundred and sixty-six homesteads were characterized. The majority, 88.4%, had perimeter fences and animals' sheds constructed with acacia branches while the rest (11.6%) had thorny shrubs found in the study area as well as shrub fences. Most of the houses (95.5%) were thatched with grass and cow dung. Other roofing materials were used but to a lesser extent, including nylon and plastics (3%), animal skin (1.1%) and corrugated iron sheets (0.4%).

The average height of perimeter fences at the

homestead was 102.4 cm, with an average thickness of 114.5 cm. There was an average of 3 dogs per homestead (range: 0-7). A mean of 275 livestock, including cattle and shoats, were recorded in each of the characterized homesteads.

Homesteads were located at an average distance of 5.76 km to the nearest water source(s) and 3.68 km to river valleys. Most were dry depending on the season. Most of the homesteads were located close to inselbergs and linear ridges with an average distance of 1.87 and 2.64 km respectively, however most homesteads were at an average of 8.85 km far from mountain ranges. Settlements were found to be strategically located, with an average distance of 1.14 km between homesteads, with most of them about a kilometer from thick bushes.

Survey of predation incidences (Livestock kills at homesteads, grazing fields, watering points)

Numbers of domestic animals preyed on by each predator over the four years of study are shown in Figure 3. Goats (41.7%, n = 1138) were the most preyed on domestic species having been killed by all the carnivores. The highest number of goats (23.1%, n = 263) were killed by the leopard, while the crocodile (0.26%, n = 3) and the lion (8.9%, n = 102) recorded the least goat kills respectively. Camels (3.4%, n = 92) were the least predated on among domestic ungulates by all the predators, with the lion recording the highest camel kills (84.4%, n = 74). The lion (22.5%, n = 615) and hyena (22.4%, n = 612) were on the other hand the most nuisance carnivores having depredated on the highest number of domestic ungulates, followed by the leopard at (19%, n = 521). Crocodile killed the least (0.2%, n = 6). Most carnivores had a preference for goats followed by sheep except the lion that preferred cattle. This could be attributed to the population dynamics of the domestic ungulates in the study area as well as the size on edible meat in the different species and ease of kill (Figure 4).

The total number of domestic ungulates killed at the watering point were the lowest (4.5%, n = 124) compared to the homestead (21.4%, n = 584) and the grazing field (49.9%, n = 1363), where half of all the kills were recorded to have taken place. Amongst all the predators the jackal had the highest number of kills at the homestead (33.6%, n = 196) followed by the eagle at (23.5%, n = 137). The two predators, jackal and the eagle prefer the young of the small stock that area grazed near the homesteads. Amongst the carnivores found in the study area, the hyena had the highest kill (15.4%, n = 90) while the lion killed the least (4.8%, n = 28) at the homestead. Analysis carried out indicated a strong association between all the predators and kills at the homesteads (Figure 5).

At the watering point it was shown that the lion

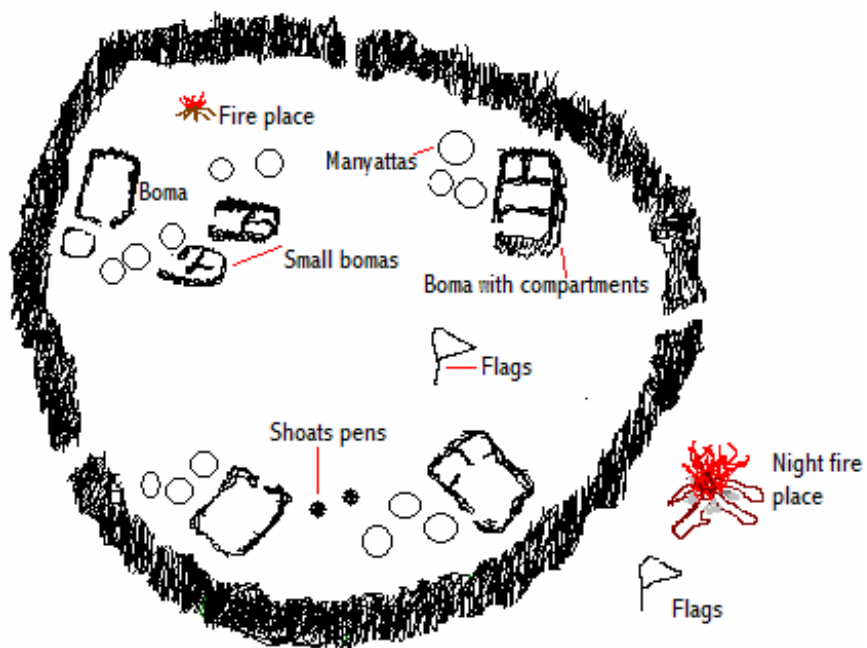


Figure 3. A typical homestead showing parameters characterized at the study area.

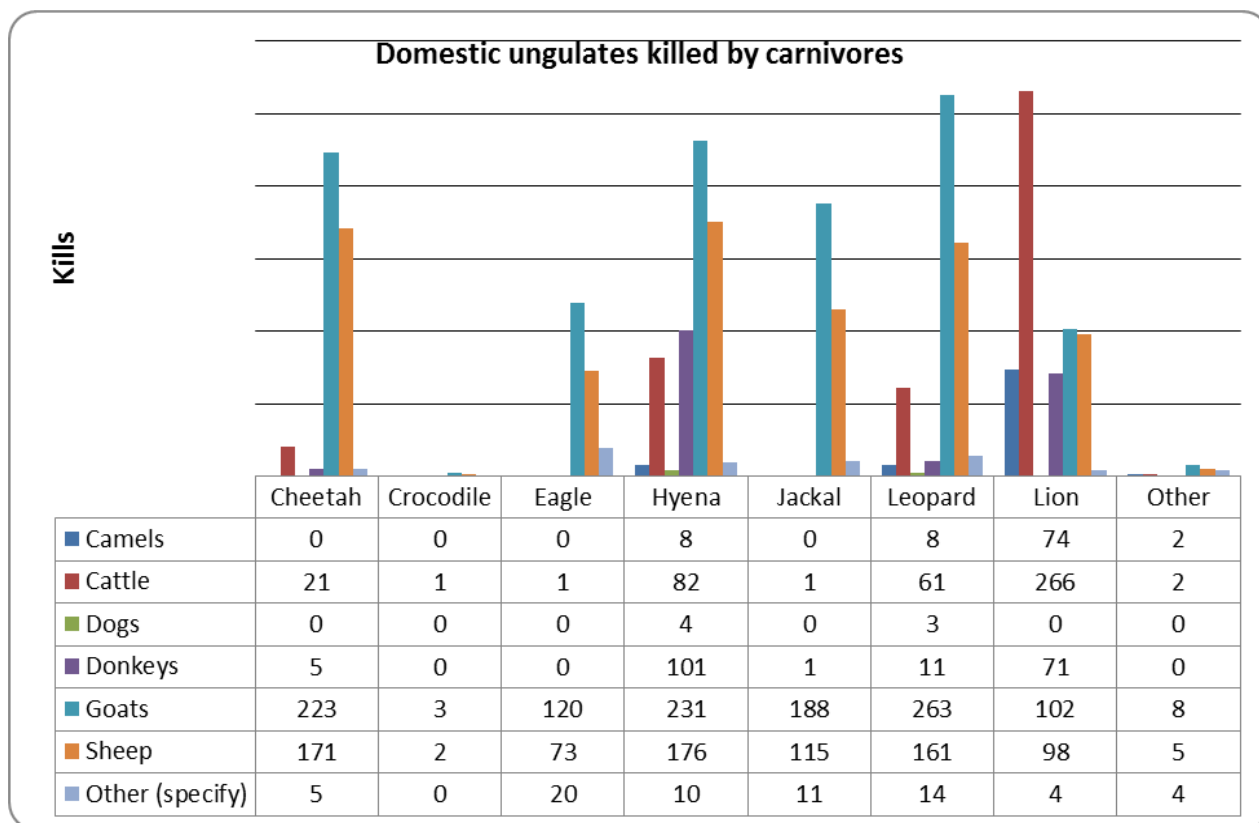


Figure 4. Showing the magnitude of losses during study period (four years) through depredation by the different types of carnivores in the study area.

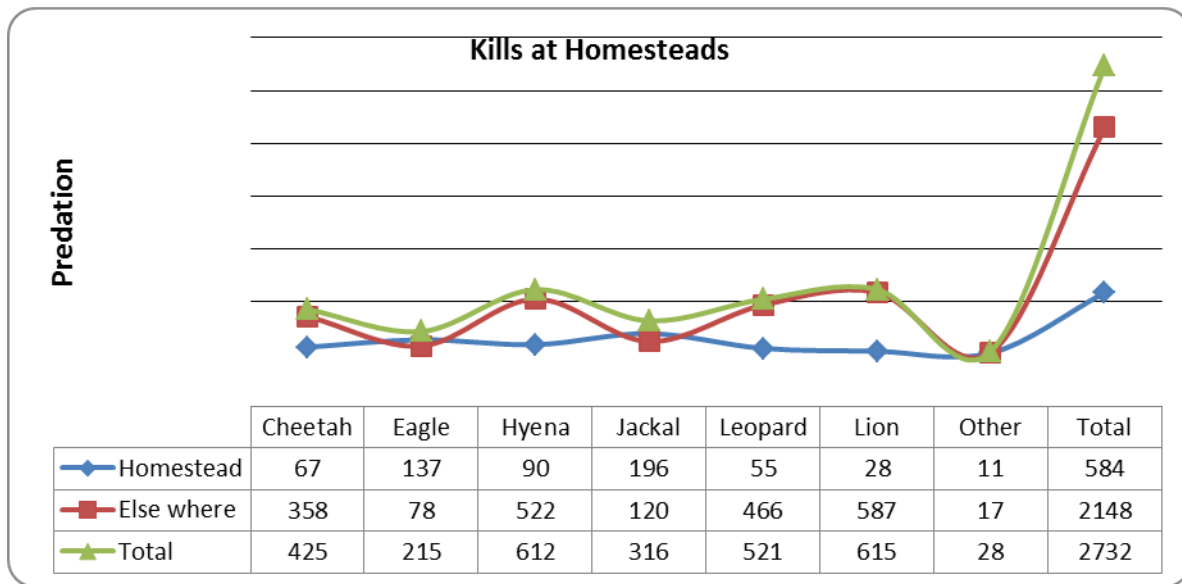


Figure 5. Shows predation of domestic ungulates by different carnivores at the homesteads.

recorded the highest kill at (42.7%, n = 53, followed by the leopard (16.1%, n= 20 while the jackal killed the smallest number (3.2%, n = 4 of domestic ungulates. There was a strong association of the lion with watering point as a location of kill (P<0.05) and chi square > 3.84

The lion (32.7, n = 446) and the cheetah (23.2, n = 316) killed most of the domestic animals at the grazing field during the study period respectively, while the eagle and jackal recorded the least kills at (2.3, n = 32 and (4.8%, n = 66 respectively (data not shown).

Motion sensor cameras studies

Motion sensor cameras mounted at different carnivore den sites as well as areas frequented by the predators provided added accuracy to the identification of individual animals. At some instances, the striped and spotted hyenas were shown to exist at the study area but at different den locations (Figure 6). Other carnivores captured by the cameras were the leopard and jackal. It was also possible to show that in some instances the carnivores shared their denning areas with other animals, most notably the porcupine (*Hystrix ristata*).

Carnivore den sites characterization

A total of 104 carnivore dens were identified at the study area, (59.6%, n = 62) were actively in use while (37.5%, n = 39) had no resident carnivore at the time of characterization. Most dens were located at inselbergs

with an average height of 165.5 m. More than half (65.8%, n = 48) of the dens had not been visited by human beings, since they had no visible human activity, whereas (23.3%, n=17) of the dens had minimal human activity. A small number (11%, n = 8) of the dens showed pronounced human activity marked by presence of fire places and food leftovers with the cave rocks' colored with the morans' hair dyes.

Apart from the resident carnivores, other animals mostly wild ungulates were reported at the den sites, these include; dikdik (51.6%, n = 16), rock hyrax (12.6%, n = 4), gerenuk (12.9, n = 4), clip springer (9.7%, n = 3) and gazelles (6.5%, n = 2). There were indications that two cheetahs were also cited at the den site throughout the study period though they were not the resident carnivore. Pictures are important in determining habitat used by wild carnivore species, and appropriate livestock husbandry practices may be developed.

DISCUSSION

Increased livestock population, climatic factors, land degradation, increased human population continue to caused an imbalance in the Samburu ecosystem where carnivores, humans and livestock no-longer co-exists harmoniously (Ocholla et al., 2013). The co-existence has thus resulted to increased conflict bearing in mind that more than 50% of wildlife are in community grazing area and community group ranches (Kameri-Mbote, 2005). In the study area, the entire homestead sampled had perimeter fence, made of thorny branches, in most

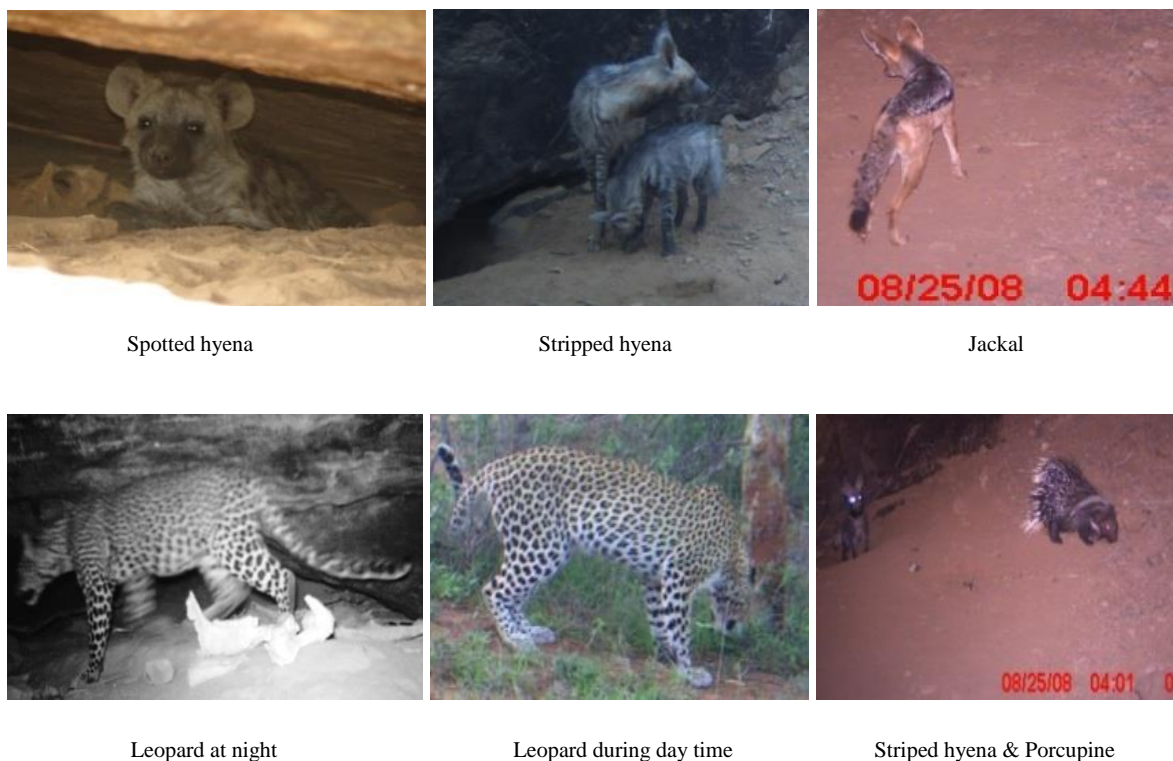


Figure 6. Showing images of carnivores and other animals sharing den sites captured at the study area.

cases from the acacia tree. The homesteads were desired to have separate animal sheds for shoats, cattle, camel and donkeys. Human dwelling houses were specifically located on the periphery, with most vulnerable animal (shoats) positioned at the center while donkeys which were also regarded as guard animals had a shed next to the perimeter fence (Figure 2). On average the perimeter fence was 102 cm high and 114 cm thick. In most cases the fence was not an effective barrier for keeping the carnivores away. This was due to decay and degradation of the fences that was observed particularly during droughts. Similar observations on use of poorly maintained acacia fences as homestead perimeter fences that could not keep carnivores away have been made by other authors (Ocholla et al., 2013; Okello, 2004).

All the carnivores identified in this study were shown to have a strong association with homestead as a livestock killing site, ($P < 0.05$), the hyena having the highest night incidents at the homesteads. This was attributed to poor fencing of animal sheds in the study area. Better fencing technology should be encouraged in the study area to reduce preventable conflicts. Such predator proof mobile bomas have been tried elsewhere with very encouraging results. Manoa and Mwaura (2016) have reported a 91.1% reduction in livestock predation at night as a

result of using the predator proof bomas at Amboseli, Kenya.

Dogs were kept in most homesteads with an average of 3 dogs per homestead. Some homesteads however had as many as seven while others had none. Though dogs were kept as guard animals, kills at the homesteads still occurred at night mostly by the hyena; (15.4%, $n = 90$) and the jackal killed; (33.5%, $n = 196$) young shoats left at the homestead under the care of young children. The effectiveness of the dog as a guard animal greatly depends on how the animal was trained and bonded with livestock. The Samburu people have been using the dog to chase predators away and also alert the pastoralist of their presence. There are instances where dogs have been preyed on by leopards (Okello et al., 2014; Ocholla et al., 2013).

Location of homesteads was observed to be strategic, and was mostly influenced by proximity to water sources, grazing fields and shrubs for the browsers. The convenience of these essentials was also found to be favored by wild ungulates and by extension the carnivores. Characterization of carnivore denning sites showed that hyenas and leopards preferred mounting ranges and inselbergs. This close co-existence could be attributed to the observed human–carnivore conflict in the study area, an observation that was also made by Okello

et al. (2014), who attributed increased depredation to livestock encroachment to carnivore habitat. The situation is worse during droughts when livestock are moved to carnivore ranging zones in search for pasture, hence becoming the primary prey (Treves and Karanth, 2003).

Conclusions

The phenomenon of human carnivore conflict is something that will be there as long as human beings, livestock and carnivores continue to share the same habitat. This therefore calls for sustainable policies that can guide and manage the three to create a harmonious relationship that is sustainable. Predation on livestock is a major factor in human wildlife conflict in Samburu. Significant off-take was reported in this study. The conflict is compounded by the habitat characteristics, community practices including shelter, management of herds both at night and during the day. The impact of the off-take by carnivores is significant and definitely impacts the Samburu pastoral area as a source of meat for the Kenyan market and their livelihood. The study also demonstrates that the problem of human carnivore conflict is complex and real. The effective management of the conflict for better results including economic and social outcomes requires paradigm shift supported by strong policy decisions and management of community perceptions and practices. Homestead and livestock shelter construction stand out as contributors to off takes at night. Devolved government is getting grounded in Kenya and County based studies should generate keen interest and contribute to policy and practice for sustainable livelihoods. Policy on compensation should be enacted to enable compensation for loss of livestock to wildlife. This will lessen the conflict by reducing retaliatory practices and ultimately creating a positive attitude towards the problem carnivores. The County Government together with the involved communities needs to embrace the aspect of ecotourism within the conservancies, thus best managing their resources including wildlife, land and livestock.

This study is specific to Samburu County and underpins its relevance and timeliness as pastoralism remains a major source of livelihood in this jurisdiction. This study also shows close interaction between humans and animals which could also be of importance for other dimensions of study in human carnivore studies including a one health dimension. Diseases at the human-animal interface is an area of concern with specific attention to emerging and re-emerging diseases as demonstrated by Owaga et al. (2014).

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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