HUMAN-WILDLIFE INTERACTION IN SERENGETI AND NGORONGORO DISTRICTS OF TANZANIA: A CASE STUDY ON SMALL MAMMALS

FJ Magige
Department of Zoology and Wildlife Conservation, University of Dar es Salaam,
P.O. Box 35064, Dar es Salaam
Tel.: +255745291726, Fax: +255222410480, Email: magige@udsm.ac.tz

ABSTRACT

In the Serengeti and Ngorongoro Districts, small mammals are said to provide protein and income to the local people. However, they are simultaneously reported to conflict with farming activities. These conflicting aspects have not been investigated there. The present article considers human-small mammal interactions in six villages adjacent to the protected areas. Data were obtained through questionnaire administration to the local people in the districts. Small mammals were hunted in the two districts for food purposes and some villagers declared that they were earning income from selling small mammals products. Seventy percent of the respondents in Serengeti District claimed that among the hunted small mammals, the rabbits were the most preferred animals whereas <5% of the respondents in Ngorongoro Districts declared to prefer rabbits. In terms of gender, there was no significant difference between males and females in the preference of rabbits in both districts. However, the frequency of hunting was higher in Serengeti District than in Ngorongoro District and dogs were significantly more used for hunting than were other means of hunting. Some small mammals, such as rodents, were a nuisance in raiding crop fields and food stores. In attempting to protect their crops and other properties against small mammal destruction, villagers used various strategies including trapping and poisoning although these methods were often ineffective. Some villagers suggested extermination of the small mammals as a control measure. Despite the fact that small mammals were destructive, about 26% (n =150) of respondents disagreed with the proposal of animal extermination, instead they suggested establishment of conservancies or seeking for the government intervention. Domestication of small animals for reptile farms, ecologically focused small mammal management techniques and improved storage structures might reduce the conflict.

INTRODUCTION

Human-wildlife conflict is a major concern of most people living next to protected areas in Africa. Conflict is here defined as any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, and on the conservation of wildlife populations, or on the environment (Anon 2005). It occurs when growing human populations overlap with established wildlife territories, creating reduction of resources or life to some people and/or wild animals (Wikipedia 2012). As the world's population increases, there is an increasing demand for space and resources for which the population extends to wild animal habitats and their natural wildlife territory is displaced. Agricultural expansion has squeezed wildlife into smaller and fragmented spaces (Sillero-Zubiri and Switzer 2001). Human wildlife encounters with negative results such as crop damage, animal death, property damage, habitat destruction, injuries to people, injuries to wildlife and the like are increasingly taking place in the protected areas such as national parks and game reserves and also in backyards and neighbourhoods. This is particularly true of areas adjacent to protected areas which can harbour large

populations of wildlife (DeStephano and DeGraaf 2003). This has created an increasing concern among biologists who carry out wildlife research in places where people live nearby protected area (Miller and Hobbs 2002).

Traditionally, it is widely believed that, it is the larger herbivores including elephant (*Loxodonda africana*), buffalo (*Syncerus caffer*) and hippopotamus (*Hippopotamus amphibius*), and large carnivores such as lion (*Panthera leo*), leopard (*Panthera pardus*), cheetah (*Acinonyx jubatus*), spotted hyena (*Crocuta crocuta*), wild dog (*Lycaon pictus*) and crocodile (*Crocodylus sp*.) that are responsible for most of the human-wildlife conflicts (Anon 2005, Parker *et al*. 2007, Nyahongo and Røskaft 2011). However, small animals can also be responsible for high levels of human –wildlife conflicts. In Africa, some small mammals are a source of conflict, although generally, they play important ecological roles such as soil aeration, seed dispersal, provision of food for large animals, indication of the status of environmental health and formation of linkages in the food chain (Aschwanden 2005).

A wide variety of small vertebrate pests such as primates (baboons, monkeys), rodents (porcupine, rats, mice), and springhares come into conflict with farming activities in Africa. Over 25 species of rodents have been recorded as pests in agriculture, causing a wide range of damage and losses in crops such as cereals, legumes, vegetables, root crops, cotton and sugarcane (Hubbard 1972, Fiedler 1994). They cause considerable damage to crops before and after harvest, damage electric and other installations and are reservoirs or vectors of serious infectious diseases (Fiedler 1988, Makundi *et al*. 1991). Impacts of these small mammals have led into considerable economic loss and food insecurity given that their abundance is greater outside than inside the protected areas (Caro 1999). Many people have thus developed negative attitudes towards wildlife, protected areas and conservation in general (Sillero-Zubiri and Switzer 2001).

The present study sought to explore the existing conflict between human and small mammals, the opinions of the people about the conflict and solutions to reduce the conflict. Community opinion plays an important role in planning and management of wildlife. Information about attitudes of the community towards wildlife is continuously becoming a prerequisite in designing optimal management strategies (Brown and Decker 2005, Wambuguh 2008).

METHODS

The study was conducted in November 2010 in the two districts of Serengeti and Ngorongoro which are in West and East of the Serengeti National Park, respectively. The two districts were chosen because they are close to the protected areas which are the Serengeti National Park and Ngorongoro Conservation Area respectively. Serengeti District lies between latitude 2° 0′ 0′′S and longitude 34° 49′ 60′′E whereas Ngorongoro District lies between 2° 45′ 0′′S and 35° 30′ 0′′E. In total, 6 villages (three in each district) (Fig. 1) that were randomly selected basing on the closeness to the protected areas and agricultural activities were studied. In Serengeti District, studied villages included Kisangura, Nyamburi and Machochwe, whereas in Ngorongoro District, the villages were Ololosokwani, Magaiduru and Soitsambu. The study area is composed of highland savannah mainly with thorn woodland trees (with species of *Acacia, Commiphora, Ficus, Combretum and Podocarpus*) and extensive grass plains (Herlocker 1976).

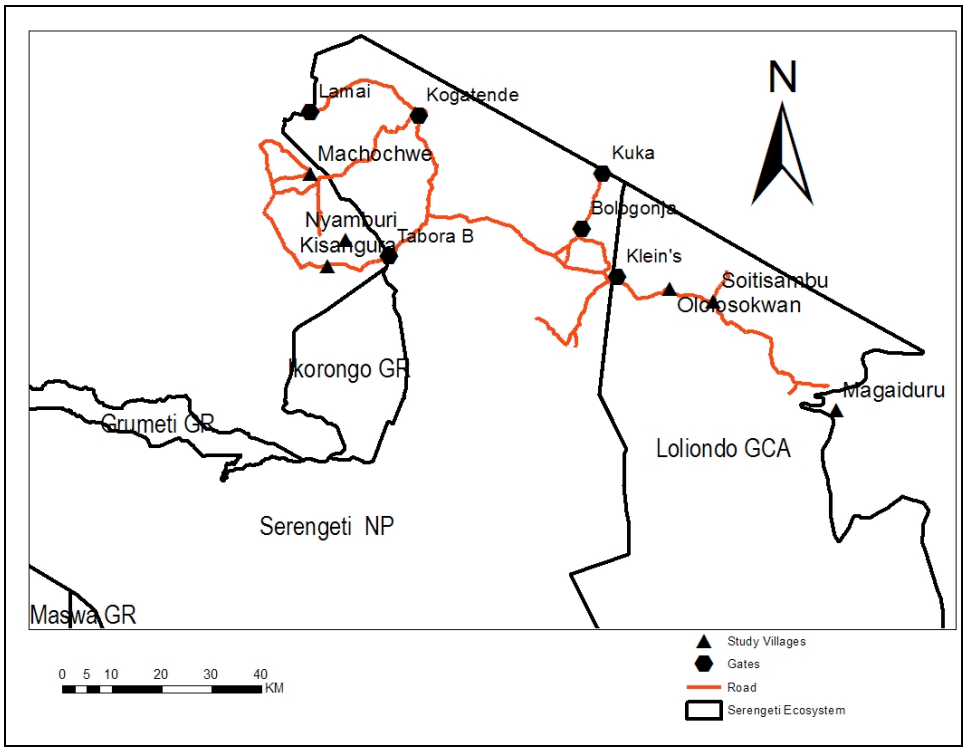

Figure 1: Map of the protected areas in the Serengeti ecosystem with approximate locations of studied villages. (GR=Game Reserve, NP=National Park and GCA=Game Controlled Area).

There was a high degree of dependence on agriculture for subsistence within these two Districts. Over 90% of the respondents in this study were entirely dependent on agriculture as their sole or main source of livelihood. Agricultural activities included crop production and livestock keeping, although, small scale business and hunting were also practised. The main tribes in the selected villages were Kurya and Maasai in Serengeti and Ngorongoro, respectively although there were immigrants from neighbouring villages and other places in the country. The immigrants moved to these villages mainly because of marriage or in search of pasture, land, employments or due to relocation by the Tanzania National Parks Authority (Pers. Obs.).

A variety of crops were grown locally, including carbohydrate staples such as maize (*Zea mays*), cassava (*Manihot esculenta*), sorghum (*Sorghum bicolor*) and finger millet (*Eleusine coracana*) in Serengeti, while in Ngorongoro it was mainly maize and beans (*Phaseolus vulgaris*). In Ngorongoro, meat and milk from their livestock was the major source of protein although bush meat was sometimes taken.

Data on the human–small mammal conflict was collected by using questionnaires. In each village, 5% of the total households were chosen. The household is all the people living together in a house. The survey therefore comprised a total of 150 households that were randomly selected from the list of households from each village

office. In each household only one person aged 15 years and above, male or female, was interviewed and therefore making a total of 150 questionnaires administered. The questionnaires were administered from house to house where a selected person and the interviewer stepped aside to avoid other family members influence on the responses during the interview session. The questionnaire contained 30 questions for which it took about 20-30 minutes to fill in. Questionnaires focused on: (i) level of education (ii) main activities in the village (iii) types of small mammals preferred for food (iv) methods used to hunt small mammals (v) conflicts with small mammals (vi) problem small mammals (vii) methods used to kill problem small mammals and (viii) opinion on how human-small mammal conflicts could be addressed. In addition, the respondents were also asked to estimate the amount of money that a family could get by selling small mammals products. Only small mammals weighing less than 5 kg were considered in this study.

Data analysis

Descriptive statistics (mean, percentages, range and standard error), and non parametric test (Chi-square test and Mann Whitney U test) were used to determine significance of differences between data sets at the 0.05 significance level. The Mann Whitney U test was used because the data was not normally distributed while the Chi square test was used to analyse the nominal scale data. The analyses were performed by using the SPSS 15.0 package (SPSS 2006). Data are presented as mean ± standard error.

RESULTS

In total, interviewed males in Serengeti District were 61% (n = 71), and 39% (n = 71) were females. In Ngorongoro District, males scored 54% (n = 79) and 46% (n = 79) were females. Among the respondents in Serengeti, the tribe that dominated was Kurya (86%, n = 71) the rest were Jita, Sukuma, Ikoma, Kisii or Haya. Ngorongoro respondents were mainly Maasai (99%, n = 79) and only one person was a Pare from Kilimanjaro Region. In terms of level of education, most of the interviewed people had primary education (Serengeti: 86%, n = 71; Ngorongoro: 46%, n = 79). In Ngorongoro many respondents did not have formal education (39%, n = 79), whereas in Serengeti only 4% (n = 79) of the respondents had no formal education. The remaining 10% in Serengeti and 15% in Ngorongoro had secondary, adult, college or university level education.

Preferred small mammal

Interviewees recognised small mammals as being edible, with some species considered a delicacy. Types of edible small mammals were somewhat different in the two districts. In Serengeti, they included several genera of rabbits, porcupines, hedgehogs, mongoose and squirrels, whereas in Ngorongoro animals preferred included rabbits, porcupine, hyrax and mole rats. In terms of preference, the rabbit scored higher than other animals in both districts. Seventy percent of the respondents in Serengeti (n=71) stated that rabbit was the most preferred compared to other animals combined (Chi square: $\chi^2 = 41.68$, df=1, $p<0.001$) whereas in Ngorongoro only 4% claimed to prefer the rabbit and in this district there was no significant difference between rabbit preference and other animals combined (Chi square: $\chi^2 = 0.5$, df = 1, $p=0.478$) indicating that people in Ngorongoro do not really prefer small mammals. In addition, there was no significant difference between females and males in terms of the preference to the rabbit in both districts.

Means used for hunting small mammals

Various means were used in hunting of small mammals in both districts. The frequency of using those means in hunting small mammals was high in Serengeti

District than in Ngorongoro District (Fig. 2) indicating that the frequency of hunting was also higher in Serengeti than in Ngorongoro District. In Serengeti district, dogs were more frequently used than all the other means combined (Chi square: $\chi^2 = 25.09$, df = 1, $p<0.001$). In Ngorongoro District many respondents claimed that the small mammal hunting was not a common practice. Although ropes scored a fairly higher value, there was no significant difference between uses of ropes and of other types of hunting gears combined (Chi square: $\chi^2 = 2.27$, df = 1, $p = 0.13$).

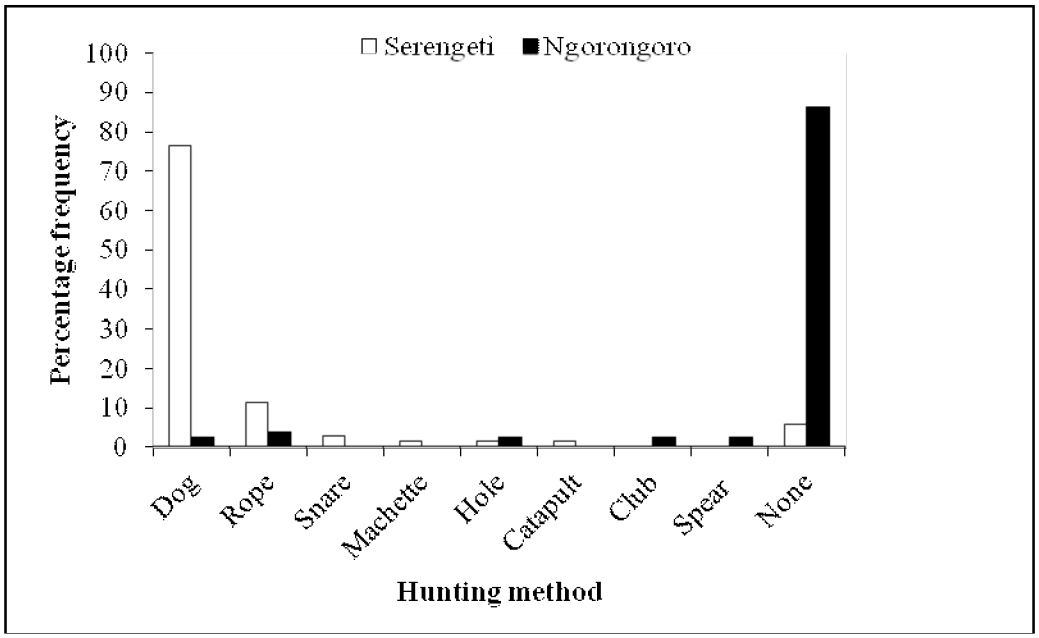

Figure 2 Hunting methods used by villagers to kill small mammals in Serengeti and Ngorongoro Districts, Tanzania. November 2010.

Economic importance of small mammals

In both villages, respondents stated that some people in their villages earned income by selling the products from the hunted small mammals particularly rabbits. In the Serengeti prices for rabbits were as follows, (Tsh. 3,329 ± Tsh. 1974, range Tsh. 500 – Tsh. 10000, n = 71). In Ngorongoro, prices were (TSh. 4500 ± Tsh. 5579, range: Tsh. 500 - Tsh. 14000, n = 79). Buyers were fellow villagers, however, in terms of prices per rabbit, there was no significant difference between the two districts (Mann Whitney U test: $U = 85$, $n_1 = 41$, $n_2 = 5$, $p > 0.05$).

Destructive small mammals and the control measures

Rodents were reported to destroy crops and properties. Over 90% of respondents from each district cited rodents as destructive animals in both farms and in food stores. Rodents inflicted significantly more damage on crops than other properties, and there was no significant difference between the two districts; Serengeti and Ngorongoro Districts with respect to destruction (Chi Square:

χ^2=0.35, df=1, p = 0.55). Respondents could not give exact estimates of the loss from their crops, although they claimed that they incurred big farms losses. Maize, sorghum and cassava were the commonly destroyed crops (Table 1). The damage in crop fields was reported to be year-round, but often increased in the harvesting season (early dry season) when the risk from crop damage was perceived to be at its greatest. Following the destructive behaviour of these mammals, villagers resorted into killing them by using various methods (Fig. 3). Approximately 90% and 58% of the respondents in Serengeti and Ngorongoro districts respectively admitted that different methods were used in controlling rodents. Villagers in both districts i.e. Serengeti (31%, n=71) and Ngorongoro (30%, n=79), responded that poisoning was more frequently used than other methods and there was no significant difference in the use of poison between the two districts (Chi square: χ^2 = 0.087, df =1, p = 0.77). In addition, some of the respondents claimed that despite the efforts of controlling the small mammals by using poison, the populations remained high and therefore suggested various ways of dealing with the small mammals so as to resolve the human-small mammal conflicts (Table 2), the remaining respondents had no answer to the alternative control measures.

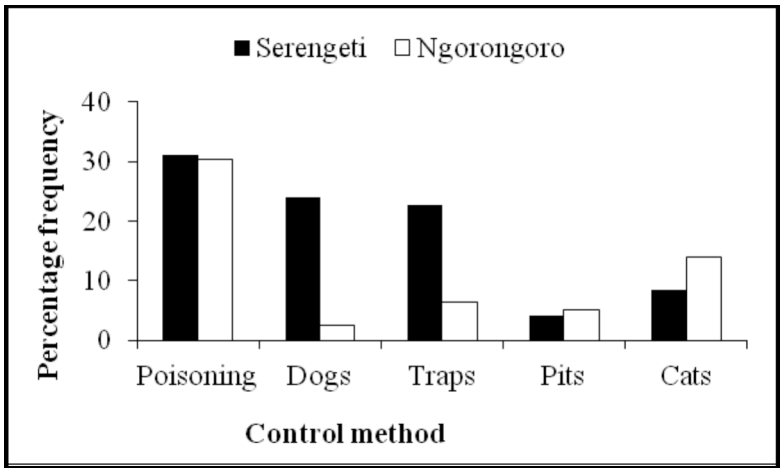

Figure 3: Percentage of respondents who reported various control measures for small mammals in Serengeti and Ngorongoro Districts, Tanzania. November, 2010.

Table 1: Percentage of respondents who reported crop destruction by small mammals in Serengeti and Ngorongoro Districts, Tanzania. November, 2010.

Serengeti District		**Ngorongoro District**	
Item	**% of respondents**	**Item**	**% of respondents**
Maize	45.1	Maize	60.8
Sorghum	29.6	Sorghum	8.9
Cassava	29.6	Cassava	0.0

Table 2: Responses of participants (%) on measures to be taken to resolve the human-small mammal conflict in Serengeti and Ngorongoro Districts, Tanzania. November, 2010.

Item description	Serengeti (%)	Ngorongoro (%)
Extermination of all small mammals	16.2	10.8
Use of electric fences	0.0	0.3
Conduct Conservation education	7.4	8.5
Government intervention	2.8	6.3
Establishment of conservancies	19.0	6.0

DISCUSSION

Meat from wild animals is reported to constitute an important part of the diet in most areas in Sub-Saharan Africa (Anstey 1991, Barnett 2000). Results obtained in the current study indicate that some villagers in both Ngorongoro and Serengeti Districts were taking small mammals as food and some even made business out of the mammals. Similar findings were reported by Mfunda and Røskaft (2010). These findings also do not deviate from other findings obtained elsewhere. The small mammals have been exploited for food in many rural areas in Africa (Child 1970, Ajayi *et al.* 1978). For example, the giant rat (*Cricetomys gambianus*), a nocturnal, burrowing rodent, is considered a delicacy in some parts of West Africa (Ajayi *et al.* 1978).

Although some small mammals can be beneficial in terms of food and income, some have the potential to cause considerable damage locally (Makundi *et al.* 1991). Crop damage by rodents is a large issue of much contention in Tanzania. Most of the time people come into conflict with small mammals when they damage crops and properties. This happens because, small mammals have similar basic needs as humans and conflicts arise when they move from their natural habitats onto agricultural land and feed on the produce that humans grow for their own consumption.

Cereal crops are the frequently cultivated field crops within the communities and they form the basis of most households' meals in the Serengeti region (Lowassa 2004). Coincidently, majority of small mammals prefer cereals and this was worrying the villagers in both districts; they felt that the damage caused by such animals would increase particularly in the fields that were close to or at the protected area boundary. Naughton – Treves (1996) and Hill (2000) reported many similar findings.

In protecting their crops against small mammal destruction, villagers utilized strategies that were often ineffective and could be considered cruel. The opinions gathered from the respondents regarding the measures to be taken to resolve the human-small mammal conflict indicated that some villagers have even suggested the extermination of all destructive mammals or use of electric fences. The downside is that electric fences can electrocute both the people and the small mammal (targeted and untargeted) and may cause huge ecological damage. However the method is not practical in rural areas due to installation and running costs. On the other side, animals like rodents are difficult to control because they have high resilience to disturbance due

to their high birth and growth rates (Sillero-Zubiri and Switzer 2001). It is therefore important to control emotions in controlling the small mammals and use of ecologically-based Rodent Management as stipulated by Makundi *et al*. (1991) can effectively control the destructive small mammals better than conventional control methods.

The various measures proposed by the respondents to resolve or minimise the conflict have several components of conservation approach. Proposed approaches included (i) establishment of conservancies for the small mammals which can be used in the tourist industry (ii) establishment of farms, including crocodile and snake farms that would make use of domesticated small mammals as their prey. Domestication of small mammals is therefore recommended in those villages where small mammals can be used as a source of protein and income generation for improvement of livelihoods.

CONCLUSION AND RECOMMENDATION

The best cure in the conflict between human and small mammals is prevention. Therefore it is recommended that the people in the relevant communities should strengthen their food stores at home. If there is no access to food, water, shelter or nesting sites, small mammals particularly rodents will go elsewhere and will not be able to produce or maintain significant populations (Mason and Littin, 2003). Where practicable, preventing access with small mammal proofing, especially of food storage areas, should be a first measure adopted for the minimization and possibly prevention of the conflict between humans and small mammals.

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