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Human Wildlife Conflicts to communities surrounding Mikumi National Parks in Tanzania: A case of selected villages

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***Abstract*—** *Human wildlife interaction is not a new phenomenon, it has existed since the beginning of humankind, it is evidenced by the fact that, many national parks are surrounded by human residents. The interaction between human and wildlife is of different nature depending on the culture of the surrounding human as well as wildlife community. For decade's human wildlife conflicts has been a great conservation challenge due to increased human population, international trade and change of policies. The challenge is more significant in a sense that it negatively affects both human and wildlife sustainability. Therefore a study was conducted to villages surrounding Mikumi national Park to assess reasons for conflicts between human and wildlife and account how communities prevent wild animals to destructs their agriculture products. Three villages were selected for study (Doma, Maharaka and Mkata, all villages surrounds Mikumi National Park Ecosystems. Different methodology includes: - Field observation, Household survey, Field interview, In-depth interview and Ethnography study were used. However descriptive analysis and non parametric test were performed by using SPSS 16 versions and Kruskal-wallis test respectively to compute mean, standard error, percentages and differences of wildlife consumption. Results suggests that, there is a gradual increase of human-wildlife conflicts which lead to loss of people's lives, as well as their livelihoods such as farms and farms product. Statistically results depicted that the average size of the farm affected at Doma, Maharaka and Mkata villages were 3.8 ± 0.1, 2.0 ± 0.1 and 2.2 ± 0.1 acres respectively, while at Mkata village 32 goats, 24 sheep and 76 cattle were reported to be killed by wild carnivores. In other way conflicts may result to poaching activities which may threaten the existence of huge herbivores such as Elephants and Rhinoceros. Apart from that, conflicts may lead to poor performances of tourism industry in the country. Research recommends that more efforts should be taken by the government and other stakeholders to prevent conflicts around all national parks so as to create good and conducive environment for human being life and wildlife in order to allow good performance of tourism industry for economic development of the country.*

***Keywords*— Human, Wildlife, Conflicts, National Park and village.**

I. INTRODUCTION

Globally, resource Conflicts have been a major threats for sustainable management and conservation of biological diversity sector since many years ago (Ruckstuhl, 2001). Currently it is recognized as one of critical and complex problem areas that have implications on the conservation of ecosystems in global environment and development discourse (Collier *et al*, 2003). Increasing resource competition at the global environment brings about social disparity and conflicts, these types of conflicts greatly impacted environmental quality, linked to human activities (Collier *et al.,* 2005). In many African countries such as Rwanda and DRC, Malawi and Tanzania which have many biodiversity species indicates that, resource conflicts are caused by competition of scarcity of resources and human made disturbance of ecosystems (Pearce, 1994; Winter 1997).

In East African the increasing of human-wildlife conflict are highly contributed by changing of land use in areas surrounding protected areas, which bring difficulties for community based conservation to succeed (Fowler, 2001). These areas experiencing expansion of small holder cultivation in wildlife dispersal areas, the situation has been reported to reduce animal home ranges, leading to increase human wildlife interaction, which may degenerate into

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human wildlife conflict (Little, 1994). In Tanzania, human problems constraining Wildlife Sector are responsible for increasing of resource conflicts (URT, 2012). Wildlife Conservation Authority is accused for marginalizing people, denying people access to traditional and legitimate rights, property damage and risk to human life through attack by wild animals and disease transmission (UNEP, 1995). In broad sense, the primary causes of resource conflict are demographic, economic, institutional and technological (UNEP, 1995), however (WRI, 1995) reported that the habitat loss in Tanzania was a serious problem for different ecosystems (WRI, 1995).

Conover (2002) explained Human-wildlife conflict as any action by human or wildlife that has adverse impact on each other whereas (Foreman, 1992 and Gittleman *et al*. 2001), defined Human-wildlife conflict as an issue of increasing conservation concern, particularly as burgeoning human populations move over further into wilderness areas. The negative impacts of wildlife on people may include crop damage, attacking and killing livestock and people, competing for game species or acting as disease reservoirs (Nyahongo, 2007). People may affect the wildlife through a wide range of lethal methods, such as shooting, poisoning, trapping or snaring, and habitat modification, encroachment or disease exchange between wildlife and livestock (Nyahongo, 2007). Although a remarkable variety of species cause conflicts with people, from rodents such as prairie dogs to mega-herbivores like African elephants (*Loxodonta africana*) (Hoare, 1999). Large carnivores are of particular interest in this conflict, where by their behavior put them in a direct competition with people for both livestock and wild game species or their ability to kill people (Baldus, 2004; Loe and Roskaft 2004; Packer et al, 2005; Silero-Zubiri and Laurenson, 2001). Carnivore's attack is a problem, and is reported in different parts; claim hundreds of lives each year globally, although no figures are available to prove it (Loe and Roskaft 2004).

To date, Human-Wildlife Conflict is a serious problem in different parts of the world (Bradshaw, 2007).This is simply because the human population increases but the resources available are fixed, also conflicts occur because every individual in those areas aims at fulfilling basic needs using the resources without caring for others and sometimes not caring even for the future generations (Damania, 2008). Close to the protected areas, the problem is very serious because the local communities' interaction with wildlife creates negative impacts to both sides often local communities kill wildlife to obtain bush meat for household consumption, and for income generation (Kombo, 2010). However, wildlife destroys crops and kills livestock and sometime injures or kills people, livestock keepers and crop producers elsewhere in the country are fighting for grazing land that actually are farms for crops (Geoffrey, 2005).

Areas around Mikumi National Park experience similar problems; crop damage by elephants and other herbivores, livestock depredation by wild carnivores, bush meat hunting by human, human injury caused by wildlife and conflict between crop producers and livestock keepers (Emanuel, 2004). Despite the fact that all events are vivid and known by conservationists and politicians, the level and extent of such conflict along the gradient from the park is not known, thus this study was conducted to the selected villages surrounding to Mikumi National Park to determine the level and extend of these natural resources conflict and its impacts to the communities surrounding Mikumi national park.

1.2 Global Impacts of Wildlife to human livelihood

The communities affected by carnivores must also bear the indirect costs of preventing attacks to livestock's and people live in constant fear of their lives (Roskaft *et al*. 2003; Loe and Roskaft 2004). Within the immediate buffer zones of the Selous Game Reserve or other protected areas, crop raiding by elephants, bush pigs (*Potamochoerus larvatus*) and other mammals is persistent problem that constitutes, like in most other regions, a major form of human-wildlife conflict (Ikanda, 2010). Each year, hundreds of acres are destroyed by crop-raiding elephants, hippopotami (*Hippopotamus amphibious*), bush pigs and vermin primates like baboons (*Papiocynocephalus anubis*) and monkeys (*Chlorocebus pygerythrus*) (Ikanda, 2010). In Alberta Canada, over a period of 14 years (1982-1996) wolves *(Canis lupus*) caused 2,086 deaths among domestic animals, mainly cattle and to a lesser extent dogs, horses (*Equus ferus caballus*), sheep (*Ovis canadensis*), chickens (*Gallus gallus domesticus*), bison (*Bos bison*), goats (*Capra hircus*), geese (*Branta canadensis*) and turkeys (*Meleagris gallopavo*) (Musiani *et al*. 2003). In Peru, in the Amazon Province of Tambopata, a population of 3200 people live inside the northern border of the 1.5 million ha protected area of the Tambopata –Candamo Reserve claim that the ocelot (*Leopardus pardalis*), hawks (*Accipiter spp., Leucopternis spp*.), jaguars (*Panthera onca*) and pumas (*Puma concolor*) were blamed for causing most of the depredation (Naughton-Treves *et al*. 2003).

In Zimbabwe, many areas of traditional agro-pastoralist bordering protected areas suffer from livestock depredation. In particular, in the Gokwe communal land, neighboring the

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Sengwa Wildlife Research Area, rural villagers experience a negative impact from the close proximity to the reserve, wild carnivores attack domestic livestock and the conflict is severe (Butler, 2000).It was reported that, between January 1993 and June 1996, 241 livestock were killed by baboons, lions (*Panthera leo*) and leopards (*Panthera pardus*), which contributed respectively to 52%, 34% and 12% of the kills (Butler, 2000).

In Kenya, Patterson *et al*. (2004) evaluate the level of impact of carnivore attacks on two private cattle ranches that lie adjacent to boundary of the Tsavo East National Park, the carnivores responsible were lion, spotted hyena and cheetah, they consumed cows, bulls and young cattle's. In a four-year study the ranches have lost an average of 2.4% of the total herd per annum, which represented 2.6% of their economic value and amounted to US$ 8,749.

In Zanzibar, the villagers in southern border of the Jozani Forest Reserve claimed that the red colobus (*Procolocus kirkii*) to consume their coconut (*Cocos nucifera*) (Siex *et al*. 1999). They consider red colobus as the third most serious vertebrate pest. However the red colobus is one of the most endangered primates in Africa and in Zanzibar (Siex *et al*. 1999). The explained manifestation of human wildlife conflict raises a concern to review human wildlife interaction and find a modality to suitably improve livelihoods and wildlife sustenance. Currently in Tanzania for example the population of elephants is going down rapidly more than ever, poaching triggered by increased international trade and demand for ivory is said to be the main reason. However, conflicts between wildlife and human are also adding fuel to the elephant's extinction fire.

A census report by the government of Tanzania (2013) conducted in (Selous-Mikumi and Ruaha Rungwa) shows the elephants population in the two ecosystems are 13,084 and 20,090 respectively, the figures indicates a notable decline in elephants population in these ecosysterms compared to previous census. For instances in 1976, the Selous-Mikumi had 109,419 elephants, the dropped dramatically to 22,208 in 1991. Although it rose again to 70,406 in 2006, the population has dropped again in the recent years; in 2009 the number stood to 38975 while right now the number dropped to 13,084. Similar situation appears in Ruaha-Rungwa ecosystem where the 1990 census recorded 11,712 elephants. This number rose to 35,416 in 2006 but as for now only 20090 was estimated. The figure shows a decline of 66% and 36.5% respectively from 2009 to present. This paper therefore is aiming at assessing the human interaction with wildlife with the assumption that the interaction (Conflicts) has to certain extent contributed to decline of elephant's population.

II. METHODS

2.1 Description of study area

This paper studied three villages surrounding to Mikumi national park, the villages are Doma, Mkata and Maharaka, each village studied separately, Mikumi National Park is described as a single ecosystem accommodating the three selected villages.

Mikumi National Park was gazetted as a national park in August 1964 and its boundaries extended in 1975. It is the fourth largest park in Tanzania covering 3,230 km^2 (1,250 square miles). The park is located in eastern Tanzania between 7°00' and 7°50'S, and between 37°00' and 37°30'E. The park is located in Morogoro Region, 283 km (175 miles) to the west of Dar es Salaam. It shares its boundary in the extreme south with the Selous Game Reserve – a world heritage site. Mikumi and Selous make one ecosystem where animals like elephant, buffalo and zebra normally migrate between each to the northern part of the Selous and Mikumi National Park (TANAPA 2004).

2.1.1 Biodiversity

Mikumi National Park has a unique combination of flora and fauna. It supports a wide range of large mammals, including elephants, lions, giraffe, zebra and buffalo and more than 300 species of birds (Mercer, 1983; Hawkins and Norton, 1998). The bird life is intermediary between north and south. . The park is located in an area where four vegetation zones intersect making it a diverse ecotone. The four vegetation types are miombo woodland in the south, arid bush land in the north, coastal zone in the east and mountain climate in the east and west (Hawkins and Norton, 1998) .The miombo woodland consists of mainly Brachystegia spp, while Combretum-Terminalia woodland dominates between hill areas and in floodplain (Mercer, 1983). The park is also dominated by other species like *Sclerocarya caffra*, *Cassia abbreviata*, *Borassus flabellifer* and *Hyphaene ventricosa* palms. *Balanites aegyptiaca* and Ficus spp. Mikumi National Park show seasonally local floods in Mkata floodplain. The floodplain and waterholes become a habitat for fish, freshwater crabs, and other aquatic wildlife in the wet season. There are also permanent waterholes with hippos in the center of the park.

2.2 Data Collection and Analysis

The data collection methods included field observation, household survey, field interviews and in-depth interviews.

http://dx.doi.org/10.22161/ijeab/2.4.40 *ISSN: 2456-1878*

Field observation was important because it enabled the observation of a real situation of what is going on in three villages concerning the human elephant conflicts, human carnivore conflict and the agricultural (farmer) and pastoralist conflicts. Household survey was carried out in selected villages for the study basing on the research objectives. It was conducted through open ended questions and closed ended questions where a total of 156 households in three villages were involved. The data collected from household survey mainly focused on the socio-demographic characteristics of the respondents, implication of human-carnivore conflict, major carnivore causing conflict in the area, mitigation of human-carnivore conflict in the area, implication of Human-Elephant conflict on household income, effect(s) caused by elephant in the area, mitigation of human-elephant conflict in the area, possession of land, source of conflict between pastoralist and agriculturalist and what can be done to solve the conflict between pastoralist and agriculturalist. The household survey covered most of the field research time as it was one of the main data collection method. An In-depth interview was carried out; it was purposively directed to the village executive officers and also to pastoralist and some farmers, with the main issue to understand the behavior of elephants and how do they behave once they come in the villages, not only that but also, the behavior of different carnivores causing problems of killing livestock around the village. Furthermore the intention of doing in-depth interviews was to know what initiatives to solve those natural resources conflicts in their villages.

Descriptive analysis to compute mean and standard error and percentages were performed using SPSS 16 version for windows. Differences between the extents of elephant's consumption from 2008 to 2012 in each village were tested using non-parametric tests, Kruskal-Wallis tests and Mann-Whitney test were used to test non normality which highly existed. Summary statistics were quoted in tables to illustrate the distribution of data in respect to different parameters. Mean were reputed as Means ± Standard error. For all statistics, $p < 0.05$ were considered significant.

III. RESULTS AND DISCUSSION

3.1 Human carnivore conflict

Majority of the Respondents from the selected villages conduct agriculture as the main stay of their economies, agriculture activities are conducted around Mikumi National park where there is high interaction with wild animals like elephant, zebra etc, interaction creates conflicts between human being and wild animal, this always happen when wild animals destroys agriculture crops. In other way results depicts that wild animal specific carnivores kills and eat goats and cattle, for instance in Mkata village, results shows that, 5% (n=32) of the goats were killed by carnivores from January to June 2012, and 6% (n=24) of the sheep were also killed in that period of time and 4% (n=76) of the cattle were killed during the same period (January-June 2013). This situation raise conflicts between human and wild animals. It should be noted that, human being apart from agriculture also depends on animals like goats, cattle, etc (husbandry) they depends on them as commodities as they can sell whenever they face economic crises.

(Table 1) A total number of goat, sheep and cattle killed by wild animals in 2012-2013

Table.1: Livestock loss due to carnivores at Mkata village from January to June 2013

TYPE OF LIVESTOCK	NUMBER OF LIVESTOCK KILLED BY CARNIVORE		TOTAL NUMBER OF LIVESTOCK
	FREQUENCY	(%)	**N=1900**
GOATS	32	4.6	700
SHEEP	24	6	400
CATTLE	10	1.25	800

Among the three villages selected, which are Doma, Maharaka and Mkata, only Mkata village that is having livestock depredation by wild carnivores. This is simply because it is the only village keeping livestock. Other local communities in the other two villages do not keep livestock. Depredation cases found to occur in wet season involving spotted hyena, lion and wild dogs. During the dry season, herbivores concentrate within protected areas around permanent water sources whereas in wet season herbivores evenly spread around the area where situation makes hunting for carnivores more difficult enabling carnivores to hunt over larger areas. Similar observation was reported by Nyahongo (2004) and Bygott and Bygott (1975).

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Livestock grazing task in the field is usually attended by young individuals who might fall asleep or playing and not care for livestock. Thus makes easier for livestock to be killed by wild carnivores. In such cases, the animal may be attacked and killed without the knowledge of the herdsmen especially at night when most carnivores are active. Similar observation was reported elsewhere (Nyahongo 2004).

3.2 Human-elephant conflict at Doma village

Elephants are the animal species that had been claimed by majority to destroy crops in all villages, where at Doma an average of 3.8±0.1 acres of crops had been reported to be destroyed by elephants in 2012-2013. When comparing the mean values of each year, crop damage varied among years (Kruskal-Wallis test, $x^2 = 9.424$, df = 3, p = 0.0240). When data were splinted into two years period starting with 2008-2009 and 2009-2010 results suggest no statistical difference (Mann-Whitney test, U = 1.76, p = 0.230) again when comparing the next two years, 2010-2011 and 2011-2012 result suggests no statistical difference as well (Mann-Whitney test, U = 1.83, p = 0.425).

3.2.1 Human-elephant conflict

Furthermore, at Maharaka village the problem of elephant consuming crops had been claimed by majority of farmers where by an average of 2.0±0.1 acres of crops had been reported to be destroyed by elephants. The extent of crop damage varied among years (Kruskal-Wallis test, x^2 = 20.347, df =3, p = 0.000). When data were splitted into two years period and compared between two years period starting with 2008-2009 and 2009-2010 results suggest no statistical difference (Mann-Whitney test, U = 312.000, p = 0.153) again when comparing the next two years, 2010-2011 and 2011-2012 result suggests no statistical difference as well (Mann-Whitney test, U = 277.000, p = 0.027). Human-elephant conflict at Maharaka village was reported to be in extent where an average of 2.2±0.1 acres of crops had been reported to be destroyed by elephants. Meanwhile, the crop damage varied among years in the village (Kruskal-Wallis test, x2 = 60.974, df = 3, p = 0.000). Apart from that, when data were compared between two years period starting with 2008-2009 and 2009-2010 results suggest no statistical difference (Mann-Whitney test, U = 624.000, p = 0.00) again when comparing the next two years, 2010-2011 and 2011-2012 result suggests no statistical difference as well (Mann-Whitney test, U = 655.00, p = 0.001). Conflict exists in all the three villages in Doma ward which are Doma, Maharaka and Mkata because all people in these villages are practicing subsistence farming. Farmers cultivate different crops which are the same in all three villages including maize (*Zea mays*), tomatoes (*Solanum lycopersicum*), millet (*Panicum milieaceum*), paddy (*Oryza sativa*), water melon (*Citrullus lanatus*), oil seed and also different vegetables. They cultivate the crops throughout the year through irrigation scheme.

3.2.2 Effect caused by elephant in the area

The effect caused by elephant in all the three villages is very high each year. At Doma, Maharaka and Mkata the average size of the farm affected was 3.8 ± 0.1, 2.0 ± 0.1 and 2.2 ± 0.1 acres respectively. In various areas throughout Africa, elephants have destroyed more than 60% of crops in communal areas adjoining conservation areas (Anon, 2003). This situation might be due to global climatic change worldwide which leads to water shortage inside the park whereby elephants move outside the park to the nearby villages in search of food and water. .

Ways to Prevent Wild animals

Farmers in Maharaka were introduced to the new method of preventing themselves from elephant problems through the use of string, oil and paper, they were taught to surround their farms with string having oil and paper, so once elephant come across with that string they cough and then run away, this method was useful to them for a quite some time and it helped them a lot to prevent elephants from consuming crops, but from 2012 till now they claim that elephant no longer enter their farm using their front part, instead they enter the farm using their back part, and after cutting down the string having oil and paper, they start eating crops. So this technique used by elephant might be acquired by young elephant and it means after sometime this method of protecting the farms from being consumed by elephant will no longer be useful, so villagers claimed that their crops will continue being destructed by elephant as they used to destruct before the establishment of the technique.

Farmers in Mkata used pepper, oil and string to protect their crops from being destroyed by elephants. Soon after too much application of it the elephants adapted, they also enter the farm using their back and sometimes raise their head then after entering the farm they start eating the crops. This method is no longer suitable because it does not solving the problem. In Caprivi region in Namibia, fences lined with a mixture of grease and chili peppers are still being experimented (Brian and Barnes 2006).

However, farmers in Mkata are now using strong perfume to prevent elephants from entering to their farm and destroy

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the crops. They use perfume with strong smell like the perfume called "Kuluthum". They surround their farm with string and attach to the string pieces of cloth then they spray the perfume on the pieces of cloth, so once the elephant reach near the string having that piece of cloth with perfume, they go back because they dislike the sensation of strong smell. This method is used by most of farmers in Mkata and elephants are not entering to their farm once they come across with that smell. The problem a rise when farmers fail to buy that perfume because they cannot afford its price, one bottle is about 10US $ in the year 2012, so some farmers fail to prevent their farm since it is expensive.

Also one among the reasons put forward by farmers in Mkata is that the elephants move out of the park in search of fruits known as "ng'ongo" thus farmers suggested those tree to be planted inside the park so as to prevent the elephants from moving outside the park, this is not appropriate because planting the particular tree inside the park which is not there is like introducing invasive species inside the park. Exotic plants threaten the integrity of agricultural and natural systems throughout the world. Many invasive species are not dominant competitors in their natural systems, but competitively eradicate their new neighbors (Callaway and Aschehoug, 2000).

Most of the farmers in Mkata shift from agricultural activities to charcoal production activities; this is because of accumulation of farmers and pastoralist conflict and also the problem of elephant to consume crops. Most people now produce charcoal and Mkata area is now a famous place for producing charcoal. This is dangerous to the biodiversity found in the area and the survival of Mikumi National Park because too many trees are destroyed due to charcoal production hence disturbing the climatic condition of the area. Mkata was also among the villages which received food assistance from the government in the year 2013 because of being insecured. Although the area is having good and fertile soil, water is available in the area throughout the year due to presence of river Mkata, but still they asked food from the Government due to shortage of food security contributed by destruction of wild animals (Naughton-Treves and Treves, 2005).

IV. CONCLUSIONS

The problem of human-wildlife conflict increases each year and the loss that livestock keepers acquire due to depredation are very high if computed. Among the causes of the problem is poor construction of "bomas" for keeping the livestock in the area. Elephants destroy large area of crop field in all the three villages which are Doma, Mkata and Maharaka. Regardless of the local methods that have been used by the villagers the problem keeps on increasing year after year. Losses accounted by the villagers are very high from 2008 to 2012. Conflicts between livestock keepers and crop producers are only pronounced at Mkata village. It has been increasing year after year. The reason for the conflict is that the livestock keepers and crop producers coexist in the same area. The number of cases reported about the conflicts to the Village Executive Officer increases each year from 2008 to 2012.

In many situations, strategies or methods for addressing the human wildlife conflict issue are often constrained by local, national or international regulations, laws or treaties (Fall and Jackson, 2002). The ineffectiveness of some of the management practices is directly dependent on the establishment and application of policies and guidelines on a wide range of human activities. In various countries, existing wildlife policies are outdated, contradictory and require clarification, in particular those regarding land development planning and its impact on wildlife habitats. Policies on land tenure, controlled utilization of wildlife through hunting and trade of wildlife products, game farming, tourism development and compensation schemes should be strengthened and made to conform to the present national state of affairs and population requirements (Kenya wildlife Service, 1996).

V. GENERAL RECOMMENDATIONS

There is a need of trying to solve the conflict existing of natural resources in different places in our societies. This can be done by sometime using the bottom-top approach where by the solution for those problem should be initiated by the local people in the respective area. What can be done is to modify the idea brought by the local people. Apart from that the farmers should be introduced to other sources of income like bee keeping and also involving in entrepreneurship activities of which will raise their income. Also for the pastoralist, they should be provided with permanent areas where they will keep their livestock and also water sources for the livestock should be constructed in those areas. Nomadic pastoralism should be discouraged because it is environmental unfriendly. Additionally, the pastoralist should be provided with education about the minimization of the number of livestock they are having together with the ways of constructing strong "bomas" for keeping their livestock to prevent them from being consumed by the carnivores, example at Amboseli-Tsavo region in Kenya, where conflict between pastoralists and lions is a significant and growing conservation issue, a

scheme called 'Lion Guardians' was established, where young Maasai men were trained to track lions, provide advice to villagers in terms of where the tracked lions are, provide practical help in strengthening bomas, and talk to people about their problems and issues with large carnivores (Hazzah and Dolrenry 2007).

The bee keeping projects should be established on the buffer zone to minimize the extent of elephants from entering in the villages and consume the crops; this will also act as the source of income to local people. Placement of bee hives in strategic trees can be used to prevent the destruction caused by elephants as they are sensitive to the sound and sting of bees (Karidozo and Osborn 2005; Vollrath and Hamilton 2005). Elephants also have excellent hearing and the "buzz" from an active hive could also stimulate hive avoidance (O'Brien, 2002).

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