

**EFFECTIVENESS OF THE MANAGEMENT STRATEGIES OF HUMAN-WILDLIFE
CONFLICTS IN KITENGELA DISPERSAL AREA, KAJIADO COUNTY, KENYA**

By

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DECLARATION

This thesis is my original work, and has not been presented for a degree or any other award in any other university.

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This thesis has been submitted for examination with our approval as university supervisors

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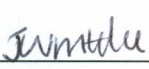
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DEDICATION

This work is dedicated to those who gave me the greatest encouragement from the start to the finish of it. My wife Beatrice stood by me and was very understanding even as I stayed up till late in the night and sometimes early morning. She also prayed for me throughout the period I was writing this work. My son Brian gave me the purpose for working hard. My parents and siblings pushed me to finish this work.

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ACRONYMS AND ABBREVIATIONS

AWF – African Wildlife Fund

ECF – East Coast Fever

GOK- Government of Kenya

HEC – Human Elephant Conflict

HWC- Human-Wildlife Conflict

IUNC- International Union for the Conservation of Nature

KII - Key Informant Interviews

KWS – Kenya Wildlife Service

LGD – Livestock Guarding Dog

MCF – Malignant Catarrhal Fever

NNP – Nairobi National Park

PAs – Protected Areas

TWF - The Wildlife Fund

WWF- World Wildlife Fund for Nature

ABSTRACT

Human-wildlife conflict (HWC) is a worldwide problem that causes suffering both to people and wildlife. The study focused on conflict caused by carnivores in Kitengela area. The population of carnivores is declining globally probably due to conflict with human beings. These animals face a risk of disappearing from the face of the earth unless proper management strategies are put into place to reverse the trend. The objectives of the study was to assess the effectiveness of various management strategies of the human-wildlife conflict at Kitengela dispersal area, examine the effects of changes in land use practices on human-wildlife conflict management at Kitengela dispersal area, establish the effects of stakeholders' involvement on human-wildlife conflict management at Kitengela dispersal area and assess local community's perceptions of wildlife on human-wildlife conflict management at Kitengela dispersal area. Some of the strategies that have been used to manage this conflict include; use of livestock guarding dogs, fencing of conservation areas/protected areas, use of chain-link fences around homesteads, education and awareness creation, livestock compensation schemes, improving livestock husbandry and relocation of problem animals among other methods. Data was collected through questionnaires, key informant interviews and direct observations. A sample of 105 respondents from Kitengela consisting of Maasai pastoralists was selected through snow ball sampling. Another sample of two key informants from Nairobi National Park was purposively sampled and interviewed. One more key informant was selected from The Wildlife Fund. The data obtained was quantitatively analyzed by way of percentages and multiple regression analysis. Qualitative analysis was achieved by summarizing the information gathered, followed by categorization and coding into emerging themes and presented in a narrative form. Results were presented in form of tables, pie charts and bar graphs. The study found out that dogs (100 % of respondents) and a combination of a variety of fences were used to manage the conflict. Use of other strategies such as compensation, awareness creation and use of incentive were not common in the study area. Majority (58.09%) of the respondents preferred fencing Nairobi National Park as a strategy to manage the conflict. There were extensive changes in land use patterns, such as crop production (59.19 % of respondents) and stone mining (34.29% of respondents) which probably led to increased conflict. Most respondents (79%) were not involved in wildlife conservation and hence they (91.4% of respondents) had negative attitudes towards wildlife. Regression analysis established a significant relationship between human-wildlife conflict management and the independent variables; effectiveness of various management strategies ($p=0.00<0.05$), compatibility of land use practices ($p=0.036<0.05$), stakeholders involvement in managing human-wildlife conflict ($p=0.20<0.05$) and local community's perceptions ($p=0.001<0.05$). It was recommended that chain-link fences should be made cheaper for local people and encourage them to engage in land use practices that are compatible with wildlife conservation. Participatory wildlife management and conservation should be encouraged and local people's attitudes and perceptions towards wildlife improved.

CHAPTER ONE: INTRODUCTION

1.1 Background information

Human-wildlife conflict (HWC) has become a serious concern not only in Kenya but the world over. There has been an increase in frequency, intensity and the consequences of interaction between people and wildlife. Many regions of the world experience one form of HWC or the other at particular places. The animals involved vary from small to large and mostly belong to three classes, that is, reptilia, aves and mammalia. The frequency, intensity and consequences of the conflict depend on several factors including but not limited to the animal species involved and proximity to people's habitation. This conflict is a serious concern and an obstacle to wildlife conservation (Dickman, 2008; Nyhus *et al.*, 2005). It also poses serious challenges to the local communities living with livestock, governments and conservation societies. Nyhus *et al.*, (2005), note that the cost of conserving large and sometimes dangerous animals is often born disproportionately by farmers and others living closest to wildlife. Hemson (2003) also says that most benefits from wildlife accrue to employees while losses accrue to livestock owners.

Herbivores and carnivores pose challenges to farmers and pastoralists respectively in different parts of the world. Herbivores such as elephants, buffaloes, zebras and antelopes destroy large tracks of crop lands every year. The African elephants and buffaloes are a threat to human life too. Large carnivore species depredate on livestock and are killed in retaliation. This has led to huge economic losses and decline in carnivore populations globally (Woodroffe, 2005). In the African rangelands, lion, leopard, cheetah and hyena are the main culprits in this conflict. They have suffered so many persecutions that there is general fear of whether they will continue to survive into the future. Increase in human population and urbanisation leading to changes in land use practices and destruction or alteration of habitats are the perceived as the root causes of the conflicts. It has, therefore, become necessary to look for working solutions in order to mitigate this conflict and subsequent impacts.

Human-wildlife conflict involving carnivores pose urgent challenges worldwide because it often pits human community against carnivores and against other humans who seek to preserve or restore wildlife populations (Treves and Kareith, 2003). This conflict is a serious problem in many parts neighbouring conservation areas in Kenya. The conflict is particularly pronounced at Kitengela dispersal area where pastoralists lose livestock at very close intervals of carnivore attack. The problem animals are believed to emanate from Nairobi National Park (NNP) which borders Kitengela. Kitengela plain is both a wildlife dispersal area and migratory corridor. Human settlements and developments have led to loss of these ecological functions of the plain and resulted in increased HWC in the area. Among the problem carnivore animals, the lion bears the greatest brunt of pastoralist fury as they have been killed and wounded through retaliatory attacks. They cause greatest impact on community livelihoods.

The Kenya Wildlife Service (KWS) has listed the lion (*Panthera leo*), leopard (*Panthera pardus*) and cheetah (*Acinonyx jubatus*) as most endangered species. These big cats have been considered threatened according to the IUCN list of threatened species (Bauer and Nowell, 2004). There is now a serious concern over their future in light of habitat fragmentation and destruction. The conflict is so serious particularly in and around Kitengela area where the local community has vowed to kill all the lions that attack its livestock. They have previously killed many lions for invading homesteads and mauling livestock.

Several techniques have been used in various places to manage this conflict. These methods include fencing of protected areas (PAs), chain link fences around homesteads and use of livestock guarding dogs (LGD). Other methods used include; controlled hunting, trapping, relocation of wildlife and compensating farmers and pastoralists for losses caused by wildlife. Insurance schemes have been used in some parts of the world to help in supporting livestock compensation policy. The success of any management strategy or combination of strategies will go a long way in promoting wildlife conservation and safe guarding people's livelihoods. It will also help to improve people's attitudes towards wildlife.

1.2 Statement of the problem

Carnivores have both economic and ecological significance to both NNP and Kitengela but are always in conflict with pastoralists. They are the park's main tourist attraction and they regulate the herbivore populations in both the park and at Kitengela dispersal area. However, as Macdonald and Sillero-Zubiri (2002) observe, wherever there is livestock, carnivores have a terrible reputation. Carnivores from NNP depredate upon livestock and threaten peoples' lives in and around Kitengela, triggering retaliatory killings hence triggering Human-Wildlife Conflict in the area. There are concerns of their conservation and continued survival and security of people and their livelihoods. NNP is important for tourist attraction, mitigation of the effects of air pollution from and around Nairobi and conservation purposes. However, its continued survival will depend on the conservation status of the carnivores which by extension is determined by the continued existence of Kitengela dispersal area.

Lack of effective HWC management strategies can be attributed to the nature and extend of the conflict. This study sought to assess the effectiveness of various management strategies in mitigating the effects of human-wildlife conflict. It also examined the effects of changes in land use practices on human-wildlife conflict; the effect of stakeholders' involvement on human-wildlife conflict management and effects of local community's perception of wildlife on human-wildlife conflict management. The purpose of this study, therefore, was to look for appropriate management strategies which could be used to mitigate the effects of Human-Wildlife Conflict. The appropriate methods would help to improve the conservation status of wildlife, maintain NNP as a tourist attraction centre and safeguard communities' interests and livelihoods. The successful strategies can then be extrapolated to other areas where similar conflicts exist.

1.3 General objective

The general objective of this study was to assess the effectiveness of the human-wildlife conflict management strategies used in Kitengela, Kajiado County in Kenya.

1.3.1 Specific objectives

The study had four specific objectives as outlined below;

1. To assess the effectiveness of various management strategies for human-wildlife conflict in Kitengela and NNP.
2. To examine the effect of changes in land use practices on human-wildlife conflict management in Kitengela area.
3. To establish the effect of stakeholders' involvement in conservation on human-wildlife conflict management in Kitengela and NNP.
4. To assess the effect of local community's perceptions of wildlife on human-wildlife conflict management in Kitengela

1.4 Research questions

The study sought to answer the following research questions;

1. Are the various human-wildlife conflict management strategies used in Kitengela and NNP effective?
2. What is the effect of changes in land use practises on human-wildlife conflict management in Kitengela?
3. What is the effect of stakeholders' involvement in conservation on the management of human-wildlife conflict in Kitengela and NNP?
4. What is the effect of local community's perceptions of wildlife on human-wildlife conflict management in Kitengela?

1.5 Study Hypotheses

The study was guided by the following hypotheses;

Hypothesis 1

Effectiveness of management strategies do not influences human-wildlife conflict management at Kitengela and NNP.

Hypothesis 2

Changes in land use practices do not influence human-wildlife conflict management at Kitengela.

Hypothesis 3

Stakeholders' involvement in conservation do not influences human-wildlife conflict management in Kitengela and NNP.

Hypothesis 4

Local community's perceptions of wildlife do not influence human-wildlife conflict management in Kitengela area.

1.6 Justification of the study

Kitengela area was selected because it functions as a wildlife dispersal area. However, this function is threatened because of anthropogenic activities resulting in habitat destruction and fragmentation. The area is experiencing land use practices that are perceived as incompatible with wildlife conservation resulting in increased HWC. Even though a lot of research has been done in the field of conservation in Kenya and in particular Kitengela area, none has been done on effectiveness of management strategies.

The study is therefore necessary as it contributes knowledge to the field of wildlife conservation in particular the carnivores. Proper conservation of the carnivores will favour the continued existence of NNP for its ecological function and as a tourist attraction centre. It will influence the policy and practice of wildlife management in Kenya. The local pastoralist community will benefit from reduced predation of their livestock and hence security of their livelihoods. The international community will benefit from this study because wildlife does not only attract tourists but is also an internationally shared heritage. The study also adds knowledge to the already existing scientific findings on conservation. The conservation of these carnivores will promote the conservation of other animals that are important ecologically and for attracting

tourists. This is due to the interconnectedness of ecological systems which makes it difficult to conserve species in isolation. Generally this study is important since it is relevant to the government, conservation societies, local communities and wildlife at large.

1.7 Scope and limitations of the study

This study focused on five main carnivores, that is, the lions (*Panthera leo*), leopards (*Panthera pardus*), cheetahs (*Acinonyx jubatus*) wild dogs (*Lycaon pictus*) and spotted hyenas (*Crocuta crocuta*). This is because of the extent and degree of conflict between them and people within Kitengela area. They are reported to frequently invade people's homes and kill livestock. Although different types of wildlife species inhabit Kitengela area, these carnivores are said to be causing most of the problems with severe consequences. The conservation of the carnivores of NNP is of critical importance since they are key species. Tourists visit the park mainly to see particularly the big carnivores, which include the lion, leopard and cheetah (Personal observation). As a result of this the viability of the park as a conservation area and tourist attraction centre depends on the conservation status of the carnivores.

1.8 Definition of terms

Conflict- is the state of disharmony between incompatible or antithetical persons, ideas or interests (online dictionary).

Human-wildlife conflict (HWC) - is any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment.

Carnivores- carnivores are the flesh eating animals. In this text the word carnivore will be used to mean lions, leopards, cheetahs, hyenas and wild dogs.

Wildlife - is the undomesticated animals found in their natural habitats (Sifuna 2009).

Wildlife management- is the guidance of decision making process and the implementation of practices to purposefully influence interactions among and

between people, wildlife and habitats to achieve impacts valued by stakeholders (Riley *et al*, 2002: Decker *et al*, 2002).

Stakeholders - are individuals and groups who may be affected by or can affect wildlife management, decisions and programmes, including: members of environmental organisations, homeowners, wildlife damage service providers, farmers, forest owners and government officials (Decker *et al*, 2002).

Local community – is used to mean the local Maasai pastoralists who reside in Kitengela area.

1.9 Research ethics

To carry out this study, permission was sought and obtained from two organizations: Kenya Wildlife Service (KWS) as reflected appendix IV and National Commission for Science Technology and Innovation (NACOSTI) as shown in appendix V. A research permit fee was also paid to both institutions. The purpose and intention of the study was made clear to the organizations before permission to collect data was granted. Data collected especially by ways of interview and questionnaire was treated with confidentiality and propriety.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter, cases of human-wildlife conflict worldwide are reviewed. In addition, the use and effectiveness of various management strategies are discussed as well as the role of various stakeholders in human-wildlife conflict management. The compatibility of various land use practices with conservation and local community's perceptions on wildlife conservation are also discussed.

2.2 Cases of human-wildlife conflict worldwide

HWC is a worldwide phenomenon which has made people to view wildlife as a liability (Dickman, 2008). The conflict occurs in various forms and involves all types of undomesticated animals. Both large and small animals are involved with consequences ranging from minor to very complicated situations. Big mammals like the elephants, buffaloes, lions, tigers and leopards are usually associated with great economic losses to both farmers and herders. According to Obunde *et al.* (2005) HWC has existed since time immemorial. In Kenya, it dates as back as early 1900 when the man-eaters of Tsavo killed railway workers. However, the conflict still dates far back than that even though there is lack of documented evidence. Man and wildlife have always interacted in one way or the other. In the past people depended on hunting to get their food and in this way they always had conflict with wildlife. The conflict was, however, not serious then because people were few and they used crude weapons. Nowadays, sophisticated weapons are used which kill many animals within a very short time.

Although the conflict is perceived as involving wildlife invading people's interests, it also occurs when people attack wildlife like in the case of poaching. When wildlife invades and destroys people's property, it suffers from retaliatory attacks which come in the form of killings, trapping and poisoning. HWC can be classified into space conflict, crop raiding, predation on livestock and attack of humans. The main driver of this conflict is competition for land between wildlife and human beings. Increase in human population has led to the need for land for agriculture, industrialization and human settlement.

Carnivores do not only cause livestock deaths but according to Linnell *et al.* (2002), they are said to also account for hundreds of human deaths annually worldwide. This is despite many attempts to use various strategies in order to try and reduce the effects of the conflict. In the USA for instance, the coyotes and wolves cause problems to sheep herders leading to increased HWC (Parkhurst, 2006). The coyotes also cause great economic losses to farmers in many countries of Europe such as Spain and France. In South America, Jaguars and pumas kill cattle (De Azeved and Murray, 2007) while in India leopards, lions and wolves attack both livestock and people (Athreya and Belsare, 2007).

Unlike other continents, the African continent is represented by all of the four carnivores under study, although they are not evenly distributed. Most of these carnivores are found in the sub-Saharan region. The northern region has seen great decline of the carnivores especially the lion's overtime probably because of their conflict with human beings. The conflict mostly involves the lion which is becoming increasingly rare outside protected area (Macdonald and Sillero-Zubiri, 2002). If this trend is left to continue, it might lead to extirpation of big cats from the regions where they are represented now. Carnivores cause problems in almost all countries in eastern, central south African region including Kenya, Tanzania, Namibia, Botswana, South Africa and Zimbabwe (Butler, 2000; Swarner, 2004).

Apart from the carnivores, Elephants cause severe damage to property in Africa and Asia (Sitati *et al.*, 2003). They destroy crops and infrastructure in many countries as well as threaten people's lives. Across the African continent Human Elephant Conflict (HEC) occurs in Mali, Burkina Faso and Cameroon (Tchamba, 1996) in the western part of Africa and in southern parts of Africa. In Kenya, elephants and rhinoceros are currently facing a serious threat from poachers who use sophisticated weapons like guns to kill large herds in very little time. They are killed for their ivory, which attract huge sums of money in the illegal markets. Faced with habitat destruction (Rood *et al.*, 2008) caused by anthropogenic activities and rampant poaching incidences, their survival to the future is at risk.

The situation of HWC in Kenya can only be described as grave. In almost every day a case of HWC is reported from various parts of the country. Among the carnivores, the lion and hyena are probably the most notorious in invading livestock. About seventy percent of wildlife in Kenya lives outside National Parks (Obunde *et al.*, 2005) the probable reason for pronounced HWC. Other problem animals include; monkeys, baboons, giraffes, crocodiles, hippopotamus, and buffalos (Sifuna, 2009). The study area is one of those places which have serious HWC incidences in Kenya. Even though the local Maasai community has co-existed with wildlife for a long time, the increase in conflict seems to compromise this co-existence. There is therefore a serious need to look for appropriate management strategies which will help mitigate the effects of this conflict.

2.3 Management strategies for human-wildlife conflict

There are several management strategies that have been used in various places to mitigate the effects of HWC with varying degrees of success. This section looks at various management strategies and assesses their effectiveness. However, it should be realized that the success of any strategy will depend on how people respond to this conflict and involvement of all stake-holders in its management. Continued coexistence between humans and large carnivores will depend on mitigating the effects of livestock depredation (Swarner, 2004) and as Smith (2005) notes, reducing this conflict involves managing people. This is in tandem with what wildlife management means, that is, management of people to a larger extent and management of wildlife to a smaller extent. Some of the strategies reviewed include: use of livestock guarding dogs, fencing, and creation of awareness among community members, compensation and relocation of problem animals.

2.3.1 Use of livestock guarding dogs

The use of livestock guarding dogs (LGDs) to protect livestock has been a common practice in many places and for many centuries. Man has always and will continue to use dogs for various purposes including hunting, company and protection against intruders as well as pets. Dogs have always been and still remain man's best friends.

A LGD is full time member of the flock that generally stays with livestock without harming it and aggressively repels predators (Green and Woodruff, 1990). Although this practice has not been common in most parts of Africa, it has been used in some countries. In Namibia for example, guard dogs have been used to protect livestock against cheetah attack (Riggs, 2004). The main problem animals in Namibia are similar to those in Kenya. It remains to be experimented in order to find out what difference LGDs can bring to the management of the human-wildlife conflict. Outside Africa this method has been used in Europe, USA and Canada (Riggs, 2001). Dogs differ in sizes and breeds, factors which determine their effectiveness. Training a dog to be livestock custodian and be able to remain close to it is another factor that is likely to determine its success. The experience of the dog as a livestock guardian can also contribute greatly to its effectiveness. Even mature dogs are not expected to bring down a lion or leopard unless their cubs. Normally dogs will take off at the roar of a lion or leopard. Leopards in fact feed on dogs. However, as Ogada *et al.* (2003) note, dogs can be effective by providing warning to people of predator presence.

2.3.2 Fencing of conservation areas/ protected areas

The practice of fencing protected areas is gaining prominence in Kenya. Even though ecologists oppose the practice of confining wildlife within a given area, fencing seems a better alternative as far as conflict mitigation is concerned. Those areas that have been fenced all round experience the least incidences of HWC. Fencing is favoured by local communities affected by this conflict. They see this as the only strategy that can reduce the conflict significantly. Some researchers such as Coggan (2006) and Walpole *et al.* (2003) have identified fencing as the single most important method of conserving biological diversity. Its main objective is to protect wild animals and natural habitats through prohibition or restriction of wildlife utilization. It prevents people from getting unauthorized access into protected areas. Wildlife range is reduced and hence preventing wildlife from coming into contact with people and their livelihoods. The method, however, has its own unique limitations. It has been found to be insufficient to preserve biodiversity (Kristjanson *et al.* 2002), especially when used alone. Fences are not hundred percent effective since wildlife can break through and sneak out of the parks. Electric fences become ineffective when there is blackout.

Some animals like the baboons are able to differentiate between the wires carrying electricity and those which do not. Elephants are clever animals which can find ways of breaking through electric fences.

In Kenya, PAs constitute 12.3% of its designated land which is within the globally recommended size of terrestrial protected area (Coggan, 2006). Generally, most of the national parks in Kenya are fenced around by use of electric fences. NNP is fenced on three sides and only the southern boundary marked by Mbagathi River is open. The fenced sides do not experience any conflict, a factor which some people use to justify their desire to have the park fenced all round.

2.3.3 Use of chain-link fencing around homesteads

Chain-link fencing is a practice that is currently gaining prominence in some parts of Kenya particularly around the Tsavo National Park. This practice of erecting chain fences around bomas, help to keep away predators at night. Predators usually scare livestock causing a stampede which makes it to break out of the enclosures hence becoming exposed to predators. This type of fencing replaces the old boma method which is not predator proof. Since livestock can not break through and the predators cannot get into the boma, killing incidences are greatly minimized. The method has also been used in Tanzania by the local Maasai community to protect their livestock (Packer and Kissui, 2010). Keeping livestock safe at night is one of the most important ways to reduce HWC since most of predators invade at night. Most cases of livestock predation around Kitengela happen at night. It is therefore important to keep livestock in properly fenced corrals at night in order to reduce depredation. This also agrees with the findings of Ogada *et al.* (2003) that rate of depredation decreased when livestock was kept in well secured corrals.

These fences, however, like any other physical barriers are very expensive and most pastoralists are likely not able to afford them. They have also not been used in many places of HWC. It therefore remains to be seen how effective they will be in reducing and managing the conflict. This makes it necessary to seek the opinion of pastoralists on the issue of erecting these fences around their bomas and their efficiency

2.3.4 Education and awareness creation on the value of wildlife

People's knowledge and understanding of wildlife in most parts of the country can only be described as poor. The only thing they know about wildlife is that it is a curse and liability they have been condemned to live with. The Maasai community in Kenya for instance, sees wildlife as belonging to the government and one of the greatest threats to their livelihoods. This means that the government should bear the sole responsibility of managing wildlife. This is a wrong notion based on the systems theory. There is need for communities, whose land harbour wildlife, to feel the sense of ownership of the same wildlife. This can be achieved through education and awareness creation among community members.

Education and awareness can be used to reduce HWCs since knowledge increases people's tolerance towards wildlife (Holmern *et al.*, 2007). When people are made to understand the value of wildlife either by sharing in the management or benefits, their appreciation for it increases and hence their tolerance. Knowledge and awareness is critical as it has been evidenced by the attitudes of white rangers towards wildlife in Kenya. They admire to see greater populations of lions, leopards and cheetahs in their ranges (Frank and Woodroffe 2001) and therefore are less likely to kill them in case they depredate on livestock. Contrary to white ranchers, most people in the local communities view wildlife negatively probably because of the low level of education and awareness about wildlife. The argument that HWC cannot be resolved but rather to reduce the rage people have towards animals is right. The way to reduce people's rage against wildlife is by making them understand the economic, ecological and cultural role of wildlife. Besides, there is need to give people incentives. Incentives and management rights can also help increase community's tolerance towards wildlife.

2.3.5 Livestock compensation scheme

Compensating farmers and pastoralists for loss of property such as destruction of crops and killing of livestock can go a long way in managing HWC. Compensation refers to the payment made by wildlife authorities and other stakeholders to victims of

wildlife damage or their kin in case of death (Sifuna, 2009). Livestock compensation can be an effective tool for minimising the impacts wildlife causes to people. It can also help reduce the negative consequences of HWC (Nyhus *et al.*, 2005). People usually attack wildlife because of the losses they incur as a result of invasion by wildlife. Rodriguez (2006) recommends compensation as one way that can increase people's tolerance towards wildlife while minimising the financial losses incurred by communities. This method has been practiced in various places with varying degree of success.

In Kenya, the government has been offering up to Ksh. 15,000 for human injury and Ksh. 30,000 for human death which was considered too little and a favour of wildlife over local communities (Obunde *et al.*, 2005). The Wildlife Conservation and Management Act (2013) has, however, revised this to not more than Ksh. 1,000,000 for human injury or death. KWS has previously been accused of frustrating efforts to have a compensation law in place. Compensation can also be done through insurance schemes where farmers can pay a premium for a cover against a defined risk. This can reduce the losses people incur and consequently reduce people's rage towards wildlife. Payment of insurance premiums has been practiced in Spain and seems to be successful (Blanco, 2003). The main shortcoming of this method, however, is the lack of continuous source of funding to run the scheme. Besides, most pastoralists are also likely to avoid proper livestock husbandry practices in order to increase the chances of predation with the hope of being compensated.

2.3.6 Improving livestock husbandry

Animal husbandry involves many practices that are intended to take proper care of livestock in order to reduce the chances of predation. This comprises of such practices as keeping few but quality livestock, taking proper vigil on livestock while out in pastures and deciding who to accompany livestock to pastures and watering points. According to Dickman (2008) livestock husbandry remains an important factor to consider in managing HWC. Keeping few, good quality animals can open up more space for ungulate growth. Ogada *et al.* (2003) found that when attentively herded and kept in corrals at night, livestock experienced lower depredation. Since lions can

distinguish warriors from children and monitor how well herds are tended (Packer and Kissui, 2010), it is proper that adults accompany livestock to pastures and watering points. It would be safer if livestock was guarded by adults than children. They note that attacks are high when cattle are attended by children than warriors and when many cattle are attended by only one herder.

2.3.7 Relocation

This is the removing of problem animals from human habitation or from areas of conflict to areas where there will be reduced conflict (Sifuna, 2009). Relocation of carnivores from NNP can be a long lasting solution to HWC. This is because the ungulates found at Kitengela do not have as serious effects on community livelihoods as carnivores. Relocation is seen as a non-lethal method of solving human-carnivore conflict where threatened species are involved (Fonturbel and Simonetti, 2011). Farmers, ranchers and pastoralist seem to favour relocation of wildlife as a desirable measure for reducing this conflict. However, the implications of translocation and relocation might be more severe both to the animals involved and ecosystems. It can also create an ecological imbalance both in the original area and the area to which the animals are moved. This method therefore needs serious research to be conducted prior to implementation. It is also an expensive activity to carry out.

2.4 Changes in land use patterns

Kitengela area has experienced a big influx of people from different places and cultures. These people practice economic activities that are not compatible with wildlife conservation. The effect of this is competition between people and wildlife for space. Increase in human population and changing of socioeconomic lifestyles have been recognised as the greatest threat to wildlife conservation (Colonna, 2011). Subdivision, selling and leasing of land which is then put into industrial and agricultural uses are the main threats affecting Kitengela area. For instance, the number of households in Kitengela increased from 5005 in the 1999 (GOK 2000) to 18892 in 2009 (GOK 2010). This means reduction in size of natural habitats which restricts biodiversity to small fragmented areas. It also blocks wildlife corridors which

serve as passage routes of animals from one ecosystem to another during certain periods of the year.

The destruction of habitats and blocking of migratory routes affect the distribution of wild ungulates in a given area. The carnivores depend on the ungulates as the main source of their diet. Pattern *et al.* (2004) observed that to reduce lion attacks on livestock, there is need to keep native ungulate populations at a healthy level as only 5.8 percent of lion diet consists of livestock.

2.5 Role of stakeholders

Stakeholders can be defined as those people who have an interest in something and affect the way that thing operates and are affected by it. There are several stakeholders in wildlife conservation and management whose active involvement brings varying results of success. In this section, the local community, NGOs, wildlife managers and scientists will be considered.

2.5.1 Local community

Involvement of the local communities in projects and other development activities as a participatory approach to development is increasingly getting attention. People's participation in the formulation and implementation of various activities of a given project greatly influences its success. There is need to incorporate the local communities in the management of wildlife to boost their appreciation of wildlife and nature in general. Sifuna (2009) notes that the success of any conservation programmes will depend on the goodwill of local communities. Local communities pay the highest costs of conservation as a result of their proximity to PAs and any management strategy that leaves them out will prove futile. Since local communities are directly affected by and affect wildlife, they are by definition part of the stakeholders and should be involved in the formulation and implementation of management decisions. Participation can also involve the sharing of benefits accruing from wildlife conservation. The local community should not only be forced to share from losses caused by wildlife but benefits too. Kiss (2004) found that benefits from

tourism motivate local communities to conserve both wildlife and the ecosystems. On the other hand, an inadequate direct benefit that local communities get from wildlife is a major bottleneck to conservation as noted by Obunde, *et al.* (2005). Macdonald and Sillero-Zubiri (2002) argue that the only workable solution in managing HWC will need compromise and strategies which do not involve sealing people from wildlife. It should also be acknowledged that local communities have indigenous knowledge that is vital in conservation. They have lived with wildlife for a long time. Scientists and wildlife managers should find out the secret behind this and tap from it.

2.5.2 Wildlife managers and scientists

Wildlife managers are charged with the sole responsibility of managing wildlife. Wildlife management constitutes the management of people and wild animals. Management of people is the most important aspect of wildlife management because human behaviours and activities influence the nature and extent of this conflict. The way wildlife managers respond towards wildlife invasion greatly influence the way the local community will also respond to such invasions. If wildlife managers are perceived as favouring wildlife more than people's livelihood, local people tend to become hostile towards wildlife. Researchers are also important in managing the conflict through research guided policies. Comprehensive wildlife management needs biological, social (Decker *et al.*, 2002) and political sciences (Macdonald and Sillero-Zubiri, 2002) for sound and informed decision making. Wildlife management must adapt to new situations and new understandings emerging from experience and the supporting biological and social sciences and research. Research can help to answer current and future needs of wildlife managers and optimize the coexistence between wildlife and people. Shemwetta and Kideghesho (2000) observe that research and extension are meaningful tools towards the management of HWC. Through research, knowledge gaps on factors and sources of these conflicts could be identified and bridged. The world is constantly changing and so the management styles should. The only way to keep in line with changing situations is through research.

2.6 Community's perceptions on wildlife conservation

The presence of wildlife on community land is a common occurrence in Kenya. The close proximity between wildlife and people's interests cause conflicts on a regular basis. People are likely to respond differently to this conflict depending on how they perceive wildlife conservation. Those animals like the carnivores which depredate on livestock are mostly perceived as liabilities and therefore the local community advocates for their elimination. For instance, Parry and Campbell (1992) found out that rural community in northern Botswana had negative attitudes towards wildlife conservation. This was due to the losses in crop destruction, predation on livestock, loss of land to conservation and lack of control over animal wildlife resources. However, white rangers in Laikipia Kenya were found to be tolerant to carnivores on their lands probably due to their perception of the carnivores as key stone species (Macdonald and Silero-Zubiri 2002). Key stone species have disproportionate effect in the ecosystem. Participatory conservation approaches can help improve local people's attitudes towards wildlife conservation and hence boost conservation efforts.

2.7 Theoretical framework

This study was based on the systems theory which looks at a phenomenon as having several components that work together as a unit. Systems theory focuses on the arrangement of and relations between the parts and how they work together as a whole (Ansari, n.d). It is a holistic approach to understanding phenomena. As such wildlife management can be considered as a system consisting many complex interacting components and stakeholders. It involves many players who need to work together in a coordinated manner in order to contribute to the mitigation of the effects of HWC. The various actors work in a synergistic manner and each contributes to the management of this conflict.

This theory was adopted for this study basically because effectiveness of wildlife management cuts across several fields and actors who must act together as a unit (Macdonald and Sillero-Zubiri 2002). It calls for collaboration, between different stakeholders to help shift the emphasis from reactive mitigation to proactive prevention strategies. It also calls for the adoption of various conflicts management

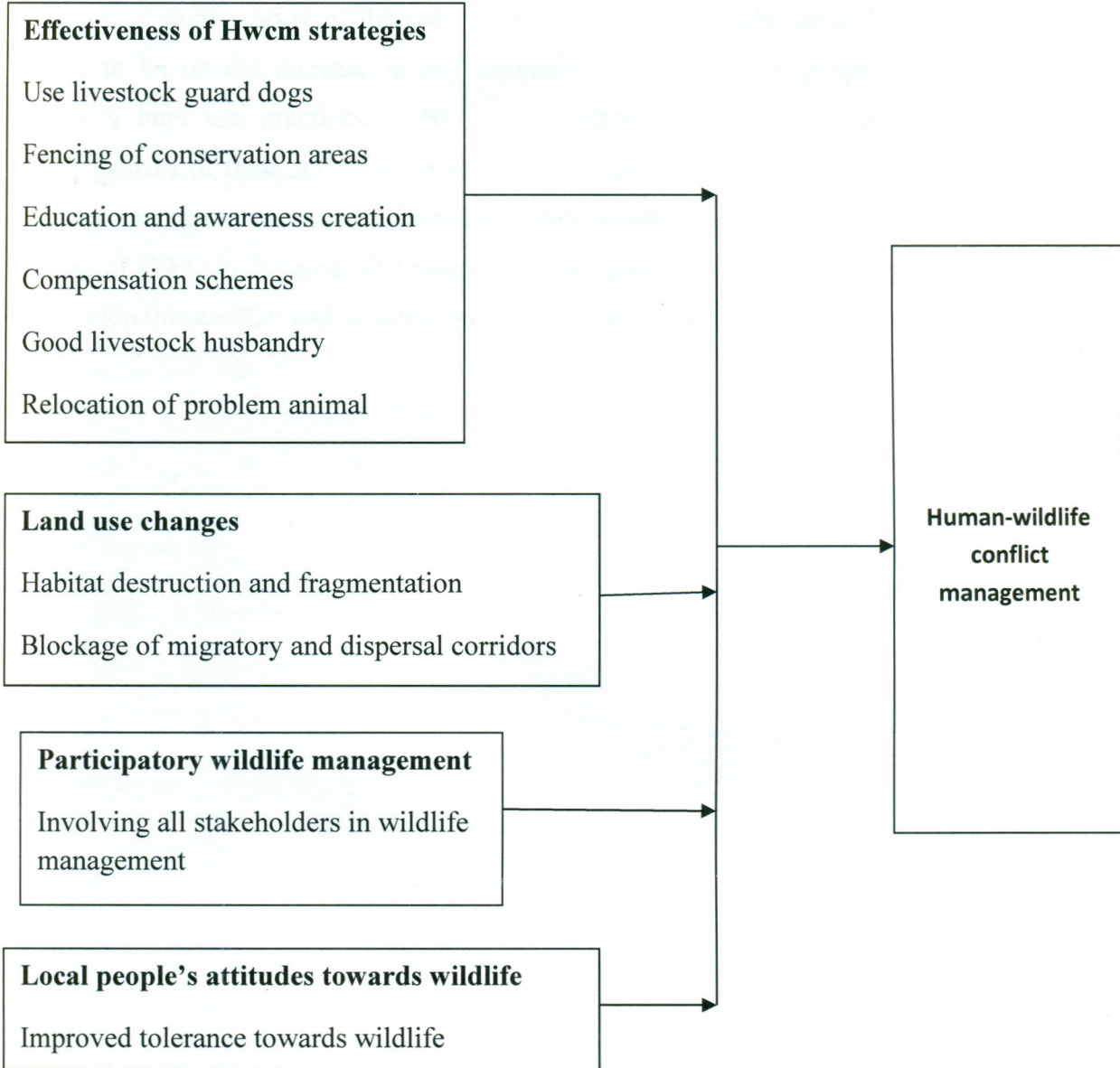
strategies for there is no single approach that can effectively mitigate against HWC. For these approaches to work there is need for partnerships between state and local government agencies, non-governmental organisations, communities and private wildlife control professionals (Decker *et al.*, 2002).

2.8 Conceptual framework

The problem of human-wildlife conflict management at Kitengela area was conceptualised as involving many factors. Some of the factors influencing the management of this conflict include: effectiveness of management strategies, land use patterns, involving all stakeholders and improving local people's perceptions and attitudes towards wildlife. Use of effective management strategies would lead to reduced incidences of the conflict. On the other hand employing ineffective strategies would mean persistence of the conflict.

Habitat fragmentation and destruction resulting from changes in and use could be the probable reason the increased cases of conflict. Land use changes also lead to the blockage of wildlife migratory corridors and dispersal areas. Stakeholder involvement in conservation and conflict mitigation is likely to greatly influence the management of the conflict. Stakeholders directly involved in this conflict include; the government through KWS, research scientists, NGOs dealing with conservation matters, and the local community who bear the brunt of wildlife invasion. Since this conflict involves different types of people, its management must of necessity involve equally many people. These stakeholders should work in a coordinated manner just as a system if appropriate solutions to this problem are to be reached.

The effective management strategies should seek to safeguard the local community's livelihoods. The way the local community perceive wildlife is influenced greatly by this conflict. Poor perceptions and negative attitudes result from the losses people incur due to invasion by wildlife. This is likely to aggravate the matter. On the other hand, positive attitude towards wildlife would be achieved if the local community obtained tangible benefits from wildlife. Good perceptions would translate to reduced conflict. Figure 1 is an illustration of the factors contributing to the human-wildlife conflict and its management at Kitengela area.

Independent variables**Dependent variable****Figure 1: Conceptual model****Source: Author****2.9 Conclusion**

HWC is a worldwide problem that is causing decline in wildlife populations. There are various strategies that can be used to manage HWC. These methods, however, do not seem adequate in solving the conflict since there are many cases reported at various places of the country. Fencing is expensive undertaking while LGDs have not

been used in Kenya and therefore their effectiveness cannot be determined precisely. Compensation policy has always caused controversy between stakeholders and there exists no documentation of the use of livestock insurance scheme in Kenya. HWC seems to be on the increase in and around the study area as people continue to diversify land use practices. This questions people's level of awareness on the consequences of their activities on wildlife. Therefore this study was carried out in order to assess the various management strategies which can be used to mitigate the effects of HWC in the area. The role of various stakeholders in either aggravating or mitigation this conflict and people's attitudes towards wildlife need to be studied.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This chapter presents the methodology that will be used to collect data for the study. It covers the research design, the target population, sample size and sampling procedure, data collection instruments, procedures and constraints and method of data analysis. It also provides a brief description of the study area.

3.2 Research design

This study adopted the descriptive research approach. Descriptive research involves measuring a variable or set of variables as they exist naturally and is useful as a preliminary research (Gravetter and Forzano, 2009). This design was selected because it enables observation and description of behaviour of a subject without influencing it. It is used to obtain a better understanding or general overview of the subject. Descriptive studies are limited in geographic scope and hence tend to be logically easier and simpler to conduct besides providing the foundation upon which other studies can be done (Mugenda, 2008).

Oloosirkon consists of seven villages. Fourteen (14) days were spent to cover the entire area since two days were used to collect data from each village. The researcher accessed each village using a motorbike and then self-administered the questionnaires on foot. While walking across the villages, observations were made and recorded in the observation checklist. Data from NNP was collected by interviewing key informants who were purposively sampled. Three days were spent to interview them. Those interviewed include; the administrator at The Wildlife Fund, community warden and one of the rangers responsible with attending to reports of carnivore attack in the community.

3.3 Target population

The target population consisted of Maasai pastoralists of Oloosirkon location in Kitengela, KWS staff at NNP and staff at The Wildlife Fund, an NGO situated within the park. The Maasai are mainly involved in herding livestock and carry out retaliatory attacks and have vowed to kill all the invading carnivores particularly the lions. KWS staff at NNP has the main responsibility of managing wildlife and problem animals come from the park. The Wildlife Fund is mostly concerned with wildlife conservation works within the park and the local community at Kitengela.

3.4 Sample size and sampling procedure

The main data for this study was obtained from the local Maasai community living at Oloosirkon location in Kitengela. In addition, some data was collected from KWS staff NNP and The wildlife Fund staff. Oloosirkon location has a total of sixteen thousand people according to the 2009 national housing and population census. A proportion of this population constituting 0.65 percent, was sampled which formed a sample size of 105 individuals. This sample size is adequate since a very big sample size would pose challenges during data collection as the questionnaires were self-administered. The research also had limitation in terms of finances and time. Since the location comprises of seven villages, fifteen individuals were selected from each village. Simple random sampling method was initially used to select individuals. Individuals selected were then used to identify others through snowball sampling method. A household constituted a sampling frame from which one individual (from 18 years old and above), and where appropriate the head of the household, was selected. Eighteen years is important because it is the maturity age in Kenya. There were two key informants from NNP staff and one from The wildlife Fund who were purposively sampled. Even though NNP is not in Kajiado County, they were included to give more data on the concerns raised by respondents at the community level in relation to HWC. Problem animals are believed to originate from the park.

Simple random sampling is a method which ensures that each member of the target population has an equal and independent chance of being included in the sample (Burton and Bartlett, 2009). This method is used when the population is uniform or

has similar characteristics (Walliman, 2005). For this study the uniformity of the population was brought about by the fact that it is a pastoral community affected by HWC. In purposive sampling the chance that a particular case will be included in the sample depends on the subjective judgment of the researcher (Nachmias and Nachmias, 1996). Cases of subject are handpicked because they have the required characteristics hence saves time (Mugenda and Mugenda, 2003). It is used to obtain focused information from specific target groups (Sekaran, 2003). In snow ball method, the initial subjects with desired characteristics are identified who help to identify others with similar characteristics (Mugenda and Mugenda, 2003).

3.5 Data collection methods and tools

The study relied on both primary and secondary sources of data. Primary data refers to information obtained first hand while secondary data is data that already exists (Sekaran, 2003). Questionnaires were used to collect data from the community at Oloosirkon area. Since the majority of the community were assumed to be illiterate or semiliterate, the researcher administered the questionnaires by himself hence helping them to understand the questions. The respondent's answer was filled in to the questionnaire by the researcher himself. The advantage of this method is that the respondents were helped to overcome difficulties with translating, interpreting and understanding the questions. Questionnaires consisted of a number of closed and open-ended questions printed in a definite order (Appendix I). Data collected from key informants at NNP was collected by use of semi-structured interviews schedule (Appendix II). Semi-structured interview has the advantage of being flexible. The interviewer starts with some defined questioning plan, but pursues a more conversational style that may see questions answered more natural to the flow of the conversation (O'Leary, 2004). Some data was directly observed and recorded in observation check list (Appendix III). In observational method, conditions, events and activities are recorded through the non-inquisitorial involvement of the researcher (Walliman, 2005). Secondary data was collected through a review of relevant books, journals, reports and websites.

3.6 Data analysis methods

Analysis of data was done in order to answer the four research questions of this study. Both descriptive and inferential statistical analysis techniques were used. Data collected was sorted, classified and coded then tabulated for ease of analysis. The data was summarized and categorized according to common themes. The SPSS (version 17) computer software aided the analysis as it is more users friendly and most appropriate for analysis of Management related attitudinal responses (Newton and Jeonghun, 2010).

Descriptive statistics was employed to analyze the data. Tables and other graphical presentations as appropriate were used to present the data collected for ease of understanding and analysis. Tables were used to summarize responses for further analysis and facilitate comparison. This generated quantitative reports through tabulations and percentages. Cooper and Schindler (2003) note that the use of percentages is important for two reasons; first they simplify data by reducing all the numbers to range between 0 and 100. Second, they translate the data into standard form with a base of 100 for relative comparisons. The results were presented on frequency distribution tables, pie charts and bar charts. Here the interest was focused on frequency of occurrence across attributes of measures. Qualitative data was analyzed manually by first summarizing the information gathered, followed by categorization and coding into emerging themes and presented in a narrative form.

A multivariate regression model was applied to determine the relative importance of each of the variables with respect to human-wildlife conflict management.

The regression model used is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Where:

Y = Human wildlife conflict management strategy

β_0 = Constant Term

β_1 = Beta coefficients

X_1 = Effectiveness of various management strategies

X_2 = Changes in land use practices

X_3 = Stakeholders in mitigating human-wildlife conflict

X_4 = Local community's perceptions

ϵ = error term (residual term that includes the net effect of other factors not in the model and measurement errors in the dependent and independent variables).

3.7 Data collection constraints

There were some challenges that were encountered during data collection period. They included initial lack of cooperation and slight hostility from respondents who thought that the research was an initiative of KWS. However, with time and constant explanation, they became receptive and cooperative. The rough terrain also was an impediment in moving from one homestead to another and from one village to the next. It was time consuming to fill the questionnaires because they were self-administered. The problem was compounded by low literacy levels among the community levels. In some case it was not possible to collect data from very old people who did not understand any other language other than the Maa language.

3.8 Study area

This study was carried out in Oloosirkon location Kitengela division and NNP. Kitengela is an administrative division with four locations, that is, Kitengela, Olooloitikosh, Sholinke and Oloosirkon. Oloosirkon location borders NNP and experiences the highest rate of human-carnivore conflict as compared to the other three locations. For this reason and due to time and financial limitations, the scope of the study was within Oloosirkon location.

Kitengela is found in Kajiado county which is situated between longitudes $36^{\circ} 5'$ and $37^{\circ} 5'$ east and latitudes $1^{\circ} 0'$ and $3^{\circ} 5'$ south (Gichohi, 2009). The area lies in the

Athi-Kipiti plains, which consists mostly of open rolling grassland and covers approximately 390 km² (Nkedianya *et al.*, 2009). Annual rainfall ranges from 500mm to 800mm spread across two rainy seasons, that is, March-May and October-December. Kitengela plains serve both as the migratory corridor and wet season dispersal area for wildlife from NNP. Animals found here include; the zebra wildebeest, Maasai giraffe, Coke's hartebeest, black rhino, African buffalo, Grant's and Thomson's gazelles, eland impala, waterbuck, lion, cheetah, leopard hyena and a high diversity of bird life.

The local Maasai community has been practicing pastoralism even though they are gradually changing to agro-pastoralism while immigrants from other communities carry out various economic activities. These include; large scale irrigated horticultural schemes, maize and wheat plantations and quarrying enterprises. The influx of non-Maasai communities into the area has increased pressure on land and altered landscape through construction of permanent settlement, industries and speculative holding of land. NNP was gazetted in 1946 and is only eight kilometres from the city centre. It covers an area of 117 km² at an altitude of 1600-1800 m. It lies between latitudes 1° 20' -1° 26' S and longitudes 36° 50'-36° 58' E (Ogutu *et al.*, 2013). Figure 2 is a map of Kitengela dispersal area while figure 3 is the map of Kenya showing the location of Kitengela and other wildlife conservation areas.

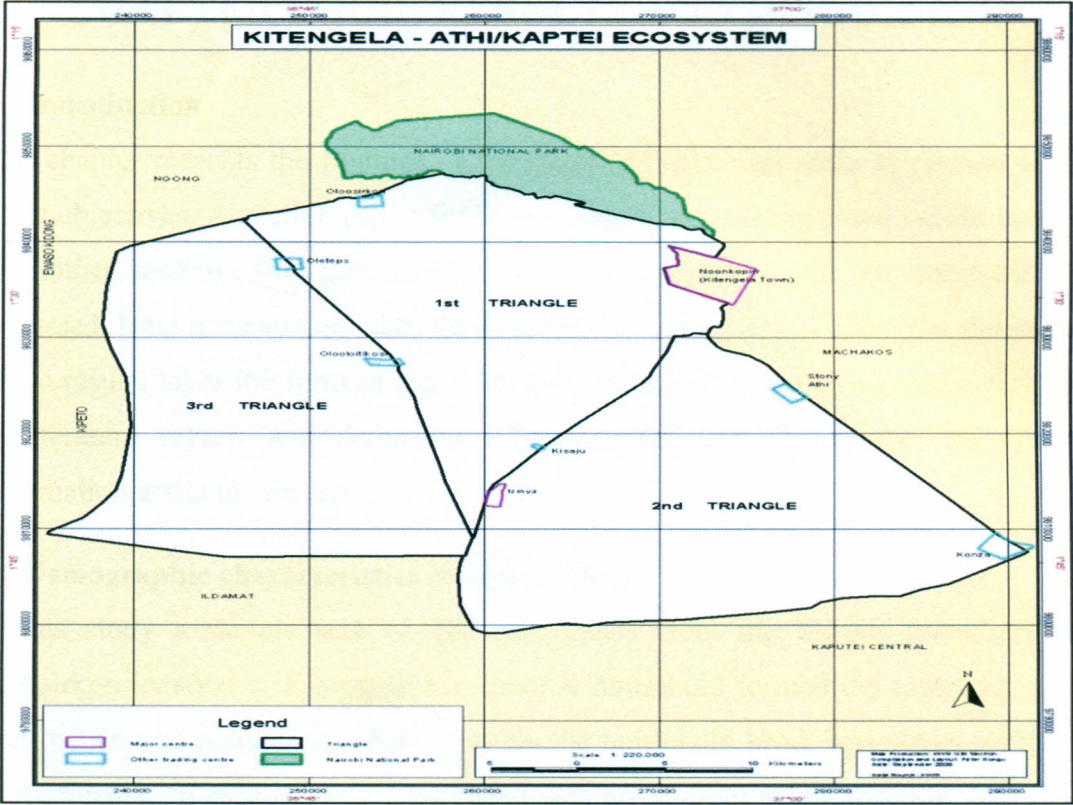


Figure 2: Map of Kitengela dispersal area

Source: Kenya Wildlife Service (2013)

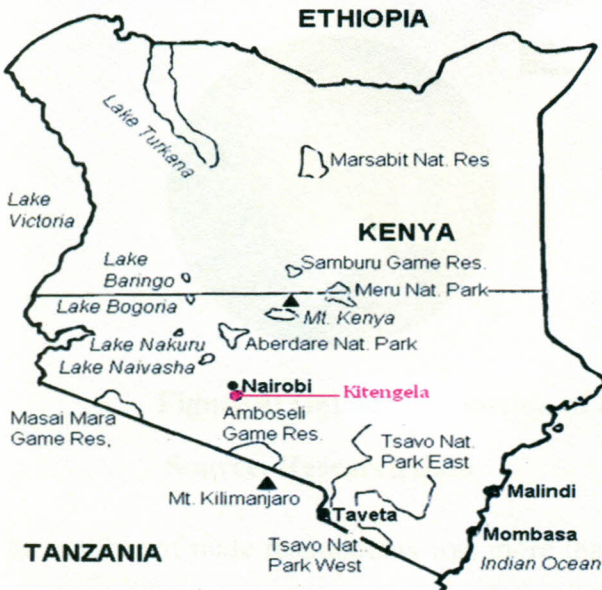


Figure 3: Location of Kitengela and other conservation areas in Kenya

Source: Kenya Wildlife Service (2013)

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the findings of the study and discusses them in relation to the study objectives. A section of the findings is presented and discussed before moving to another section. This procedure is repeated until all results are presented and discussed. Data presentation takes the form of text, tables and figures. The discussion of the results takes the form of interpretation, reference to previous research as cited in literature review and deductions. The chapter starts by giving the general information about the results.

4.2 Demographic characteristics of respondents

In this study a sample size of 105 individuals from the Maasai community at Oloosirkon location in Kitengela was used. A household formed the sampling frame from which one individual, where possible the household head, was subjected to the questionnaire. In case the household head was not present at the moment, any other available individual aged eighteen years and above was sampled. Therefore all the individuals sampled were above eighteen years of age. As figure 4 below shows, there were more male respondents (79.05 percent) than females (20.95 percent).

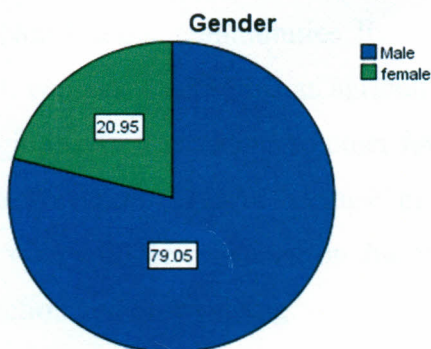


Figure 4: Gender proportion of the respondents

Source: Research data

The number of male respondents was more than that of female probably because this is a patriarchal society where male are considered superior to female. Most females shied away from participating in the study whenever there were males present even though the males were younger than them.

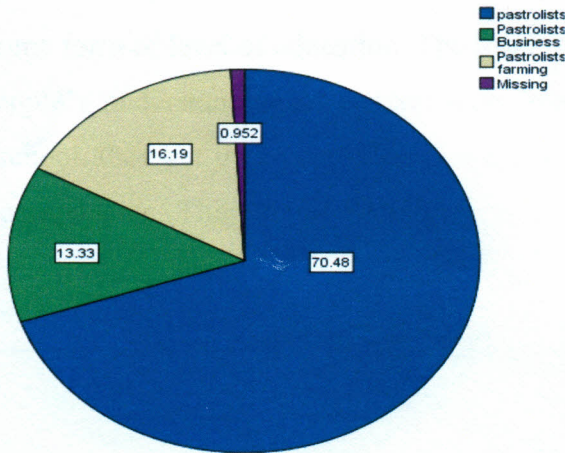


Figure 5: Occupation of the respondents

Source: Research data

Figure 5 above shows that the majority of this population (70.40 percent) practiced pastoralism as the only economic activity while 16.19 percent practiced both pastoralism and farming. The remaining 13.33 percent said they practiced a combination of both pastoralism and business. This means that all respondents kept livestock. Diversification to other economic activities came as a result of the desire to supplement livestock keeping since predation and other natural calamities such as pestilences and drought increased the risk of loss of livestock. This change can also be attributed to the influence people from other cultures have exerted on the local community. Non-Maasai communities living in the area were not pastoralists but practiced such economic activities as agriculture, business as well as quarrying. The gradual changing from pastoralism to other forms of economic activities has a serious impact on conservation. This is because most land-use practices are likely to be incompatible with wildlife conservation due to their contribution to increased conflict habitat destruction and crop raiding.

The study assumed that the community largely consisted of illiterate people but the findings do not support such an assumption. Figure 6 shows that only 27.62 percent of the sampled population never went to school while another 31.43 percent had attained at least primary education. A proportion (27.62 percent) of the sampled population had attained secondary education while the remaining 13.33 percent had attained tertiary education. This means that at least 72.38 percent of the sampled population

has attained some form or level of education. The level of education is likely to have a bearing on people's understanding of conservation issues. It is expected that when people go to school, they get the opportunity to learn about and appreciate nature, its systems and components. This would work well to improve people's tolerance for wildlife.

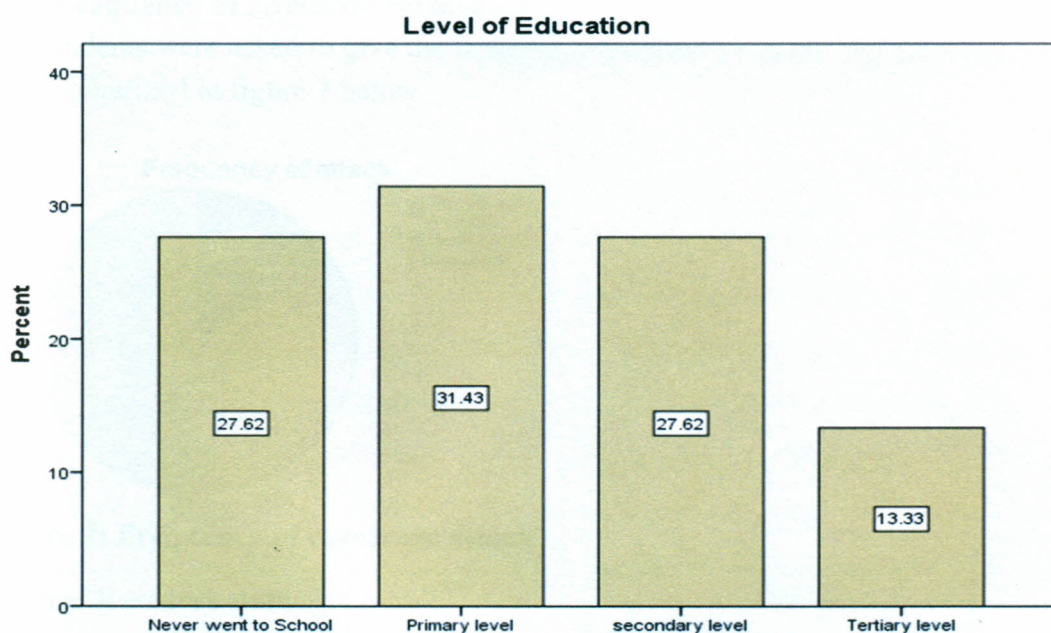


Figure 6: Level of education of respondents

Source: Research data

Over 95 of the sampled population had stayed in the study area for more than ten years. This had a bearing on peoples' understanding of the HWC. Most of the respondents were born and raised in the area. They had lived with the conflict in question all their lives. Only less than 2 percent of this population had stayed in the area for between 1-5 years. These people probably moved to the study area from other areas or they were married there. This assumption was reached since all individuals in the sampled population were over eighteen years of age and hence could not have been born in the previous one to five years.

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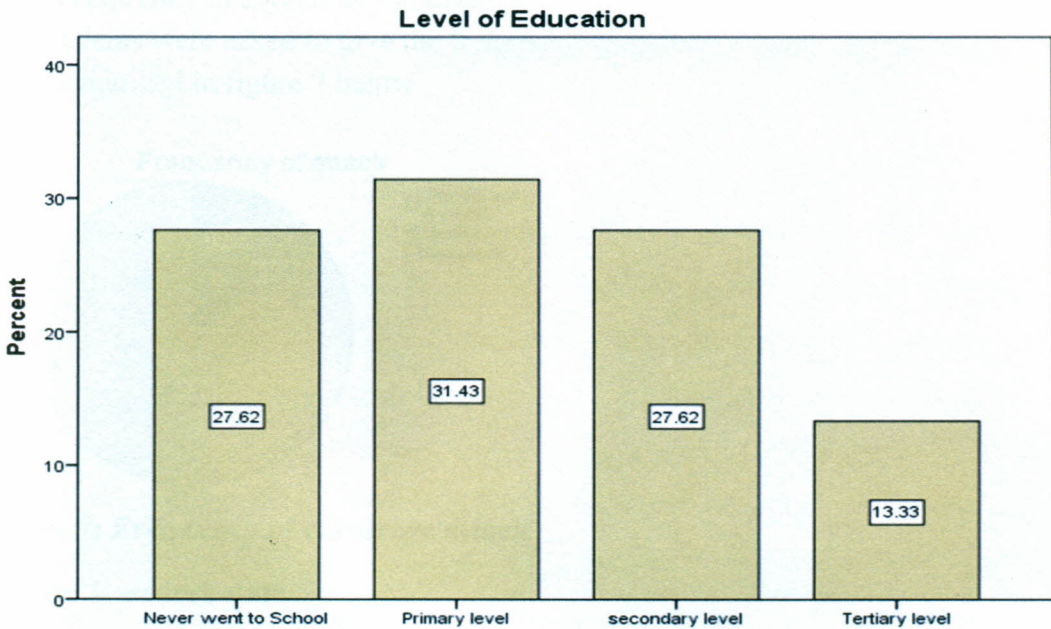


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4.3 Invasion by carnivores

The nature of carnivore attack on livestock varies from one species to another. In this section, the frequency of carnivore attack on livestock and the common invaders are considered.

4.3.1 Frequency of attack by carnivores

Respondents were asked to give the frequency of carnivore attack and their responses are summarized in figure 7 below.

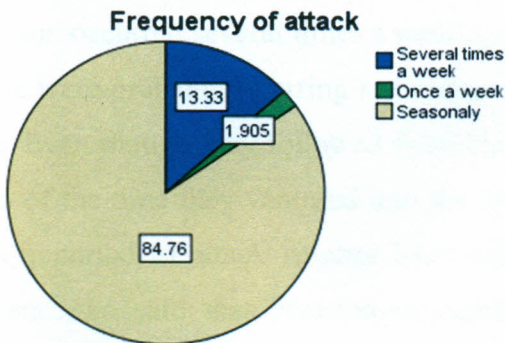


Figure 7: Frequency of carnivore attack

Source: Research data

Results on the frequency of attack show that most of the attacks occurred seasonally. Out of the total sample size, 84.76 percent said that carnivores invaded livestock during the wet season. The area experiences two wet seasons between the months of April and May, and November to December. However some of the respondents interviewed at NNP said that due to climate change, the seasons have changed and cannot be determined with precision. During the wet seasons grass grow tall in the park which makes herbivores to move out since tall grass increases predation risk. Herbivores usually feed where they are able to see around to keep alert in case of any approaching predator. Since most carnivores hunt by ambushing their prey, tall grass provides good hiding conditions with great chances of success. As a result most herbivores move out of the park during wet season as an evolutionally adaptation to avoid predation. Carnivores have also evolved to follow them out of the park. When outside the park, livestock provide easier prey for them.

Livestock are easier prey mainly due to three reasons; they are kept in enclosures hence cannot run away, they are physically weaker compared to wild herbivores and have not developed evolutionary adaptations against predation. The population of resident wild herbivore had decreased in the study area according to 66.7 percent of the respondents (see figure 19 in this text), making livestock an alternative prey for predators. This makes the carnivores to turn on them hence triggering a conflict with pastoralists.

Invasion occurred several times a week according to 13.33 percent of the respondents. These were probably referring to hyenas which were said to be common in the study area. Even though they followed lions closely in order to benefit from their hunting, most of the time they ventured into the villages alone regardless of the season. They were reported to attack smaller livestock such as the sheep and goats. The 1.905 percent who said that invasion occurred once a week was probably referring to invasion by hyenas due to confusion between daily attacks and weekly attacks. The variation in the responses is an indication of the fact that the various carnivores did not invade in the same manner. However, attack by lions left the greatest impact making the respondents to mostly refer to the seasonal attacks in their responses. It was difficult to determine the frequency at which the leopards and cheetah attacked due to their cryptic behaviours. Figure 7 above shows the frequency at which respondents said carnivores were invading livestock.

4.3.2 Common invading carnivores

Respondents gave various species as the common invaders in the area. Table 1 below gives a summary of their response.

Table 1: Summary of common invaders at Kitengela

	Lion	Hyena	Leopard	Cheetah	Jackal	Wild dog
Male	80%	75%	60%	25%	5%	8%
Female	21%	17%	13%	9%	1%	3%
Percentage	96	87.6	69.5	32.4	5.7	10.5

Source: Research data

The results show that 96 percent of the respondents mentioned lions as the common invaders while 87.6 percent mentioned hyenas. However, it was expected hyenas to be mentioned as the most common predators because they were more frequent in invasion than lions. Their invasion did not depend on seasons. Most respondents mentioned lions as the most common probably because of the intensity of the impact they left behind even though they did not attack as frequently as hyenas. This was similar to Lagendijk and Gusset (2008) who found out that lions were thought to be the most abundant, best known predators and most often held responsible for killing livestock around the greater Krugger area in South Africa.

Leopards were mentioned by 69.5 percent of respondents and cheetahs, African hunting dogs (wild dogs) and jackals being mentioned by 32.4 percent, 10.5 percent and 5.7 percent respectively as shown in table 1 above. The cumulative figures representing these findings exceed hundred percent because in some cases some respondents mentioned more than one carnivore as a common invader. These results indicate that the six types of carnivores were the ones causing problems in the study area. Lions caused most devastating impacts while hyenas were the most common predators in the area. Leopards also caused significant impacts since 69.5 percent of the respondents mentioned them as among the common invaders. Some respondents narrated how the situation was when lion invaded. They could keep on coming back throughout the night until they managed to snatch away livestock. Sometimes a lion could crouch and hide among livestock and maul one of them away after people went back into their houses.

All these animals with the exception of the wild dogs were believed to originate from Nairobi National Park. There were no wild dogs in the park hence those causing problems in the villages were believed to come from the neighbouring Ngong hills. Although there were resident cheetahs and leopards outside the park, it was difficult to sight them or even monitor their impacts on the community livelihoods. This is because of the difficult with sighting them since they hide from people. A leopard for instance could stay in a village and kill livestock several times without being noticed

by anybody. This probably explains the reason why there were no incidences of retaliatory killings against leopards.

4.3.3 Order of attack from most to least invader

The findings on the order of attack showed that 41.9 percent of the sampled population felt that the lion, hyena, and leopard followed each other in that order. Another 26.7 percent of the sampled population said that hyena, lion and leopard in that order. However, 17.1 percent of this sampled population felt that only hyena and lion invaded livestock in that order. These results simply confirm that lions and hyenas were the most common invaders whichever the order of invasion. It should be noted that most of the respondents had difficulties telling whether leopards or cheetah or both attacked their livestock. This is because of the close semblance between the two carnivores. However, assessing from the way they described the attack and the way they erected the predator proof chain-link fences, it was clear that leopards were more common than cheetahs. This conclusion was reached because some corrals were covered in all sides including the top. Such fencing is used against leopards because of their ability to climb over fences.

Most of the respondents also hinted that hyenas always followed lions in order to benefit from their hunting the probable reason for both of them being mentioned as the most common. Management or reduction of the rate of invasion by the two groups of animals could go a long way in managing the human-wildlife conflict in this area. Invasion by leopards was difficult to manage because of their ability to attack unnoticed and their arboreal skills. It was observed that carnivores especially the lions and leopards were able to penetrate through very small spaces hence the need for properly maintained enclosures at all times.

4.3.4 Livestock attacked

Several species of livestock were found to be attacked by carnivores even though some were attacked more than others. Figure 8 below gives a summary of the findings. Livestock attacked included cattle, sheep, goats, donkeys and dogs. Cattle were the most attacked according to 80 percent of respondents. This is probably

because lions which left most serious effects like hunting big sized livestock such as the cattle. Those who said that sheep were the most attacked constituted 18 percent of the respondents. They had this view probably because there were a variety of predators ranging from lions, to leopards, cheetah wild dogs and hyenas which attacked sheep. Population of sheep was the highest in the study area as compared to the other types of livestock (see table 7 in this text). In some cases, it was observed that sheep were left in the fields unattended by anybody since they did not wander as far as other types of livestock. This was the likely reason why sheep could be an easy target by predators.

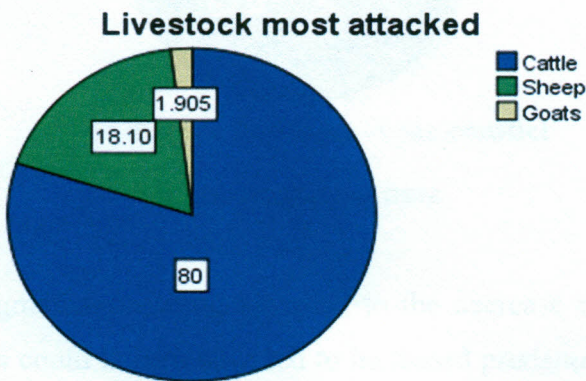


Figure 8: Livestock most attacked

Source: Research data

A small proportion of respondents (1.905 percent) mentioned goats as the most attacked. This proportion is small probably because as table 7 shows, the population of goats in the study area was small. Majority of sampled population preferred keeping sheep to goats. This is because goats were considered destructive and tended to wander far when compared to sheep. As a result, the sampled population had many sheep than goats, see table 7 in this text.

4.3.5 Trend of the conflict

Most of the respondents at 48.6 percent felt that the conflict had reduced. They argued that fencing around bomas (livestock corrals), killing of carnivores and land fragmentation led to reduction in the rate of predation and hence reduced conflict. Some people thought that probably herbivore population in the park had increased

while others admitted they did not know why the conflict had reduced. Fencing of bomas could have reduced predation if the fence used was predator proof. The chain-link fence in particular could provide good results if designed to prevent all common predators.

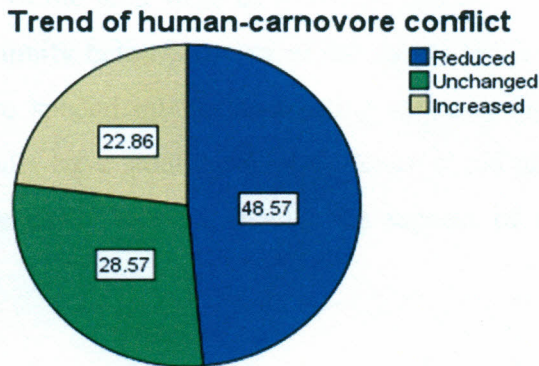


Figure 9: Trend of the conflict

Source: Research data

Land fragmentation could have led to the decrease of herbivore populations in the area. This could in turn have led to increased predation on livestock as an alternative prey. It was not still clear why people associated killing of carnivores with decrease in depredation. The answers, however, indicated that killing of carnivores and land fragmentations were common in the area. Some 22.9 percent of the respondents said that the conflict had increased while the remaining 28.6 percent said that it has not changed. The two groups associated this trend to the lack of cooperation from the Kenya Wildlife Service officers. They argued that lack of cooperation was manifested in the response speed when they reported cases of carnivore invasion and lack of appropriate compensation policy. These factors affected the way local community treated the invading carnivores.

4.4 Conflict management strategies employed in the study area

The local community in the study area employed several strategies in an attempt to reduce the impact of the human-wildlife conflict. The common strategies observed across the several villages studied included, use of dogs, fencing around bomas and taking care of livestock while out in the grazing fields. This section looks at the

effectiveness of each of these strategies together with those used by other stakeholders such as KWS and NGOs.

4.4.1 Livestock guarding dogs

The findings of the study show that 100 percent of respondents kept dogs. However, all the dogs kept in the area were of the local breeds. This means that none of the dogs in the community belongs to any of the exotic livestock guarding breeds. These dogs did not have special quality or training to guard livestock against carnivores. Local breeds usually have small body sizes hence could not scare any carnivore. This factor might have easily worked against the success of dogs in guarding livestock against predation.

As figure 10 shows, majority of the sampled population at 95.2 percent, however, said that dogs helped in reducing livestock predation by carnivores. This strongly supported the reason as to why all the respondents kept dogs. Those who agreed that dogs could help reduce predation mentioned barking as a way dogs were helpful. By barking, dogs were able to alert people of the presence of an invading carnivore. The sound produced by the dog could suggest the type of invader. For example when a dog howled very close to the door it was an indication that a lion was present or approaching. This is because the presence of a lion or lions in the compound was so devastating to dogs that if people did not arrive early enough, the dogs disappeared from that compound for several days. Dogs could only come back to the homestead several days after invasion. They barked when hyena and other small predators were approaching. Hyenas could turn away at the barking of dogs unlike the lion and leopards. Only 4.8 percent of the respondents said that dogs could not reduce predation. They probably meant that dogs could not resist big carnivores like lions and leopards. Dogs are good prey to leopards and would run away as any herbivore runs away from a carnivore predator. Lions would kill a dog that disturbs by barking at them as they hunted since they treated it as a nuisance.

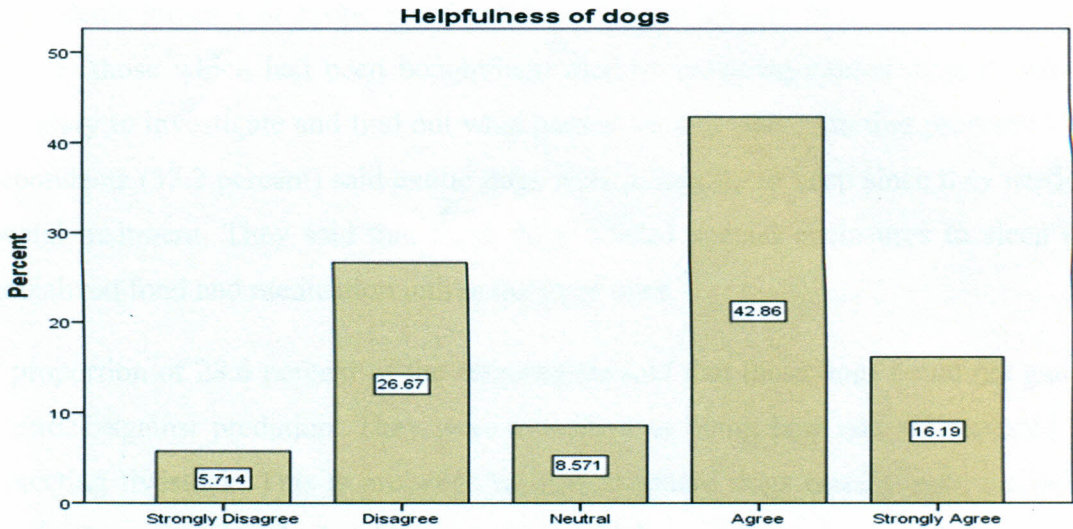


Figure 10: People's perceptions on the helpfulness of dogs

Source: Research data

On whether dogs were effective in preventing predation, 5.7 percent of respondents strongly disagreed, 26.7 disagreed while 8.6 were neutral meaning that they did not make their responses known. The remaining 42.9 percent agreed that dogs were effective while 16.2 percent strongly agreed. These results show that even if the respondents were aware that dogs could not resist carnivores, they still valued and considered them as being important in managing human-wildlife conflict.

Table 2: Reasons for not keeping exotic livestock guarding dogs

Response	Frequency (n=105)	Percentage (%)
Expensive	62	59
Liability	39	37.2
Cannot guard livestock	30	28.6
Not available	5	4.8
Total	136	129.6

Source: Research data

On the reasons for not keeping exotic livestock guarding dogs, 59 percent said they were expensive (table 2). However, on interrogating them further, some of the

respondents hinted that exotic breeds of dogs did not survive in the area. They said most of those which had been bought then died of unknown causes. It is therefore necessary to investigate and find out what caused such deaths. Another proportion of respondents (37.2 percent) said exotic dogs were a liability to keep since they needed special treatment. They said that these dogs needed special enclosures to sleep in, specialized food and medication unlike the local ones.

A proportion of 28.6 percent of the respondents said that these dogs could not guard livestock against predation. They were described as being lazy and disinterested in protecting livestock. This is probably because shepherd dogs usually need a special training as opposed to the local breeds of dogs. Unless such training is provided, these dogs are unlikely to be effective. A small proportion of 4.8 percent gave unavailability of these breeds of dogs in the study area as a reason why they did not keep them. The reason for non-availability could relate to the fact that these dogs, are expensive, unable to protect livestock or simply because they did not survive in the area. The cumulative percentage exceeds hundred because some respondents gave more than one option as the answer for not keeping the livestock guarding dogs. It could have been important to try any strategy and see what effect it could bring to the management of this conflict.

As table 3 shows, majority of the respondents (41 percent) had between 3 and 4 dogs, while 37.1 percent had between 5 and 6 dogs. Nineteen percent of them had between one and two dogs and the remaining 2.9 percent had more than 7 dogs. The number of dogs per homestead varied probably depending of the ability of the owners to feed and maintain them. Those who kept many dogs probably wanted to enhance their ability to protect livestock against predation. It was also observed that dogs fell sick and died of unknown diseases. Since the study area had a wide variety of wild animals, it is possible that some of these diseases were transmitted to dogs from wildlife. This probably is another reason why respondents kept many dogs so as to replace those which died due to diseases or killed by wildlife.

Table 3: Number of dogs per homestead

Response	Frequency (105)	Percentage (%)
Between 1-2	20	19
Between 3-4	43	41
Between 5-6	39	37.1
Above 7	3	2.9
Total	105	100

Source: Research data

4.4.2 Fencing of Nairobi National Park

There is much debate on whether or not Nairobi National Park should be fenced all round and wildlife kept in the park as a strategy for minimizing this conflict. As figure 11 below shows, 16.19 percent of the respondents strongly disagreed that the park should be fenced all round and another 20.95 percent simply disagreed. This makes a total of 37.14 of the respondents who did not favour the fencing of Nairobi National Park. They agreed with most ecologists and conservationists that fencing of the park would be inappropriate since it is too small to sustain all the animals. Lindsey *et al.* (2012), for example say that fencing makes animals to compete for limited resources. This park is only 177 km², which is considered too small in providing all the ecological requirements of wildlife to be fenced. Fencing it would turn it into a zoos and this would have negative impact on tourism and wildlife. Tourists leave their countries because they want to see animals in their natural settings since those in their countries are in zoo. It therefore will not make much difference for them to leave zoos in their countries and come to visit zoos in our country.

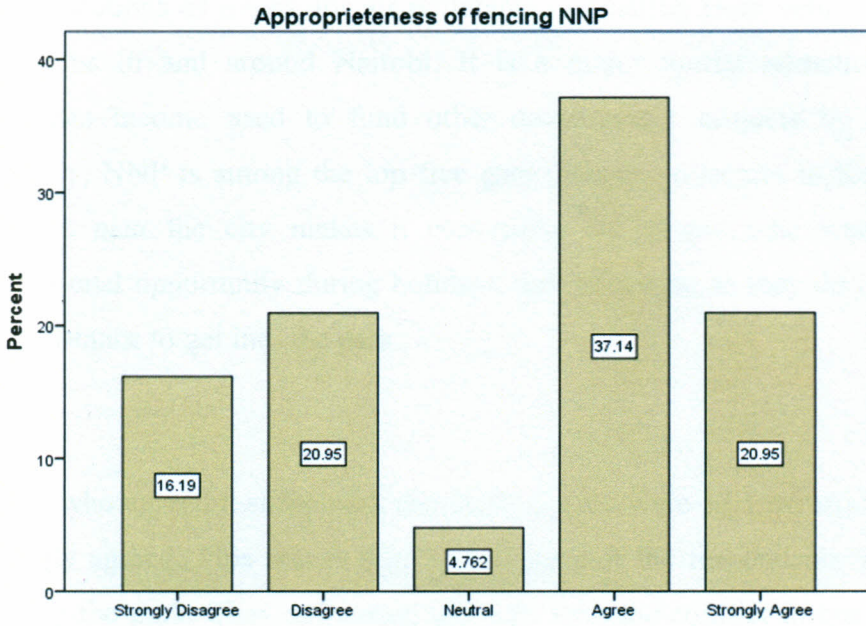


Figure 11: People's perceptions on the appropriateness of fencing NNP

Source: Research data

Some animals are permanent residents outside the park and fencing the park would mean driving all of them into the park first. This would likely cause two main problems; first, it would weaken the genetic vigour of wildlife which was sustained by the cross-breeding that took place between wildlife in and outside the park more especially the herbivores. Secondly, some animals such as the wildebeests have their breeding ground in the Kitengela area at a place called Isinya, and hence they would be prevented from accessing this area. Those who were opposed to the fencing of the park, however, did not give ecological reasons to support their argument. They instead said that the park is important for them because that is where they feed their livestock during the dry season. They grazed their livestock in the park at night to avoid being noticed by KWS officers because it was illegal for them to do so. They also watered their livestock at the Mbagathi River, which forms the boundary between the park and community land, during the same dry spells. They feared that fencing the park would deny them access to these two critical resources. Since this river forms the boundary between the park and the community land, they argued that if fencing will ever take place, then it must be done on the side of the park so that their access to the water of Mbagathi River is ensured. Some of those opposed to the proposal of fencing the park cite the benefits associated with the park.

NNP functions as a sink for air pollutants originating from vehicular and industrial emissions in and around Nairobi. It is a major tourist attraction facility which generates income used to fund other development projects by the government. Actually, NNP is among the top five gate revenue collectors in Kenya. Besides, its location near the city makes it convenient for people who want to have some recreational opportunity during holidays and weekends as they do not need to travel long distance to get into the park.

Those who agreed that the park should be fenced were 37.1 percent while 21 percent strongly agreed. This means that 58.1 percent of the respondents were in favour of fencing the park. They associated the park with the conflict in question and believe that its fencing is the only permanent solution to the problem. They argued that they were not allowed to feed their livestock in the park and yet their land teemed with several types of wildlife. Those in support of the idea argued that it was the only option remaining and the sooner it happened, the better. Even Coggan (2006) and Walpole *et al.* (2003) identified fencing as the single most important method of conserving biological diversity. Some parks in Kenya have been fenced as a strategy of reducing human-wildlife conflict. Fencing of the Mara National Game Reserve as a HWC management strategy was highly favoured by respondents in Transmara, Kenya (Nyamwaro, 2006). Some of the key informants argued that this conflict would lead to extermination of carnivores especially the lions, leopards and cheetahs and hence the park should be fenced to preserve those already remaining. They argued that since the park is small in size, population control procedures would then be employed to keep the numbers at optimal levels without exceeding the carrying capacity of the park. This would, however, require proper scientific research for some territorial animals like lions in order to establish their ranges and the number of them the park would support. Culling would be necessary as well as research on the implication of relocation of wildlife to other areas in the event the carrying capacity of the park is exceeded.

Some respondents (4.8 percent) remained neutral on the question whether the park should be fenced or not. This means that they did not make their responses known. This is probably because they feared that there might be consequences if they made their opinions known as some had suspicion that the researcher was KWS agent. It was observed that people have a very big apathy towards the government and specifically KWS. Most people did not want to participate in filling the questionnaire because they thought it was a KWS project.

On the consequences of fencing the park, majority of the respondents (42.9 percent), as figure 12 shows, said that there would be no consequences if the park was fenced. This again is clear indication that most of the community members prefer the fencing of the park. They did not visualize the benefits and disadvantages of fencing the park as discussed above. Others at 36.2 percent said that the only effect of fencing the park was the loss of the opportunity to graze livestock in the park during dry spells. This shows that most of the respondents and even community members did not value wildlife as much as they did their livestock. The effect of this is that if wildlife is to be spared, the security of livestock and the community's livelihood in general will have to be secured. Only 3.8 percent of the respondents said that fencing of the park would reduce the conflict. This is probably so because wildlife would be kept inside the park and hence people's livelihoods would be secured. However, it should be noted that it is difficult to contain such animals as the leopards simply by erecting a fence since they are able to climb over fences. Hyenas on the other hand can dig tunnels underground and sneak out of the park. Some respondents (4.8 percent) appreciated the fact that the park is too small to be fenced and said that wildlife would starve in case the park was fenced. This is an indication that not all community members are ignorant of the ecological consequences of fencing the park. Interestingly, 12.4 percent of the respondents did not comment on the consequences of fencing the park. This again probably is either because they surely did not know or they feared disclosing their views.

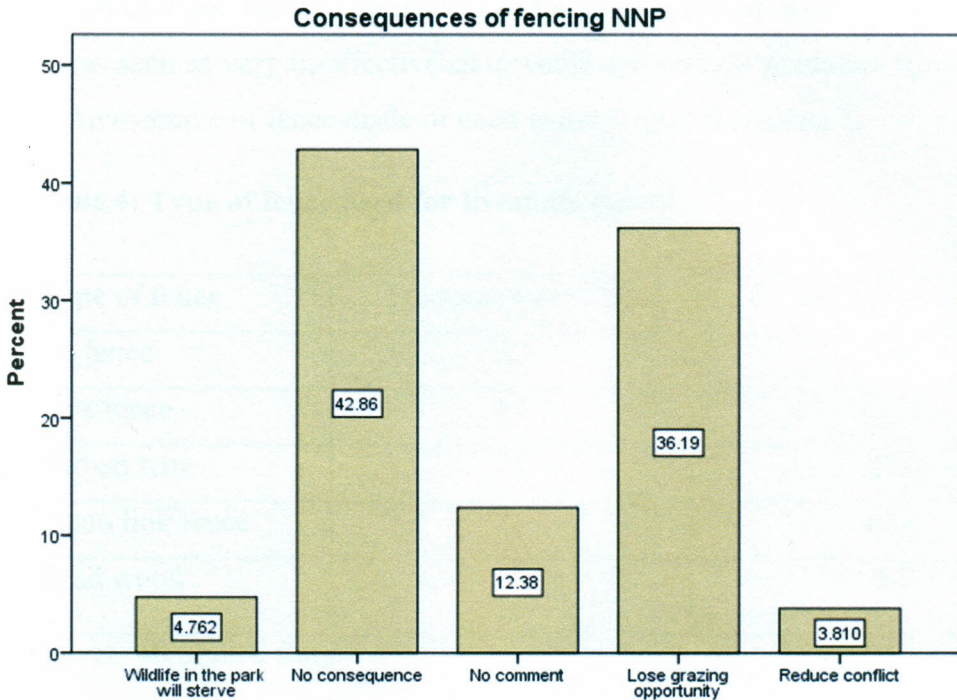


Figure 12: Consequences of fencing NNP

Source: Research data

4.4.3 Fencing around homesteads and bomas

Majority of the respondents had either one type of fence or a combination of several fences of the fences in table 4 below. Only less than 2 percent of the respondents did not have a fence around their homesteads. The most common fences observed include; barbed wire fence, live fence and the chain-link fence. Of the total sample population, 54.3 percent had live fences either around the homestead or livestock boma. Live fence consisted of a variety of thorny vegetation types planted around the boma. This particular fence was not very effective when used alone since it was not predator proof. This probably explains why it was in most of the cases reinforced with other types of fences. A proportion of 67.6 percent of respondents had barbed wire fence and a similar percentage had chain-link fence. These proportions were equal probably because chain-link fences were always reinforced with barbed wire fence. This was a common observation across the study area. Generally, the two types of fences were the main fences observed across the study area. They were also used in land partitioning an activity that was commonly observed across the study area. A

proportion of 7 percent of respondents had a fence made of dead wood. This type of fence was seen as very in-effective as it would not prevent predators from entering a boma. An example of fence made of dead wood is shown on plate 1.

Table 4: Type of fence used for livestock corrals

Type of fence	Frequency (n=105)	Percentage (%)
No fence	2	1.9
Live fence	57	54.3
Barbed wire	71	67.6
Chain link fence	71	67.6
Dead wood	7	6.7

Source: Research data

As figure 13 below shows, 3.8 percent of the respondents said the type of fence they used was very ineffective while 35.2 percent said it was ineffective. This means that 39 percent of the respondents believed that the fence did not help much in reducing predation. Majority of respondents at 46.7 percent said the fence used was effective while 7.6 percent said it was very effective. The 54.3 percent who believed that fence was useful explain probably the reason why different types of fences were a common phenomenon. Elsewhere, Ogada *et al.* (2003) also found that the rate of depredation decreased when livestock was kept in well secured corrals. Hemson (2003) also note that livestock availability to carnivores can be reduced by building enclosures for livestock that did not allow lions to enter or leave when panicked. However, Thavarajah (2008) found out that as much as physical barriers are important, they are not 100% effective in preventing predation. As such, they need to be combined with other strategies like good livestock husbandry.

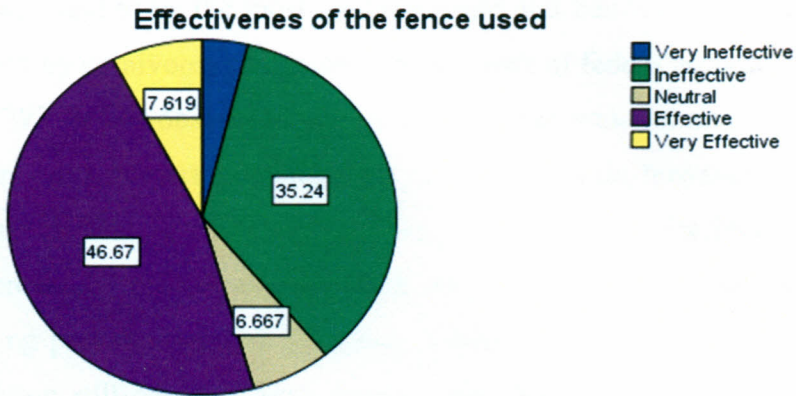


Figure 13: Effectiveness of the fence used

Source: Research data

The fence in plate 1 below shows a boma made of wood and off-cuts where livestock spend the nights. Unless people kept watch through the night, it could not prevent predation because it was not predator proof. In any case, such fence facilitated predation since livestock could not escape in case a predator came. Carnivores usually frightened livestock to cause a stampede resulting in them either jumping over the fence or breaking through it. This exposed livestock to predation because the surrounding area in most cases was bushy. This explains the reasons why it was necessary to erect not only predator proof but very strong fences.



Plate 1: A boma fenced using dead wood

Source: Author

Chain-link fence was said to be the most predator proof and hence most effective in preventing predation by carnivores compared to other types of fences according to the key informant at TWF. It was observed that this type of fence was common across the study area. In figure 14, a proportion of 4.8 percent of respondents, however, said that this fence was very ineffective while 16.2 percent said that it was ineffective. This means that 21 percent of the respondents held the view that this fence was not effective in reducing predation against livestock. Such results were probably due to the fact that predation still occurred even though chain-link fence was in place. A majority (58.1 percent) of the respondents said that this fence was effective, while 11.4 percent rated it very effective. This means that 69.5 percent of the respondents believed that this type of fence was useful in reducing predation. This probably explains why this fence was very common in the study area either singly or in combination with other types of fences. Even if carnivores caused a stampede among livestock, it became difficult for them to jump over or break through. This means that the only way carnivores could succeed in killing livestock was by getting into the boma. Some 9.5 percent of the respondents did not give their views on the effectiveness of the chain-link fence.

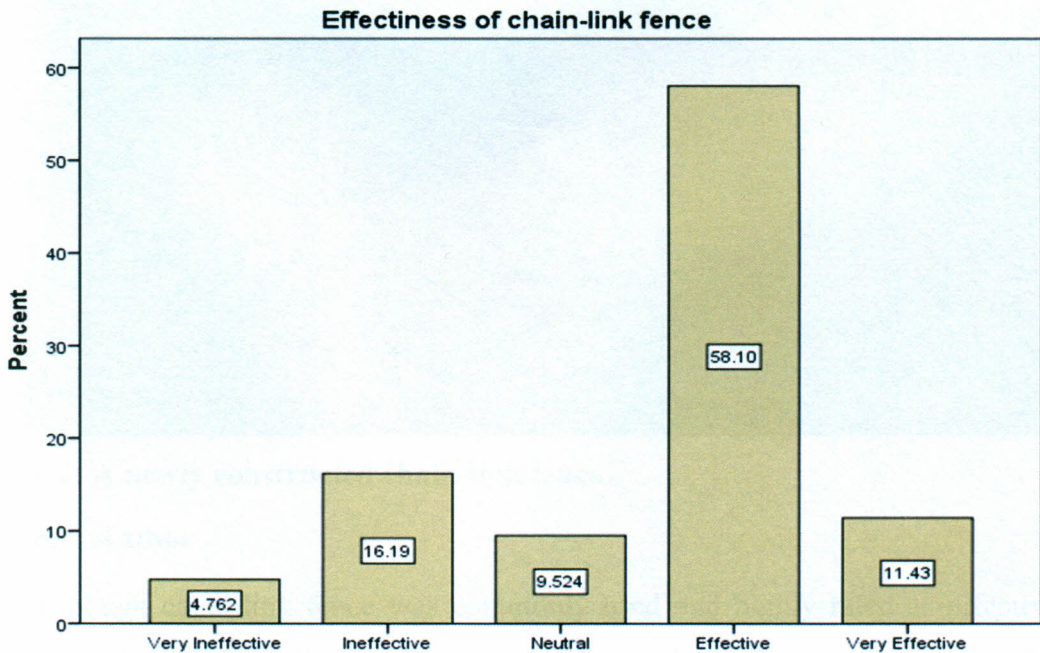


Figure 14: Effectiveness of chain-link fence

Source: Research data

The effectiveness of chain-link fence as a predator proof fence depends on how it is erected. Different carnivores have different styles of getting their ways into the boma. The lion and leopard, for example, can pass through a small opening. All they require is an opening big enough for their heads to penetrate and the rest of the body will go through. This means that fences need to be properly maintained. Lions again can jump over a fence that is nine foot high. Fencing against lion therefore requires fences which are more than nine foot high, however, as plate 2 shows, that was necessarily not the case. Some respondents explained how they erected double strands of this fence because lions could not jump over two chain-link fences close to each other. The leopard has the ability to climb fences and as such will require a fence covered in all sides including the top. Those predators which can dig underground to get into bomas, like the hyenas, require a fence with a foundation reaching underground



Plate 2: A newly constructed chain-link fence

Source: Author

Even though chain-link fence was commonly used and highly rated as effective in protecting livestock against carnivores, it had some disadvantages as shown in figure 15, next page.

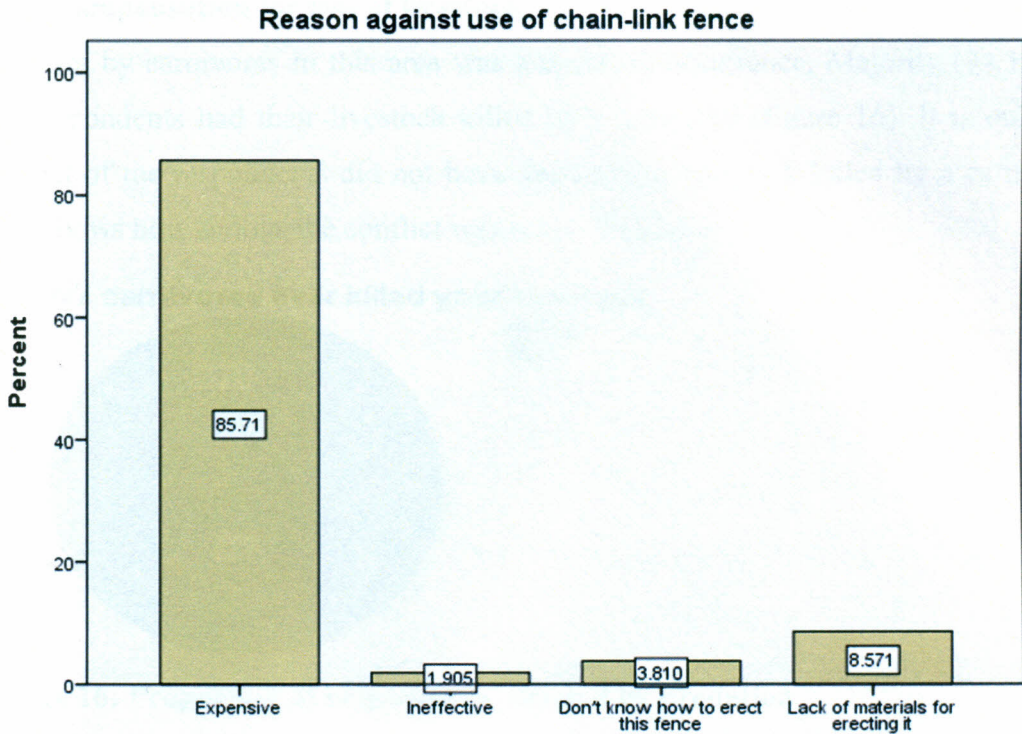


Figure 15: Reasons against use of chain-link fence

Source: Research data

The cost of erecting chain-link fence was the most significant disadvantage as 85.7 percent of the respondents said that it was expensive to erect. Only 1.9 percent of the respondents gave ineffectiveness as the disadvantage of the fence. These are those who had probably lost hope of this conflict ever coming to an end. They did not see that having a chain-link fence around their homes would resolve the conflict altogether. Some 3.8 percent of respondents said they did not know how to erect this fence. This is a clear indication that they had not used the fence before and that it was expensive to erect it. If lack of expertise was the issue, they could have hired experts to do the job. Even the 8.6 percent of the respondents who said that they lacked materials for erecting the fence simply meant that it was expensive to buy materials needed to erect the fence. Although the use of this fence should be implemented across the entire Kitengela wildlife dispersal area, it might lead to more land land fragmentation and blocking of the wildlife migratory corridors.

4.4.4 Compensation for loss of livestock

Invasion by carnivores in this area was a common occurrence. Majority (94.3%) of the respondents had their livestock killed by a carnivore (figure 16). It is only 5.7 percent of the respondents did not have any of their livestock killed by a carnivore. This shows how serious the conflict was in the study area.

Have carnivores ever killed your livestock

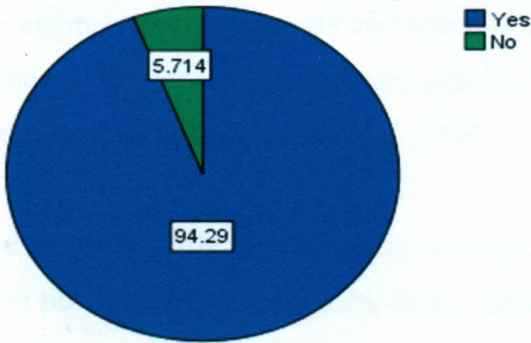


Figure 16: Proportion of respondents affected by predation

Source: Research data

Table 5: People's responses on whether they were compensated

Response	Frequency (n=105)	Percentage (%)
Yes	9	8.6
After a long time	23	21.9
None	73	69.5
Total	105	100

Source: Research data

Compensation to pastoralists for predation on livestock was a contentious issue in the study area. Even though the government through KWS maintained that it compensated for any livestock lost through predation, the effect of such compensation was not felt on the ground. Table 5 above gives a summary of how respondents viewed compensation on livestock loss. Out of those whose livestock had been attacked by carnivores, 8.6 percent said that they were compensated with 21.9 percent saying that compensation came after a long time of waiting. A majority of respondents (69.5 percent) said that they were never compensated. The same views

have been expressed by respondents in Transmara, Kenya (Nyamwaro, 2006) The proposed Wildlife Conservation and Management Bill of 2012 was yet to be passed into law by the time of doing this research. This means that those whose livestock was killed had to wait for some time to be compensated since compensation policy as spelled out in the proposed bill was yet to be in place. By the time this research was conducted, the old system of compensating locals had been stopped due to claims of abuse engineered by claimants and some KWS officials according to one of the key informants. If properly carried out, compensation can help to reduce the negative consequences of HWC (Nyhus *et al.*, 2005).

In the draft Wildlife Conservation and Management Bill 2012, compensation of amount not exceeding one million Kenya shillings was proposed if wildlife injures or kills a person or destroys property. As summarized in figure 17, 39 percent said that this move was acceptable while 5.7 percent said it was highly acceptable. Those who said that it was slightly acceptable stood at 12.4 percent. Therefore, those who answered positive to this question stood at 57.1 percent. Rodriguez (2006) recommends compensation as one way that can increase people's tolerance towards wildlife. If people's tolerance towards wildlife is increased then the conflict is likely to decrease.

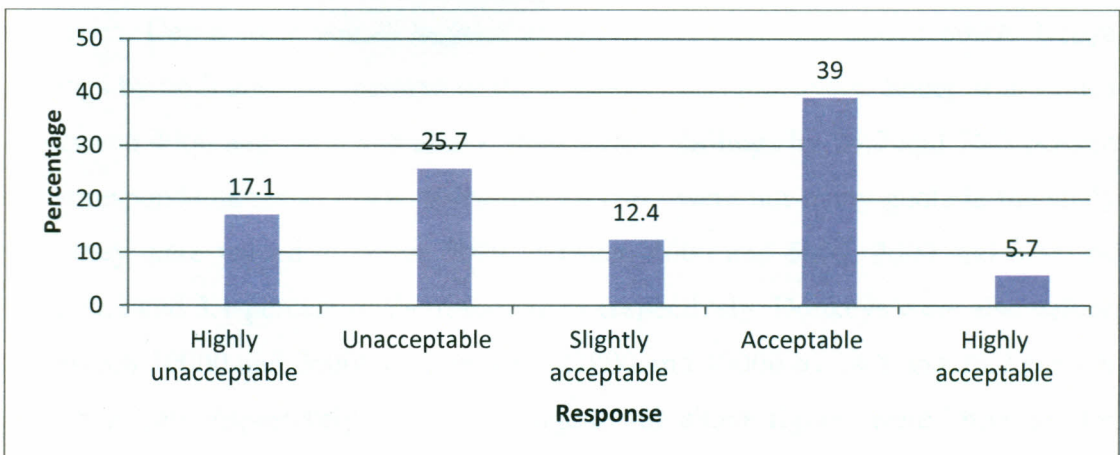


Figure 17: Respondents' views on the proposed compensation rates

Source: Research data

The remaining proportion of respondents answered in the negative with 17 percent saying it was highly unacceptable and 25.7 percent saying it was unacceptable. Those who answered in the positive, however, doubted whether the government would actually pay. Their doubt was based on the fact that there was a stringent procedure in making the compensation claims and mistrust on government promises. Claimants were required to prove without any doubt that wildlife indeed killed livestock, injured or killed people or destroyed crops. They were also required to prove that they took all steps possible to prevent invasion by wildlife. The respondents who answered in the negative argued that the value of human life could not be adequately compensated in monetary terms. They said that human life or their body parts could not be bought in shops. These findings were consistent with what Parry and Campbell (1992) found out concerning rural communities' opinion on government motives. They were distrustful of government motives and had poor opinion of the department of wildlife and national parks. There is need for the government and other stakeholders to think of insurance schemes and paying insurance premiums towards livestock predation cover. This strategy according to Blanco (2003) has been successful in other places of the world.

In determining the acceptable amount of compensation, respondents were asked to give the monetary value of their livestock. Table 6 gives the summary of their responses. Cattle were valued highest at 41000 to 60000 and above 60000 Kenya shillings by 66.3 and 33.7 percent of the respondents respectively. Sheep was valued at between 4000 and 5000 and above 5000 Kenya shillings by 23.7 and 76.3 percent of the respondents respectively. Even though there were not many goats in the study area, they were valued at above 5000, between 4000 and 5000, 2000 and 3000 by 66.7, 30.2 and 3.1 percent of the respondents respectively. Donkeys were also valued at between 10000 and 20000 and between 21000 and 40000 by 74.8 and 25.2 percent of respondents respectively. The knowledge of the above figures were important for the government and all those involved in conservation in determining the right amount to give while compensating for each type of livestock lost. However, determining loss and compensation values can be challenging because the values of livestock (or crops) may vary with age, size or productive status (Nyhus *et al.* 2005). They also recommend that compensation programmes must ensure that local people

are part of the overall management of the problem and participate in determining what constitute appropriate compensation.

Table 6: Acceptable amount of compensation for livestock loss

Livestock	Acceptable amount of compensation (Ksh.)	Percentage (%)
Cattle	41000-60000	66.3
	61000 and above	33.7
Sheep	4000-5000	23.7
	Above 5000	76.3
Goat	2000-3000	3.1
	4000-5000	30.2
	Above 5000	66.7
Donkey	10000 20000	74.8
	21000-40000	25.2

Source: Research data

As figure 18 below shows, most of the respondents (82.9 percent) preferred to be compensated in cash. Another 14.3 percent preferred compensation in terms of both cash and livestock and 2.9 percent preferred livestock as a mode of compensation. Those who preferred cash argued that they did not trust the government as it could give them unworthy livestock. They therefore preferred receiving money so as to buy livestock on their own. This is another indication of the glaring mistrust the local community had on the government.

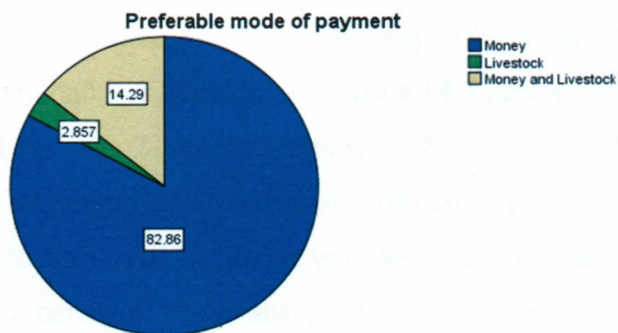


Figure 18: Preferred mode of compensation

Source: Research data

There was a mixed feeling on the effect of compensating the right amount of money to people on their reaction to carnivores. Some respondents at 58.9 percent felt that the move would not change the way they treated carnivores, while 41.9 percent said that it would lead to them not to retaliate against invading carnivores. Those who felt that their reaction would not change maintained that they could not withstand a situation where carnivores killed their livestock no matter how much money they were compensated. They said that sparing the carnivores would encourage them to come again and again which might have led to them losing more livestock. Compensation actually is a method for increasing people's tolerance for a problem and not a method of preventing the problem from occurring (Hemson, 2003).

4.4.5 Livestock husbandry

The data on livestock husbandry was used to assess the relationship between the way livestock was cared for and the trend of predation. Respondents answered questions on the number of livestock per homestead and the risk of attack between small and large herds of livestock. They also gave data on their preference in reducing the size of their livestock and the number of people attending livestock to pastures and watering points.

4.4.5.1 Number of livestock per homestead

Livestock found in the study area included cattle, sheep, goats and donkeys. Table 7 gives the summary of the number of each species of livestock per homestead visited. The study found out that hundred percent of the respondents owned cattle. A small proportion of 6.7 percent had less than 10 cows while 14.3 percent had between 10-20 cows. Those who had between 21 and 50 cattle were 22.8 percent while 38.1 percent and 18.1 percent had between 51-100 and above 100 cows respectively. Sheep were also found in every homestead visited. Those with less than 10 sheep were 3.8 percent while 5.7 percent had between 10-20 sheep. Another group of 13.3 percent had between 21-50 sheep, 31.4 percent had between 51-100 sheep and 45 percent had above 100 sheep. Goats were not as many as either sheep or cattle. Most of the

respondents (48.6 percent) did not keep goats while the remaining 32.4 percent had less than 10 goats.

Table 7: Number of livestock per homestead

Number	Cattle (%)	Sheep (%)	Goats (%)	Donkey (%)
None	0	0	48.6	39
Less than 10	6.7	3.8	32.4	61
Between 10-20	14.3	5.7	14.3	0
Between 21-50	22.8	13.3	3.8	0
Between 51-100	38.1	31.4	1	0
Above 100	18.1	45	0	0

Source: Research data

Many respondents said that they did not keep goats because they were way-ward and destructive to vegetation. Donkeys, although considered very important beast of burdens, were not found to be many in the study area. Most of the respondents at 61 percent had less than 10 donkeys while the remaining 39 percent did not keep donkeys.

Table 8: Risk of attack between small and big herds of livestock

Response	Frequency (n=105)	Percentage (%)
Same	102	97.1
Different	3	2.9
Total	105	100

Source: Research data

On whether the rate of predation had any relationship with the size of herd of livestock, 97.1 percent of respondents felt that the rate of predation was not different between big and small herds of cattle. Only 2.9 percent of the respondents said that there was a difference in the rate of predation and the size of the herd of livestock. This shows that respondents did not view that reducing the size of herds of livestock

would affect the rate of predation. This is probably the reason why as table 9 below shows, none of the respondent preferred reducing the size of livestock.

4.4.5.2 Preference in reducing the size of livestock

The larger proportion of respondents (81.9 percent) said they did highly not prefer reducing the size of their livestock (table 9). This is an indication of the strong feelings they have at the suggestion of reducing the size of their livestock. Another proportion of 17.1 percent said they did not prefer reducing the size of their herds. This means that 99% of the respondents would rather increase the size of livestock than reduce it. The remaining one percent of the respondents declined from giving their views on this question. It was commonly observed that those who were suspicious of the purpose for this study did not freely give their opinion on some of the questions.

Table 9: Preference in reducing the size of livestock

Response	Frequency (n=105)	Percent (%)
Highly not preferable	86	81.9
Not preferable	18	17.1
Neutral	1	1
preferable	0	0.00
Highly preferable	0	0.00
Total	105	100.0

Source: Research data

4.4.5.3 Number of people attending livestock

The number of people accompanying livestock to pastures and watering points ranged between one and three. Most of the respondents (78.1 percent), as table 10 shows, said that only one person accompanied livestock, while 21.9 percent said 2-3

people did the job. This small number is probably due to economic considerations since in some households people were hired to take care of livestock.

Table 10: Number of people attending livestock

No. of attendants	Percentage (%)
1	78.1
2-3	21.9
Above 3	0

Source: Research data

Most of the people attending to livestock were between 18 and 30 years of age at 80 percent (table 11). However, 19 percent were over 30 years old while 1 percent of the respondents said they were less than 18 years of age. At the age between 18 and 30 years, people are considered both mature and strong. This is the probable reason why most of the livestock attendants ranged around this age group.

Table 11: Age of people attending livestock

Average age (yrs)	Percentage (%)
Below 18	1
18-30	80
Above 30	19

Source: Research data

Generally, livestock husbandry remains an important factor to consider in managing HWC according to Dickman (2008). According to Thavarajah (2008) successful management plan for a predator species is reliant on effective livestock husbandry, education and financial incentives for those people who are affected by the conflict. Ogada *et al.* (2003) confirms that attentively herded and kept livestock experience lower depredation, while Muruthi (2005) notes that wildlife species attack livestock that are poorly defended. The respondents in this study gave the preceding results

probably because they did not want to take any blame as ones contributing to occurrence of HWC due to their livestock husbandry practices. It was also clear that they did not want to reduce the size of the heard of their livestock as a conflict reduction strategy.

4.5 Changes in land use practices and conservation

The study found out that the local people had diversified to other economic activities other than pastoralism as shown in appendix VI. People engage in a combination of a variety of economic activities ranging from mining of stones, business, real estate, horticulture and agriculture. Those doing business were at 53.33 percent while 49.52 percent practiced agriculture. Those who practiced mining of stones were 34.29 percent while 4.67 percent and 17.14 percent practiced horticulture and engaged in real estate respectively. Evidence for horticultural activities was the presence of green houses in as observed in some places in the study area. The respondents did not practice these activities singly but in combination. That explains why the cumulative percentage exceeds hundred. Agriculture and horticulture were practiced by 54.19 percent of respondents which is a reflection of how rapidly people were diversifying from pastoralism. These activities were not compatible with wildlife conservation since they led to more conflict as wild herbivores destroyed crops. The area was originally dominated by pastoralists whose activity was to herd livestock. The land was left open which factor supported the coexistence between wildlife and people. Crop production, however, requires erecting of fences and this has led to more land fragmentation as it was frequently observed across the study area.

The 34.29 percent of the respondents who said that they practiced mining as an economic activity provided another example of land practice that was incompatible with conservation. It was observed that quarries had been opened in most of the villages. Excavation of stones in the study area had led to a great degree of landscape destruction. As Colonna (2011), observe, increase in human population and changing of socio-economic lifestyles have been recognized as the greatest threat to wildlife conservation. In this particular study area, the land that initially supported large numbers of wild ungulates had been reduced into large open hazardous quarries. Plate 3 shows one of the quarries in the study area with a truck and people loading

stones. The sprawling real estate business in the area indicated that soon there would be no habitat for wildlife. Smith (2005) notes, that HWCs have become an internationally recognized concern for management agencies and stakeholders as viable wild habitats areas are becoming islands surrounded by development and cultivation. Traditionally, the Maasai community did not construct permanent housing units for themselves. Observations made during the data collection period showed that even members of the Maasai community had permanent stone houses. Permanent housing units were usually accompanied by either a barbed wire fence, or chain-link fence or a perimeter wall. These resulted in the blockage of migratory corridors and fragmentation of land which was meant to be open wildlife dispersal area. The decline of wildebeest population from 38000 in the year 1978 to 10000 in the year 2012 is attributed to land fragmentation.



Plate 3: A quarry from which stones are extracted as an economic activity

Source: Author

4.6 Stakeholders involvement in conservation

There are many stakeholders in wildlife conservation and management. They include the local community, research scientists, the government and non-governmental organizations. The cooperation and partnerships among these stakeholders determines the effectiveness of managing HWC.

4.6.1 Local community's participation in conservation

Members of the local community are critical stakeholders in conservation since they own the land that forms dispersal area and migratory corridors for wildlife. An assessment was done to determine how they participate in conservation matters.

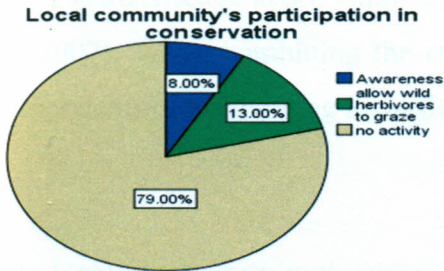


Figure 19; Community participation in conservation

Source: Research data

As figure 19 shows, 79 percent of the respondents did nothing in contributing towards conservation. This large number of local people not interested in conservation is a result of lack of benefits from wildlife generated revenues and projects. When the local people only suffer losses caused by wildlife, they are less likely to enthusiastically have interest in wildlife conservation. This is a very big proportion of the population that did not participate in conservation taking into account the fact that this conflict occurred between local people and wildlife. This is against Macdonald and Silero-Zubiri's (2004) argument that workable solutions for managing HWC need compromise and strategies which do not involve sealing people from wildlife. Redpath *et al.* (2004) also observe that successful resolution of HWC requires that participation of local communities and other stakeholders in formulating management decisions. Local community could play a vital role in reducing the impact of this conflict if it had sufficiently been involved in the management of wildlife. This is true because as Sifuna (2009) finds, the success of any conservation programmes depends on the goodwill of local communities.

Thirteen percent of the respondents said that they participated in conservation by allowing wild herbivores to graze on their land. The fact that members of this

community allowed wildlife to stay on their land was a reason to prove that they were critical stakeholders in wildlife conservation and management. The remaining eight percent of the respondents said that they participated in creating awareness on the importance of wildlife to the community members. Awareness creation is important because knowledge about wildlife increases people's tolerance towards it (Holmem *et al.* 3007). When combining the two groups, then it is found that 21 percent of the respondents did something towards conservation against 79 percent who did nothing.

The local community took various steps to reduce the conflict. As figure 20 shows, majority of the respondents (56.2 percent) reported fencing of bomas as the step taken to minimize the conflict. Keeping of dogs, reporting to KWS, awareness creation and moving away from conflict areas were also reported as steps taken towards reducing the conflict. Some respondents (18.1 percent), however, said that they did nothing.

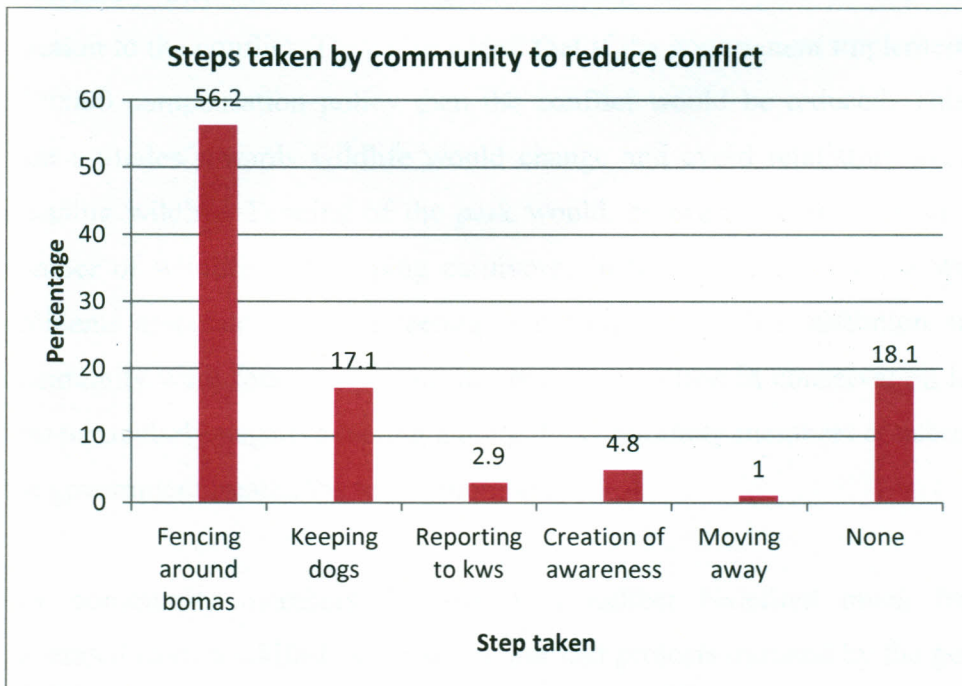


Figure 20: Steps taken by community to reduce conflict

Source: Research data

4.6.2 Role of KWS in wildlife conservation

The government is mostly represented in conservation issues by KWS. This body is charged with the responsibility of wildlife management and conservation across the country. It therefore manages all wildlife in and outside protected areas in Kenya. These include national parks, game reserves, ranches, sanctuaries and botanical gardens. The key informants agreed that HWC is a serious problem occurring especially during the wet seasons. They said that traditionally this occurred during the months of April to May and October to December although seasons are changing. They also confirmed that the conflict is aggravated by encroachment into wildlife dispersal areas leading to blocking of migratory corridors.

On the role of KWS in mitigating the conflict, they said that it had put in place electric lights in different places within the community to scare away carnivores at night. They also confirmed that it used to build schools and dams although they stalled due to lack of funds. Compensation also stalled causing more bitterness from community members. They suggested fencing of the park as the only practical solution to the conflict. They also added that if the government implemented the Ksh. 1000000 compensation policy then the conflict would be reduced. This is because their attitudes towards wildlife would change and avoid retaliatory attacks towards invading wildlife. Fencing of the park would, according to them, lead to increased number of wildlife and keeping carnivores in the park. However, it would lead to problems associated with inbreeding and congestion. This institution and the local community were found to pulling in opposite direction in conservation issues. There was particularly negative feeling among the community members concerning the way the government treated the local community.

The community members felt that they neither benefited much from revenue generated from wildlife-based tourism nor had projects initiated by the government to benefit them. As a result the government was perceived as a parasite on community resources. The government needs to provide incentives to encourage the local people to conserve wildlife. Incentives would also go a long way in improving the relationship between the local people and KWS.

4.6.3 Role of research scientists

Research scientists were essential in conducting research and disseminating information relating to wildlife conservation. Sharing of information on scientific findings would lead to increased awareness on the nature of the conflict by all stakeholders. Research and extension are meaningful tools towards the management of HWC according to Shemwetta and Kideghesho (2004). Decker et al (2002) also agree that comprehensive wildlife management needs biological and social science. Political sciences are also necessary for sound and informed decision making as far as Macdonald and Sillero-zubiri (2002) are concerned. KWS had several research scientists responsible for management and conduction of research in different areas. There was, for instance the senior scientists, scientist southern area and scientist responsible for different species.

4.6.4 Role of NGOs

Non-governmental organizations involved in conservation of wildlife in the study area included: TWF, Friends of Nairobi National Park (Fonnnap) and the African wildlife fund. Their main activity was to mobilize funds used for conservation work. TWF for example mobilized funds and helped to support local people in erecting chain-link fence. It uses up to 80 percent of its funding on community projects. The remaining 20 percent is used to cover administrative expenses according the key informant at TWF. NGOs can be of help in designing programmes geared towards either managing or mitigating the conflict. They can also be involved in advocacy especially in those issues in which KWS is unable to campaign against being a government agency.

NGOs are better positioned to raise funds for conservation since some donors will rather they channel their funds through them than central governments. Communities also trust NGOs more than government agencies. They therefore work better with NGOs than the government agencies. Friends of Nairobi National Park (Fonnnap) for several occasions fed lions with beef to discourage them from going out of the park. Fonnnap is an NGO found in NNP. This helped conserve lions when their population declined significantly due to retaliatory killings and when herbivore populations went down in the park.

4.7 Community's perceptions on wildlife conservation

The objective of the questions asked in this section was to assess people's perceptions on wildlife conservation. Respondents were asked to give their opinions on different aspects of wildlife conservation. The questions asked related to the perceptions of community members on the presence of wildlife particularly herbivores on their land, perception on the importance of wild carnivores and the importance of Nairobi National Park. They were also asked to give their views concerning the conflict and to arrange various HWC management strategies in order of their effectiveness in managing this conflict.

4.7.1 Community's perception on the presence of wildlife on their land

The study area being a wildlife dispersal area had wide variety of wild herbivores present. To find out whether these herbivores contributed in any way in aggravating the conflict, respondents were asked to give the impacts wildlife had on their land. These animals were found to have various impacts on both the community and their livestock.

Majority of the respondents (68.6 percent) said that wild herbivores infected livestock with diseases and transmitted pests. There are several diseases that are common to both wildlife and livestock. Most of such diseases have wild animals as their reservoirs and livestock get infected when they come into close contact with wildlife. One such disease which respondents gave repeatedly as an example was the Malignant Catarrhal Fever (MCF). Wildebeests are the carriers of the pathogens causing this disease and it is transmitted to livestock which eat the grass on which wildebeests calf their young ones. It should be noted that Kitengela area provides breeding grounds for wildebeests. Ticks were quoted by hundred percent of respondents as being among the pests transmitted from wildlife to livestock. The red ear tick is particularly dangerous as it causes, East Coast Fever (ECF) in a variety of domestic animals.

Another 29.5 percent of respondents said that wild ungulates destroyed their crops. As plate 4 shows, farming as an economic activity was common in the study area, besides

pastoralism. Wild animals destroyed their crops because most of farms had no fences or at least the fences were porous. The turning of the local people into agriculturalists portended more trouble for wildlife as this created two centres of conflict, that is to say, crop destruction by herbivores and predation by carnivores.



Plate 4: A maize plantation with poorly maintained barbed wire fence around it

Source: Author

Crops were likely to attract more herbivores which would in turn attract more carnivores into the community land. Some respondents constituting 12.4 percent said that wild herbivores competed for grass with livestock (plate 5) while another 4.8 percent said they competed for water with livestock. These percentages are not big, probably an indication that competition for grass and water was not a major concern for community members. This is supported by the fact that they have always lived with wild herbivores without much conflict. They even could allow wildlife to lick salts meant for livestock. In Botswana, Parry and Campbell (1992) found out that rural communities also had negative attitudes towards wild animals because they destroyed crops and preyed on livestock. Their negative attitudes were as a result of losing land to conservation and lack of control over animal wildlife resources. Plate 5 below shows a picture of zebras that were found grazing very close to a homestead where they could lick salts meant for livestock.

The 13.3 percent of the respondents who said some herbivores were dangerous to human life quoted hippopotamus and buffaloes as the example of such animals. One percent of the respondents said wild herbivores did not have any effects while 4.8 percent did not comment on this issue. On economic effects, destruction of crops was given at 60 percent, eating of grass was given at 50.5 percent. Attraction of carnivores

was given as an economic activity at one percent as was the cause of soil erosion. Some animals were said to be dangerous as an economic activity at 3 percent while 9 percent of the respondents has no comment. They probably did not associate the presence of wild herbivores on their land with any economic effect. The presence of wildlife on the community land generally has some effects on people's lives. The government should look for ways of providing incentives to people so that they can continue co-existing with wildlife on their land. The cumulative percentage exceeds 100 percent because most respondents gave more than one options as the impacts caused by wildlife. Table 12 below gives the summary of the impacts caused by wild herbivores on the community'.

Table 12: Impact of carnivores on the community's economic activities

Responses	Frequency (n=105)	Percentage (%)
Destroy crops	63	60
Eat grass	53	50.5
Destroy fence	14	13.3
Cause soil erosion	1	1.0
Attract carnivores	1	1.0
Some are dangerous	3	2.9
No comment	9	8.6

Source: Research data



Plate 5: Zebras grazing on community land close to a homestead

Source: Author

On the population trends of resident wild herbivores, 66.7 percent of the respondents believed that the populations had generally decreased. The key informants also agreed that there was a decrease in the population of wild herbivores at Kitengela. The decrease could be associated with habitat destruction caused by land use changes, land fragmentation and partitioning. These were observed to have extensively taken place in the study area. The consequence of reduced wildlife populations is that carnivores eventually turned on livestock on failing to get their usual prey. Usually carnivores and especially lions prey more on wild ungulates than livestock (Pattern *et al*, 2004). Hemson (2003) agrees that adequate wild-prey abundance may reduce livestock predation by large carnivores. However, decrease in native wild ungulates results in increased rate of livestock predation and hence increased HWC. In India, Athreya (2007) found out that declining habitats and prey species was a cause for leopard presence in human dominated areas. Figure 21 is a summary of the finding of population trend of wild herbivores on community land.

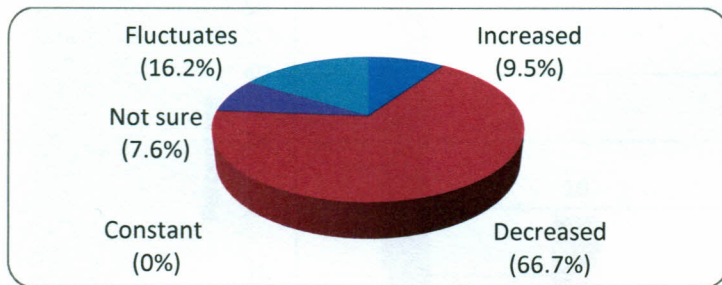


Figure 21: Population trend of resident wild herbivores on community land

Source: Research data

Some 16.2 percent of the respondents felt that the populations were fluctuating because they would decrease and increase with different seasons. This is because as earlier discussed, more herbivores move into Kitengela area during wet seasons and into the park during dry seasons. It is only 9 percent of the respondents who felt that the populations had increased. These were probably referring to populations of herbivores during the wet seasons when wildlife moved out of the park. This reasoning was supported by the fact that the wild herbivore populations had greatly reduced which led to more invasions. Eight percent of the respondents said that they were not sure which direction the trend was taking. These are probably those who had

not lived in the study area long enough so as to be able to give the accurate account of the population trends.

4.7.2 Perception of people on the importance of carnivores

The perception people have towards wildlife is an indication of how they will treat animals in case of a conflict. If they perceive wildlife positively then they are likely to spare them after invasion. Carnivores were the major cause of the conflict in the study area. It is probably for this reason that 57.1 percent of the respondents strongly disagreed and 19 percent just disagreed that carnivores had any importance to them. This means that 76.1 percent of the respondents did not consider carnivores as being important to them.

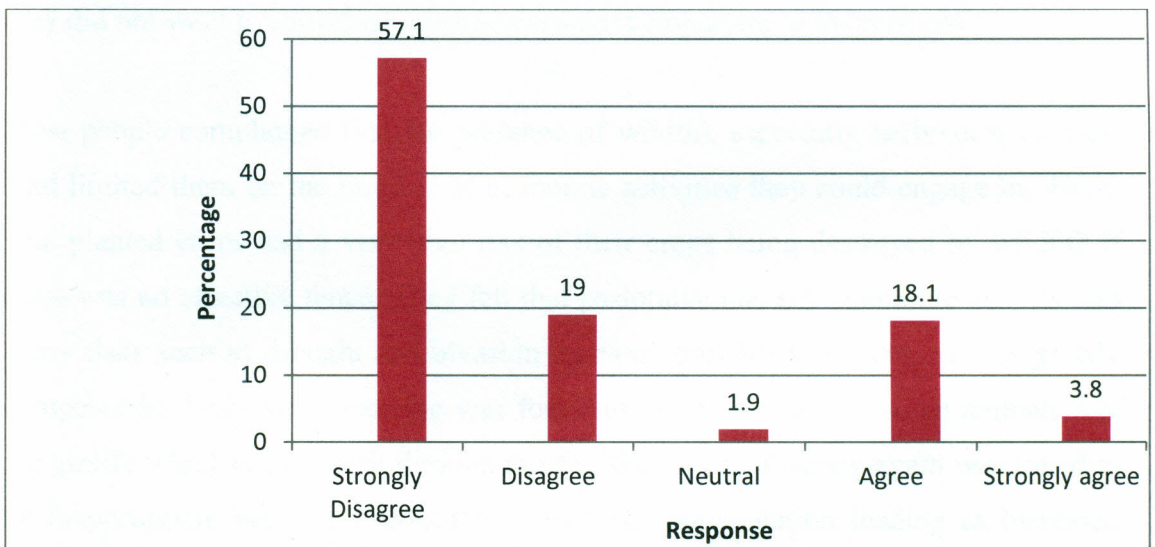


Figure 22: Respondents' opinion on the importance of carnivores

Source: Research data

Lions for instance were viewed as the greatest cause of economic loss through predation of livestock particularly cattle which were valued most by community members. Some of the respondents argued that lions ate everything unlike other predators which could have parts of the hunted prey remain.

The large number of respondents who did not view carnivores as being important to them is an indication of the lack of awareness on the importance of wildlife to the community. It would also be an indication of benefit sharing from tourism. Such benefits as Kiss (2004) found out motivate local communities to conserve both wildlife and ecosystems. Thavarajah (2008) also found out that sharing of financial benefits derived from wildlife between communities affected HWC can help achieve co-existence. On the other hand, Obunde *et al.* (2005) observe that an inadequate direct benefit that local communities get from wildlife is a major bottleneck to conservation. Those who agreed that carnivores were important to them were 18.1 percent with 3.8 percent strongly agreeing. Those who viewed carnivores as important said that God had given them wildlife to live with. Others cited revenue generation to the government through tourism as the reason why carnivores were important. Some 1.9 percent of the respondents, however, remained neutral meaning they did not want to say whether carnivores were important to them or not.

Most people complained that the presence of wildlife especially herbivores on their land limited them on the number of economic activities they could engage in. Those who planted crops had a very high risk of their crops being destroyed by wildlife if there was no effective fence. They felt that pastoralism as any economic activity had many risks such as drought and invasion by carnivores while agriculture was greatly hampered by herbivores. Fencing was found to be ineffective for some animals like the giraffe which could break through most of the fences. Fencing again was found to be inappropriate because it contributed to land fragmentation leading to increased conflict.

Consultative meetings among different stakeholders to discuss wildlife issues are very important in mitigating the impacts of this conflict as it can reduce local people's anger towards wildlife. Such meetings, however, did not take place in the study area. Majority of the respondents at 57.7 percent reported that they never had meeting with KWS to discuss issues related to wildlife conservation or the conflict at hand. Lack of such meeting was another probable reason why farmers thought carnivores were not important to them.

It was also observed that there existed a bad relationship between the local community and the government. This is supported by the fact that most respondents were hesitant to participate in filling the questionnaire until they proved that the researcher was not affiliated in any way to the government or KWS. They actually threatened to beat him up if they discovered that he had been sent by the government. Such poor relationship between these two important stakeholders only served to jeopardize wildlife living outside the park. There is therefore need for regular meetings between government and the local community to share and explore the various human-wildlife conflict management strategies. The government and other stakeholders should learn from the indigenous knowledge of the local community as they share their research findings and other modern conservation approaches to the community. KWS staff was reported to visit the community area only after invasion according to 42.3 percent of the respondents. They said that KWS only went to the villages if they heard that carnivores were still in the villages or had been killed. One percent of the respondent did not answer the question on consultative meetings.

The speed with which KWS responds to reports of carnivore attack could influence the local community's actions on the invading carnivores. Some respondents at 2.9 percent said that KWS officers did not come on reports of carnivore attack. The majority of the respondents at 72.4 percent said that KWS were slow in their coming. A proportion of 20 percent said that KWS officials came fast enough while 4.8 percent said that they come very fast. This is an indication that not all community members who had strong negative feelings about KWS. However, the percentage of those without negative feeling towards wildlife was very small as to be significant.

Figure 23 is the summary of responses on the question of what could be done to reduce retaliatory attacks on carnivores. Majority (40 percent) of the respondents said that carnivores should be kept in the park. This was followed by 20 percent of the respondents who said that fencing the NNP would reduce retaliatory attacks. This means that 60 percent of the respondents held the opinion that to spare carnivores from retaliatory attacks; they must be prevented from killing livestock in the first place. This is considered a hard stance given that even though the park was fenced,

some carnivores could still sneak out. Seven percent of the respondents had equally a hard stand because they said that nothing could be done to reduce retaliatory attacks.

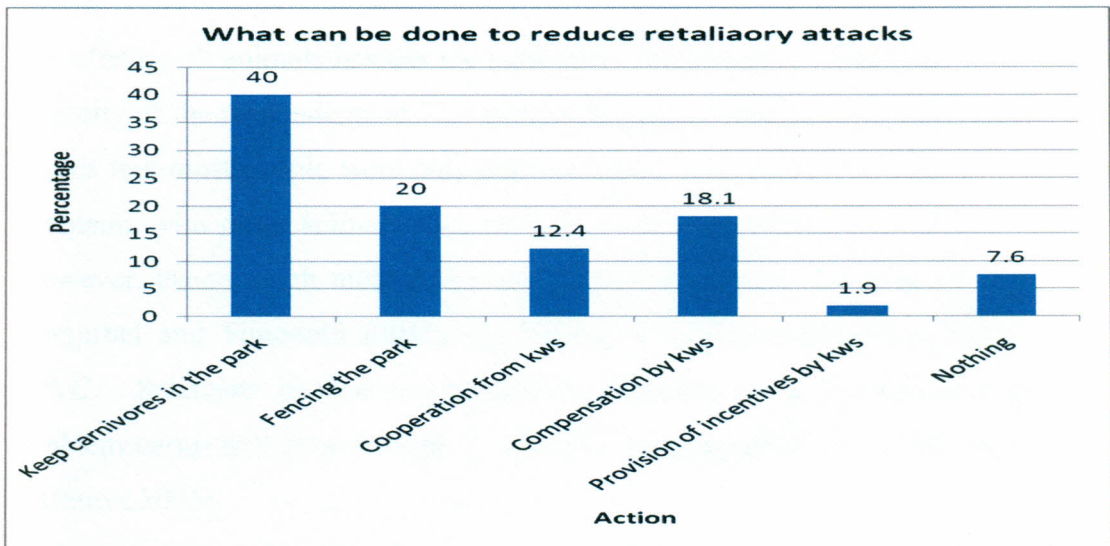


Figure 23: What can be done to reduce retaliatory attacks

Source: Research data

This meant that such attacks would continue regardless of any efforts to manage the conflict. Some 12.4 percent of said that there was need for KWS to cooperate with them in order to reduce retaliatory killings. This means that there was a feeling among some of the community members that KWS was not cooperating with them enough as far as this conflict is concerned. Some respondents who constituted 18.1 percent said that there was need for compensation from KWS to help reduce retaliatory attacks. Another 1.9 percent said KWS should give incentives to make them not kill invading carnivores.

4.7.3 People's perception on Nairobi National Park

Carnivores associated with this conflict mostly emanated from NNP. As a result people had varying feelings about the park and the animals. Those who agreed that carnivores should be relocated from NNP were 34.3 percent, while 26.7 percent strongly agreed. This means that 61 percent of the respondents held the view that carnivores in NNP should be relocated to other places. Those who disagreed with this opinion were 16.2 percent and a similar percent of the respondents strongly

disagreed. Therefore, in total 32.6 percent of the respondents held the view that carnivores in the park should not be relocated. The remaining 6.7 percent remained neutral.

On whether all animals besides the carnivores should be relocated from the park, the majority of the respondents at 72.4 percent disagreed while 27.6 percent agreed. This means that most people were only uncomfortable with carnivores but had no serious problems with other animals such as herbivores even though they destroyed crops. However, even though most people did not prefer relocation of animals from NNP, Fonturbel and Simonetti (2011) see relocation as a non-lethal method of solving HWC. Scientists do not recommend translocation as a managerial strategy for problem carnivores even though it is legally recommended as a HWC management (Athreya 2005).

On whether the park should be closed down, 75.2 percent of the respondents said that the park should not be closed down. This is an indication that most of the respondents attach some benefits to the park. The remaining 24.8 percent agreed that the park should be closed down probably because they thought that problem animals came from there. Many people have questioned the wisdom of having a national park in a major city. However, NNP has three main functions and therefore important. These functions include; revenue generation, act as carbon sink and recreational functions. NNP is among the five top tourism related revenue collectors in Kenya. It absorbs most of the industrial and vehicular emissions in Nairobi hence help in carbon sequestration. Fencing of the southern part of the park will be inappropriate because the move would convert the park into a zoo owing to its size. The park is only 117 km² which can not sufficiently support wildlife if it was confined within the park.

4.7.4 Community's view on the conflict

Figure 24 below is a summary on the general views of the respondents about the conflict. Some respondents (34.3 percent) said that KWS should keep carnivores in the park. This is probably because to them, carnivores were the major problem wild animals. Other animals were not such a serious bother as compared to the carnivore

which killed and ate their livestock. A proportion of 26.7 percent of respondents said that KWS needed to cooperate with the local community in order to reduce the conflict. The respondents kept on repeating that the government through KWS needed to cooperate with them in order to minimize the effects of this conflict. There was a general feeling among the respondents that the government was not cooperative enough.

A group consisting of 12.4 percent of the respondents said that fencing of NNP could help reduce the conflict. The fencing mentioned here targeted keeping carnivores in the park. Need for compensation was also mentioned at a rate of 7.6 percent as a way of reducing the conflict. Compensation was of critical importance and therefore needed to be taken into account seriously. However, 19 percent of the respondents said that nothing could be done and this conflict would never end. This probably was the group which had become so disillusioned that they lost all hopes of this conflict ever being resolved. Majority of the respondents at 69.5 percent strongly agreed that carnivores had caused great losses to the community. Those who just agreed were 21 percent.

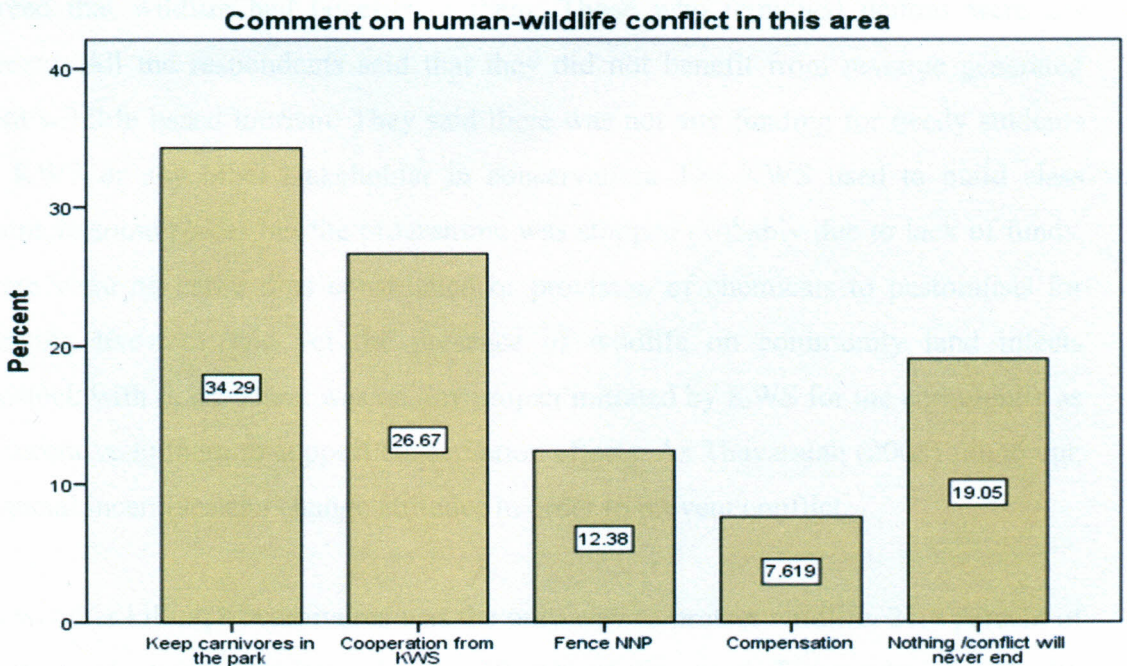


Figure 24: Respondents' general comments on human-wildlife conflict

Source: Research data

This means 90.5 percent of the respondents held a feeling that carnivores have caused great losses to them. Only 4.8 percent of the respondents strongly disagreed with this opinion while a similar percentage remained neutral and did not make their opinion known.

On whether wildlife on the community land, which was mainly herbivores, should be taken back to the park, 50.5 percent agreed while 38.1 percent strongly agreed. This gives a total of 88.6 percent were in favour of removing wildlife from community land. Those who strongly disagreed were 3.8 percent with a similar percentage disagreeing and another similar percentage being neutral.

On whether wildlife on community land was beneficial to them, 52.4 percent strongly disagreed while 36.2 percent agreed. This gives a total of 88.6 percent with the feeling that wildlife on their land had no benefit to them. It should be noted that this proportion is similar to that which felt that wildlife should be removed from the community land. Another proportion of 4.8 percent agreed that wildlife was beneficial to them while 3.8 percent strongly agreed. In total 8.6 percent of the respondents agreed that wildlife had benefits to them. Those who remained neutral were 2.9 percent. All the respondents said that they did not benefit from revenue generated from wildlife based tourism. They said there was not any funding for needy students by KWS or any other stakeholder in conservation. The KWS used to build class rooms in some places but the programme was stopped probably due to lack of funds. There were no cattle dips constructed or provision of chemicals to pastoralists for spraying livestock and yet the presence of wildlife on community land infects livestock with ticks. There was no any project initiated by KWS for the community as an incentive to them to support conservation efforts. As Thavarajah (2008) found out, financial incentives can change attitudes in order to prevent conflict.

On whether killing of carnivores was the only way to protect wildlife, 21.9 percent of the respondents strongly agreed while 40 percent disagreed. Those who agreed with this opinion were 16.2 percent with a similar percentage strongly in agreement. This gives a total of 61.9 percent of the respondents with the feeling that killing of carnivores is not the only way to protect livestock. Another fraction of 32.4 percent

was in favour of the opinion. Those who remained neutral on this issue were 5.7 percent.

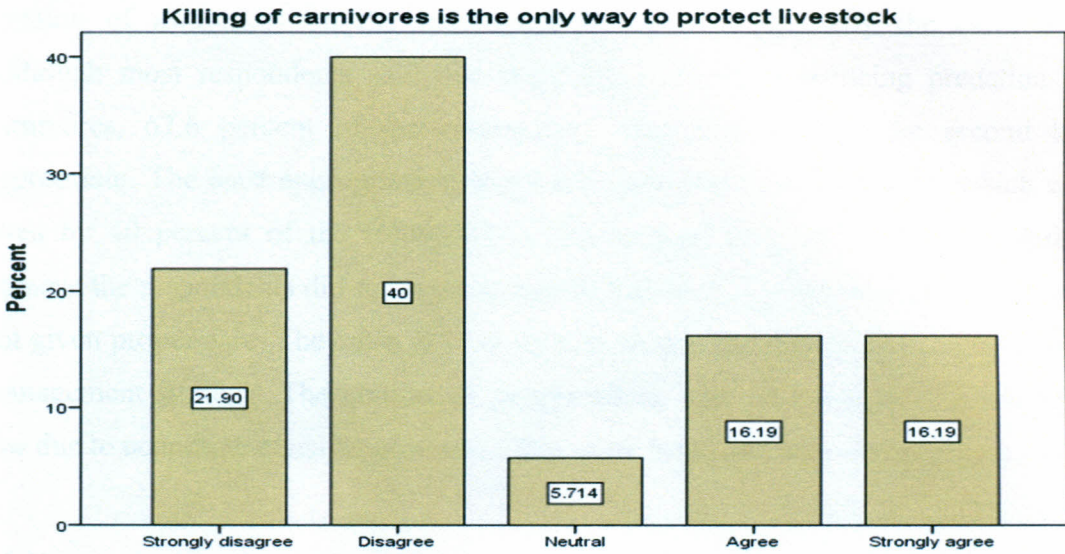


Figure 25: Comments on the killing of carnivores

Source: Research data

According to some key informants, lions bear the brunt of retaliatory attacks because they walk in prides and hang around their prey hence are easily found. The conflict led to killing of 11 lions in the year 2003 and 6 lions in 2012. Due to this conflict, the population of lions in the park has been fluctuating. For instance, in the year 2003 only 9 lions were left in Nairobi national park, however, this number had grown to 40 by 2011. With only less than 2000 lions in the country currently (according to the KIs), there is a need to look for appropriate measures to conserve them. Other carnivores such as leopards, cheetah wild dogs, and hyenas have different behaviours, they tend to hide and hence not easily found or killed. It is for the same reasons that it is difficult to estimate their populations.

In determining the appropriate strategies for managing this conflict, seven different strategies were listed and respondents were asked to arrange them from the most to the least effective. Fencing of protected areas was rated number one by 47.6 percent of the respondents. The second most effective method was said to be the use of chain link around bomas by 46.3 percent of the respondents. Compensation to pastoralists after invasion was rated number three by 54.3 percent of the respondents. Relocation

of problem animals from NNP was rated number four by 39 percent of the respondents. The fifth most effective strategy as rated by 31.4 of the respondent was creation of awareness on the importance of wildlife especially the carnivores. Although most respondents said that dogs were helpful in reducing predation by carnivores, 67.6 percent of the respondents rated this strategy the second last appropriate. The least appropriate strategy was good livestock husbandry which was rated by 40 percent of the respondents. This strategy was least popular probably because the respondents did not want to submit that they lost livestock because it was not given proper care. They also did not want to reduce the size of their livestock as a management strategy. The number of people taking care of livestock was also kept low due to economic consideration since they were hired and thus attracted cost.

4.8 Regression Analysis of the Findings

The researcher conducted a multiple linear regression analysis so as to determine the relationship between the factors affecting human wildlife conflict management and the four independent factors namely: effectiveness of various management strategies, changes in land use practices, stakeholders' involvement in wildlife conservation and local community's perceptions on wildlife.

Table 13: Regression model summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.843	0.742	0.724	0.4216

- a) Predictors: (Constant), effectiveness of various management strategies, changes in land use practices, stakeholders' involvement in wildlife conservation and local community's perceptions on wildlife.
- b) Dependent variable: Human wildlife conflict management

The study used the R square. The R Square is called the coefficient of determination and tells us how the human-wildlife conflict management varied with effectiveness of various management strategies, changes in land use practices, stakeholders involvement in wildlife conservation, and local community's perceptions on wildlife.

The four independent variables that were studied explain 74.2% of the factors affecting human wildlife conflict management as represented by R Squared (Coefficient of determinant). This therefore means that other factors not studied in this research contribute 25.8% of the factors affecting human wildlife conflict management.

Table 14: Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.72	9	1.302	44.231	.000(a)
	Residual	3.432	52	0.066		
	Total	15.152	61			

a) Predictors: (Constant), effectiveness of various management strategies, changes in land use practices, stakeholders' involvement in wildlife conservation, and local community's perceptions on wildlife

b) Dependent Variable: Human wildlife conflict management

The study used ANOVA to establish the significance of the regression model from which an f-significance value of p less than 0.05 was established. The model is statistically significant in predicting how effectiveness of various management strategies, changes in land use practices, stakeholders' involvement in wildlife conservation and local community's perceptions affect human wildlife conflict management. This shows that the regression model has a less than 0.05 likelihood (probability) of giving a wrong prediction. This therefore means that the regression model has a confidence level of above 95% hence high reliability of the results.

Table 15: Coefficient results

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.116	.186		0.623	.535
Effectiveness of various management strategies	0.577	.068	.559	8.478	.000
Changes in land use practices	0.157	.043	.257	3.676	.036
Stakeholders' involvement in human-wildlife conservation	0.082	.042	.301	2.252	.020
Local community's perceptions	0.021	.002	.245	6.906	.001

- a) Predictors: (Constant), Effectiveness of various management strategies, changes in land use practices, stakeholders involvement in wildlife conservation and local community's perceptions on wildlife
- b) Dependent Variable: Human-wildlife conflict management

The established regression equation was

$$Y = 0.116 + 0.577X_1 + 0.157X_2 + 0.082X_3 + 0.021X_4 + \varepsilon$$

The regression equation above has established that holding all factors (effectiveness of various management strategies, changes in land use practices, stakeholders' involvement in human-wildlife conflict management and local community's perceptions on wildlife) constant, factors affecting human wildlife conflict management will be 0.116. The findings presented also shows that taking all other independent variables at zero, a unit increase in effectiveness of various management strategies will lead to a 0.577 increase in the scores of the human wildlife conflict management. A unit increase in compatible land use practices, will lead to a 0.157 increase in human wildlife conflict management. On the other hand, a unit increase in stakeholders' involvement in managing human-wildlife conflict will lead to a 0.082 increase in the scores of the human wildlife conflict management; and a unit increase in improvement on local community's perceptions will lead to a 0.021 increase in the scores of the human wildlife conflict management. This infers that effectiveness of

various management strategies influences the human wildlife conflict management most followed by stakeholders' involvement in managing human-wildlife conflict, compatibility of land use practices, and then local community's perceptions. The study also established a significant relationship between human wildlife conflict management and the independent variables; effectiveness of various management strategies ($p=0.00<0.05$), compatibility of land use practices ($p=0.036<0.05$), stakeholders involvement in managing human-wildlife conflict ($p=0.20<0.05$) and local community's perceptions ($p=0.001<0.05$) as shown by the p values. The researcher dropped the regression model because $p>0.5$ and $t<1.96$. Therefore the restated model is as follows:

$$Y=0.577X_1+0.157X_2+0.082X_3+0.021X_4+ \varepsilon$$

This supports the systems theory upon which this study was based since human-wildlife conflict management was found to be influenced by several factors. This means that several actors need to synchronise and work in a coordinated manner in order to mitigate against this conflict.

Non-parametric correlation

A Spearman correlation is used when one or both of the variables are not assumed to be normally distributed. The values of the variables were converted in ranks and then correlated. The study correlated effectiveness of various management strategies, changes in land use practices, stakeholders involvement in wildlife conservation and the local community's perceptions on wildlife under the assumption that both of these variables are normal and interval.

Table 16: Correlations

			Effectiveness of various management strategies	Changes in land use practices,	Stakeholders involvement in conservation	Local community's perceptions on wildlife
Spearman's rho	Effectiveness of various management strategies	Correlation Coefficient Sig. (2-tailed) N	1.000 .000 61	.617 .000 61	.547 .000 61	.667 .000 61
	Changes in land use practices,	Correlation Coefficient Sig. (2-tailed) N	.617 .000 61	1.000 .000 61	.437 .000 61	.235 .001 61
	Stakeholders involvement in conservation	Correlation Coefficient Sig. (2-tailed) N	.547 .000 61	.437 .000 61	1.000 .000 61	.441 .002 61
	Local community's perceptions on wildlife	Correlation Coefficient Sig. (2-tailed) N	.667 .000 61	.235 .000 61	.441 .000 61	1.000 .000 61

The results suggest that the relationship between effectiveness of various management strategies and changes in land use practices ($\rho = 0.617$, $p = 0.000$) is statistically significant. Effectiveness of various management strategies and stakeholders in managing human-wildlife conflict had a rho of 0.547 and a p value of 0.000 therefore denoting statistical significance. Similarly, the effectiveness of various management strategies and local community's perceptions on wildlife posted a rho of 0.667 with a p value of 0.000 therefore providing a statistical significance. Changes in land use practices and stakeholders involvement in managing human-wildlife conflict had a

rho of 0.437, $p=0.000$ further pointing to a statistical significance. On the same note, the changes in land use practices and the local community's perceptions on wildlife correlated at $\rho=0.235$ and $p=0.001$. This therefore is statistically significant. Finally, the stakeholders involvement in managing human-wildlife conflict and local community's perceptions stood at a correlation of $\rho=0.441$ and $p= 0.002$ revealing statistical significance.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study, conclusions and recommendations based on the objectives and findings of the study. The main objective of this study was to assess the effectiveness of the management strategies used to mitigate the effects of this HWC conflict at Kitengela.

5.2 Summary

Human-wildlife conflict is a serious problem facing pastoralists in Kitengela area and it elicits emotive reactions among the local people. The sampled population had more males (79.05 percent) than females (20.95 percent) probably because it is a patriarchal society. Pastoralism was their main economic activity even though people engaged in other forms of economic activities such as agriculture, mining and business. Literacy levels were high with 72.38 percent of the sampled population having attained some form or level of education. Carnivores mostly invaded livestock during the wet seasons which coincides with the time most herbivores move out of NNP into the Kitengela dispersal area. The lion left the greatest impact while the cattle were the most attacked livestock.

To mitigate against the conflict, all respondents kept local breeds of dogs which majority said were helpful in managing HWC. This was mainly through barking and therefore alerting them of the presence of a predator. Combinations of a variety of fences were also used including barbed wire fence, stone fence, deadwood fence and chain-link fence. However, a combination of both chain-link and barbed wire fences was most common across the study area. This combination was said to be effective in preventing predation (69.5 percent of the respondents) although 85.7 % of them said it was expensive to erect. Some respondents (58.1%) favoured fencing of NNP as conflict mitigation strategy. Compensation for livestock loss was low as only 8.6 percent of respondents had been compensated. However, most of the respondents (57.1 percent) said that figures for compensation in the then proposed Wildlife (management and conservation) Bill 2012 were acceptable to them. The preferred

mode of compensation was in cash (82.9 percent of respondents). Respondents kept large herds of livestock with sheep being the majority followed by cattle, goats and donkey in that order. They (97.1 percent of respondents) felt that the rate of predation was not different between big and small herds of livestock and did not prefer reducing the size of their livestock. Only one person accompanied livestock to pastures and watering points according to 78.1% of respondents. Most of those attending livestock were between 18 and 30 years of age. Some respondents (61 percent) held the view that carnivores in NNP should be relocated to other places to reduce the conflict. Fencing of protected areas was rated most effective HWC management strategy by 47.6 percent of the respondents followed by use of chain link fence around bomas. Good livestock husbandry was rated least effective strategy by 40 percent of the respondents.

3.3 Livelihoods

There were several land use changes in the study area different from the traditional pastoral use. These land use changes included; mining of stones (34.29 percent of respondents), real estate (17.14 percent of respondents), and agriculture (54.19 percent of respondents). Some 53.33 percent of respondents carried out a varied of businesses which did not have a direct influence of HWC management. Construction of permanent stone houses with fenced compounds was also commonly observed in the area

3.4 Stakeholder

Stakeholder (local community) involvement in conservation and HWC management was low. Most of the respondents (79 percent) said that they did nothing towards wildlife conservation. Some (8 percent), however, said that they created awareness on wildlife conservation among the community members. Allowing herbivores to graze on community land was also given as a way of participating in conservation. The respondents also said that they did not benefit from projects resulting from proceeds of wildlife based tourism. Some NGOs were, however, involved in conservation efforts and two of them (Friends of Nairobi National Park and The Wildlife Fund) were cases in point. The majority of the respondents (72.4 percent) said that KWS was slow in responding to reports of wild carnivores' invasion in the community.

On the local community's perceptions of wildlife, herbivores were considered destructive to crops while carnivores caused great losses to the community. Herbivores also infected livestock with diseases and pests as well as competing for pasture and water. Some herbivores were considered dangerous to human life. Most of the respondents (40 percent) said that KWS should keep wildlife in the park while 20 percent said that the park should be fenced with 18.1 percent saying compensation would help reduce retaliatory attacks. On the hand, carnivores were considered as not important to community by 76.1 percent of the respondents. A total of 61 percent of the respondents held the view that carnivores in NNP should be relocated to other places. However, 72.4 percent disagreed that herbivores should be relocated from NNP.

5.3 Conclusion

The first objective of the study was to assess the effectiveness of various HWC management strategies. The local community tried to manage HWC conflict by using a range of techniques but none of them was hundred percent effective. Use of dogs to prevent predation for example was only effective as a means of alerting people on the presence of a predator but could not resist most of them. Lions, which were most common invaders followed by hyenas, could make dogs to desert homesteads for days. The use of predator proof fences especially the chain-link fence was common in the study area even though it was expensive to erect. It was used it in combination with barbed wire fence and was said to be most effective compared with other types of fences. Fencing contributed to habitat fragmentation and blocking of wildlife dispersal areas when not restricted to bomas. Complete fencing of NNP would reduce the conflict but lead to serious ecological issues in NNP owing to its small size. Local community would also suffer because they would lose alternative watering points during dry spells.

Compensation for crop destruction and loss of livestock did not take place by the time of conducting this research and people were embittered as they thought that the government was always short changing them. The end result of this was poor relations

between the local community and KWS with wildlife suffering retaliatory attacks as a consequence. Even though good livestock husbandry could reduce conflict, respondents did not favour reducing the size of livestock. They, however, favoured relocation of carnivores from NNP which would lead to serious ecological imbalance in the park.

The second objective was to examine the effects of land use changes on HWC management. The study found out that the local community engaged in economic activities that were not compatible with wildlife conservation. Growing of crops was becoming common leading to increased conflict due to crop destruction by wild herbivores. Fencing around farms resulted in more habitat fragmentation and blocking of wildlife dispersal areas. Mining of stones led to landscape degradation and destruction of wildlife habitat. Much of the land had been subdivided and sold off to people from outside the Maasai community. They built permanent stone houses surrounded mostly by chain-link fence which further led to loss and blockage of wildlife dispersal areas. All these lead to decrease in wild herbivores resulting to carnivores invading homesteads and killing livestock.

The third objective sought to establish the effect of stakeholders' involvement in conservation on HWC management. Management of this conflict requires the participation of all stakeholders including the local community, the government, research scientists and NGOs. The local community is especially important because it suffers the consequences of living with wildlife. Projects initiated using wildlife based tourism proceeds would provide incentives for them to continue supporting wildlife. The response speed by KWS on invasion reports can determine the nature of working relationship between them and the local community. NGOs also play critical role in forming an impartial link between KWS and the local community. They involve themselves in mobilizing funds towards conservation and mitigating the effects of HWC conflict.

The fourth objective assessed the effect of local community's perception of wildlife on HWC management. The community had negative attitude towards wildlife especially carnivores. People viewed wildlife as the source of their misery and wanted to have it driven back to the NNP. They did not attribute the presence of wildlife on their land with any benefit. This means that the level of awareness on the importance of wildlife among the community members was very low. The result of such low level of awareness was lack of appreciation of wildlife and decreased tolerance when it either destroyed crops or killed livestock. Negative attitudes leads to increased aggression towards wildlife and hence increased conflict.

5.4 Recommendations

The study came out with the following recommendations;

1. Make chain-link fence cheap and affordable to all community members

It was found out that the chain-link fence was most commonly used and most effective compared with other types of fences. Most respondents, however, said that this fence was expensive for them to construct. It is therefore necessary for all stakeholders to come together and look for ways of making the construction of this fence cheaper and affordable to all people affected by this conflict. This can be done through provision of subsidies to pastoralists who desire to use the fence or through partnerships between various stakeholders to mobilize funds for constructing the fence. Stakeholders can also mobilize funds to buy materials needed to construct the fence and distribute them to pastoralists. There is also need to ensure that the fences are well maintained to make them predator-proof at all times. The construction of the fence should be predator specific tailored.

2. Encourage the local community to engage in economic activities that are compatible with conservation.

Gradual change of economic activities from the traditional pastoralism was evident and contributed to HWC conflict. The local community should be encouraged to pursue only those economic activities that are compatible with wildlife conservation. Mining of stones and crop farming destroyed habitat leading to

reduced number of wild herbivores. This in turn resulted in more HWC since livestock remained exposed to predation. They should be given incentive to discourage them from selling their lands to private developers to avoid land subdivisions and fencing. This would lead to increase of the number of wild herbivores in the community land and in turn cushion livestock against predation.

3. Encourage participatory wildlife management and conservation

Contemporary management practices require that stakeholders should be involved at all levels of decision making. Local people's indigenous knowledge in wildlife management and HWC management skills is as important as scientific research role of scientists and fund raising role of NGOs. All stakeholders need to be brought on board in wildlife management decision making and should work as a unity (systems theory approach). There is also need to improve the working relations between the local Maasai community and KWS. It should be emphasized that mitigation of the HWC will not be achieved by one or few groups of stakeholders but by the concerted efforts and cooperation of all stakeholders working in a coordinated manner.

4. There is need for change of attitude and perception local community has on wildlife.

The study found out that most people had negative attitude towards wildlife because of the losses they suffered through predation and destruction of crops. They perceived wildlife as both a threat to their livelihoods and source of their misery. This situation needs to be changed in order to make them more appreciative of wildlife and become more tolerant to it. Compensation for livestock loss and crop destruction can go a long way in appeasing local people. Attitudes can also change if the local people benefit from projects initiated using the proceeds from wildlife related tourism. There is also need to try and create awareness on the importance of wildlife to the local Maasai community in order to boost their appreciation and tolerance of wildlife.

5.4 Recommendation for further research

1. Research on the range and ecological requirements of carnivores in NNP

There is need for scientific research on the range and ecological requirement of carnivores of the NNP in order to determine the population of carnivores the park can support in case it is finally fenced off. The lions in particular are known to be territorial and knowledge of their range is necessary in order to determine how many of them the park can accommodate at any one time.

2. Research on the carrying capacity of NNP

There is need also to research on the carrying capacity of the park in order to determine the optimal number of animals of all species it can support. This will enable the management of the park to apply population control measures to prevent animals from going out of the park due to factors relating to population pressure. Knowledge of the park's carrying capacity can help the management to understand when to cull or relocate some animals in order to keep them at levels that are in tandem with the park's ability to support them.

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APPENDICES

Appendix I: Questionnaire for collecting data from Kitengela

Dear Sir/ Madam

My name is James Makini, a Masters Degree student at Kenyatta University carrying out a research on **Effectiveness of the Management Strategies of Human-Wildlife Conflicts at Kitengela, Kajiado County**. As an important stakeholder, you have been selected to participate in the study by answering some questions. The information collected through this questionnaire will be used for academic purposes only and will be treated as confidential. It intends to collect information meant for writing a thesis report for the Degree of Master of Environmental Studies (Community Development) in the School of Environmental Studies of Kenyatta University.

The purpose of this study is to look for appropriate management strategies that will be used to mitigate the effects of human-wildlife conflict not only at Kitengela but Kenya at large. This will go a long way in boosting the conservation status of wild animals (especially the big cats) and safeguarding people's interests. Participating in filling this questionnaire is voluntary. However, you are strongly requested to participate since you are in a good position to provide the information needed.

Since information collected through this questionnaire will be confidential, you are requested not to write your name anywhere on this questionnaire.

I could like to appreciate in advance for your co-operation and taking time to fill this questionnaire.

Thank you.

Sign.....

A). Background information about respondent

1. Sex: Male () Female ()

2. Age in years:

less than 10	11 - 17	18 and above
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3. Occupation:

4. Level of education: Check as appropriate

Never went to school	0	
Primary level	1	
Secondary level	2	
Tertiary level	3	

5. Duration you have lived here: check as appropriate

Less than 1 year	1	
1-5 years	2	
6-10 years	3	
More than 10 years	4	

B). Effectiveness of various human-carnivore conflict management strategies.

6. How often do the carnivores attack livestock in this area?

Several times a week	Once a week	Once in two weeks	Once a month	Seasonally
1	2	3	4	5

13. Which of the following breeds of dogs are found in Oloosirkon area?

Exotic	Local breeds
1	2

14. Do you agree that dogs can reduce the rate of predation on livestock by carnivore?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

15. What factor(s) discourage the use dogs in protecting livestock against predation?

You can

Check more than one option.

Dogs are expensive to buy	1	
Dogs are liabilities to keep	2	
Dogs are not available	3	
Dogs cannot protect livestock against carnivores	4	

II. Fencing of conservation areas

16. Is it appropriate to fence Nairobi National Park in order to solve the problem of human-Carnivore conflict?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

17. Comment on the consequences, if any, of fencing Nairobi National Park.

18. How do the wild herbivores living outside the park affect your normal daily lives?

19. How do the same herbivores interfere with your economic activities?

20. What are the population trends of the resident wild herbivores on the community land?

Increasing	Decreasing	Remained constant	Not sure	Fluctuates
1	2	3	4	5

III Chain-link fences around homesteads

21. Which type of fencing do you have around your homestead?

- 1). None 2). Live fence 3). Barbed wire fence
 4).Chain link 5). Other (specify) _____

22. How effective is the type of fence you use in protecting livestock against predation?

Very ineffective	Ineffective	Neutral	effective	Very effective
1	2	3	4	5

23. How would you rate the effectiveness of chain-link fences in reducing predation of big cats on livestock?

Very ineffective	Ineffective	Neutral	effective	Very effective
1	2	3	4	5

24. What is the reason(s) against the use of chain-link fence in this area?

Expensive	Don't know this particular fence	Ineffective	Don't know how to erect it	Lack of materials for erecting it
1	2	3	4	5

IV. Education and creating awareness on the importance of wildlife to the local Community

25. How do you agree or disagree with the statement that the carnivores are important to you?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

26. How often do the community and wildlife managers hold consultative meetings to discuss wildlife issues?

Never	Annually	Monthly	Weekly	After invasion
1	2	3	4	5

V. Livestock compensation

27. Have the carnivores ever killed your livestock?

Yes	No
-----	----

28. How are people compensated in case of attack on their livestock by carnivores?

29. In the proposed new wildlife bill 2012 the government has revised upwards the money payable as compensation to amount not exceeding Ksh.1, 000,000 in case of either human injury or loss of life. Is this amount acceptable to you?

Highly unacceptable	Unacceptable	Slightly acceptable	Acceptable	Highly acceptable
1	2	3	4	5

30. How much money in Kenya shillings should the government compensate for the killing of the following animals so that carnivores can be spared?

Any other (specify)

Cattle	10000-20000	21000-40000	41000-60000	> 60000	
Sheep	1000	2000	3000	> 3000	
Goat	1000	2000	3000	> 3000	
Donkey	10000-20,000	21000-40000	41000-60000	> 60000	

31. How would you like to be compensated in case carnivores kill your livestock?

1. Money 2. Livestock 3. Both money and livestock

32. Would compensating you with the right amount of money affect the way you treat

Carnivores?

VI. Livestock husbandry

33. How much livestock do you have? Check in the table as appropriate.

	None	Less than 10	10- 20	21-50	50-100	> 100
Cattle						
Sheep						
Goats						
Donkeys						
Fowl/chicken						

Any other (specify) _____

34. How does the risk of carnivore attack compare between big and small herds of livestock?

35. Would you prefer reducing the size of livestock?

Highly not preferable	Not preferable	Neutral	preferable	Highly preferable
1	2	3	4	5

36. How many people accompany your livestock to pastures/ watering points?

1	2	3	4	5
None	1	2-3	4-5	More than five

37. What is the average age in years of those accompanying livestock to pastures and watering points?

1	2	3	4
Below 10 years	10-17	18-30	Above 30

VII. Relocation of problem animals

38. To what extent do you agree with the following statement.

Carnivores should be relocated from Nairobi National Park?

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

39. Should Nairobi national park be closed down?

40. Should all animals in Nairobi National Park be moved to another place?

41. Arrange the following conflict management strategies from the most effective to the least effective. Start number 1 with the most effective strategy.

Use of livestock guarding dogs	
Fencing round protected areas/parks	
Use of chain-link fences around bomas	
Creating awareness and educating communities on the benefits and value of wildlife	
Providing compensation to herders in case of livestock loss to big cats.	
Improving livestock husbandry	
Relocation of problem animals	

C. Compatibility of land use practice with conservation.

42. What other economic activity do you engage in other than pastoralism?

Horticulture	1
Agriculture	2
Mining	3
Real estate	4
Business	5

43. Since the time you started living here to how do you view the trend of human-carnivore conflict?

Reduced	
Unchanged	
Increased	

44. What do you think has contributed to the trend in your answer above? Please give details.

D. Role of stake holders

Local community

45. How do you participate in activities meant to contribute towards wildlife conservation?

46. Do you share in the proceeds from wildlife based tourism? Give details.

Funding of need children to go to school	
Construction of classes	
Construction of cattle dips	
Sponsoring students going for further education	
Community project	

Any other, (specify) _____

47. State any step you have ever taken in an attempt to reduce human-wildlife conflict within the community.

48. Explain what can be done to reduce retaliatory attacks on carnivores by pastoralists?

49. How fast does the KWS staff respond to reports of carnivore presence within the community?

Never respond	Slowly	Neutral	Fast	Very fast
1	2	3	4	5

50. Give any information you think is important as far as human-big cats conflict is concerned.

E. People's perceptions and attitudes towards wildlife

Key: S.D - Strongly disagree D –Disagree N – Neutral

A- Agree S.A – Strongly Agree

	S.D	D	N	A	S. A
Carnivores have caused great losses to pastoralists in this area.					
Killing of carnivores is the only way to protect livestock					
All wildlife outside the park should be taken back into the park					
Presence of wildlife on the community's land is beneficial to them					

51. How do you agree or disagree with the following statements?

Appendix II: Interview schedule for collecting data from key informants

A). Nature of the conflict

1. How real is Human-carnivore conflict?
2. At what frequency are carnivores killed by pastoralists? Are any statistics available?
3. What particular animals are killed? Any available statistics?
4. How has the conflict impacted on conservation?
5. How do you view the trend of this conflict?
6. Are the carnivore populations in the park increasing or decreasing? Any available statistics?
7. What about herbivores?
8. Does the community complain about wild herbivores in its land?

B). Fencing

9. How can the use of chain-link fence around bomas by pastoralists affect this conflict?
10. Is there any place/s where this particular fence has been used? What effect has it had?
11. Does the organization support the community in any way to fence around their bomas? What can the organization do to support pastoralists fence around their bomas?
12. Which other strategy can the community use effectively to manage this conflict?

C). Other management strategies

13. What other management strategies can be used to mitigate against this conflict?
14. How does the community at Kitengela benefit from wildlife conservation?

15. What is the place of awareness creation on the importance of wildlife among the local community members in managing this conflict?
16. Does your organization have meetings with community members to discuss wildlife issues?
17. What can be done to change the local community's attitude towards carnivores?
18. Is there any compensation for invasion on people or their livelihoods?
19. The Ksh.1000000 compensation in the proposed wildlife bill looks attractive to pastoralists. How affordable is it.
20. Does it include compensation for killing of livestock by carnivores?
21. How will the implementation of such policy affect this conflict and wildlife conservation as a whole?

D). Nairobi National Park

22. What will be the effects of fencing the southern part of the park?
23. How important is NNP?
24. How do you view its continued existence?

C). Role of stakeholders in conservation

25. What particular activities does your organization involve in with regard to conservation?
26. What role does your organization play in mitigating this conflict?
27. How does your organization benefit from conservation?
28. What role can other NGOs play in managing this conflict?
29. What is the role of KWS in managing the conflict?
30. What role can scientists play in the management of this conflict?

31. How have the changes in land use patterns in Kitengela impacted on wildlife conservation.
32. What impacts have such changes on this conflict?

D). Conclusion

33. What is the best strategy or combination of strategies for managing this conflict?
34. Give any comment regarding this conflict and conservation as a whole.

6. Type and proximity of houses.

	Permanent	Temporary
Type		
Proximity to each other		

Species of wild animal present in the area

Appendix IV: Research Authorisation letter from KWS



ISO 9001:2008 Certified

Winner: COYA 2010 Awards in Corporate Citizenship & Environment, and Human Resource Management.

KWS/BRM/5001

4 October 2013

Mr. James Ayusa Makini
P.O.Box 47293-00100
NAIROBI
e-mail: jamesayusa@gmail.com

Dear *Mr. Makini,*

PERMISSION TO CONDUCT RESEARCH IN NAIROBI NATIONAL PARK

We acknowledge receipt of your letter dated 3 October 2013 requesting for permission to conduct research on a project titled: *Effectiveness of the management strategies of Human-Wildlife Conflicts at Kitemela, Kajiado County*. The study will generate data and information that will assist in mitigating human-wildlife conflicts in and around Nairobi National Park.

You have been granted permission to conduct the study from October to December 2013 upon payment to KWS of academic research fees of Ksh. 1000. However, you will abide by the set KWS regulations and guidelines regarding the conduct of research in and outside protected areas. You will also be required to work closely with our Senior Scientist in-charge of Southern Conservation Area (SCA), whom you will give a copy of the research proposal and a progress report on the study.

You will submit a copy of your findings to the KWS Deputy Director, Biodiversity Research and Monitoring on completion of the study.

Yours *sincerely,*

SAMUEL M. KASIKI, PhD, OGW
DEPUTY DIRECTOR
BIODIVERSITY RESEARCH AND MONITORING

Copy to:

- DDD&CS
- Senior Warden, Nairobi N. Park
- Senior Scientist, SCA

P.O Box 40241-00100, Nairobi, Kenya. Tel:+254-20-6000800, 6002345. ISDN: +254-020-3992000/1000
Wireless: +254-020-2379407/8/9. Mobile: +254-735 663 421, +254 -726 610 508. Fax:+254 -020-6003792
Email: kws@kws.go.ke Website: www.kws.go.ke

Appendix V: Research authorisation letter from NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No.

Date:

8th April, 2014

NACOSTI/P/14/9549/878

James Ayusa Makini
Kenyatta University
P.O.Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Effectiveness of management strategies for Human-Wildlife Conflict at Kitengela, Kajiado County,*" I am pleased to inform you that you have been authorized to undertake research in **Kajiado County** for a period ending **31st December, 2014**.

You are advised to report to **the County Commissioner and the County Director of Education, Kajiado County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


SAID HUSSEIN
FOR: SECRETARY/CEO

Copy to:

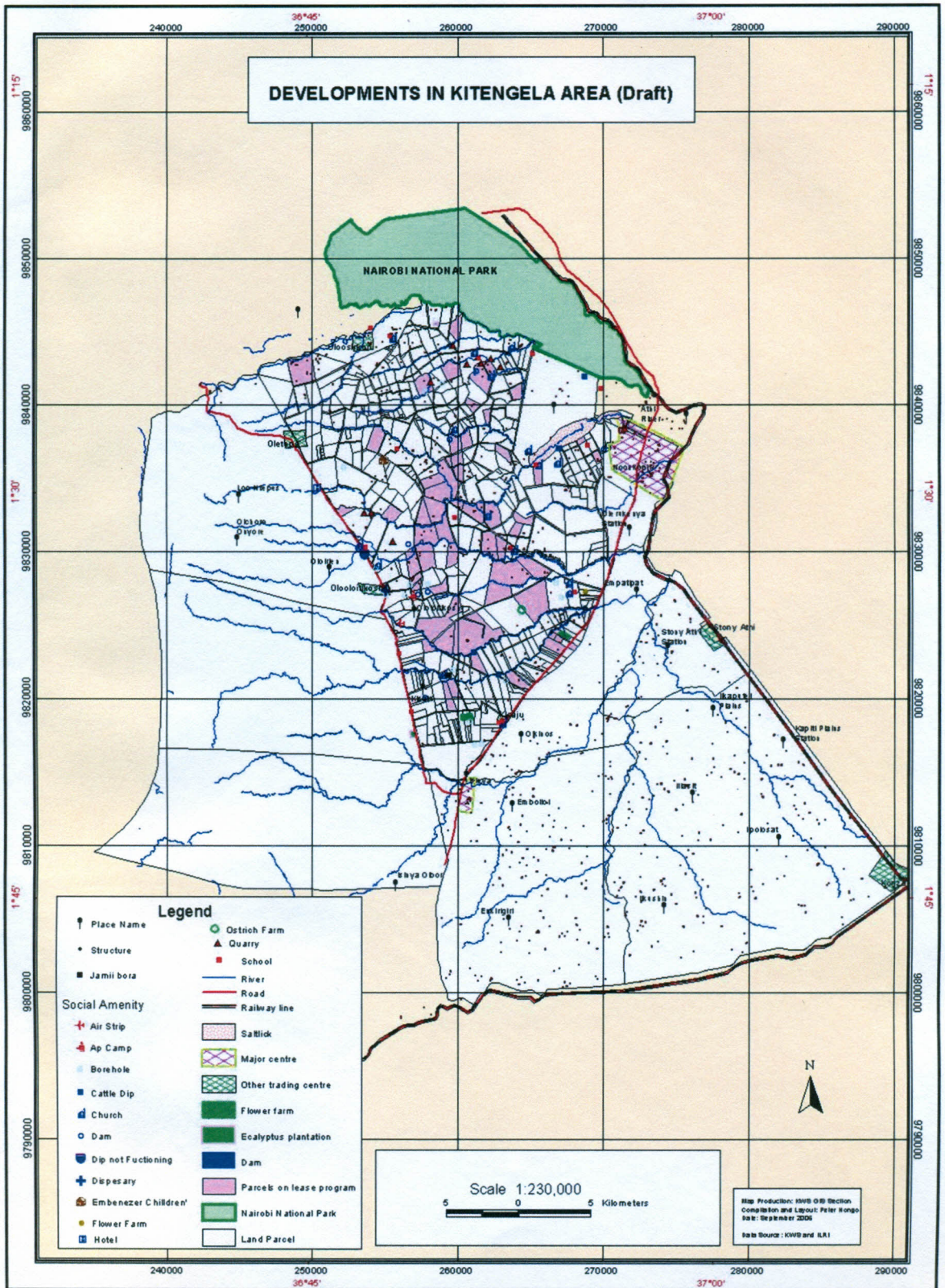
The County Commissioner
The County Director of Education
Kajiado County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified

Source: National Commission for Science, Technology and Innovation

Date April 8, 2014

Appendix VI: Developments in Kitengela area



Source: Kenya Wildlife Service (2013)