



TECHNICAL UNIVERSITY OF KENYA

Education and Training for the Real World

**EFFECTIVENESS OF USING INDIGENOUS KNOWLEDGE
IN HUMAN-WILDLIFE CONFLICT MANAGEMENT IN
SAGALA, TAITA TAVETA, KENYA.**

GATHUKU NELSON MWANGI

REG. NO: 112/01265

**A Project Proposal Submitted To The Technical University Of
Kenya. School Of Physical Sciences and Technology, Department
Of Geo Sciences and the Environment, in Partial Fulfillment of
the Award of Bachelor Of Technology In Environment Resource
Management**

NOVEMBER 2015

DECLARATION

I hereby declare that this dissertation submitted to the Technical University of Kenya, is a record of an original work done by me under the guidance of Mr. Mulati, Faculty Member, Faculty of Applied Science and Technology, School of Physical and Applied Sciences. Any similarity to other works is purely coincidental.

Name: Gathuku Nelson Mwangi

Registration Number:

Signature:

Date:

APPROVAL

This dissertation titled, “Effectiveness of using indigenous knowledge in human-wildlife conflict management in Sagala, Taita Taveta, Kenya” has been done under my supervision and has been submitted to School of Physical and Applied Sciences for examination with my approval as the researcher’s supervision.

Name: Mr. Mulati

Position held:

Signature:

Date:

DEDICATION

I dedicate this work to my mother, Lucy Wangui, my sisters Ruth and Zipporah, my grandmother Zipporah and my extended family.

I also dedicate this study to my ERM family and classmates, to my friends Steve, Ken and Collins.

Most importantly I dedicate this work to everyone working for the conservation of wildlife, to the rangers in Kasigau and to the kind and hospitable residents of Sagala ward.

ACKNOWLEDGEMENT

I would like to thank Save the Elephants, Dr. Lucy King and the Elephants and Bees Project for giving me the internship opportunity and resources to conduct my research in Sagala area. I wish to acknowledge Dr. Flora Namu for her input.

I would also like to thank my fellow interns: Christin, Tess, Dorcas and Sophia for their support out in the field and also in the office. I am indebted to Elephants and Bees employees: Nzumu, Emmanuel, Grace and John for their full support in the field, guidance in and around Sagala, translation and company.

I am forever grateful for my aunt Florence and uncle, Charle and grandmother Wa Mweri for their patience and unrelenting support throughout my four years in campus.

I convey my gratitude to my lecturers Dr. Kiiru for her support in all my wildlife endeavours, Mr. Mulati, my project and industrial based learning supervisor for keeping up with me despite the distances, Dr. Sitoki for offering guidance this research, Dr. Oteki for giving me directions on introduction to this research and on how to conduct data collection for my research and finally my classmate Gloria Ngare for her help in finalizing this report.

LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|--------------|---|
| ANOVA | Analysis of Variance |
| ASDSP | Agricultural Sector Development Support Programme |
| CBO | Community Based Organizations |
| FAO | Food and Agriculture Organization |
| FDG | Focus Group Discussion |
| GIS | Geographical Information Systems |
| GK | Government of Kenya |
| HWC | Human- Wildlife Conflict |
| IFAD | International Fund for Agricultural Development |
| IFAW | International Fund for Animal Welfare |
| IK | Indigenous Knowledge |
| IUCN | International Union for Conservation of Nature |
| KWS | Kenya Wildlife Service |
| LEK | Local Ecological Knowledge |
| NGO | Non-governmental Organizations |
| NEMA | National Environment Management Authority |
| SPSS | Statistical Package for Social Scientists |
| SSI | Semi structure interviews |
| TEK | Traditional Ecological Knowledge |
| UN | United Nations |
| UNEP | United Nations Environment Programme |
| WGRIP | Working Group on the Rights of Indigenous Populations |
| WWF | World Wildlife Fund |

Table of Contents

| | |
|---|-----|
| DECLARATION | i |
| DEDICATION | ii |
| ACKNOWLEDGEMENT | iii |
| LIST OF ABBREVIATIONS AND ACRONYMS..... | iv |
| ABSTRACT..... | x |
| CHAPTER ONE | 1 |
| INTRODUCTION | 1 |
| 1.0 Background of the Study | 1 |
| 1.1 Statement of the Problem..... | 3 |
| 1.2 Objectives | 3 |
| 1.3 Hypothesis..... | 3 |
| 1.4 Research Questions..... | 3 |
| 1.5 Justification of the Study | 4 |
| 1.6 Scope of the study..... | 4 |
| 1.7 Limitations of the study | 4 |
| 1.8 Assumptions of the study..... | 5 |
| 1.9 Ethical issues..... | 5 |
| 1.10 Definitions of significant terms..... | 6 |
| CHAPTER TWO | 7 |
| LITERATURE REVIEW | 7 |
| 2.0 Introduction..... | 7 |
| 2.1 Indigenous Knowledge: theories and definitions..... | 7 |
| 2.2 Level of indigenous knowledge | 8 |
| 2.3 Effectiveness of indigenous knowledge in managing human-wildlife conflicts..... | 10 |
| 2.4 Conceptual framework..... | 13 |
| CHAPTER THREE | 15 |
| METHODOLOGY | 15 |
| 3.0 Introduction..... | 15 |
| 3.1 Research design | 15 |
| 3.2 Population under study | 16 |
| 3.2.1 Location | 16 |
| 3.2.2 Climate, soils and zonation | 16 |
| 3.3 Sampling Methods | 18 |
| 3.3.1 Sample..... | 18 |
| 3.3.2 Sampling techniques | 18 |
| 3.4 Methods of data collection..... | 20 |
| 3.4.1 Semi-structured interviews | 20 |
| 3.4.2 Focus group discussion | 22 |

| | |
|---|----|
| 3.4.3 Questionnaires..... | 23 |
| 3.4.4 Observation..... | 23 |
| 3.5 Quality control: Reliability and Validity | 24 |
| 3.6 Data Analysis..... | 24 |
| CHAPTER FOUR..... | 28 |
| DATA PRESENTATION, ANALYSIS AND INTERPRETATION | 28 |
| 4.0 Introduction..... | 28 |
| 4.1 Profile of respondents | 28 |
| 4.2 Level of indigenous knowledge | 30 |
| 4.2.1 Relationship between respondents' profiles, attitudes and indigenous knowledge | 33 |
| Profile variables and current level of indigenous knowledge | 33 |
| 4.2.2 Attitudes toward wildlife | 35 |
| 4.2.3 Current indigenous knowledge and attitudes towards wildlife | 36 |
| 4.3 Effectiveness of using indigenous knowledge in human-wildlife conflict management in Sagala | 37 |
| 4.3.1 Effectiveness in terms of 'number of times mentioned' | 41 |
| 4.3.2 Effectiveness in terms of time, cost, people needed, people using the technique and impacts.... | 42 |
| 4.3.3 Modern techniques used to mitigate human-wildlife conflicts in Sagala | 45 |
| CHAPTER FIVE | 48 |
| DISCUSSIONS..... | 48 |
| CHAPTER SIX..... | 51 |
| CONCLUSION AND RECOMMENDATIONS..... | 51 |
| 6.1 Conclusion | 51 |
| 6.2 Recommendations..... | 52 |
| REFERENCES | 54 |
| Appendix I | 56 |
| Appendix II | 64 |

LIST OF FIGURES

| | |
|---|----|
| Figure 1: Conceptual framework | 14 |
| Figure 2: Indication network..... | 19 |
| Figure 3: Age of respondents interviewed | 28 |
| Figure 4: Education levels of participants | 29 |
| Figure 5: Frequency distribution of the current level of Indigenous knowledge | 31 |
| Figure 6: the relationship between age and the current level of indigenous knowledge | 34 |
| Figure 7: Mean values of the different levels of IK in the four villages | 34 |
| Figure 8: the correlation between gender, occurrence of conflicts and attitudes..... | 36 |
| Figure 9: Individual level of IK and attitudes toward wildlife | 37 |
| Figure 10: Problem animals in Sagala | 38 |
| Figure 11: Some of the ‘non-lethal’ indigenous techniques | 40 |
| Figure 12: “Lethal” techniques used by Sagala residents | 41 |
| Figure 13: Measures of effectiveness of IK techniques | 44 |
| Figure 14: ‘Modern’ techniques used to mitigate HWC in Sagala | 47 |

LIST OF PLATES

| | |
|---|----|
| Plate 1: Area of study..... | 17 |
| Plate 2: Conducting an interview in Mgange village | 21 |
| Plate 3: An interactive FGD with Kileva Eastfield pupils | 22 |
| Plate 4: Common problem animals in Sagala caught on camera traps | 39 |
| Plate 5: Some non-lethal techniques | 40 |
| Plate 6: A working beehive fence around a maize farm | 46 |

LIST OF TABLES

| | |
|---|----|
| Table 1: Coding of variables using SPSS | 22 |
| Table 2: Education level of respondents | 30 |
| Table 3: Frequency distribution table of the current level of Indigenous knowledge | 30 |
| Table 5: Summary of ANOVA based on level of IK between villages..... | 35 |
| Table 4: Gender balance and youth willingness to acquire indigenous knowledge | 32 |
| Table 6: Mean value of indicators of effectiveness of using beating drums..... | 42 |
| Table 7: Summary of the means of variables for each IK technique | 43 |

ABSTRACT

This study was about the use of indigenous knowledge in human-wildlife conflict management. The purpose of the study was to investigate the effectiveness of using indigenous knowledge in managing human-wildlife conflicts. The objectives of the study were to assess the level of indigenous knowledge and investigate the effectiveness of using indigenous knowledge in managing human-wildlife conflicts. The study used cross-sectional design which incorporated ethnography and co-relation designs. Both qualitative and quantitative methods were employed to gather data from villagers from four villages in Sagala ward. Data was collected from the villagers, schools and organizations in the ward during the period between February and March 2015. A sample size of 50 respondents who were relevant to the study was selected. Self administered semi-structured interviews, questionnaires, focus group discussion and observations were the instruments of the study and data was analysed using SPSS and Ms Excel. The results were presented using pie charts, boxplots, bar graphs, scatter plots, error bars, brief statements and frequency distribution tables. The study established that indigenous knowledge used in Sagala is effective in mitigating human-wildlife conflicts. However, the study also established that there are lethal and non-lethal indigenous techniques which should be set apart to avoid severe impacts on the environment and on people. It also established that IK is lost due to drug abuse, modern technology, religion, lack of documentation, death of practitioners and ignorance. The study concludes that the limited use of IK, over-reliance on modern ways of conflict mitigation and negative attitudes towards wildlife has led to increase in HWC, loss of lives and livelihoods and death of important wild animals. The study recommends that all sectors should be involved in the storage and preservation of indigenous knowledge and techniques, the need for environmental education and wildlife awareness to change people's attitudes towards wild animals and the discouragement of using destructive/lethal techniques. The study also recommends government involvement in mitigating HWC in terms of compensation, stricter laws and installation of working electric fences around the park. It recommends the integration of traditional knowledge and modern scientific concepts so as to increase effectiveness. Finally, the study recommends the need for further studies to fill gaps left in the investigation on effectiveness of indigenous knowledge.

Key Words: *Indigenous Knowledge, indigenous population, lethal techniques, scientific knowledge, extinct, endangered species, wildlife conservation and management*

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Human- wildlife conflict has been in existence for as long as humans and wild animals have shared the same resources and landscapes. All countries developed or not, are affected by human-wildlife conflicts (FAO, 2009). From Baboons in Namibia attacking young cattle, to one-horned Rhino in Nepal (Asia) destroying crops, to European bears and wolves killing livestock in countries of Europe, to Rocky mountain elk attacking people in the US (North America), to Jaguars predating on livestock in Brazil (South America) and attacks by Australian Magpies on humans – the problem is universal (Ladan, 2014).

According to Smith and Kasiki (2014) these human-wildlife incidents involve crop raiding animals that consume or destroy food crops and injure or kill those people trying to protect their farms. These incidents arise when the interests when the interests of humans and wildlife- real or perceived-do not coincide. These interests include competition between wildlife and humans for food (Schaul, 2013), extending human activities in areas originally preserved for wild animals, land use changes and the consequences of population pressure have led to decrease in land and other resources available for wildlife resulting to HWC (Kenya Wildlife Policy, 2011).

The main species that cause these incidents include large herbivores (elephants, buffaloes, and hippopotamus), large mammalian carnivores (lions, leopards, cheetahs, spotted hyenas and wild dogs) and crocodiles (Marque *et al*, 2009).

Africa is a continent with lots of wildlife and the people predominantly lived in rural areas and many people engaged in primary production such as farming, nomadic herding, fishing and mining. It is based on this reasons that human-wildlife conflict is particularly prevalent in the continent. The problem of human-wildlife conflict is particularly common and pronounced as rural and peri-urban communities are affected all over the continent (Ladan, 2014).

Traditional African societies considered wild animals as a source of great wealth rather than threats; however, in the 20th Century with expansion and development of modern agriculture, exploitation and diminished interaction with large wildlife species came to be increasingly dominated by conflicts (Marque *et al*, 2009). Leblanc and Bricka (2013) further argue that the origin of HWC to the transfer of western concepts such as “biodiversity”, “conservation education” and “nature” to local inhabitants who “do not understand nature”. These models and concepts have led to dismissal of the fact that relationships to the environment as they unfold in African societies may offer new and more legitimate opportunities to think about and implement conservation practices (Yamakoshi, 2013).

Human-wildlife conflicts in Kenya have been on the rise in the past few years, for example in the Mount Kenya area hardly a day goes by without an incident occurring between a farmer and the elephants. Elephants inhabiting the park can easily stray outside its perimeters and cause damage to crops and homes, and even injury and loss of life (IFAD, 2014). In Nairobi human-lion conflict has been observed in Kitengela, 15km south of Nairobi National Park where locals killed six lions which had killed the locals’ livestock in 2012 (Wildlife Direct, 2012). Human-elephant conflicts are also prevalent in Samburu, Amboseli and Tsavo ecosystems where elephants raid the indigenous people farms causing death of livestock and destruction of crops (King L.E, 2014).

Various efforts have been made in a bid to reduce human-wildlife conflicts. At the national level, the Draft Wildlife policy identifies human-wildlife conflicts as an issue of national concern and these policy objectives include land use zoning to reduce HWC, erection of barriers, community participation, and translocation of problem animals and also compensation of affected persons (Wildlife Policy, 2011).

Currently the KWS is responsible for wildlife conservation and conflict management countrywide however this overall mandate which is broad and centralized has contributed to the many challenges facing wildlife conservation in Kenya today (Wildlife Policy, 2011).

At the local level increase in agricultural activities and growth in population has led to increased conflicts in Sagalla near Tsavo East national park. This is worsened by the fact that the park does not have a functional electric perimeter fence which has aggravated human wildlife conflict through crop destruction and bodily harm and even death by wild animals. This results to loss of livelihoods and increased vulnerability, thereby making most families food insecure. (Mballuka *et al*, 2014).

1.1 Statement of the Problem

Increase in poaching and human-wildlife conflicts cases in various parks in Kenya has contributed greatly to the endangerment of a variety of plant and animal species such as the African elephant (*Loxodonta Africana*) and the white rhino (*Ceratotherium simum*). Efforts to conserve these species by reducing conflicts have not gone unnoticed, but these efforts which hugely rely on modern strategies, technologies and techniques have not been as effective as expected. The use of indigenous knowledge has not been fully utilized in HWC management and so long as this trend continues wildlife will still be at huge risk of extinction mostly from interference.

Therefore the overall purpose of this study is to examine the effectiveness of using indigenous knowledge in managing human-wildlife conflicts.

1.2 Objectives

Main Objective: To investigate the effectiveness of using Indigenous Knowledge in human-wildlife management

Specific objectives of the study were;

- i. To assess the level of indigenous knowledge in the area of study
- ii. To investigate the effectiveness of indigenous knowledge in managing human-wildlife conflicts

1.3 Hypothesis

The study was used to test the following hypotheses;

- i. There exists indigenous knowledge in the area of study
- ii. Existing indigenous knowledge is effective if utilized in managing human-wildlife conflict

1.4 Research Questions

The following questions were answered in this study;

- i. What is the level of indigenous knowledge in the area of study?
- ii. What are the major causes of loss of indigenous knowledge?
- iii. How effective is indigenous knowledge in managing human-wildlife conflicts?

1.5 Justification of the Study

The study was intended to contribute valuable knowledge to the field of indigenous knowledge and management of human-wildlife conflicts. It is one of the few studies that have been done to try and establish the effectiveness of specific indigenous techniques used in mitigating human-wildlife conflicts and it is expected to contribute new knowledge on this topic. This new information will be used for reference by students, researchers, locals and organizations.

Other than just investigating the effectiveness of IK, this study also points out holes in this field and identifies causes of loss of indigenous knowledge. The study by establishing the level of indigenous knowledge will also contribute to the preservation of locally available knowledge. It is also expected to make a huge change in reducing human-wildlife conflicts by clearly analyzing each technique and proposing the effective ones.

1.6 Scope of the study

Data collection was conducted between February 2015 and March 2015 through a cross-sectional survey design. The study was conducted using 50 respondents from villages, schools and NGOs in Sagala area. Data was collected by the researcher using semi-structured interviews, focus group discussions, observations and photographs. The study specifically assessed the level and effectiveness of using indigenous knowledge in human-wildlife conflict management in Sagala ward, Taita Taveta.

1.7 Limitations of the study

Financial barriers are a common limitation to almost all research studies. The research required costs such as: printing costs, mapping and survey costs, meetings' allowance costs, transport costs etc. this constrain was reduced through the support of Dr. King and the Elephants and Bees project and personal savings. Volunteers were used as subjects to reduce these constraints.

Time constrains; the time to do the research was inadequate due to other commitments. To save on time the researcher worked effectively over the time period given and sought help from other people doing similar research or doing research in the same geographical area.

Physical barriers and inaccessibility to various populations due to poor road conditions in the study area limited data collection. This was avoided by using road and area maps and the researcher had guidance in the form of colleagues while at the Elephants and Bees project.

Language barrier between the researcher and respondents was also a major challenge during interviewing. This barrier was overcome by getting help from a colleague who acted as the translator since he was fluent in Swahili, English and the local dialect/ Kisagala.

Data collection was further hindered by uncooperative respondents, climate which was dominated by high day temperatures common at the coast of Kenya. To counter this, the researcher sought out respondents whom the elephants and Bees employees knew rather than total strangers. Data collection took place during the early morning or in the evening when the temperatures were not too high and also to fit in with respondents' schedules.

1.8 Assumptions of the study

- I. One assumption of this study was that there exists indigenous knowledge in the area of study.
- II. The subjects would be cooperative and provide relevant information associated with the topic of research
- III. Another assumption was that the sample selected from the population was a representation of all the current situations in other Kenyan communities experiencing HWC.
- IV. There was ongoing human-wildlife conflict in the area of study

1.9 Ethical issues

Direct consent was obtained by attaching consent forms to every SSI. Before the interviewees answered any questions they were required to sign and agree or disagree to be audio recorded, to be quoted, whether the researcher should take note, photographs and whether the results are to be shared.

The data reported in this research is honestly reported and no data has been withheld by the researcher, methods were used as explained in the methodology section and intellectual property of others respected by citing relevant literature accordingly. In the use of the data collection instruments there was no bias towards or against any sex, race, gender or tribe and no respondent was harmed physically or psychologically.

1.10 Definition of significant terms

Indigenous knowledge: Indigenous knowledge (IK) is the local knowledge; knowledge that is unique to a given culture or society. IK contrasts with the international knowledge system generated by universities, research institutions and private firms.

Indigenous people/populations: are people defined in international or national legislation as having a set of specific rights based on their historical ties to a particular territory, and their cultural or historical distinctiveness from other populations that are often politically dominant.

Local ecological knowledge: is often described as local and holistic, integrating the physical and spiritual into a worldview or “cosmovision” that has evolved over time and emphasizes the practical application of skills and knowledge. TEK is the product of careful observations and responses to ever changing environmental and socio-economic conditions: as we now know, adaptation is the key to survival

Conflict: to come into collision or disagreement; be contradictory, at variance, or in opposition; clash.

Human wildlife conflicts: refers to the interaction between wild animals and people and the resultant negative impact on people or their resources, or wild animals or their habitat. It occurs when growing human populations overlap with established wildlife territory, creating reduction of resources or life to some people and/or wild animals.

Effectiveness: The degree to which something is successful in producing a desired result; success:

Intervention: Any activities designed to reduce the severity or frequency of encounters between people and wild animals or any activity that increases people’s tolerance to wildlife.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this chapter, the researcher reviewed literature related to indigenous knowledge and human-wildlife conflicts. The review was conceptualized under the objectives of the study and focused mainly on the level, amount, type of indigenous techniques and their effectiveness in human-wildlife conflict management. These were considered the main issues of the study. In addition, the theoretical framework, conceptual framework and variables used in the study were discussed.

2.1 Indigenous Knowledge: theories and definitions

The Centre for Traditional Knowledge (2014) states that IK involves the practices of the elders and is based on customary law and its essence is found in the language of the people. Usher (2004) disputes the essence of IK as language by explaining that other than language other essences of IK are observations and experiences which form the basis for any IK system. The Forest Stewardship Council of Canada (FSC Canada, 2004) supports Usher's claim by adding that IK or traditional ecological knowledge (TEK) is rooted in the spiritual, health, culture and experiences of those who are close to the lands/ indigenous populations.

The study considering the numerous variations in definition of IK, therefore adopted all the above explanations as adequately summarized by the Convention on Biological Diversity (2015) as:

“...the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and agricultural practices, including the development of plant species and animal breeds. Traditional knowledge is mainly of practical nature, particularly in such fields as agriculture, fisheries, health, horticulture, and forestry”

Populism theories: Methodological v/s Ideological

The study was modeled on the theory of methodological populism which was advanced by Olivier de Sardan (2005) and used by Lanzano (2013) in his study titled, “What kind of knowledge is ‘indigenous knowledge’? Critical insights from a case study in Bukina Faso”. The theory postulates that ‘grass-roots’ groups and social actors have knowledge and strategies that should be explored without commenting on their value of validity.

This theory was preferred over the ideological populism theory also advanced by Sardan. Ideological populism “paints reality in the colors of its dreams” and is also biased disabling and ignoring scientific procedures whereas methodological populism is a positive factor which opens new fields of investigation. Sardan further supports methodological populism claiming that “it leads to obtaining innovative results and also sets itself the task of describing the agency and the pragmatic and cognitive resources that all actors (in this case indigenous populations) have, regardless of the degree of domination or deprivation in which they live”

As applied in this study, the theory holds that IK and people (grass-roots and social actors) can help improve the effectiveness of techniques being used to mitigate HWC since they lead to innovative results and also open new fields especially when used without ignoring scientific procedures.

However in adapting this theory, the researcher was not ignorant of its main shortcoming in that it tends to be “thrown together in explanations of- and sometimes being overshadowed by- the ideological populism theory” (Sardan 2005; Lanzano, 2013).

2.2 Level of indigenous knowledge

The World Bank estimates that there are 300 million indigenous people worldwide and they safeguard within their traditional territories about 80% of the planet’s biodiversity (The World Bank, 2014).

African communities have always had a cultural background governing the use of genetic plants and animal resources therefore being able to manage conflicts. In Kenya all 62 ethnic groups have a rich IK base with deep knowledge of medicinal plants, food resources, wild and domestic animals unique to themselves (Mong’ou, 2008). However the level of this knowledge is threatened by a multitude of factors as discussed.

The level of indigenous knowledge is expressed in terms of the amount of indigenous available for use, either stored or held by the indigenous people. Lockwood predicts that 90% of the world's languages may become extinct within this century and this does not only mean the loss of the means to communicate more importantly it signifies loss of knowledge that is embedded in that lifestyle (Lockwood *et al*, 2006).

According to Mong'ou (2008) IK has not been well documented or properly packaged to allow dissemination and the death of practitioners (elites or elders) equates to the loss of precious indigenous knowledge. Ocholla (2013) supports this by stating that very little of this knowledge has been recorded, yet it represents an immensely valuable database that provides insights on how different communities continue to survive where wildlife, people and livestock all interact and compete for the same resources. This has led to increase in the rate of conflicts.

Apart from lack of proper recording and storage of IK, loss of this knowledge has been due to continuous adaptation and manipulation over the years (Mong'ou, 2008). This has either led to the complete loss of IK or the reduction of the capability of this knowledge to solve human- wildlife conflicts. Ream (2013) further states that traditional systems are being eroded by social and technological changes and as they continue to experience shifts towards globalization, some knowledge runs the risk of being lost if it is not documented.

The amount of this knowledge further depends on the localities, either rural or urban. In Kenya most of this indigenous knowledge is mainly concentrated in rural and peri-urban areas where the main activities are pastoralism, agro-pastoralism or agriculture and less of it is found in urban areas where modern education is the main source of knowledge.

IK presence and amount also depends and varies according to the wildlife species the community is exposed to. For example, African indigenous people have had a complex but generally negative perception of crocodiles. There seems to be almost no IK remaining about the role of crocodiles in the natural ecosystem, in contrast to the perceptions held by older generations concerning the roles of many terrestrial wildlife species. Consequently, crocodiles are seen as threats and a cause of conflict because they attack livestock and compete for fish (Ocholla *et al*, 2013).

On the positive side various efforts and organizations have been put in place to try and preserve indigenous knowledge and communities. For instance, the Working Group on the

Rights of Indigenous Populations (WGRIP) established on November, 2000 has the following mandates regarding to Indigenous people; to examine the concept of Indigenous populations/communities in Africa. To study the implications of the African Charter on Human Rights on the wellbeing of indigenous people and consider appropriate recommendations for the monitoring and protection of the rights of indigenous populations (UN Declaration of the Rights of Indigenous People of 2008).

In Kenya, The Constitution of Kenya (2010 Revised Edition) swears to promote all forms of national and cultural expression through literature, the arts, traditional celebrations, science, communication, information, mass media, publications, libraries and other cultural heritage (Article 11 Section 2a). It also recognizes the role of science and indigenous technologies (Section 2b) and also swears to recognize and protect the ownership of indigenous seeds and plant varieties, their genetic and diverse characteristics and their use by the communities of Kenya (Section 3b).

Further, The Kenya Resource Centre for Indigenous Knowledge (KENRIK) was established in 1995. Its role is to document and preserve the endangered/ threatened indigenous knowledge held by different communities in Kenya which have traditionally served an important role in environmental conservation, natural resource management, food security and traditional health care systems (National Museums of Kenya, 2014). The National Environment Management Authority has also coordinated the formulation of the action plan for mainstreaming indigenous knowledge into development (Mong'ou, 2008).

2.3 Effectiveness of indigenous knowledge in managing human-wildlife conflicts

IK has been effective in human-wildlife conflict management since local people have managed the land on which they live and the natural resources which surround them (Roe *et al*, 2009). The IUCN proposes that indigenous communities' effective participation in wildlife conservation programs just like experts could result into more comprehensive and cost effective conservation and management worldwide (IUCN, 2010).

Furthermore, the communities also have different cultural beliefs on wildlife existence that has enabled them to live alongside the animals harmoniously. This includes the myths, legendary and cultural beneficial attachment they have with different wildlife species (Ocholla *et al*, 2013). Lockwood *et al* (2006) explains that local and indigenous communities

generally have considerable knowledge about the species they use, especially where they have been using the product for generations. In such cases the use of the product is likely to be sustainable. Smajgl and Larson (2007), explain that indigenous people have integral and unique relationships with the earth, including land, seas, resources and wildlife therefore the people do not fragment their rights and obligations regarding to their ecological, spiritual, cultural, economic and social dimensions (Posey, 1999).

This knowledge is often identified as an important source of information, however, active use of this information is limited and the importance of this information is only highlighted in principle but limited in practice (CARACAL, 2014). This limited use in practice is due to differing opinions from the locals and that indigenous is locally restrictive and in most cases does not apply outside the locality (Padilla and Kofinas, 2014). This restriction makes the available indigenous knowledge ineffective when applied in other different ecosystems or localities. For instance the indigenous knowledge used in managing conflicts in Samburu can only be used to a small extent in Tsavo National park since these two ecosystems' indigenous people have different ways of life.

Effectiveness of indigenous knowledge has further been hindered by the top-down approach mentality of 'let elders and leaders pass' (Padilla and Kofinas, 2014) this is less effective compared to the less top-down and less restrictive community participation.

There have been cases of successful use of indigenous knowledge in synergy with modern knowledge in managing human-wildlife conflicts. Many conventional scientists involved with local groups have expressed increased appreciation in the value of IK in implementing and monitoring practices as well as learning about landscapes through monitoring and assessment (Ballard *et al*, 2008).

A proper success story of integrating traditional knowledge with modern knowledge is the Elephant and Bees Fencing project in Tsavo East. Auditory fences that use recorded bee sounds and actual traditional beehive fences are erected around farms and homesteads, this has resulted to elephants changing their routes and heading away from the bee sounds, furthermore it has led to improvement in livelihoods through the sale of honey from these fences (King L.E, 2014).

Berkes (2012) however argues that although co-management in some cases brings scientists, locals and managers together for shared decision making, combining knowledge systems is a

challenging practice. This in turn has led to ineffectiveness of indigenous knowledge when used to manage human-wildlife conflicts.

Human-wildlife conflicts cannot be managed solely by using indigenous knowledge. Intervention strategies endeavor to avoid the conflict from occurring in the first place and take action towards addressing its root causes (FAO, 2009).

A variety of techniques, some employing use of indigenous knowledge have been used in various parks in Kenya as interventions to mitigate HWC. Ndung'u (2013) proposes such methods as creation of artificial and vegetation barriers, burning fires to keep wildlife away, manual guarding of the farms and guard animals, making noises and shining torches towards animals to scare them off the farms and also throwing spears and stones to chase away wild animals.

Common indigenous methods that are used to minimize conflicts in the study area include fencing, use of deterrents, human vigilance and use of guard animals such as dogs. However, if the conflicts become unbearable some of the locals may kill the problematic animals as a last resort.

Fencing is one the most commonly used method. FAO (2009) states that if properly designed, constructed and maintained fences can be almost completely effective in preventing HWC and, apart from mitigating HWC fences also help prevent the transmission of certain endemic diseases such as foot and mouth diseases.

Fences may be artificial or vegetation barriers, electric or non-electric fences. King L.E (2014) recommends use of the more socially and economically suitable traditional beehive fences due to the high costs of electric fences and these fences not being feasible with the animals and the community. Fences have also been effective in managing HWC compared to digging ditches to keep wildlife at bay (Ndung'u, 2013). Vegetation fences are one of the most ecologically friendly ways of reducing HWC. In Samburu fences made using thorny acacia trees are used to make enclosures around *manyattas* and livestock sheds. However this method of fencing has not been as effective since (according to respondents) some predators such as the lion and leopards can jump over the fence and attack the livestock and that these fences require frequent repairs and it needs specific type of thorn to be effective (Ocholla *et al.*, 2014).

However in Kenya, the fencing of farms has created physical barriers to migratory species such as zebras and wildebeest, or species making seasonal displacements such as elephants. Fencing reserves may affect the dynamics of wildlife populations and hinder their natural migratory and dispersal behavior, especially in the case of highly territorial species such as lions (Lamarque *et al*, 2009)

The next most common method used in the Sagalla area has been the use of deterrents. These are devices that are used to repel animals without harming them. Deterrents used in Sagalla are mostly of acoustic and visual in nature.

Acoustic deterrents are those that shock wildlife away by emitting an unexpected loud noise or specific sounds known to scare wildlife. Among the Samburu, traditional acoustic methods that are widely used by agro-pastoralists throughout, mainly against elephants includes beating drums, tins and trees; using whips in addition to shouting, yelling and whistling.(Ocholla *et al*, 2014).

Bee sounds have been used in the area to repel away elephants and change their movement routes away from the farms. Playback methods have been conducted in Samburu, Buffalo Spring National Reserve and Tsavo in Kenya and have revealed that elephants run from the sound of disturbed honey bees (King L.E, 2014).

Visual deterrents are the traditional methods involving use of brightly colored cloths, brightly colored beehives (King L.E, 2014) flames and smokes of fire lit by *morrans* and plastic hanged from a simple fence at the edge of fields such as scarecrows (Ocholla *et al*, 2014). However some of these deterrents are not environmentally friendly such as the use of fire may lead to forest fires and hence death of both plants and animals. All this techniques can be very effective if fully integrated with the IK of the locals and also if they are included in modern scientific techniques of managing HWC such as use of GIS and remote sensing.

2.4 Conceptual framework

The principle objectives of this study were to determine the effectiveness of using indigenous knowledge in conflict management and to assess the level of IK in the area of study. In the conceptual framework used in this study, indigenous knowledge was hypothesized to influence human-wildlife conflict management and conservation of wild animals. Indigenous knowledge was defined in terms of the level/amount and type. The dependent variable in the

study was human-wildlife conflicts in the area of study and the independent variable in the study was indigenous knowledge. The intervening variable in this study will be the other ways/techniques that are used in human-wildlife conflict management.

Effectiveness of this knowledge on human-wildlife conflict management was defined in terms of economic (time, labor, cost), impacts on human, popularity and impacts on the ecosystem.

The framework postulated that the level of local ecological knowledge in a community directly affects the effectiveness of HWC management efforts, improved livelihoods and the conservation of species. However, this relationship may be affected by other factors such as technology, religion and migration.

The relationship between the different variables in the study will be expressed in the framework as in **Figure 1**.

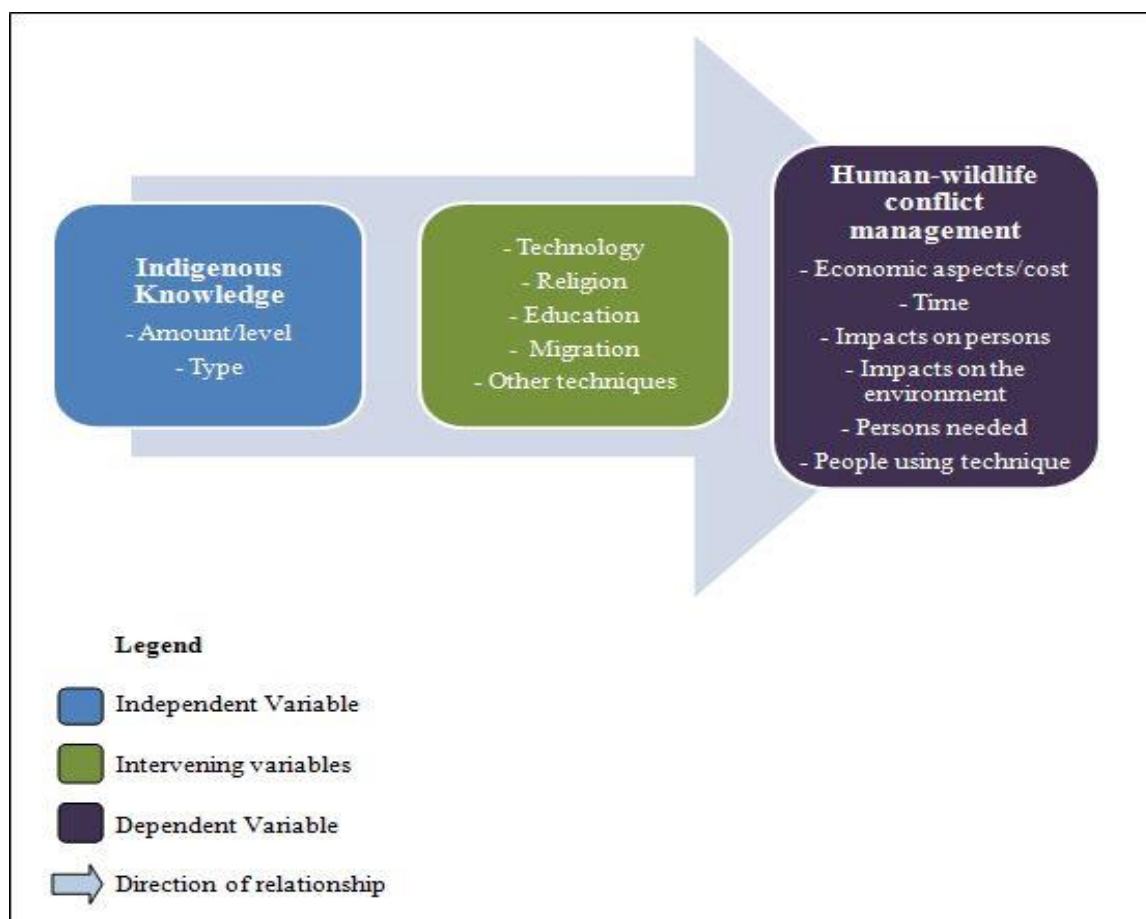


Figure 1: Conceptual framework for the relationship between indigenous knowledge and human-wildlife conflict management.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

In this chapter, various materials and methods that were used for the research are discussed in details. Data collection was also made successful by determining the type of research design that was appropriate for the study. The target population was also described, and the researcher came up with proper sampling procedures and data collection tools fit for the study.

This chapter also describes how the data was coded and analyzed.

3.1 Research design

A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of the study (Creswell 2009). This study primarily used a Cross-Sectional research design which is mostly applied in social sciences. This study used ethnography and correlation designs to make up the cross-sectional design.

Oso and Onen (2009) describe correlation as “a research design where a researcher compares two or more characteristics from the same group and determines whether or not, and to what extent an association exists between two or more paired and quantifiable variables”. Correlation design was ideal to this study since it provided the basis for understanding the relationship between the various variables and also helped to determine to what extent these variables had an impact on each other. The researcher was able to establish a relationship between age, education, gender and the level of indigenous knowledge in Sagala ward. Correlation between the present indigenous knowledge and human-wildlife conflict management was also established.

Ethnography is a research design where a researcher studies what is happening as it is lived and practiced by the people and helps identify the presence or absence of attributes rather than disapprove them (Oso and Onen, 2009). In the study ethnography was crucial since it helped in generating a grounded theory and provided a clear picture of the study area and its various attributes.

Data collected was both qualitative and quantitative. Qualitative data focused on the responses, attitudes and experiences of the respondents on IK and generally on wildlife and HWC. Quantitative data was derived in terms of time, cost and people needed for each of the mentioned indigenous techniques of dealing with wild animals.

3.2 Population under study

The population under study was Taita Taveta with the population under study being the areas around Tsavo East National Park.

3.2.1 Location

Taita Taveta County is one of the six counties in the Coastal region of Kenya. It borders Tana River, Kitui and Makueni counties to the North, Kwale and Kilifi counties to the East, Kajiado County to the North-west, and the Republic of Tanzania to the South and South-west. Further, the County covers an area of 17,084.1 square kilometres (Km²) and lies between latitude 2° 46' South and 4° 10' South and longitude 37° 36' East and 30° 14' East. (GoK, Google maps and Wikipedia, 2015)

3.2.2 Climate, soils and zonation

The county is divided into two major topographical zones. These are the upper zone, and lower zone. The upper zone is suitable for horticultural farming, while Precious gemstones are found and mined in the lower plain. The major rivers in the county are Tsavo, and Voi rivers. A major spring in the county includes an Mzima spring which is one of the major water supply to Mombasa while Small springs and streams include Njuguni, Sanite, Maji Wadeni, Humas Springs and Lemonya Springs.

The county is dry, except for high catchments areas in the hills. The effect of the south – easterly winds influences the climate of the county. The hilly areas have ideal conditions for condensation of moisture, which results in relief rainfall. The county experiences two rain seasons: the long rains between the months of March and May and the short rains between November and December. The county receives an annual rainfall of between 157 and 1200 mm with an annual mean of 650 mm while the annual temperature varies from 18 to 25°C. The county has 7 types of agro ecological zones: LH2, UM3, LM4, LM5, LH5, LH6. This, coupled with the cooler temperatures, makes the highlands have more potential for the production of horticultural crops, maize and beans (Agricultural Sector Development Support Programme, 2015)

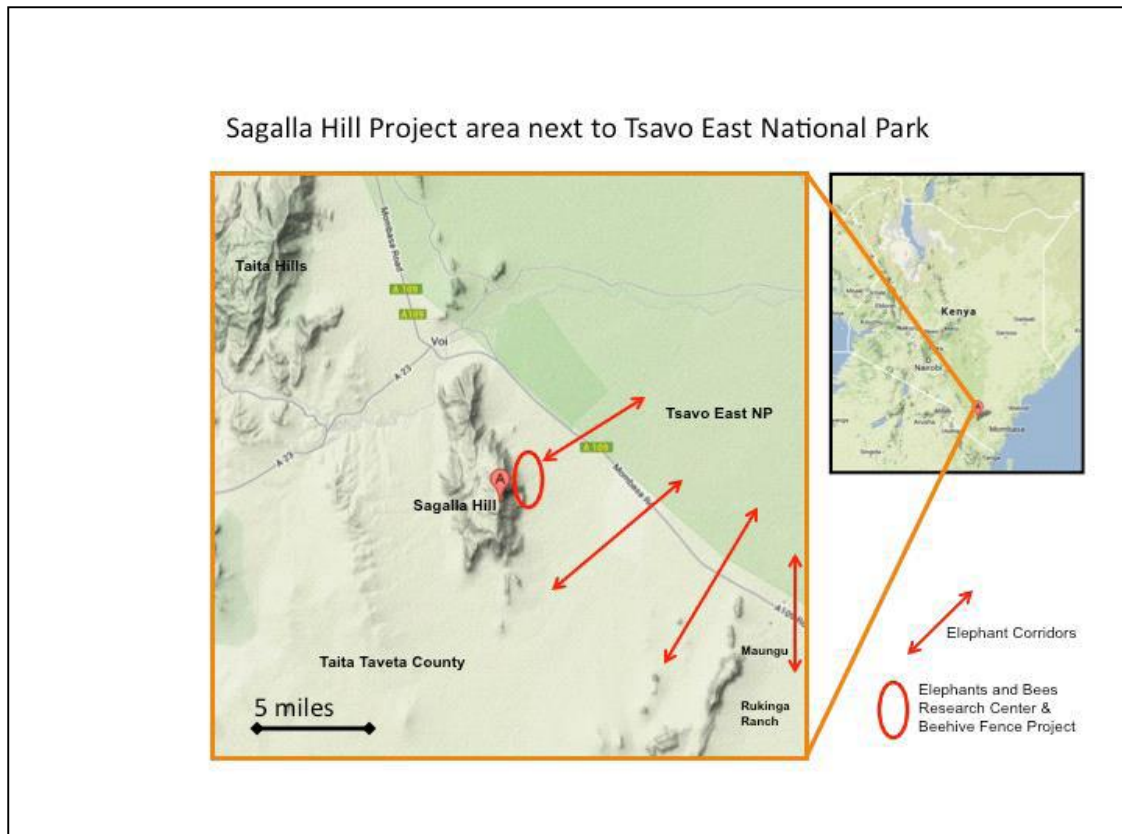


Plate 1: Study area (Sagala) next to Tsavo East National Park (Source: Elephants and Bees Project)

Target population

According to Nachmias (2008) a population is the aggregate of all cases that conform to some designated set of specifications.

The population under study was the residents of Sagalla ward. It is one of the six wards in Voi Sub County. It covers an area 3,269 Km² and is divided into four sub locations namely: Kishamba, Talio, Teri and Ndara. These are further sub divided into Mwanga, Mwandala Bondeni, Kaloleni, Kwa Kidola (Nyika/Mchanga), Kwa Ngware villages of Kishamba Sub location, Talio Nyika, Zongowani, Rakhasi villages of Talio sub location, Rakhasi, Zongowani, Marapu villages of Teri sub location, Kirumbi, Mazieni, Mwakoma, Uwanjani villages of Ndara sub location (Mbaluka *et al.* 2014). Due to time and financial constraints the research was conducted on purposively selected villages in Sagalla ward namely Mwakoma, Kirumbi, Mgange and Kizumanzi.

As per the National population census of 2009, the population of Sagala is estimated at 10,816 people. Males 5,385 and 5,431 females. Households are 2,756 and 827 farm families (Mbaluka *et al.*, 2014). This area suffers from HWC since they practice a variety of

agricultural activities which attract elephants in search of food. Activities in this area include: Crop, livestock and fish production. Crops include Maize, cowpeas, green grams and beans are the main crops produced. Other crops being grown are sorghum, groundnuts pigeon peas, cassava and sweet potatoes (Mbaluka *et al*, 2014)

3.3 Sampling Methods

Sampling is the process of selecting units (e.g. people, animals, plants, organizations) from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen (Trochim 2006). In the study at hand the target population was the area surrounding the park but the sample chosen was Sagala ward. Sagala was chosen due to its proximity to Tsavo East National Park hence exposure to frequent human-wildlife conflicts. The researcher also chose Sagala as the sample area since he worked there for the Elephants and Bees research project for 3 months (also the data collection period; see project schedule Appendix II) hence ease of access to participants.

3.3.1 Sample

The sample for the study consisted of 50 participants. This consisted of males and females, all age groups and participants of various occupations who were selected from 4 villages in Sagala ward. 45 respondents from the four villages were interviewed and 5 questionnaires were answered by employees of Wildlife Works, an NGO working in Taita Taveta. One school (Kileva Eastfield primary school) was chosen for the focus group.

3.3.2 Sampling techniques

The study employed purposive sampling, stratified sampling, cluster and snowball sampling.

Purposive sampling consists of detecting cases within extreme situations as for certain characteristics or cases within a wide range of situations in order to have all the desired situations (Abugah, 2009). Based on the assumption that indigenous knowledge varies according to the age with older people having high IK (practitioners) and young people being the recipients and representatives of the current level of IK, the researcher therefore selected a larger sample of people of age 51 years and above and also a larger sample of participants of age 21-30 years. One school was selected to act as representative of the young population and also as a measure of whether knowledge is being passed on to the next generation.

Cluster sampling is used where a population is large and dispersed but grouped into units such as villages, houses, buildings... (Abugah, 2009). This method was used to select the four villages considering their proximity to each other and to the culturally and religiously significant Sagalla Hill which is relevant to Indigenous Knowledge studies. The researcher also made an assumption that villages on top of the hill had differences with villages at the foot of the hill. Two villages on top of the hill were selected to represent the relatively humid zone while the foot of the hill is drier. The two ecological zones were also assumed to have different problem animals and hence different indigenous techniques.

The target population was not homogenous in terms of sex, age, occupation, length of stay among other characteristics. Using stratified sampling, the population was therefore divided into various homogenous strata such as age groups (recipients and practitioners of indigenous knowledge) and occupation/livelihood. This was done so as to improve the external validity of the study.

Snowball sampling was used to identify and interview IK practitioners locally known as *wazee*. The snowball technique used as shown in **Figure 2** where in this study, the first practitioner/*mzee* was identified by the researcher's guide and translator. The *mzee* then identified other practitioners who in turn were asked to recommend other people with a rich IK background. The cycle ended when one *mzee* was recommended more than once. In total about 4 *wazee* were interviewed as IK practitioners as identified by the indication network.

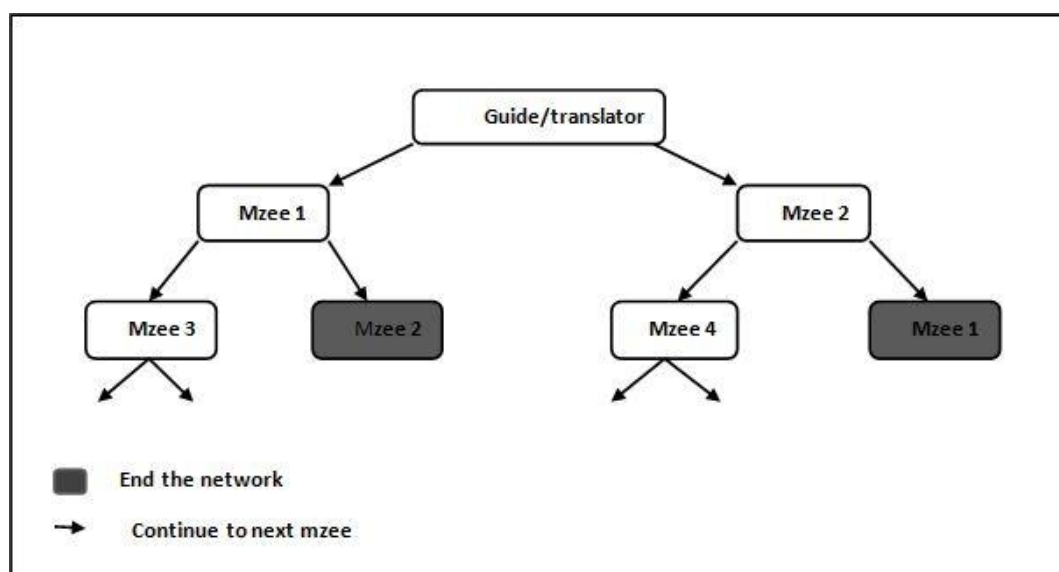


Figure 2: Indication network adapted from Braga and Schiavetti (2013)

Snowball sampling was very useful to the study since the researcher did not spend too much time looking for the IK practitioners.

3.4 Methods of data collection

This study applied multiple methods of data collection since it involved both qualitative and quantitative data. The study required collaboration from all stakeholders such as the local community members/ indigenous residents, researchers, students, government and Non-Governmental Organizations.

The following tools were used to assess the level and also effectiveness of indigenous knowledge in the area of study.

3.4.1 Semi-structured interviews

Semi-structured interviews consist of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to diverge in order to pursue an idea or response in more detail (Gill *et al.*, 2008). An interview is a face-to-face, interpersonal role situation in which an interviewer asks respondents questions designed to elicit answers pertinent to the research hypothesis (Nachmias 2008). Due to the exploratory nature of this study semi-structured interviews were the main method of data collection. Interviews were important in this study since they were useful in assessing the attitudes, responses concerning IK and also in assessing the level of IK in the area and whether it has been effective presently or in the past. According to Creswell (2009) interviews are useful when participants cannot be directly observed, participants can provide historical information and it allows researcher control over the line of questioning.

However the close-ended questions in the SSI necessitated the need for follow-up questions in order to avoid ambiguity and to obtain more information in the case of unresponsive participants.

Realization of the interviews

Wherever possible, interviews should be conducted in areas free from distractions and at times and locations that are most suitable for participants (Gill *et al.*, 2008). From preliminary surveys, the researcher realized that due to the high temperatures in the afternoon there were fewer activities in the villages. The interviews were therefore conducted mostly in the

afternoon in order to fit in with the schedule of the participants. This (interviewing) took place either on the farms or at the respondents' homes.

A total of 45 participants were interviewed from the four villages: Mwakoma, Kirumbi, Mgange and Kizumanzi. The number of people interviewed in each of the villages varied due to accessibility by the researcher and also due to varying populations. Villages at the foot of Sagala Hill, Mwakoma and Kirumbi, had more respondents (14 and 11 respectively) while the villages up Sagala Hill, Mgange and Kizumanzi had less respondents (11 and 9 respectively).

The Elephants and Bees research project in Sagala facilitated the door-to-door interviews by aiding with a local guide/translator and maps to the various villages. The project also assisted the researcher in the selection of the villages which helped in saving time and resources during data collection.

Recording of the interviews, taking of photographs and notes were done with permission from the participants.



Plate 2: Conducting an interview in Mgange village (Source: Nelson, 2015)

3.4.2 Focus group discussion

A working definition of FDG as used by Gill (2008) was adapted;

“The focus group interview... taps into human tendencies. Attitudes and perceptions relating to concepts, products, services or programs are developed in part by interaction with other people. We are a product of our environment and are influenced by people around us.”

Erminia (2007) states that “FGDs can help focus the group’s attention on the core study topic and also make subsequent comparative analysis more straightforward; they can also be helpful with young people and to discuss sensitive topics.”

Realization of the Focus Group discussion

Schools in Sagala are far spread and only one was easily accessible by foot. The researcher conducted a few focus group discussions with Class 8 students of Kileva Eastfield Primary school. The FGDs were made successful by using visuals such as films and also the discussions were narrative-like where the students were asked to recite local poems, narrate stories and folklore. Questions by the moderator (the researcher) were unstructured.

The number of participants in a FGD is very crucial. Stewart and Shamdasani (1990 and Gill 2008) suggest that it is better to slightly over-recruit for a focus group and potentially manage a slightly larger group, than under-recruit and risk having to cancel the session or having an unsatisfactory discussion. The class had 16 students all of whom were involved in the FGD.



Plate 3: An interactive FGD with Kileva Eastfield pupils (Nelson, 2015)

3.4.3 Questionnaires

Questionnaires are more practical method of data collection especially the open-ended design which also contributes a large amount of data to the study. Questionnaires not only helped in determining the level of IK but also indicated whether this knowledge has been effective when used in managing human wildlife conflicts.

Realization of the questionnaires

Open ended questionnaires were issued to the Wildlife Works which was used as a representative of other NGOs neighboring Tsavo East National Park and dealing with human-wildlife conflict management.

3.4.4 Observation

This entails the systematic noting and recording of events, behaviors and artifacts/ objects and also organisms in the social setting chosen for the study (Marshall and Rossman 2006). It is direct since it enables researchers to study behavior as it occurs therefore firsthand data. Observation can be used in situations where people are unwilling or unable to express themselves verbally. The relationship between a person and his/her environment is not altered therefore researcher can observe the impact of the environment on the subjects. Also, unusual aspects can be noticed during observation.

However according to Creswell (2009) when using observations;

“Researcher may be seen as intrusive, personal/private information observed by researcher is not reportable, researcher may not have the required observation skills such as good attending and observing skills also certain participants such as children may present special problems in gaining rapport...”

Realization of observation as a data collection tool

Observations took place every day without any pre-planning. This was possible since the researcher was working with the Elephants and Bees project as an intern throughout the data collection period. Activities on the project were mostly fieldwork and these provided adequate exposure to the surrounding and culture of the residents of Sagala hence first-hand information was derived easily.

An observation checklist and scribbled field notes were used to collect data techniques that are being used in managing HWC in Sagala. The data was also recorded using photographs.

Observation was used to assess the reaction of the locals towards wild animals and their attitudes on the subject of IK. Observation was mostly non-participant in nature.

This method aided in determining whether the current use of IK such as fencing and use of deterrents have been effective in mitigating HWC. Impacts of the techniques were also recorded from the observations.

3.5 Quality control: Reliability and Validity

The study's reliability by as proposed by Silverman (2006) was realized by checking the transcripts to ensure they did not have mistakes during transcription. The researcher also made sure there were no changes in the meaning of codes during data input into SPSS and cross-checked codes as used by various researchers. In interviews reliability was assured by using tape recorders and carefully written and thorough transcripts. To improve on the reliability and validity of the instruments, 3 pilot interviews were conducted and from the gaps in the data collected new semi-structured interviews were formulated. The data collected in the pilot was not used in the final analysis since it had inconsistencies which would make analyses difficult.

Both validity and reliability of my study will be established by triangulation as advocated for by Yin (2009). This means that the various methods of data collection (interviews, questionnaires and focused groups as discussed in this Chapter) and the data collected (qualitative and quantitative) were compared to see whether they support one another. This comparison is done in a triangular shape hence the name *triangulation*. This ensured that the study depicted reality by giving a complete picture of the study.

Samples selected composed of heterogeneous participants, that is, the samples were made up of various sexes, age, occupation among other characteristics and this was useful in improving the external validity of the study.

3.6 Data Analysis

Data analysis involves making sense out of texts and image data (Creswell 2009). This study being exploratory and descriptive involved both qualitative and quantitative analysis. Throughout the study the latest version of Statistical Package for Social Scientists (IBM SPSS Statistics 22) was used for the analyses and presentation of the results.

The researcher adapted Creswell's guide to analyzing data by following the steps below;

Step 1: organization and preparation of data- the recorded interviews were transcribed using brief statements and, materials scanned such as pictures and maps. The responses were summarized and typed into Ms Excel sheets so as to make it easier to export the data to the SPSS application. Field notes were typed and incorporated into the spreadsheet as additional information to the responses.

Step 2: reading through the data- reading through all that was gathered provided a general sense and the researcher was able to get the overall meaning. From this preliminary analysis the researcher presented brief findings using graphs and pie charts as a requirement at the end of the internship at the Elephants and Bees research project.

Step 3: detailed analysis. Analysis began with the coding process. Bourque (2004) defines coding as "the process by which verbal data are converted into variables and categories of variables using numbers, so that the data can be entered into computers for analysis." Coding facilitates the organization, retrieval, and interpretation of data and leads to conclusions on the basis of that interpretation (Sharon, 2004).

For the study at hand codes were developed during the analysis. Data was converted using various Likert scales; occurrence of conflicts was converted using a 4-point Likert scale, individual and current levels of IK using a 5-point Likert scale and Importance of wildlife using a 4-point Likert scale (**Table 1**). Numerical data such as age, length of stay, cost, time and number of people needed were entered just as they were recorded in the field.

As indicated in the coding in **Table 1**, positive attitudes/responses were assigned a higher value on the Likert scale and negative responses a lower value. For example "Yes" was assigned 2 while "No" and "No answer" awarded 1 and 0 respectively.

The actual analysis involved, ANOVA and t-tests to compare different means and correlation analyses which were made between the various variables. Correlation analyses were made between the independent variables (age, length of stay, education, occurrence of conflicts, gender balance, and eagerness of youth to learn IK) and the dependent variables which were attitudes towards wildlife, individual and current level of IK. Correlation was also made to assess how attitude towards wildlife affected the level (individual and current) and type of IK present in Sagala ward.

Correlation (r) coefficients in SPSS used were Pearson, Kendall's tau-b and Spearman although the most used was Pearson's correlation coefficient. Simple frequency descriptive statistics, ANOVA and T-tests were used to compare the means of variables as measured on the Likert scale.

Correlation analyses of the variables were guided by the conceptual framework outlined in **Chapter 2** of this study.

Results from the SPSS were presented using various methods. Pie charts, boxplots, error bars, scatter/dot plots, bar graphs, histograms and frequency distribution tables were the most preferred form of data presentation. Results that could be easily explained were presented using brief statements.

| Variable (s) | SPSS Coding and labeling |
|--|---|
| Gender | 0.00 = "Male" 1.00 = "Female" |
| Education | 1.00 = "No education" 2.00 = "Primary" 3.00 = "Secondary" 4.00 = "Tertiary" |
| Occurrence of conflicts | 1.00 = "Very Frequently" 2.00 = "Frequently" 3.00 = "Occasionally" 4.00 = "Rarely" |
| Taught IK? Youth eager to learn/ Gender balance. Any IK about wild animals, Any Organizations using IK? | 0.00 = "No answer" 1.00 = "No" 2.00 = "Yes" |
| Your level of IK Current level of IK | 1.00 = "None" 2.00 = "Too little" 3.00 = "Little" 4.00 = "About right" 5.00 = "A lot" |

| | |
|------------------------|--|
| Importance of wildlife | 1.00 = “Unimportant” 2.00 = “Moderately important” 3.00 = “Important” 4.00 = “Very important” |
| Time | 0.00 = “No answer” 1.00 = “Long” 2.00 = “Whole night” 3.00 = “Few hours” 4.00 = “No time” |
| Cost | 0.00 = “No answer” 1.00 = “Expensive” 2.00 = “Cheap” 3.00 = “No cost” |
| People needed | 0.00 = “No answer” 1.00 = “Many” 2.00 = “Few” 3.00 = “None” |
| People using | 0.00 = “No answer” 1.00 = “None” 2.00 = “Few” 3.00 = “Many” |

Table 1: Coding of variables using SPSS

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This study was used to investigate the effectiveness of using indigenous knowledge in human-wildlife conflict management. This was in light of the increase in poaching and human-wildlife conflicts cases in various parks in Kenya which has contributed greatly to the endangerment of a variety of plant and animal species such as the African elephant (*Loxodonta Africana*) and the white rhino (*Ceratotherium simum*). The use of indigenous knowledge has not been fully utilized in HWC management and so long as this trend continues wildlife will still be at huge risk of extinction mostly from interference from humans.

The data collected was analyzed using the IBM's Statistical Package for Social Sciences (SPSS) Version 22 and Microsoft Excel. This chapter presents the results of the analyses.

4.1 Profile of respondents

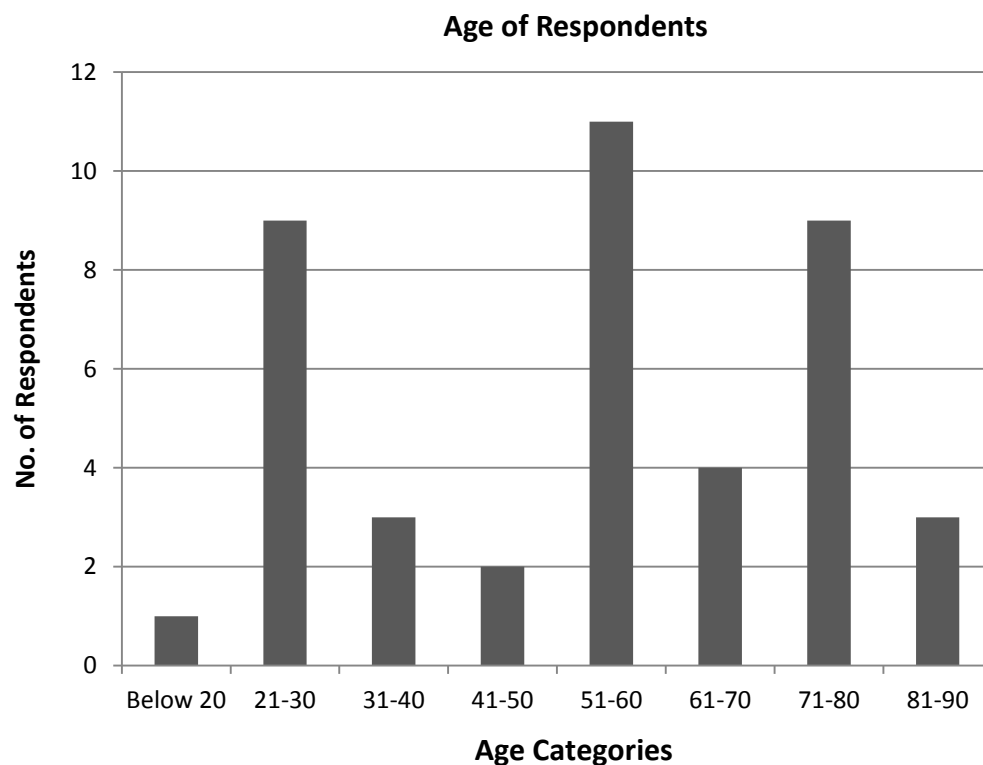


Figure 3: Age of respondents interviewed

45 respondents from the four villages were chosen for the sample. Of the 45 three were used for the pilot study, 1 respondent refused to participate and responses from the other 2 were not included in the final analysis since the results were inconsistent with the final draft of the SSI. 42 interviews were used for the analysis; this resulted to a 93% response rate.

As indicated in **Figure 3** the ages of the respondents ranged from 20 to 90 years, 63% were male and 37% were female. As stated in the sampling procedures majority of the participants were aged between 21 and 30 years (21%) and over 50 years (64%). Age and the length of stay of respondents in Sagala were almost perfectly correlated ($r = 0.81$, $p = 0.00$) with 86% of respondents having lived in Sagala since birth. 91% of the participants interviewed were farmers involved in either crop growing and livestock keeping or both, of the remaining 9% one was a carpenter, one a teacher, a brick smith and one was unemployed.

The education levels of the respondents are as summarized in **Figure 4 and Table 2**

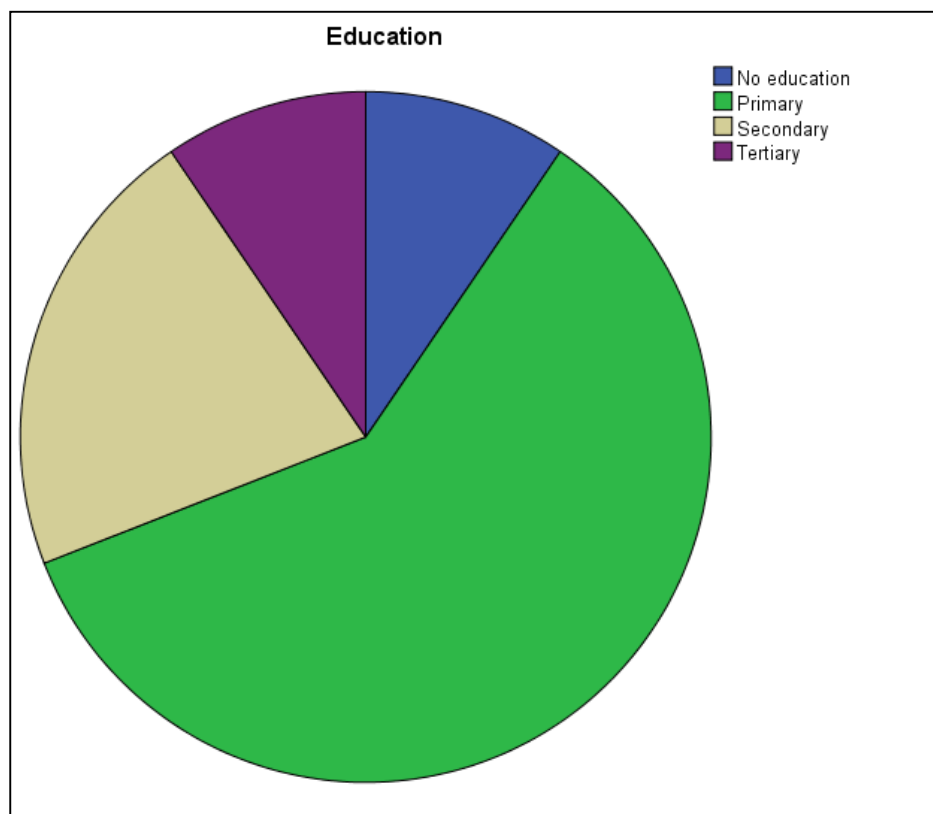


Figure 4: Education levels of participants

Education

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|--------------|-----------|---------|---------------|--------------------|
| Valid | No education | 4 | 9.5 | 9.5 | 9.5 |
| | Primary | 25 | 59.5 | 59.5 | 69.0 |
| | Secondary | 9 | 21.4 | 21.4 | 90.5 |
| | Tertiary | 4 | 9.5 | 9.5 | 100.0 |
| | Total | 42 | 100.0 | 100.0 | |

Table 2: Education level of respondents

4.2 Level of indigenous knowledge

The first objective of this study was to investigate the level of indigenous knowledge in Sagala. To achieve this objective, the respondents were asked to react to several statements intended to assess the current level indigenous knowledge. The status of indigenous knowledge was rated as being a lot, about right, little, too little and no indigenous knowledge. The current level of indigenous knowledge was defined in terms of the forms in which it is found in and the respondents were also asked to mention some of the reasons for their answers on the current level of indigenous knowledge.

Data on this objective was analyzed under the hypothesis “there exists indigenous knowledge in Sagala”. The results are summarized in **Figure 5** and **Table 3**.

Current IK?

| | | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-------------|-----------|---------|---------------|--------------------|
| Valid | None | 11 | 26.2 | 26.2 | 26.2 |
| | Too little | 16 | 38.1 | 38.1 | 64.3 |
| | Little | 11 | 26.2 | 26.2 | 90.5 |
| | About right | 1 | 2.4 | 2.4 | 92.9 |
| | A lot | 3 | 7.1 | 7.1 | 100.0 |
| | Total | 42 | 100.0 | 100.0 | |

Table 3: Frequency distribution table of the current level of Indigenous table knowledge

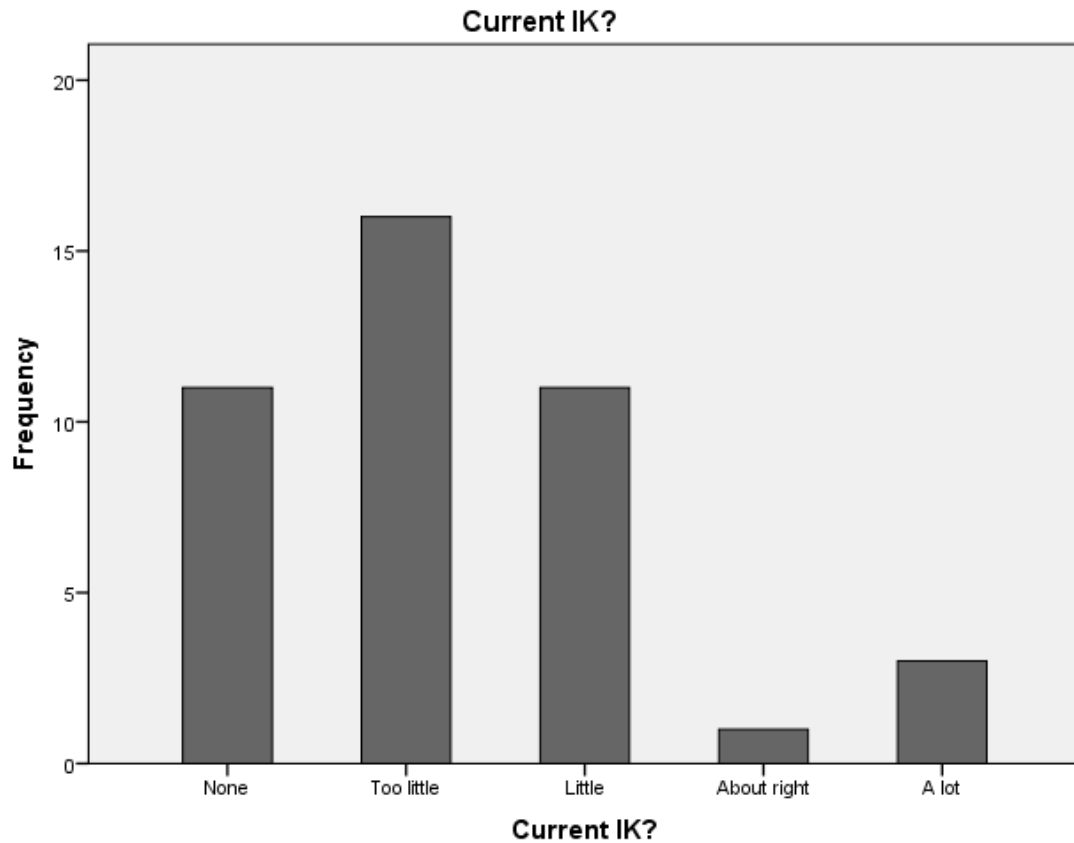


Figure 5: Frequency distribution of the current level of Indigenous knowledge

According to the established classes on the Likert scale, 26% of the respondents stated that there was no indigenous knowledge, 38% stated that the current level was too little and 26% stated that the current indigenous knowledge is little. Cumulatively 90% of the respondents stated that the current level of indigenous knowledge as either being too little, little or there is no indigenous knowledge left. The indicator of indigenous knowledge on HWC management as measured by the Likert scale ranged from 1 to 5 with an average value of 2.26. In general, the indigenous knowledge about reducing conflicts with wildlife was too little (2). Individual IK had a mean of 3.3 (Little) as measured by the Likert scale. The study established that indigenous knowledge exists in Sagala and therefore the hypothesis “there exists indigenous knowledge in Sagalla” is accepted.

Additional data on the current level of indigenous knowledge was obtained by asking the respondents to state which form this knowledge is found in and the reasons for the low level of indigenous knowledge. Forms of indigenous knowledge were analyzed according to the number of times each was mentioned by respondents (counts). Indigenous knowledge in the form of dances and songs had the highest counts (20 each), followed by narratives with a count of 19 and daily observations had a count of 6. Poems and riddles had 0 counts while

others like school education and practical training had a total of 5 counts. In total there were 70 mentions of the various forms in which the current level of indigenous knowledge is found in.

Reasons for the loss of indigenous knowledge and traditions were mentioned as, religion with the highest frequency (21 times), modern technology and medicine with 21 counts. Ignorance and lack of indigenous knowledge practitioners also had high frequencies of 17 and 14 counts respectively. Other factors leading to loss of indigenous knowledge were lack of unity (5 counts), drug abuse (3 counts) and lack of record keeping with 3 counts. Religion and modernity account for 50% (42 counts out of a total of 84 counts) of the reasons for the loss of indigenous knowledge with ignorance and lack of experts (combined percentage of 37%) also having a significant contribution to this loss.

The level of indigenous knowledge was also predicted by asking the respondents whether the current generation (youths) are eager to acquire this knowledge. The responses to this question as measured by the Likert scale had an average of 1.36 (**Table 4**). This means that most young people are not eager to learn or acquire the indigenous knowledge. (No=1 and Yes=2). Results from the FDG with the school children indicate that knowledge is being passed on to children since all of them (100%) knew about ways to keep away wild animals.

However, the current level of indigenous knowledge is equally distributed across gender (Mean=1.57) since 72% of the participants stated that both sexes are taught about indigenous practices equally.

Descriptive Statistics

| | N | Minimum | Maximum | Mean | Std. Deviation |
|-----------------------|----|---------|---------|--------|----------------|
| Gender balance | 42 | .00 | 2.00 | 1.5714 | .70340 |
| Youth eager to learn? | 42 | .00 | 2.00 | 1.3571 | .65598 |
| Valid N (listwise) | 42 | | | | |

Table 4; Mean values of Gender balance and youth willingness to acquire indigenous knowledge

4.2.1 Relationship between respondents' profiles, attitudes and indigenous knowledge

Profile variables and current level of indigenous knowledge

The researcher also performed correlation and cross-tabulations using SPSS to determine whether the current level of indigenous knowledge was influenced by the profile variables of the respondents. The variables included the age, gender, education and location of the villages relative to Sagalla hill.

In the study, the age of respondents did not influence the current level of indigenous knowledge ($r = -0.07$, $p = 0.64$; **Figure 6**), however there was an insignificant ($p = 0.66$) tendency of indigenous knowledge reducing as age of respondents increased. For every unit increase in age there was a 0.004 decrease in the current indigenous knowledge with all other factors constant.

There was no correlation between the level of education and current level of indigenous knowledge ($r = 0.07$, $p = 0.64$), or between education and the individual levels of indigenous knowledge ($r = 0.09$, $p = 0.98$). Indigenous knowledge levels had the tendency of being equally distributed across all education groups.

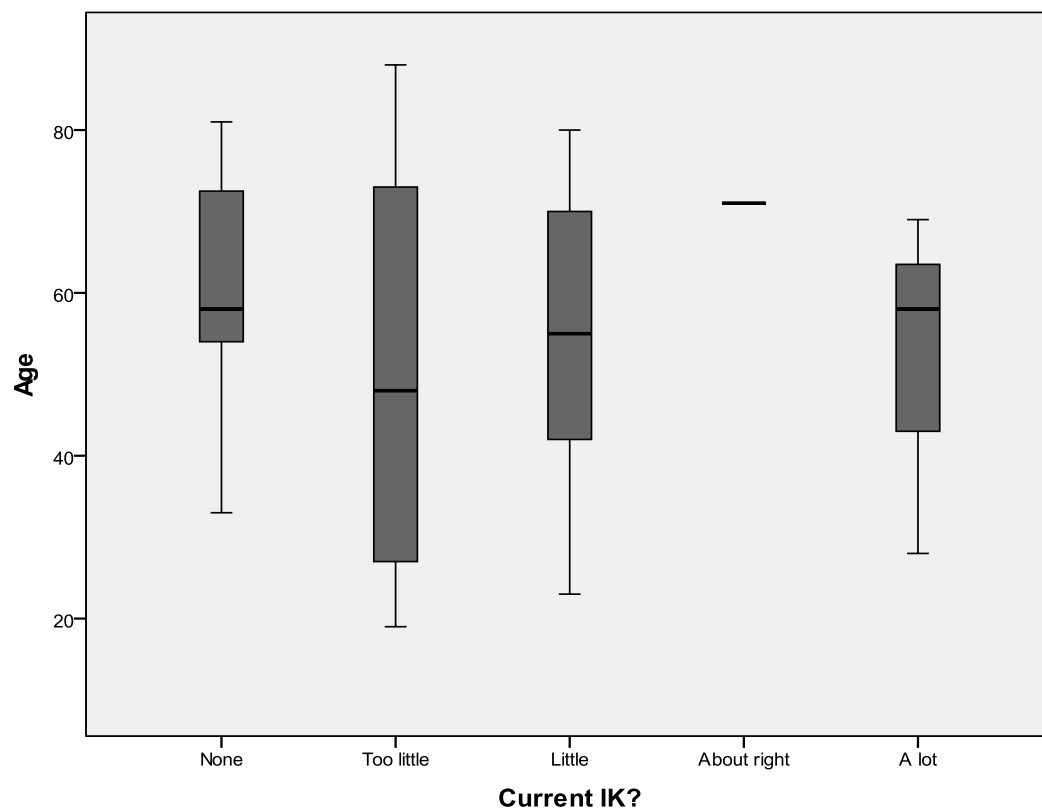


Figure 6: the relationship between age and the current level of indigenous knowledge

There was no correlation between the gender of respondents and the current level of indigenous ($r = -0.11$, $p = 0.49$) however there was an insignificant correlation ($r = -0.20$, $p = 0.21$) between gender and personal levels of indigenous knowledge with male respondents being more knowledgeable than females.

The specific current level of indigenous knowledge (as measured by the Likert scale) for each village was also assessed. The data was analyzed using ANOVA to compare the mean levels of indigenous knowledge in different agro-ecological zones in Sagala (**Figure 7**)

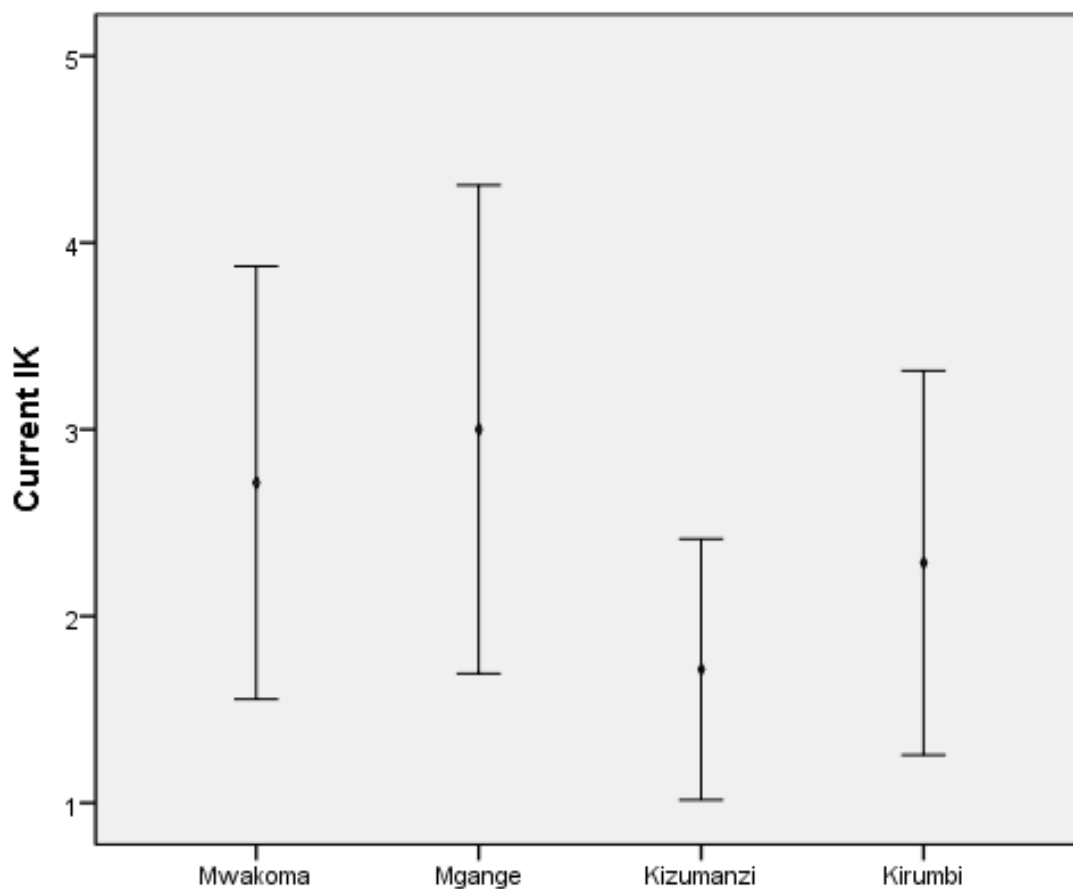


Figure 7: Mean values (95% Confidence Level) of the different levels of IK in the four villages

Although there was no significant difference on the level of indigenous knowledge in the four villages (One way ANOVA $F_{3, 38} = 1.50$, $P = 0.23$; **Table 5**), Mwakoma and Mgange had high levels of current indigenous knowledge (**Figure 7**).

ANOVA

| Level | | | | | |
|----------------|----------------|----|-------------|-------|------|
| | Sum of Squares | df | Mean Square | F | Sig. |
| Between Groups | 5.294 | 3 | 1.765 | 1.496 | .231 |
| Within Groups | 44.825 | 38 | 1.180 | | |
| Total | 50.119 | 41 | | | |

Table 5: Summary of ANOVA based on level of IK between villages

4.2.2 Attitudes toward wildlife

Under the first objective of the study, perceptions of the respondents towards wildlife and conservation were analyzed under the hypothesis that “attitudes towards wildlife and conservation affect the type of indigenous knowledge and practices being used to reduce human-wildlife conflicts”.

The indicator for attitudes towards the value of wildlife had an average of 2.55 (\pm S.E). The participants proved to be aware of the importance of wild flora and fauna. 48% of respondents thought that wildlife is important, 19% stated that wildlife is very important, 31% thought that wildlife is unimportant while 2% thought that wildlife is of moderate/little importance to them or to their village.

However 90% of the respondents who had positive attitudes (Very important to moderately important=67%) towards wildlife stated that the only importance of wildlife is tourism and economic growth of the country. All the respondents with negative attitudes towards wildlife said that wildlife is important to the government and not to them since wild animals only destroy their farms and homes.

Correlation analyses were also done using SPSS to establish whether the age, education, gender, personal level of indigenous knowledge occurrence of conflicts influenced the attitudes of participants towards wildlife in Sagala.

Attitude was significantly correlated to gender ($r = 0.40$, $p = 0.008$; **Figure 8**) with male respondents having more positive attitudes towards wildlife. Attitude was not correlated with age ($r = -0.08$, $p = 0.60$), level of education ($r = 0.19$, $p = 0.23$) or the respondent's indigenous knowledge on wildlife ($r = -0.08$, $p = 0.60$).

However the attitudes towards wildlife was insignificantly correlated to the occurrence of conflicts ($r = 0.24$, $p = 0.13$), this is a slight indication that the more severe conflicts became the less people thought wildlife to be important.

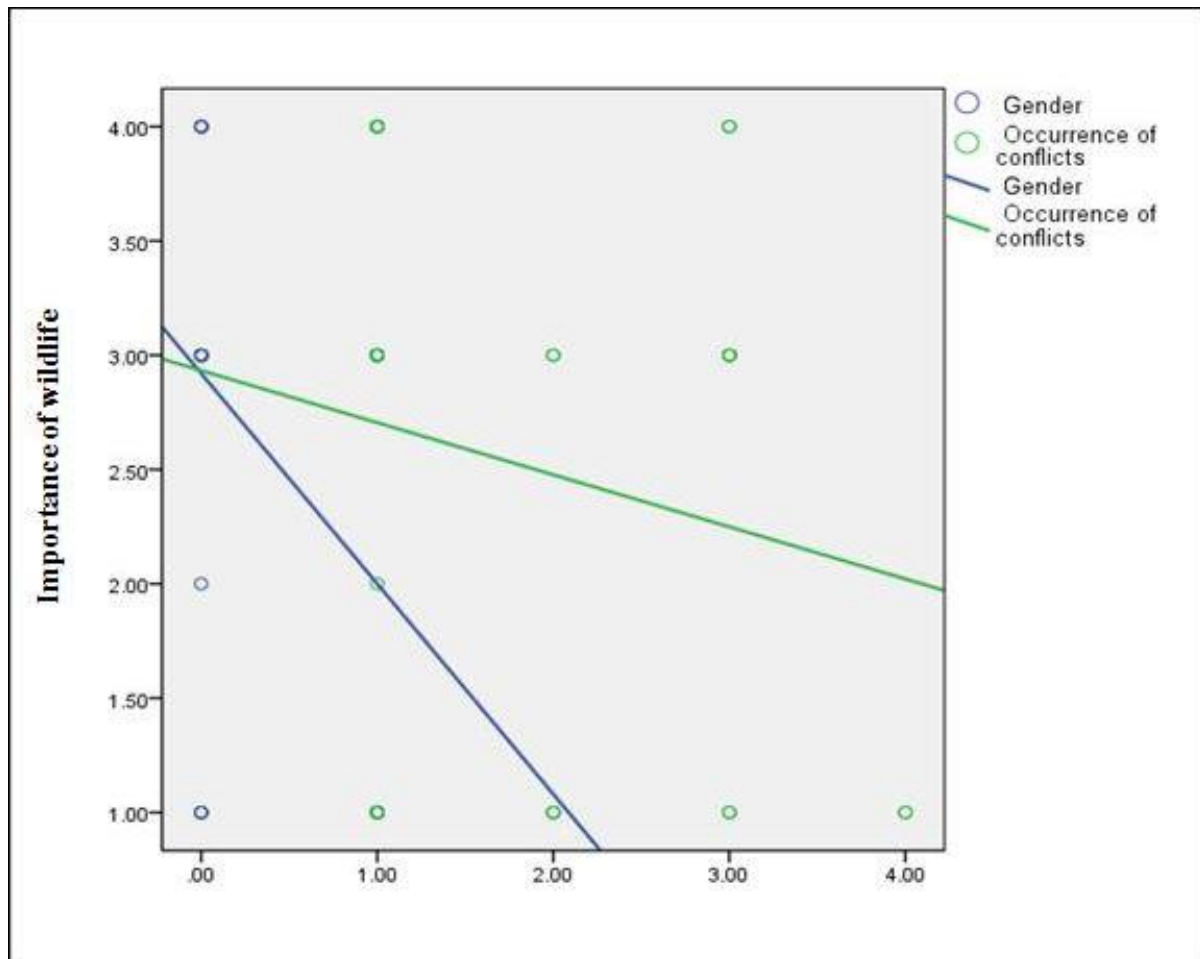


Figure 8: the correlation between gender, occurrence of conflicts and attitudes of respondents towards wildlife. N = 42 respondents, 27 Male and 16 Female respondents.

4.2.3 Current indigenous knowledge and attitudes towards wildlife

In the study, correlation analyses indicated that the index of attitude towards wildlife was positively but insignificantly correlated to the participant's personal level of IK ($r = 0.21$, $p = 0.18$; **Figure 9**). Respondents with no IK had the tendency to have negative attitudes towards wildlife while those who indicated they had some level of indigenous knowledge (too little, little, about right and a lot) had relatively positive attitudes towards wildlife.

On the other hand, the current level of indigenous knowledge was not correlated with attitudes towards wildlife ($r = -0.079$, $p = 0.621$).

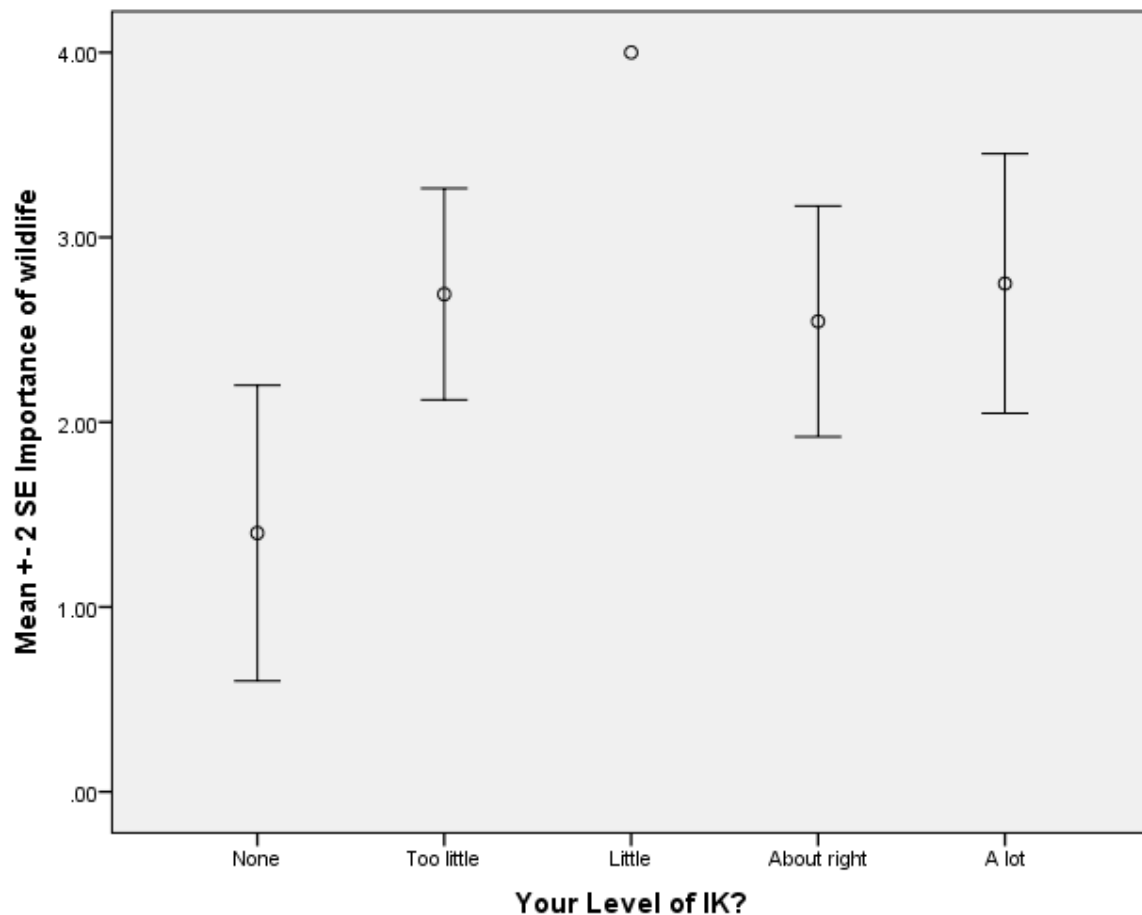


Figure 9: The correlation between the respondents' individual level of IK and attitudes toward wildlife (\pm SE)

4.3 Effectiveness of using indigenous knowledge in human-wildlife conflict management in Sagala

The main objective of the study was to investigate the effectiveness of using indigenous practices in minimizing human- wildlife conflicts. To achieve this objective the respondents were asked to describe each indigenous technique that they use in their farms in case of an invasion by a wild animal.

Effectiveness of each technique was measured in terms of cost, persons needed, time spent until the animal (s) leave the farm, number of people using the technique (popularity), impact on the people using it and impacts on the biotic and abiotic environment.

Data collected from study was analyzed under the hypothesis, “existing indigenous knowledge is effective if utilized in managing human-wildlife conflict”.

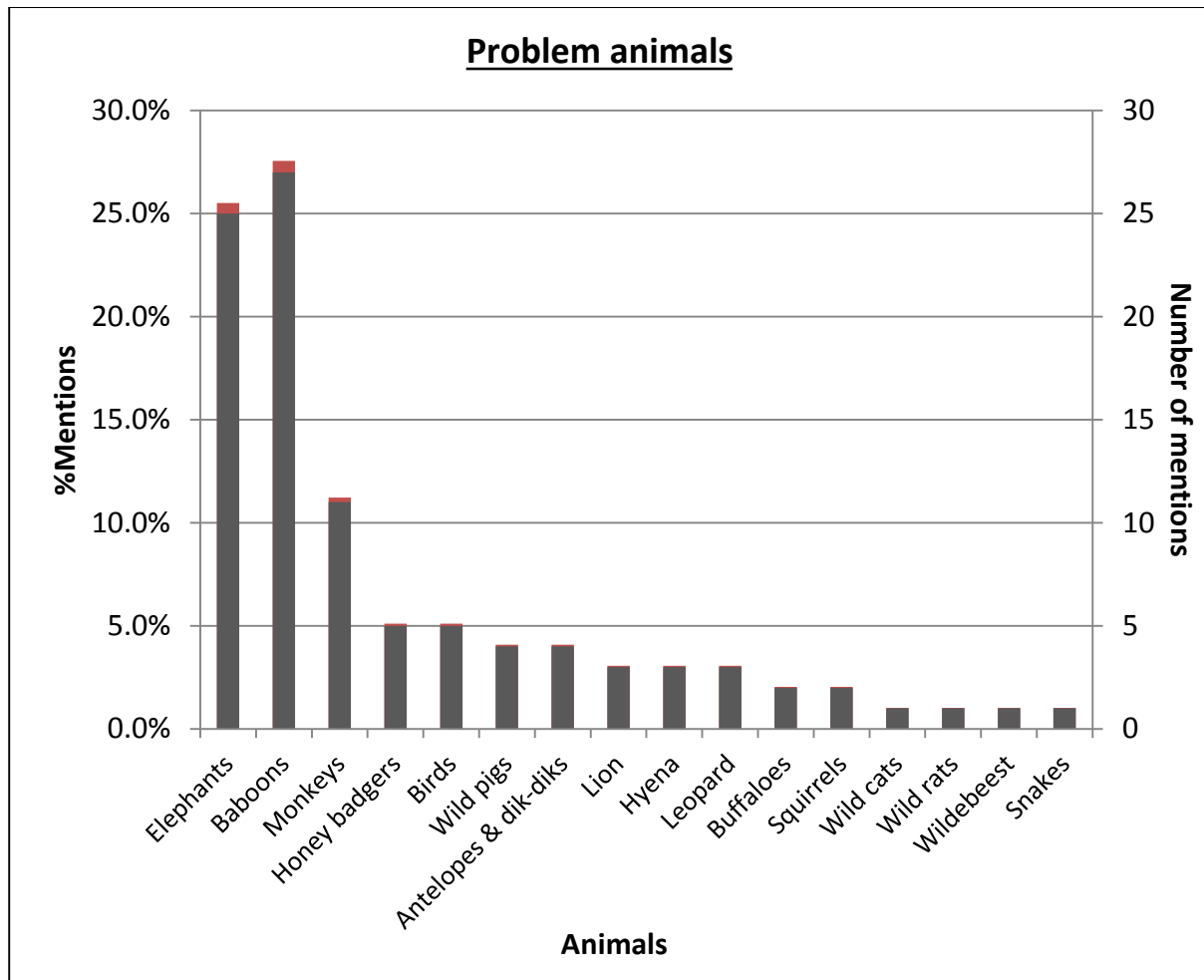


Figure 10: Problem animals in Sagala

According to the respondents, the choice of technique to use depends on the problem animal. For example, techniques for elephants are not suitable for problem animals such as the baboon. For elephants the most common method is beating drums/ tapping iron sheets while for baboons chasing them with stones, animal guards and human guards are the most commonly used methods. As shown in **Figure 10**, Elephants (26%), baboons (28%) and monkeys (11%) are the most notorious problem animals. Other common problem animals mentioned were honey badgers (5%), birds (5%), wild pigs (4%) and antelopes/ dik-diks (4%).

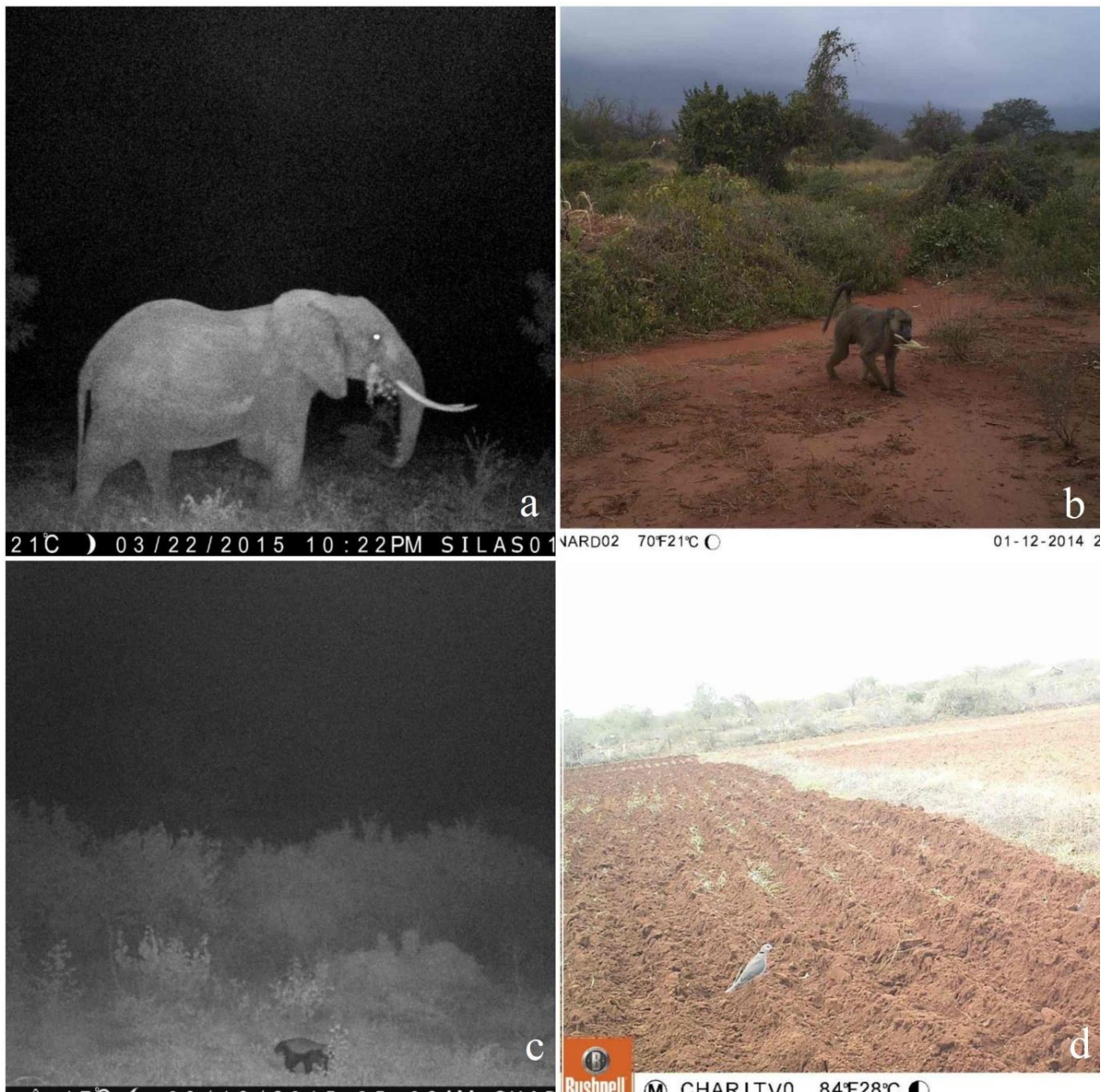


Plate 4: Common problem animals in Sagala caught on camera traps; (a) the African elephant/ *Loxodonta africana*; (b) Olive baboon/ *Papio anubis*; (c) honey badger/ *Mellivora capensis*; (d) Ring-necked dove/ *Streptopelia capicola* (Source: Elephants and Bees research project, 2015)

As indicated in **Figures 11** and **12**, the indigenous techniques used to manage human-wildlife conflicts in Sagala were classified as either lethal or non-lethal techniques as proposed by Ngung'u (2013). The lethality of a technique was judged by its impacts on the people and on the environment.

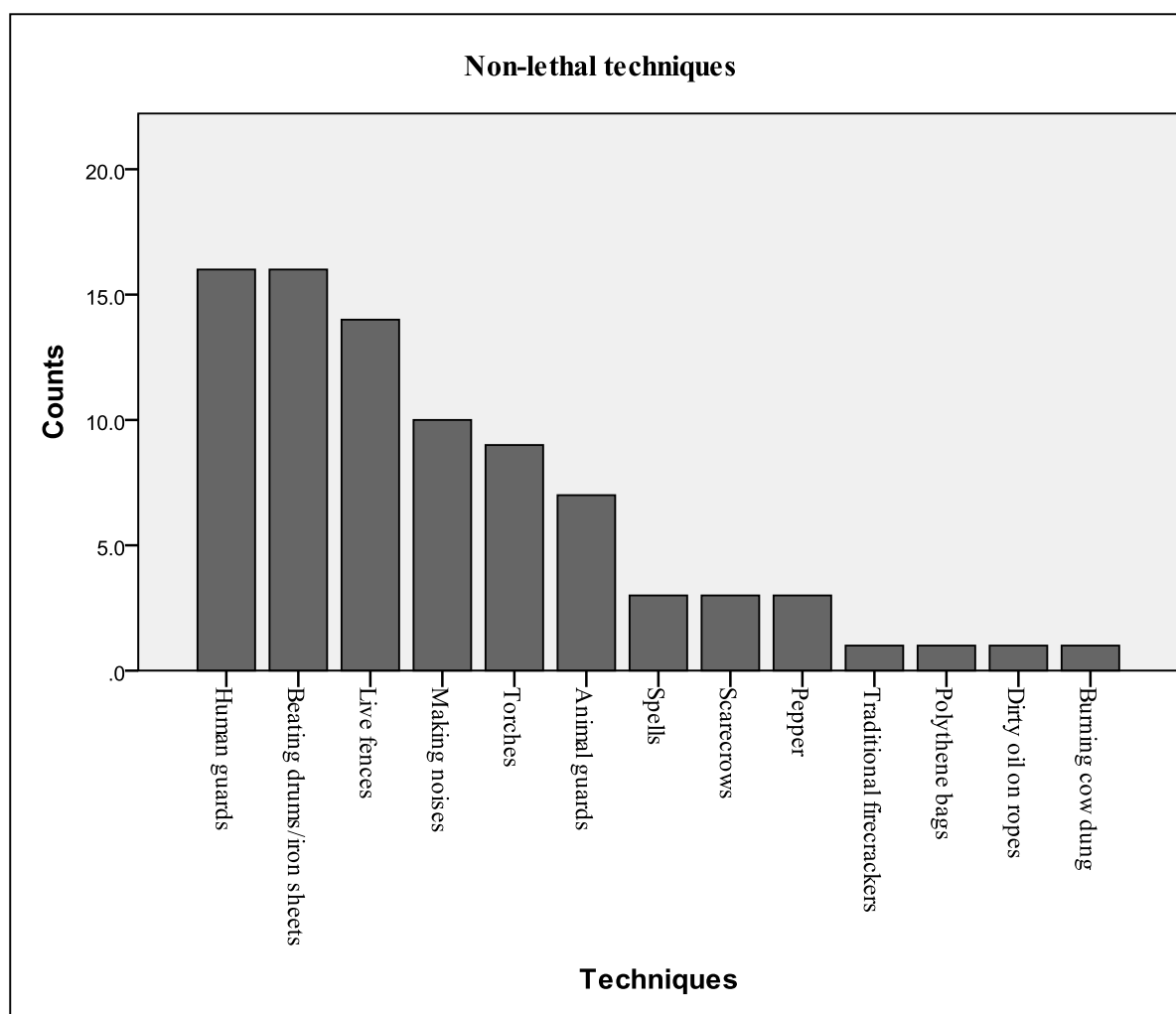


Figure 11: some of the ‘non-lethal’ indigenous techniques used by Sagala residents



Plate 5: Some non-lethal techniques (polythene for birds and scarecrows) used in Sagala (Source: Nelson , 2015)

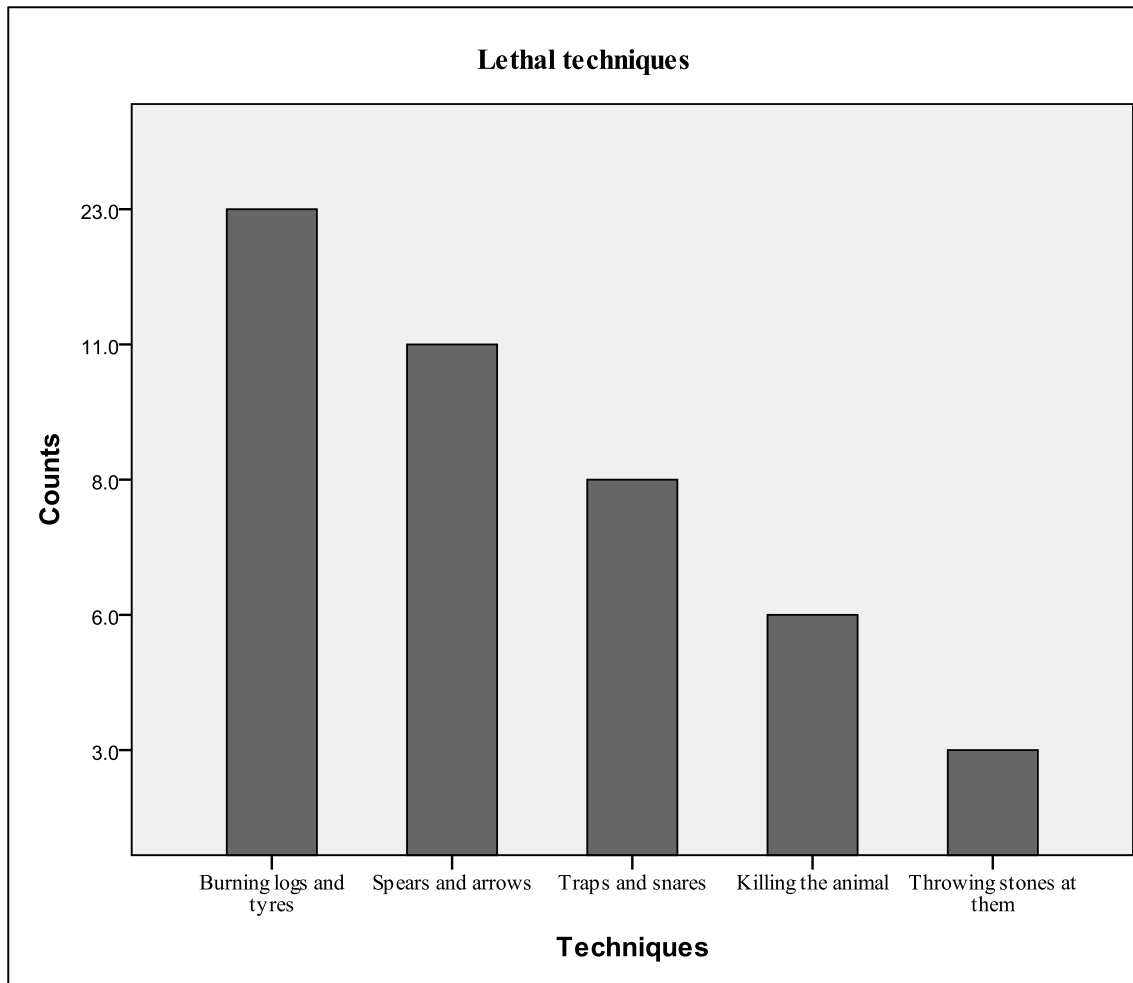


Figure 12: “lethal” techniques used by Sagala residents

4.3.1 Effectiveness in terms of ‘number of times mentioned’

The results in the above figures indicate that there are more non-lethal than lethal indigenous techniques. Non-lethal were most frequently mentioned (85 times/63%), lethal techniques were less popular being mentioned 51 times only (37%). However, burning of logs and tires which is a lethal technique was the most cited technique (23 times). Other lethal techniques mentioned included use of spears and arrows (11 times), trapping the animals using snares (8 times), killing the animals (6 times) and throwing stones at the animals with 3 mentions.

The effectiveness of each technique was first assessed by the times (frequency) each technique was mentioned by the respondents by asking them to mention the various they personally use to chase/keep away wild animals. The effectiveness of the techniques was therefore initially based on the assumption that “the more times a technique is mentioned the more effective it is”.

Of the non-lethal techniques mentioned, use of human guards (19%), beating drums and iron sheets to scare away the animals (19%), live/organic fences (17%), blowing whistles and making noises (12%), use of torches (11%) and animal guards such as dogs (8%) were the most effective techniques as suggested by the respondents.

Other techniques mentioned as either not being effective or are no longer used were; spells and herbs, spraying pepper, scarecrows (3 mentions/4% each), use of traditional firecrackers, tying polythene bags on vegetation, applying dirty oil on rope fences and burning of cow dung (1 mention/1% each).

4.3.2 Effectiveness in terms of time, cost, people needed, people using the technique and impacts on people and the environment

19 indigenous techniques used to mitigate human-wildlife conflicts were mentioned but of these only 10 were the most cited hence an indication of effectiveness. These techniques whose effectiveness is further analyzed in this section were: lethal techniques such as trapping the animals using snares, spears and arrows and burning of logs and tires. Non-lethal such as use of human guards, beating drums and iron sheets to scare away the animals, live/organic fences, blowing whistles and making noises, use of torches and animal guards such as dogs.

The effectiveness of each was analyzed using descriptive statistics in SPSS 22. Descriptive and distribution tables for the 10 effective techniques were derived as shown in **Table 5** and summary results of the mean values of the techniques presented in **Table 6**.

| Beating drums/iron sheets | | | | | | |
|----------------------------------|-----------|-----------|-----------|-----------|------------|----------------|
| | N | Minimum | Maximum | Mean | | Std. Deviation |
| | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic |
| Time | 16 | .0 | 3.0 | 2.000 | .2739 | 1.0954 |
| Cost | 16 | 3.0 | 3.0 | 3.000 | .0000 | .0000 |
| Persons needed | 16 | .0 | 2.0 | 1.000 | .1826 | .7303 |
| People using | 16 | .0 | 3.0 | 2.625 | .2562 | 1.0247 |
| Valid N (listwise) | 16 | | | | | |

Table 6: mean value of indicators of effectiveness of using beating drums (N = number of mentions)

| Technique | N (Counts/frequency) | Time | Cost | Persons needed | People using |
|------------------------------|-------------------------|------|------|----------------|--------------|
| Non-lethal techniques | | | | | |
| Beating drums/iron sheets | 16 | 2.00 | 3.00 | 1.00 | 2.63 |
| Live fences | 14 | 1.23 | 2.46 | 2.92 | 2.00 |
| Human guards | 14 | 2.29 | 2.60 | 1.50 | 2.36 |
| Noises (whistles & horns) | 11 | 2.18 | 2.73 | 0.91 | 2.64 |
| Animal guards | 6 | 2.33 | 1.00 | 3.00 | 3.00 |
| Torches | 9 | 3.44 | 1.33 | 1.78 | 1.89 |
| Lethal techniques | | | | | |
| Burning logs & tires | 23 | 2.50 | 1.80 | 1.40 | 2.65 |
| Spears and arrows | 11 | 2.14 | 2.57 | 1.00 | 2.00 |
| Traps and snares | 8 | 3.38 | 1.50 | 2.63 | 2.38 |
| Kill problem animal | 6 | 2.67 | 2.67 | 1.00 | 2.00 |

Table 7: summary of the means of variables for each IK technique

A technique was considered effective if the method uses less time and money, requires few people and is used/ preferred by many people.

In terms of time, torches and traps/ snares are the most effective with means of 3.44 and 3.38 respectively. This implies that using torches takes a few minutes to an hour until the problem animal leaves while setting up traps takes a few minutes hence no time is wasted. Burning of tires and logs (2.5) and killing the problem animals (2.67) are relatively effective with both techniques taking only a few hours to work. Beating drums/ iron sheets, human guards, making noises and use of animal guards take the whole day or night (2) for them to work hence ineffective in matters of time. Live fences (1.23) take the longest time to work since plants used for live fences take time to grow before they can keep away wild animals.

Cost-wise beating drums, live fences, human guards, making noises, spears/arrows and killing the problem were cited as the cheapest (2.5-3.0) since the respondents incur little or no costs in the techniques. Burning logs and tires and traps/snares were described as cheap, people need to buy traps, snares and old worn-out tires that are burned to chase away the

animals. Animal guards (1) and torches (1.33) were mostly cited as expensive to buy dogs at 300-400 Ksh each or barter trading chickens for dogs and buying torches at an approximate cost of 400-500 Ksh.

The number of people needed to chase away the problem animal(s) was also used to assess effectiveness. Live fences do not need the participation of people just needs planting of the seedlings. Traps and snares also need one or two people (2.63) to just set up the traps in the bush and wait for the animals to walk into the traps. Use of animal guards/dogs does not need the involvement of people (3). Torches need few people (2) to ‘blink’ the torches towards the direction of the problem animal. Beating drums, human guards, noises, burning logs and tires, spears and arrows, and killing the problem animals require many (1) people for them to work.

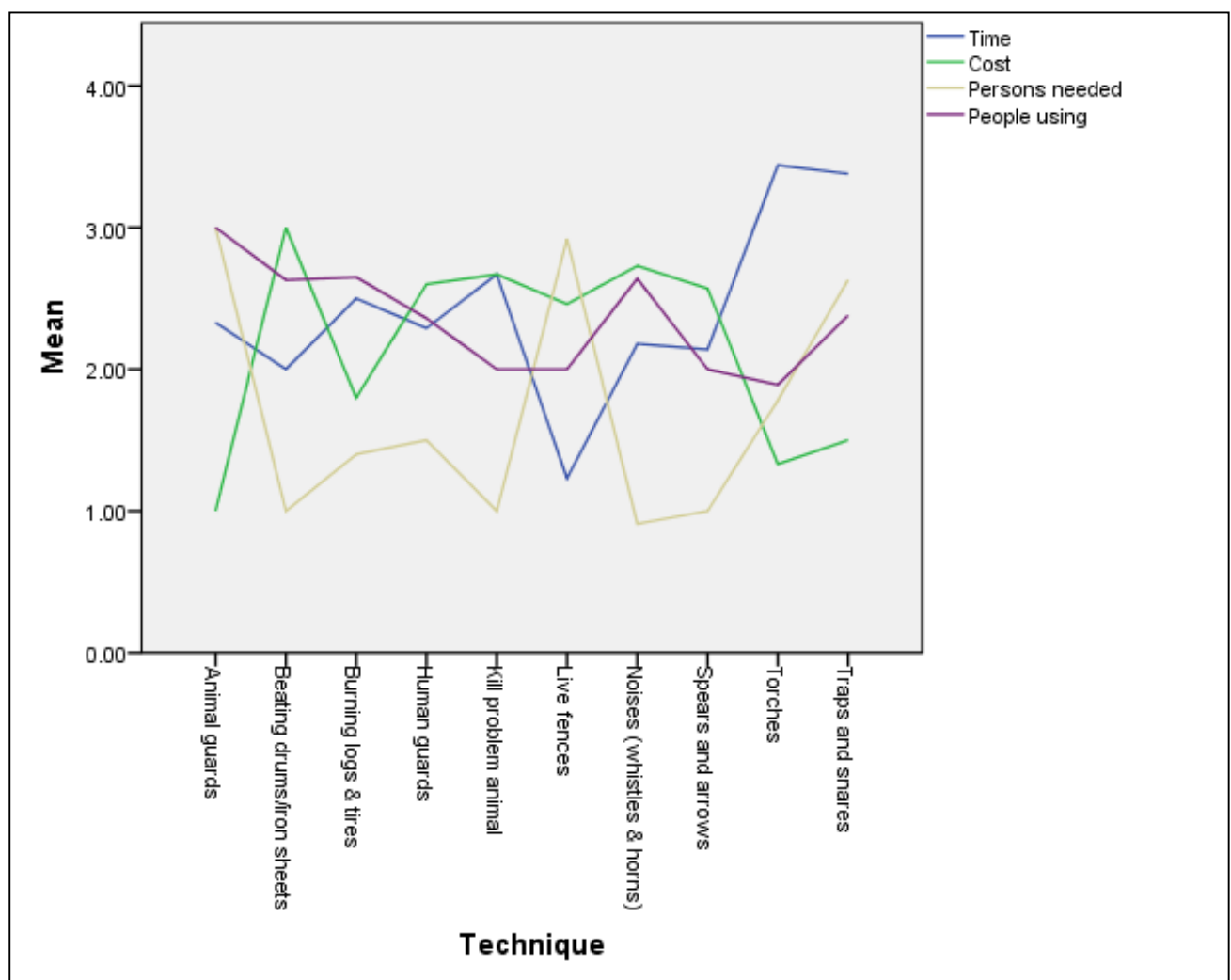


Figure 13: Mean values (\pm SE) of the various measures of effectiveness of IK techniques

Beating drums, noises, animal guards, burning logs and tires were cited as the most preferred indigenous techniques with participants citing these methods as used by many people. Live fences, human guards, torches, spears and arrow, straps/snares and killing the problem animal are not as popular being used by few people. In general, all the mentioned techniques are used by people since no technique scored 1 (None).

Beating drums and iron sheets, noises, human guards were identified as having negative impacts on people like loss of sleep, fatigue and health complications, noise pollution and sometimes attack by baboons. Burning fires posed the risk of users being burned, people also tend to walk into traps and snares set for wild animals, hunting and killing animals using spears and arrows could result to attacks by wild animals. Use of torches and animal guards has no negative impacts on people while use of live fence has positive impacts such as income from *Jatropha* fences.

Live fences were cited as having environmental benefits such as soil fertility, noises lead to noise pollution in the area. Burning fires was cited as the most environmentally unfriendly technique which may lead to forest fires, destroy soils and causes soil erosion by clearing bushes. Traps, killing the problem animal and use of spears lead to death hence reduction of wild animals.

To conclude on the effectiveness, from **Figure 13** it can be observed that no single technique achieved the maximum score in all measures of effectiveness, that is, no costs incurred (3.00), no time used (4.00), used by many people (3.00) and required no labour (3.00). Also no technique achieved the minimum score in the variables used to exemplify effectiveness.

4.3.3 Modern techniques used to mitigate human-wildlife conflicts in Sagala

Under the main objective “to investigate the effectiveness of using indigenous practices in minimizing human- wildlife conflicts in Sagala” the use of modern techniques was also assessed. This was done so as to compare whether people prefer modern or traditional techniques to manage HWC.

As is evident in **Figure 14** the most commonly used methods to keep away invading wild animals are use of beehive fences (33%/ 18 mentions) and firecrackers (24%/ 24% mentions). According to King (2014) beehive fences are “auditory fences that use recorded bee sounds

and actual traditional beehive fences are erected around farms and homesteads, this has resulted to elephants changing their routes and heading away from the bee sounds...”

Beehive fences are a project which was started by the Elephants and Bees project in Sagala.

The elephants and Bees research project is one of the Save the Elephants innovative programs designed to explore the natural world for solutions to HEC (King, 2009).



Plate 6: a working beehive fence around a maize farm (Source; Elephants and bees project, <http://elephantsandbees.com/>)

On the other hand firecrackers are used to scare away animals using bullet-like sounds.

According to respondents, this is mostly done by Wildlife Works which is an NGO working to mitigate HWC in Taita Taveta among other activities. All respondents who cited beehive fences as a modern technique also stated that it was the most effective (100%) technique while firecrackers were stated as most effective (27%), moderately effective (37%) and least effective (36%).

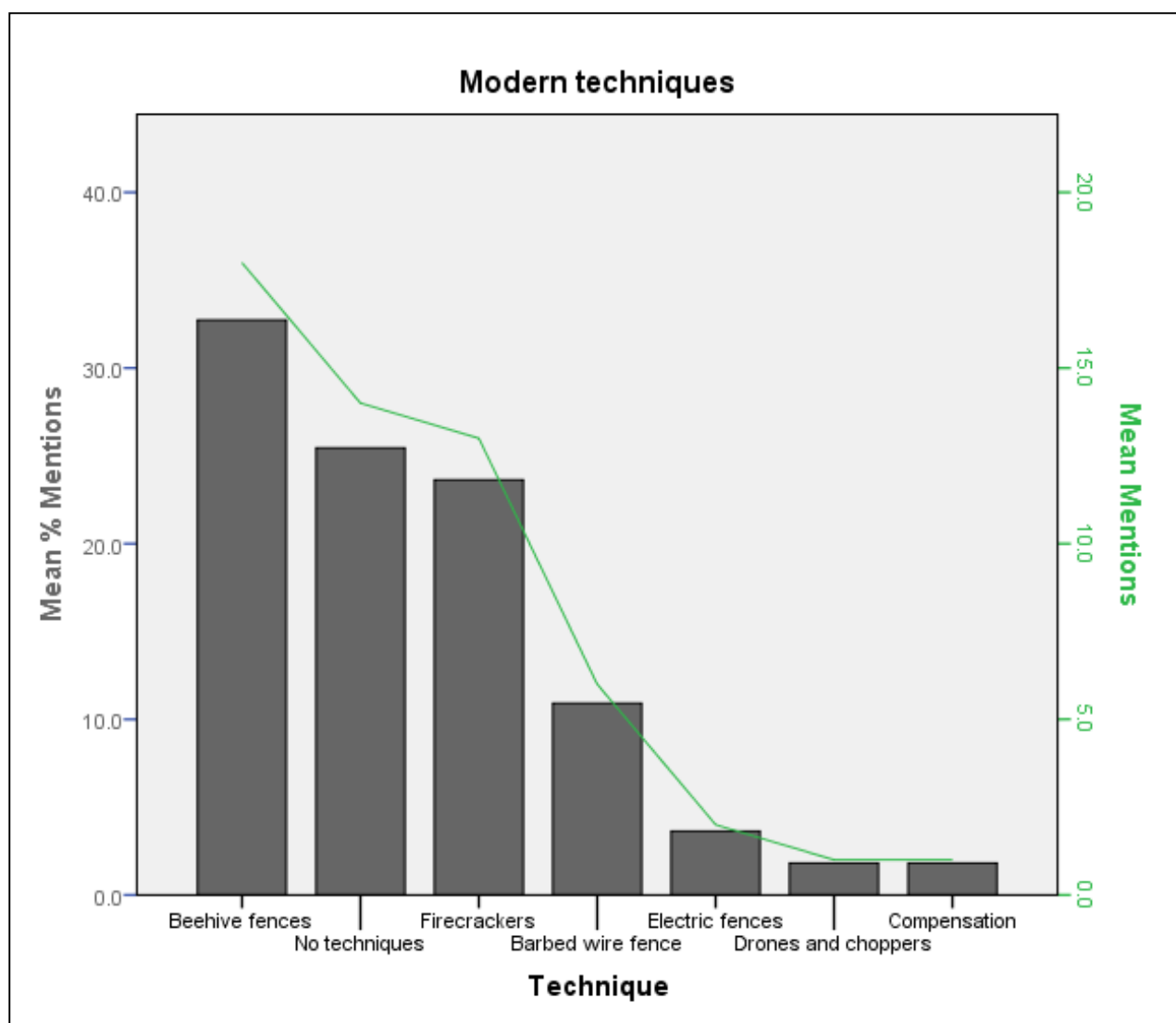


Figure 14: ‘Modern’ techniques used to mitigate HWC in Sagala

CHAPTER FIVE

DISCUSSIONS

The study at hand investigated the level of indigenous knowledge in Sagala Ward as the first objective. Data analyses and interpretation of interviews, questionnaires and FGDs of responses from respondents from Sagala revealed that the average current IK is very little whereas individual IK is little. This could be attributed to lack of unity/social gatherings among the residents, drug abuse, religion and modern technologies, lack of proper record keeping, ignorance by the youth and death of practitioners.

Reasons for the low level of IK in Sagala have been previously highlighted by Mong'ou (2008) who identified poor record keeping, Ream (2013) blamed the loss on modern technologies while Ocholla (2013) identifies death of practitioners/elites and lack of proper record keeping as the main causes of loss of IK. From the study, negative perceptions about wildlife was also identified as a reason for the decrease in individual IK, Ocholla (2013) expresses the same view. These negative attitudes are as a result of increased attacks by wild animals and the lack of awareness on the ecological value of wildlife.

It was assumed that older people and less educated people had higher levels of indigenous knowledge. This assumption was however incorrect since the findings showed there was no correlation between age and IK or, between education and IK. There was no significant difference in the levels of IK between the four villages and this could be because of less immigration into Sagala and also the people who live in the villages at the foot of the hill moved from villages on Sagala hill.

This knowledge however little, is preserved in a variety of forms including songs and dances, narratives, experience and observations. These forms have been documented by the Convention on Biological Diversity (2015) and also explained by both Usher (2004) and FSC Canada (2004).

The main objective of the study was to investigate the effectiveness of using IK in HWC management in Sagala. As noted by the respondents, techniques vary according to the type of problem animal for instance, throwing stones, human and animal guards are effective against baboons and monkeys while beating drums and fires are effective against elephants. Ocholla

(2014) and King (2014) agree with this as evidenced in their research on acoustic methods in Samburu and Beehive fences in Sagala respectively.

From the study, the most used techniques in Sagala are burning of logs and tires, use of traps, spears and arrows, beating of drums and iron sheets, human guards, live fences, making noises, killing problem animals and use of animal guards such as dogs. FAO (2009) heavily supports the use of well designed, constructed and maintained live fences. However, Ocholla (2014) does not support use of fences since some animals can jump over fence and hedges. Lamarque (2009) further disapproves the use of fences since they might interfere with natural migration and dispersal behaviors. The study also showed that killing problem animals by throwing stones, spears and arrows as proposed by Ndung'u (2013) are not effective since they lead to death of wild animals.

Acoustic deterrents such as noises and beating drums were identified as being popular. This is supported by King (2014) and Ocholla (2014). They also propose use of visual deterrents such as brightly colored clothes (King, 2014) and Ocholla (2014) who advocates for use of fires and flame. The study however identified the use of fires and flames as having negative impacts on both humans and the environment hence ineffective. The preference of these deterrents could owe to the fact that they are all cheap.

The findings from the study indicate that lethal techniques (Ndung'u, 2013) are the most preferred techniques such as burning of logs and throwing fire, spears and stones to chase away wild animals. This could be attributed to the negative attitudes of the respondents towards wild animals by some respondents who do not see any value in wildlife. This is expected since the first instinct in case of an account with a wild animal is fight or flight. Ocholla (2013) reported the same about crocodiles.

To conclude on the effectiveness of using indigenous knowledge the study has proved that each technique is effective in one factor or the other (cost, time, people using and needed and their impacts). No single technique achieved the ideal effectiveness that is; it was cheap, used less time, is used by many people, requires less labor and has no impacts on the ecosystems or humans.

Beehive fences and use of firecrackers are the most effective modern techniques that are being used in Sagala to keep away wild animals. The respondents stated that these methods are cheap and other than reducing HWC, beehive fences also bring in extra income for

farmers. King (2014) has documented the effectiveness and economic benefits of beehive fences. The preference of both techniques can also be attributed to the culture of Sagala residents such as beekeeping and use of traditional firecrackers (burning of some specific tree branches called *mbii*).

As shown in the study most of these passed down ways of life and of dealing with problems are very crucial in preserving species at the same time improving the livelihoods of villagers. Sardan (2005), Lanzano (2013) and Roe (2009) also found out that indigenous knowledge can be very effective in increasing harmony between man and his environment.

Non-lethal techniques are effective in HWC management and this may be partly attribute to beliefs by the people about specific animals such as baboon which Sagala residents believe “they are just like us (humans) and eating them is like eating one of us. The high rate of use of non-lethal techniques can also be explained by the fear of authority (KWS) and killing of protected animals which bears a heavy fine or long jail terms. According to IUCN (2010), indigenous communities’ effective participation in wildlife conservation programs just like experts could result into more comprehensive and cost effective conservation and management worldwide. Lack of government support in dealing with human wildlife conflicts has also increased the reliance of Sagala residents on traditional methods.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study investigated the effectiveness of using indigenous knowledge in human-wildlife conflict management in Sagala. It was intended to determine the level and effectiveness of IK in reducing conflicts in Sagala. The study established that there is little indigenous knowledge left in the study area/Sagala and that indigenous knowledge can be effective in human-wildlife conflict management. Lethal and non-lethal techniques were identified as the major classification of indigenous techniques with lethal techniques having negative impacts on the environment and people.

In view of these findings the researcher concludes that if no efforts are put in place to preserve the available knowledge then the remaining sustainable techniques and cultures of indigenous population will be totally lost. This will in turn lead to increase loss of biodiversity and human lives and source so income.

Indigenous techniques cannot be ideally effective (100%) if used in isolation since they vary in individual effectiveness due to factors such as cost, time, labor and impacts on people and the environment. The synergy of these techniques is necessary if conservation of species and sustenance of livelihoods is to be realized. However, not all techniques should be used since a majority of them lead to adverse impact on the ecosystem and these should be the last choice for conservations and the indigenous population.

Traditional/indigenous knowledge should also avoid biasness against modern scientific knowledge and vice versa. This will result to opening of new fields and increase in combined effectiveness in Human-wildlife conflict management efforts.

This means that the use of the non-lethal, cost effective and time saving indigenous techniques will result to more effective conflict management efforts. This will in turn result to preservation of protected animal species, improved local economy and agriculturally sustainable livelihoods.

6.2 Recommendations

This study found that indigenous knowledge has considerable impacts on human-wildlife management efforts, providing evidence that IK can be effective in reducing human-wildlife conflict. The study also highlighted the attitudes towards wildlife, level of IK and factors leading to the loss of traditional knowledge systems. Despite the limitations this study should be useful in contributing valuable data on IK techniques, serve as reference for other scholars and also help in preserving the available indigenous knowledge.

Basing generalizations on the findings of this study, the researcher recommends that;

Relevant community based organizations (CBOs), the government and other parties concerned with indigenous knowledge need to invest in ways of storing and preserving IK. This can be achieved by the development of local libraries, cultural museums to document the local practices, language, taboos and beliefs. Respondents also recommended that there is a need for the unification of villagers which can be realized by use of cultural events such as dances and formation of cultural groups. To ensure the passing on of IK to the future generations, IK knowledge should be incorporated in the modern school curricula. The negative attitudes towards wildlife can be tackled by the creation of awareness and environmental education about the non-economical (socio and ecological benefits) of wildlife.

Indigenous knowledge should be exploited, spread and implemented in managing human-wildlife conflicts. The synergy rather than the individual use of identified techniques (non-lethal) will increase the efficiency of the techniques considering the diversity of problem animals in Sagala area.

Despite the promotion of conservation of all indigenous techniques some of them should be discouraged. The use of lethal-techniques should be discouraged by educating the people on their impacts on people's health, soils, water, flora and fauna. Strict rules and regulations by the local authorities on which techniques are to be used need to be enforced so as to avoid the negative impacts of these lethal techniques.

KWS should put up effective electric fences around the park especially where it borders villages and households so as to reduce invasion of the farms by animals. This will reduce the number of animals that are being killed by villagers using the lethal-techniques identified.

Compensation by the government needs to be effective in case of an attack by wild animals, this will reduce the need to kill problem animals and change the attitudes toward animals.

The study identified use of beehive fences and firecrackers as the most preferred modern techniques since they are derivations of indigenous techniques. The use of local ecological knowledge only cannot ensure 100% effectiveness of HWC mitigation measures and therefore the combined use of conventional science and traditional knowledge is required (King, 2014 and Ballard 2008).

Further, the researcher recommends further studies to assess the in depth effectiveness of using IK in conflict management such as the difference in agricultural produce before and after scenarios.

REFERENCES

1. **Bourque, Linda B** (2004). "Coding." In *The Sage Encyclopaedia of Social Science Research Methods*, Edited by Michael S. Lewis-Beck, Alan Bryman, and Timothy Futing Liao, v. 1, 132-136. Thousand Oaks, Calif.: Sage Publications.
2. **B.P Anthony, P.Scott and A. Antypas** (2010). *Sitting on the Fence? Policies and Practices In Managing human-wildlife conflicts in Limpopo Province, S.A.* *Conservation and Society Journal*. <http://www.conservationandsociety.org>
3. **CARACAL** (2014). *Human-wildlife Conflict in Chobe, Botswana*. <http://www.caracal.info>
4. **C. F. Nachmias and D. Nachmias** (2008). *Research Methods in Social Sciences*. St Martins Press Inc. London.
5. **C. Webb and J. Kevern** (2008). *Focus groups as a research method: a critique of some aspects of their use in nursing research*. Article first published online: 7 JUL 2008.
6. **E. Padilla and G.P Kofinas** (2014). "Letting the Leader Pass": Barriers to Using Traditional Ecological Knowledge in Co-management as the Basis of Formal Hunting Regulations. *Ecology and Society Journal*.
7. **F.Lamarque, J.Anderson, R.Fergusson, M.Lagrange, Y.Osei-Owusu and L.Baker** (2009). *Human-wildlife conflict in Africa: Cause, consequences and management strategies*. Food and Agriculture Organization (FAO) Forestry Paper 157.
8. **G.O.Ocholla, J.Koske, G.W.Asoka, M.M.Bunyasi, O.Pacha, S.H.Omondi and C.Mireri** (2013). *Assessment of Traditional Methods Used by the Samburu Pastoral Community in Human-wildlife Conflict Management*. *International Journal of Humanities and Social Sciences* vol. 3 No. 11.
9. **G.Yamakoshi and V.Lebian** (2014). *Conflicts between Indigenous and Scientific Concepts of Landscape Management for Wildlife Conservation: Human-Chimpanzee Politics of Co-existence at Bosou, Guinea*. <http://primatologie.reveus.org/1762> (Accessed on 19/12/2014)
10. **H. Oliveira and A. Schiavetti** (2013). *Attitudes and LEK of experts in relation to conservation and bycatch of sea turtles (reptilia: testidunes) Southern Bahia, Brazil*. *Journal of Ethnobiology and Ethnomedicine* 9.15
11. **IFAD** (2014). *Human-Wildlife conflicts in the Mt. Kenya Area*. <http://www.ruralpovertyportal.org>
12. **IFAW** (2014). *Determining Elephant Populations in Tsavo*. <http://www.ifaw.org> (Accessed on 20/12/2014)
13. **IWGIA** (2011). *The Indigenous World*. IWGIA Africa.
14. **J. Creswell** (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. Sage Publications, USA.

15. **King, L.E.** (2014). Save the Elephants: Elephants and Bees Project. <http://elephantsandbees.com>
16. **K. M Yurco** (2011). Pastoral Movements in Pastoralism: Shifting Traditions and Institutions of Modern Management Strategies in Laikipia, Kenya. University of Michigan.
17. **Lockyer, Sharon** (2004). "Coding Qualitative Data." In *The Sage Encyclopedia of Social Science Research Methods*, Edited by Michael S. Lewis-Beck, Alan Bryman, and Timothy Futing Liao, v. 1, 137-138. Thousand Oaks, Calif.: Sage
18. **KWS (2014)**. Human-wildlife Conflicts Mitigation Measures <http://www.kws.org>. (Accessed on 10/12/2014).
19. **M. Lockwood, G.L Worboys and A. Kothari** (2009). *Managing Protected Areas: A Global Guide*. Earthscan UK and USA
20. **M. Mbaluka, E. Wawire, J. Kiara, J. Mwanganda, J. Kwamboka and E. Mwakiremba** (2014). Crop Damage Assessment Report; Sagalla Ward. County Government of Taita Taveta.
21. **NEMA** (2009). State of the Environment Report: Effects of Climate Change and Coping Mechanisms. NEMA Kenya. Page 120-121
22. **O. Ansah, F.E and Mji. G** (2013). African Indigenous Knowledge and Research. *African Journal of Disability* 2. Article #30 page 5. <http://dx.doi.org>
23. **Paula and N. Suleiman** (2011). Human-wildlife conflict in Nairobi. <http://baraza.wildlifedirect.org>
24. **P. Gill, K. Stewart, E. Treasure & B. Chadwick** (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal* 204, 291 – 295.
25. **R.K. Yin** (2009). *Case Study Research: Design and Methods* 4th edition. Sage Inc. (page 102 and 117)
26. **R.J. Smith and S.M. Kasiki** (2014). A Spatial Analysis of Human-Elephant Conflict in the Tsavo Ecosystem, Kenya. African Elephant Specialist Group IUCN.
27. **Save the Elephants Annual Report** (2014). <http://www.savetheelephants.org>
28. **Stewart D W, Shamdasani P M.** (1990). *Focus groups. Theory and practice*. London: Sage Publications
29. **The Laws of Kenya.** (2008). the Constitution of Kenya. Government of Kenya
30. **T. Mong'ou** (2008). Kenya's Biodiversity: Wonder plant Gemstones Biodiversity Monitoring. *Mazingira News* July-September 2008 issue No. 004.
31. **WWF** (2015). Human-wildlife conflict. <http://www.panda.org>

Appendix I

Consent form and the Semi-structured interview

| | |
|---|---|
| Sheet No. <input style="width: 50px; height: 20px;" type="text"/> | |
| <u>USE OF LOCAL ECOLOGICAL KNOWLEDGE IN MANAGING HUMAN-WILDLIFE CONFLICT IN SAGALLA, TAITA TAVETA</u> | |
| <i>Semi-structured interview for Sagalla community members.</i> | |
| <u>RESPONDENT'S PROFILE</u> | |
| NAME: _____ | VILLAGE: _____ |
| OCCUPATION: _____ | GENDER: _____ |
| AGE: 20-30 years <input style="width: 30px; height: 20px;" type="checkbox"/> | Specific: <input style="width: 40px; height: 20px;" type="checkbox"/> |
| 30-60 years <input style="width: 30px; height: 20px;" type="checkbox"/> | |
| 60 years > <input style="width: 30px; height: 20px;" type="checkbox"/> | |
| Date: _____ | |
| Time: From _____ To _____ | |
| INTERVIEWER: _____ | |
| SIGNATURE: _____ | |
| <p>I am an undergraduate student at the Technical University of Kenya studying a Bachelor's degree in Environment Resource Management. I am currently doing a research study for my fourth year titled, 'Effectiveness of Using Local Ecological Knowledge in Managing Human-Wildlife Conflict in Sagalla which is supported by the Elephants and Bees Project.</p> <p>I therefore would like to ask you a few questions about the indigenous knowledge (local ecological knowledge) and how it is being used in managing human-wildlife conflicts.</p> <p>The findings of this research will be purely for academic purposes and will only be shared with your permission.</p> | |
| <u>Respondent to check</u> | |
| i.I agree to be audio-recorded | <input style="width: 30px; height: 20px;" type="checkbox"/> |
| ii.I agree the interviewer to take notes | <input style="width: 30px; height: 20px;" type="checkbox"/> |
| iii.I agree the findings of the study to be shared | <input style="width: 30px; height: 20px;" type="checkbox"/> |
| iv.I agree to be quoted | <input style="width: 30px; height: 20px;" type="checkbox"/> |

PART ONE: INTRODUCTION

Q1. How long have you lived in this area?

Q2. Did your forefathers live here too?

Yes

☐

No

☐

Q3. What has been the main source of livelihood for your family over years?

Farming

☐

Livestock keeping

☐

Bee keeping

☐

Employed

☐

Others (Specify)

☐

.....

Q4. This area has been known to experience human-wildlife conflicts. How often do you come into conflict with wild animals?

➤ Very Frequently

☐

➤ Frequently

☐

➤ Occasionally

☐

➤ Rarely

☐

➤ Never

☐

Q5. Was this was the case in the past?

Yes

☐

No (Go to Q₆)

☐

Q6. What has changed?

PART TWO: LEVEL OF LOCAL ECOLOGICAL KNOWLEDGE

Q1. What is your level of education?

Primary

☐

Secondary

☐

Tertiary

☐

(specify whether college, university or training institute)

Q2. Is the traditional education system still intact (ongoing)?

Yes (Go to Q₄)

☐

No (Go to Q₃)

☐

Q3. How much of local ecological knowlegde do you know?

➤ None

☐

➤ Too little

☐

➤ About right

☐

➤ A lot

☐

Q4. Can you state some of the traditional (on plants, natural features and animals) that you are aware of?

Q5. In which form is this knowledge found in?

| | |
|--------------------|--|
| Songs | |
| Dances | |
| Riddles | |
| Poems | |
| Narratives/Stories | |
| Others (specify) | |

Q6. Who communicated this knowledge to you?

Q7. How much of this knowledge is currently available?

A lot

☐

Little

☐

Very little

☐

Probes: - Is it equally distributed across gender?

Yes

☐

No

☐

- If No. What is the cause for this inequality?

- Are young people eager to acquire/learn this knowledge?

Yes

☐

No

☐

Q8. What do you think are the causes for the loss of indigenous knowledge?

PART THREE: EFFECTIVENESS OF USING LOCAL ECOLOGICAL KNOWLEDGE IN HUMAN-WILDLIFE CONFLICT MANAGEMENT

Q1. How important is wildlife to you?

- Very Important
- Important
- Moderately Important
- Of Little Importance
- Unimportant

☐
☐
☐
☐
☐

Probe: *(If respondent states wildlife as important)* What are the benefits of wildlife?

Q2. What are the causes of conflicts between humans and wildlife?

- Water
- Food
- Migration
- Habitat destruction (in the park)
- Others (specify)

☐
☐
☐
☐
☐

.....

Q3. What are the main problem animals in your homestead?

Q4. Is there any local knowledge (beliefs, customs or taboos) about these animals?

Yes

☐

No

☐

Q5. What traditional ways or techniques were and/or are still used to keep away problem animals? State the effectiveness of each technique

| TECHNIQUE | MEASURES OF EFFECTIVENESS | | | | | |
|-----------|---------------------------|----------------|-------------------|-----------------------------------|--------------------|--------------------------------------|
| | Time (t) used (hours) | Persons needed | Cost of technique | No. Of people using it/popularity | Impacts on persons | Impacts on environment (flora+fauna) |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Gathuku Nelson M., 2015

Q6. Other modern techniques are being used to keep problem animals away. Can you mention some that are being used in this area and their effectiveness?

| TECHNIQUE | EFFECTIVENESS (Most effective, Moderately effective, least effective) |
|---------------------|--|
| Electric fences | |
| Barbed wire fence | |
| Drones and choppers | |
| Firecrackers | |
| Compensation | |
| Others (Specify) | |

PART FOUR: CONCLUSION

- Do you know of any organizations (NGOs or Governmental organizations) that are utilizing local ecological knowledge to manage HWC in your area?

Yes

☐

No

- If yes, then mention some of them.

- What do you think should be done to preserve local ecological knowledge?

THANK YOU VERY MUCH FOR YOUR TIME

Gathuku Nelson M., 2015

Appendix II

Project schedule

| TASK | MONTH | | | | | | | | | | | | |
|---------------------------------------|-------------|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------------|--|
| | Dec 2014 | Jan 2015 | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov 2015 | |
| Proposal writing | | | | | | | | | | | | | |
| Defending proposal and approval | | | | | | | | | | | | | |
| Collection of data | | | | | | | | | | | | | |
| Analysis | | | | | | | | | | | | | |
| Report writing and editing | | | | | | | | | | | | | |
| Revision and Approval of final report | | | | | | | | | | | | | |
| Submission of final report | | | | | | | | | | | | | |