ROLE OF INDIGENOUS KNOWLEDGE IN MANAGEMENT OF MARINE RESOURCES; CASE ANALYSIS OF KURUWITU AND MKUNGUNI FISHING VILLAGES IN KENYA

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A thesis submitted in partial fulfillment of the requirements for the Masters of Environmental Studies (Community Development) of Pwani University

NOVEMBER, 2016

DECLARATION

This is to certify that:

(i) This thesis is my original work towards the attainment of the Master of Environmental Studies (Community Development), except where indicated.

(ii) Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature and acknowledgement of collaborative research and discussions.

This work was done under the guidance of Dr. Andrew Wamukota and Dr. Bernerd Fulanda of Pwani University, Kenya.

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DEDICATION

To Sally Ballo for the long time I stayed away from you. Thank you for your understanding and may God Bless you.

ACKNOWLEDGEMENT

I give thanks to God, the Almighty for giving me life and strength to carry out my studies. I would also like to thank my supervisors Dr. Andrew Wamukota and Dr. Bernerd Fulanda for guiding me in my research and the writing of this research thesis.

Thanks to the Kenya Coastal Development Project (KCDP) for financing my studies. I would like to acknowledge the support of the Dean, School of Environmental and Earth Sciences; Dr. Maarifa Mwakumanya, and CoD Department of Environmental Studies (Community Development); Dr. Hilda Ong'ayo throughout my studies.

Finally, I would also like to thank my parents for their moral support throughout the study. Thank you very much, everyone!

ABSTRACT

The use of indigenous knowledge in conservation of natural resources, and especially marine, has received increasing attention in recent years. This is partly attributed to its extensive contribution to the management of local resources and to the spiritual, cultural and economic well-being of local communities. However, modernization of the management regimes from indigenous knowledge- to scientific knowledge-based approaches is slowly phasing out the use of indigenous knowledge in resource-use and management. The overall aim of this study was to identify the existing types of indigenous knowledge practices, assess perceptions and attitudes of local communities towards marine resource management, to determine the influence of local institutions in preservation of indigenous knowledge used in management of marine resources and to evaluate the contribution of the indigenous knowledge to marine resource management. The study was conducted through a descriptive survey design using semi-structured questionnaire, Key Informant Interviews (KIIs), field observations and Focus Group Discussion (FGDs). Descriptive statistics in MS Excel® and Inferential statistics (*Chi*-square) in Statistical Package for Social Sciences (SPSS) were used to analyze the data. Results showed both similarities and differences in the types of indigenous knowledge in the two villages; Kuruwitu and Mkunguni villages. For example, fishers associated loud sound of waves splashing on the reef with the coming of rains and a rough sea, which often rhyme with the South-East Monsoon winds (SEM or *Kusi*) and minimal fishing activity was recorded in during such periods. Fishers in both villages relied on the lunar cycle to determine the sea-state and plan for fishing activities. The fishers demonstrated indigenous knowledge in identification of marine fish species and their habitats. This knowledge was valuable in determining with fair accuracy, how to locate the target fish species for both subsistence and commercial purposes. However, some differences were also noted between the two villages; e.g. 65 % of the respondents in Kuruwitu village were aware about the causes of ecosystem degradation and pollution,

compared to only 25% in Mkunguni. The study recommends the documentation and promotion of the use of indigenous knowledge for marine resource management, thus ensuring that it is not lost out due to modernization. In addition, knowledge used in assessing marine weather and state of the sea can be enhanced to guide climate change mitigation and alleviate disasters in these villages and beyond. Additionally, environmental agencies in Mkunguni village which appeared less focused on conservation should create more awareness on ecosystem degradation and pollution. Further studies are needed to assess the magnitude of pollution and its effects on both quantity and quality of fish consumed and link these with indigenous knowledge, associated with some traditional beliefs and taboos in these coastal communities.

ACRONYMS

BMU	Beach Management Unit
CCA	Community Conservation Area
CRA	Commission on Revenue Allocation
EMCA	Environmental Management and Coordination Act
ERC	Ethical Review Committee
GoK	Government of Kenya
GSC	Global Scientific Community
KCDP	Kenya Coastal Development project
KCWA	Kuruwitu Conservation and Welfare Association
KII	Key Informant Interview
KNBS	Kenya National Bureau of Statistics
LMMA	Locally Managed Marine Area
MPA	Marine Protected Area
MTCG	Msambweni Turtle Conservation Group
NGO	Non-Governmental Organization
NEM	North-East Monsoons
SEM	South-East Monsoons
SPSS	Statistical Package for Social Sciences

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Indigenous knowledge is the systematic body of knowledge acquired by local people through accumulation of formal and informal experiences, as well as intimate understanding of the environment in a given culture (Berkes *et al.,* 2000; Hagar, 2004; Boikhutso, 2012). This form of knowledge is in the hands of local institutions that play a crucial role in natural resource management by defining practices, assigning roles and guiding interactions of people on resource-use (Masalu *et al.,* 2010). Examples of traditional institutions include informal administrative leadership, households and religious institution among others. Indigenous knowledge in conservation biology is often expressed in form of customs, beliefs and taboos (Cinner, 2007; Waweru, 2012), which form a rich cultural heritage that is complex and dynamic among communities, and may be difficult to be understood by outsiders (Kajembe *et al.,* 2001).

In 1993, the Global Scientific Community (GSC) agreed to integrate indigenous knowledge with scientific knowledge so as to manage the scope, complexity and uncertainty of global environmental issues affecting natural resources (Reid *et al.,* 2006; Berkes, 2008). Studies around the world have demonstrated the success of using indigenous knowledge in the management of marine resources (Hamilton, 2005; Cinner, 2007; Masalu *et al.,* 2010). Some countries have stepped-up efforts towards documenting "species-specific information" of marine environment using local methods while others have gone ahead to amend their country's constitutional structures to include indigenous knowledge (Thornton & Scheer, 2012). For example, countries such as Britain have ensured that policies, rules and regulations on marine resources are incorporated with indigenous knowledge so as to safeguard marine resources from over-exploitation (MCZ, 2010). In Indonesia, the government prepares fisheries management action plans in consultation with

the *Bajo* fishing community, one of the most widespread and dynamic maritime adapted ethnic groups in the eastern part of the country (Johannes *et al.*, 2000; Hamilton, 2005; Langton *et al.*, 2005). These studies show that the consultations help the Indonesian government to tap on fisher's indigenous knowledge on fish stocks and spawning grounds, and the associated traditions, in enhancing the management of marine resources. In the coast of Belize, biologists used local fishers who have lived in that area since the 1920s to identify spawning sites for snappers and explain the relationships between the snapper with whale shark abundance and ecological behavior (Heyman *et al.*, 2001).

Similar studies have also been conducted in Africa with promising results. For example, the Malagasy tribe uses taboos to regulate resource use within and adjacent to all of Madagascar's national marine parks (Cinner, 2007). In Tanzania, families living adjacent to the Usambara forest use local institutions i.e. traditional leadership, traditional healers, taboos and practices in conservation and utilization of the forests and wildlife resources (Kweka, 2004).

In Kenya, *Kayas* have evidently typified cases of the use of indigenous knowledge and culture in natural resource management. The *Kaya* forests have played a significant role in the traditional way of life of the Mijikenda tribe along the Kenyan coast (Wangila & Shauri, 2009). According to UNESCO, the conservation of *Kaya* forests has largely been hinged on the prevailing traditional beliefs, knowledge and practices of the Mijikenda that continue to permeate their society to date (UNESCO, 2016). There are numerous coastal villages located within some important coastal forests and the communities living around the forest are involved in sustainable conservation through active application of indigenous knowledge because they consider the forests as "abodes of the ancestors" (UNESCO, 2016).

Over the many decades, the Mijikenda communities are abandoned the *Kayas* as places of residence. Consequently, these *Kayas* acquired a spiritual significance and cultural importance whose mere existence justified the development of restrictions and beliefs that

resulted from the community's experience with the natural environment. Therefore, indigenous knowledge has preserved the existence of the *Kaya* forests and, sustained and conserved the once sprawling forests which have, over time been, highly degraded. The above highlighted examples show that indigenous knowledge has been widely used globally and in Kenya, and its availability is not confined to scientific literature, but also among the resource-users (Barthel *et al.,* 2010).

Despite the importance of indigenous knowledge and traditions in the management of natural resources, some studies show that indigenous knowledge that was once valued and treated as the norm in ensuring sustainability of environmental resources has been lost or replaced with modern knowledge systems (Bennetta & Dearden, 2014a). These modern knowledge systems tend to overlook the importance of indigenous knowledge at the grassroots level and matters are complicated where illiteracy levels are high. Evidently, overlooking indigenous knowledge has greatly affected natural resource management. For example, among the coastal and riparian communities, fishing practices have deteriorated thereby negatively impacting the community's approaches to sustainable exploitation of marine resources (Friedlander & Sladek, 2003; McField *et al.,* 2007).

Most studies on indigenous knowledge are aimed at documentation of the knowledge. However, there has been little focus on the interaction of man with the environment and the use of indigenous knowledge to improve their livelihoods and sustain resource-use (Woodley, 2004). From the available studies, one can deduce that the tendency to overlook indigenous knowledge in marine resource conservation has negatively impacted on the conditions of the marine environment.

The Kenya coast is an area full of rich traditions that have been practiced by the communities for many years (Spear, 1978; GoK, 2009; Waweru, 2012). Studies have shown that these traditions and particularly those practiced by fishing communities and enforced by

social and cultural norms have had positive impacts on fisheries management (McClanahan *et al.*, 1997; Ochiewo, 2004). However, societal change has over time led to weakened cultures and adoption of new practices and technologies that are replacing some important traditions (McClanahan *et al.*, 1997; Ochiewo, 2004; Waweru, 2012). As a result, the indigenous knowledge that was used to conserve marine resources is slowly becoming "irrelevant" and is less applied by modern fisheries resource managers (Waweru, 2012).

The fishing communities in Kuruwitu, in north-coast Kenya, and Mkunguni in the south-coast have utilized the coastal and marine resources since time immemorial. These communities have evolved with the marine environment and subsequently devised best indigenous approaches to manage the resources. Fishers are known to associate with the sacred *Kaya* forests. For example, in the Southcoast of Kenya, the fishers are known to believe in animism and ancestral worship in some aspects of the fishing activities (McClanahan *et al.*, 1997; Ochiewo, 2004; Okeyo, 2010). Consequently, indigenous knowledge of the *Kaya* Forests and the traditional practices has played a key role in conservation and sustainable utilization of the resources (Spear, 1978; GoK, 2009).

A survey of available literature indicates that there are few studies focusing on the application of indigenous knowledge in resource management along the Kenya coast (GoK, 2009; Okeyo, 2010; Waweru, 2012). This study sought to contribute to the existing body of indigenous knowledge and resource management by documenting indigenous knowledge and assessment of its contribution to marine resource management and conservation.

1.2 Problem Statement

The survival of mankind is very much dependent on the sustainability of our natural resource exploitation patterns (UNDP, 2012). With numerous gaps in scientific literature, indigenous knowledge is fast becoming an important element in the sustainable exploitation of natural resources (Thornton & Scheer, 2012). A number of studies have

demonstrated the importance of indigenous knowledge on natural resource management (Johannes *et al.,* 2000; Kweka, 2004; Langton *et al.,* 2005; Cinner, 2007) .

However, despite the availability of such evidence, there has been a shift in the marine resource management regimes in Kenya, from local to national systems that have not been cognizant of indigenous knowledge in marine resource conservation (Okeyo, 2010). This has led to indigenous knowledge being overlooked in favor of scientific management approaches that are poorly adapted to the local conditions due to the data-deficient nature of the systems, and especially for the less literate resource- users (Alidina, 2005; Campbell, 2005).

Notwithstanding, indigenous knowledge is still widely applied by many local communities in the management of marine resources in Kenya. However, this application of indigenous knowledge in the management of natural resources has not been well documented in regard to Mkunguni and Kuruwitu, which are two key fishing villages along the coast. Consequently, there is a need to document the uses and importance of indigenous knowledge in natural resource conservation, and make comparative studies to determine the precise nature of how indigenous knowledge still impacts marine resource utilization and management along the Kenya coast.

The scarcity of scholarly information on the uses and importance of indigenous knowledge in marine resource management and conservation in Kuruwitu and Mkunguni villages has negatively impacted the marine ecosystems. Such a scenario negatively impacts community livelihoods along many coasts, and especially in developing countries (McField *et al.,* 2007). The biggest challenge emanates from the fact that such crucial knowledge may not be successfully applied to the sustainable use, and management of marine resources alongside scientific knowledge.

Consequently, there is need for continuous documentation of indigenous knowledge and identification of its usefulness across different areas along the coastal and marine environments in the quest for sustainable management of coastal and marine resources. The overall focus is to create a database for indigenous knowledge in order to provide an inference in the future when the older generations of custodians of the knowledge are long gone.

1.3 Aims and Objectives

The present study was aimed at documenting indigenous knowledge and its contribution to marine resource management. The study looked for similarities and differences on the application of indigenous knowledge between two local communities that share more or less similar marine ecosystems and fisheries along the Kenya coast. The main objective of this study was to assess the role of indigenous knowledge in the management of coastal and marine resources in Kuruwitu and Mkunguni fishing villages along the Kenyan Coast.

The specific objectives were to:

i). Identify the types of indigenous knowledge and practices relating to marine resource management in Kuruwitu (north-coast) and Mkunguni (south-coast) fishing villages in Kenya;

ii). Assess the perceptions and attitudes of the local communities towards marine resource management;

iii). Determine the influence of local institutions in the preservation of indigenous knowledge used in management of marine resources;

iv). Evaluate the contribution of the indigenous knowledge to marine resource management.

1.4 Research Questions

i). What are the types of indigenous knowledge and practices relating to marine resource management in Kuruwitu (north-coast) and Mkunguni (south-coast) fishing villages in Kenya?

ii). What are the perceptions and attitudes of the local communities towards marine resource management?

iii). What is the influence of local institutions in the preservation of indigenous knowledge used in management of marine resources?

iv). What is the contribution of indigenous knowledge to marine resource management?

1.5 Significance of the Study

The present study documented indigenous knowledge and practices used by the local communities along the Kenyan Coast. This is because the conservation of marine bio-diversity is important in safeguarding the socio-economic livelihoods of many communities globally. However, due to increased influence of modern scientific methods, the traditional-based management approaches, which are envisaged in the memories of the older generations as undocumented indigenous knowledge, are becoming increasingly forgotten. This indigenous knowledge plays an important role in the conservation and even recovery of degraded marine resources, but decreasing use of indigenous knowledge has led neglect resource management. This scenario has led to failed to safeguard degradation environment, and foresee the continued propagation of sound marine environmental health as a source of livelihood for the coastal communities.

Against that backdrop of contemporary challenges of losing indigenous knowledge that was helpful in sustainable exploitation of natural resources, the documentation of this knowledge is imperative in the preservation of cultural heritage of the local communities for continued posterity of the populace. The results provide a documentation of this knowledge and

marine conservation practices that can be used in management of marine resources as well as restoration of environmental quality. The research findings present additional valuable knowledge on the importance of indigenous knowledge in marine resource management, particularly in Mkunguni and Kuruwitu villages which present two cases along the Kenya coast where efforts in management and conservation of marine resources has shown initial signs of success.

1.6 Scope of the Study

The study was carried out in Kuruwitu village in north-coast and Mkunguni village in south-coast along the Kenya. Kuruwitu was chosen purposely because it is one of the pioneer fishing villages to establish a Locally Managed Marine Area (LMMA) along the Kenya Coast (Yusuf, 2011; Rocliffe & Peabody, 2013). On the other hand, Mkunguni was chosen because of the high number of fishermen operating in the area whose indigenous knowledge of marine resources and interaction with the marine environment has not been documented. The village has about 150 licensed fishers as per records from the State Department of Fisheries and the Blue Economy (Tondwe *et al.,* 2015). Mkunguni village lies off areas where marine protection is unheard of but where indigenous knowledge has served to conserve the marine resources in these areas. The nearest MPA to Mkunguni is the Mombasa MPA which remotely lies at 63 km to the north of the village. However, there is a community conservation reserve area near Diani, about 24 km also to the north of Mkunguni village. Therefore, Mkunguni's lack of proximity to an MPA and the presence of an LMA in Kuruwitu offered two villages for comparative assessment of the use of indigenous knowledge in the management of marine resources in these villages.

1.7 Theoretical Framework

Marine resources, like any other common natural resources, face numerous management problems (Hardin, 1968; Ostrom, 2010) due to the increasing demands of resource-users

over the scarce resources (Mildner, 2011). In the case of marine resources with multiple competitions between resource-users, there is likelihood of degradation of the ecosystems with resultant decline in the fish stocks, thereby escalating resource-use conflicts, which is common among the between different groups of resource-users (Tunje *et al.,* 2016). It is therefore crucial for different stakeholders to resolve the conflicts and promote better management and sustainable exploitation of marine resources (Singh, 2011; Mosepele *et al*., 2015).

According to the "*Cultural theory*" communities that use the traditional "*Common's system*" exhibit three dimensions that govern resources-use including resource users, resource-use rights, and rules (Geva-May, 2002; *Cultural Theory,* 2017). Swedlow (2014) noted that a homogeneous group of resource-uses tend to have similar behavior on the exploitation of resources which culminates to a culture. Geva-May (2002), while using the "*Cultural theory*", argues that "*cultural conditions*" in form of rules and regulations are developed to legitimize different patterns of social practices in order to promote the social unity. Chai (2011) and Jenkins-Smith (2014) recognize the importance of various institutions in enhancing social harmony and stability through the enforcement rules and regulations among/between the resource-users and the resources. Geva-May (2002) further highlights that the institutions enforcing the rules and regulations are more often than not, inclined towards solving resource-use conflicts and problems and controlling the governance systems.

Swedlow (2014) advanced the "*Cultural theory*" arguing that the management of marine resources is dependent on human skills and, that authorities are necessary for protecting marine resources against user-abuse. Kahan *et al.* (2010) further explains that culture changes from time to time and is dependent on both the internal and external "environment" of a particular community. The "*Cultural theory*" therefore encourages bold

experimentation with different scenarios of resource-use control in order to improve human skills and ultimately achieve sustainable resource management (Swedlow, 2014).

1.8 Conceptual Framework

The present study assessed the types of indigenous knowledge, perceptions, attitudes and the role of local institutions in the management of marine and coastal resources in Kenya.

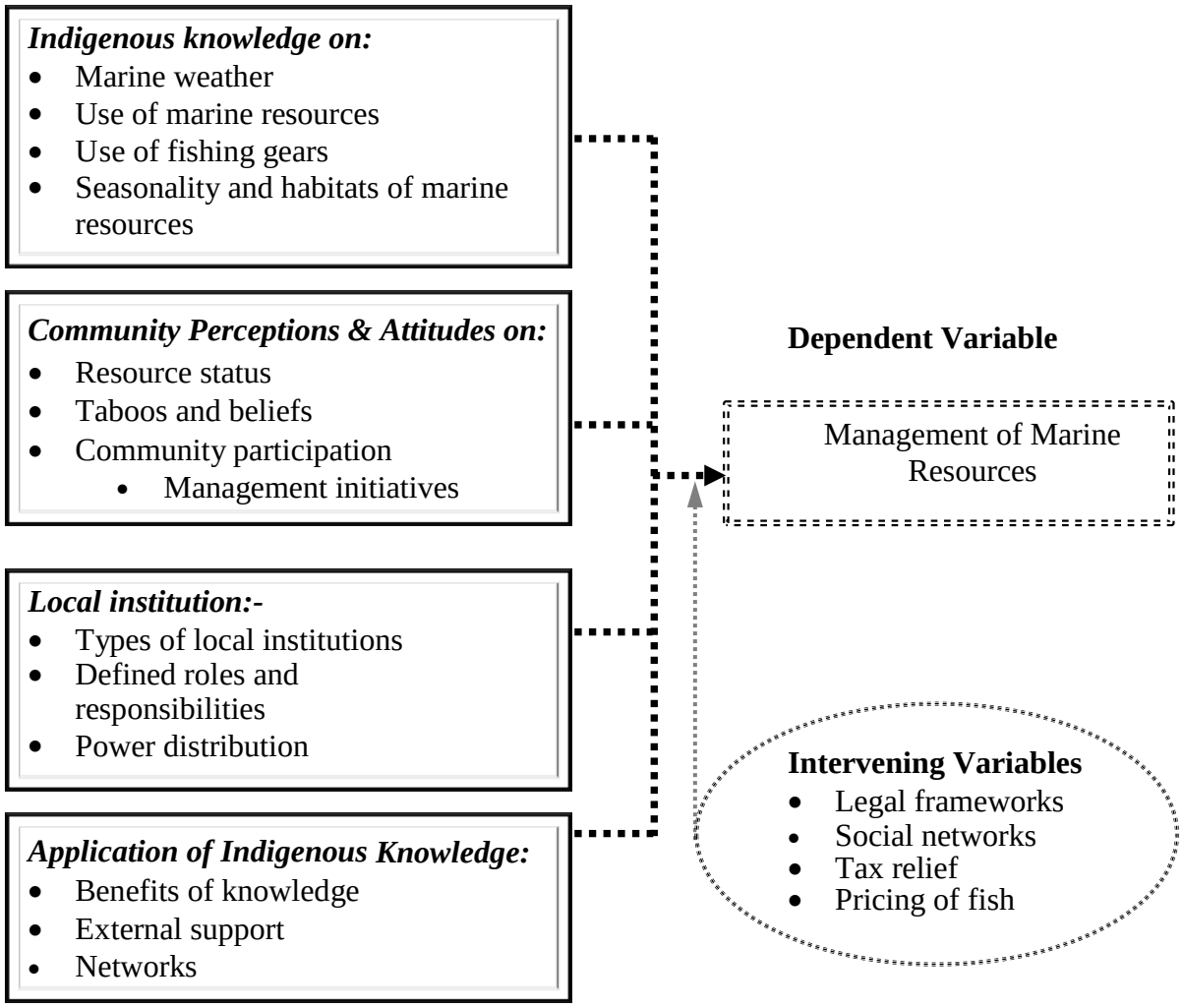
The factors influencing resource management were categorized into:-

1. Types of indigenous knowledge, including awareness on their existence and how they are practiced.

2. Perceptions and attitudes including participation of community members in conservation initiatives, practice of taboos and beliefs, and the factors that contributed to change in fishery resources

3. Local institutions encompassing any existing rules and regulations, community conservation groups, village elders and leaders.

4. Use of indigenous knowledge including benefits accruing from the use of indigenous knowledge, as well as the associated external funding geared towards support of the management initiatives using indigenous knowledge.



(*Adopted from Ogada (2013*) and modified to suite this study)

Figure 1: Conceptual Framework showing Relationships of the Variables used in the Present Study

Table 1: Operationalization of the Variables of the Study

Variables	**Description of variables**	**Research Type**	**Data Collection Instruments**
Socio-demography	State age in years Education- level of schooling Naming: Ethnicity, religion, household size, income levels and occupation	Descriptive	Questionnaires Focus Group Discussions Key Informant Interviews
Awareness and its application for sustainability	Naming and describing; marine weather, marine resources, their habitat and seasonality, fishing gears operation and limitation	Descriptive Survey	Questionnaires Focus Group Discussions Key Informant Interviews
Perception and attitudes (Rate each using the Likert scale[1])	Taboos and beliefs Fishery resources Participation	Descriptive Survey	Questionnaires Focus Group Discussions
Local institutions influence on indigenous knowledge Village elders Community conservation groups	Name and description of taboos and belief How are rules & regulations enforced How are conflicts resolved, power and authority distributed Management initiatives, level of engagement of community Awareness of rules & regulations, enforcement & adherence	Descriptive Survey	Focus Group Discussions Questionnaires Observation Key Informant Interviews
Benefits accrued from use of indigenous knowledge in resource management	Promotion of alternative livelihoods e.g. eco- tourism Funding support for social amenities in support of indigenous community initiatives in resource management	Descriptive Survey	Focus Group Discussions Questionnaires Observation Key Informant Interviews

[1] **Likert Scale:** a series of statements, which asks how much a person agrees or disagrees with them e.g. 1=very poor, 5= Excellent

1.9 Definition of Terms

Indigenous Knowledge: this is the systematic body of knowledge acquired by local people through accumulation of formal and informal experiences, as well as intimate understanding of the environment in a given culture (Berkes *et al.*, 2000; Hagar, 2004; Boikhutso, 2012).

Resource management: is a process aimed to ensure that the consumptive and non-consumptive utilization of marine resources is done in a way intended to maintain the long-term availability of these resources to provide fundamental life support to current and future generations.

Marine resources: this refers to naturally occurring endowments in the marine environment including oceans, and intertidal ecology, estuaries, lagoons, coral reefs, fish, the open-sea, the sea floor and corals.

Livelihood: this is comprised of assets and activities done as a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and remain stable both now and in the future, while not undermining the natural resource base.

Local community*:* is a geographically defined group of people living in an area as a given time, often a fishing village. These people live around the marine resources and are directly affected (both positively and negatively) by the resources.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter contains a review of the existing literature on marine resource management along the Kenyan coast, perceptions and attitudes on marine resource management, context of indigenous knowledge in management and institutions involved in the preservation of indigenous knowledge. The review was also done with the purpose of providing a theoretical framework to assumptions made in finding answers to research questions in this study, and to achieve the objectives of the study.

2.2 Global Overview of Marine Resource Management

It is with no doubt that global marine resources have an intrinsic value on people's livelihoods (Gelcich *et al.,* 2008; Roberts & 2010). However, various factors such as the rapid growth of population, dense inhabitation of some coastal areas and over-dependence on marine resources have threated the future of marine ecosystems on which the livelihoods of millions and millions of coastal folks are anchored (Léopold *at al.,* 2014; Long *et al.,* 2015). Studies around the world show that major loopholes exist in the management systems of marine resources (GoK, 2009; Jokiel *et al.,* 2011; UNDP, 2012; Obiero *et al.,* 2015). While the destruction of managing marine resources continues, countries are coming up with various strategies inorder to safeguard the livelihoods of millions of people and, restore the integrity of the marine resources (Prober, 2011; Sousa, 2016). For instance, in Canada, a lot of NGOs are advocating for community-based management units and operationalization of the international treaties as an approach to sustainable management of the marine resources (Browman *et al.,* 2004; David *et al.,* 2012). The overall aim is to minimize the problems associated with the top-down approach which imposed strategies to communities, often in conflict with existing communities' norms, values and indigenous practices (Levine, 2016).

In Hawaii, the government has been supporting a concept of dedicated access privileges or catch shares within the Hawaiian Archipelago (Williams *et al.,* 2006; Jokiel *et al.,* 2011). It

has been observed that such an approach bestows the exclusive right of access to pre-determined annual fish harvests to designated individuals or communities thereby reducing the competitive urges (to scaramble for resources) among the fishermen. Jokiel *et al.* (2011) outlines the strengths and limitations of such an approach, and concludes that if well practiced, this program presents the best management approch that can promote increased production of fish, and minimize wasteful and deleterious fishing practices.

In West Africa, the World Bank set up the Africa Regional Fisheries Program with the objective of sustainably scaling up the contribution of marine fisheries to the economic growth of the nine (9) West African countries (Boisrobert & Virdin, 2008). In the early 2000's, the government of Mozambique pushed for the use of more sustainable fishing practices through the development of consumer-driven markets (Nkhata *et al.,* 2009). This initiative has been supported in various approaches, including boycotting fish from habitats considered as depleted, and pushing for the sustainable managemnt of marine resources (Nkhata *et al.,* 2009). Within the Kenyan coast, the impact of deleterious fishing practices on the efforts geared to sustainable management of the coastal and marine fisheries resources remains major concern to fishery managers (Mbaru, 2012; Tunje *et al.,* 2016). Therefore, this study sought to assess the community's attitudes and perceptions on fishing practices as a factor influencing the sustainable management of the fisheries resources in the two villages.

Kenya's coastal and marine resources support the livelihoods of about 2.7 million people and contribute immensely to the national income (McClanahan *et al.,* 2005; GoK, 2009). Until the last decade, the management of the fisheries resources in Kenya employed a top-down approach, with the State Department of Fisheries charged with the legislation and enforcement of the Fisheries Act Cap 378 of 1989. However, under the Fisheries Beach Management Unit (BMU) regulations of 2007, the management of the resources was devolved to include a co-management approach (GoK, 2007; Ogada, 2013); resource-users and the government or government's relevant authorities have a mutual arrangement for the

administration of fisheries and other natural resources to ensure sustainability (Ogada, 2013). Co-management integrates people's indigenous knowledge of environmental conservation and resource-use with scientific approaches using knowledge derived from scientific research (Simon, 2013).

The establishment of beach management units (BMUs) along the coast has also promoted the use of community conserved areas (CCAs) including Locally Managed Marine Areas (LMMAs) as an approach to the conservation of marine resources (Samoilys *et al.,* 2011; Rocliffe *et al.,* 2014). According to Mwaipopo *et al.* (2011), BMUs in Kenya have been known to apply indigenous knowledge in their resource-use strategies, and the approach is rated as more effective in the management of marine resources than the top-down approach previously employed by the central government. While the establishment of BMUs was also targeted at the establishment of community conservation areas and related marine protected areas in Kenya, with inclusion of local communities to strengthen the co-management approach to resource management, a survey of existing literature suggests that little or no studies have evaluated the performance, or documented any resistance to such initiatives, as is the case in other areas (Chan *et al*., 2012). Although some studies have been conducted to assess the efficiency of co-management efforts in integrating local fishery communities to management of fishery resources in Lake Victoria, Kenya (Obiero *et al*., 2015), similar studies or literature for the Kenya coast is clearly. Notwithstanding, the studies in Lake Victoria still provide an opportunity for comparison, with possible application to Kuruwitu and Mkunguni fishing villages where inefficiency appears to have impeded the process of co-management among different stakeholders.

The use of co-management and BMUs as an approach to management of marine resources has demonstrated the importance of involving the local communities in conservation initiatives (Howe, 2001; Samoilys *et al.*, 2011). It is important that this involvement be cognizant of the norms and customary attributes of the targeted community, making sure

that the rules and legislation to be applied to the fishery is clearly understood in context with the environment in which the BMUs operate (Etiegni *et al.,* 2016). Although the push for sustainable management of the fisheries resources has remained elusive in many countries, there are indications that all-inclusive approaches are the key to ensuring the sustainable exploitation of the resources (GoK, 2009).

Studies along the Kenya coast indicate that the coastal and marine habitats and ecosystems have undergone some tremendous degree of damage and degradation due to anthropogenic activities. These activities, ranging from overfishing, erosion associated with land-use changes, habitat degradation and species loss, and mangrove degradation have been augmented by issues such as global warming and climate change-triggered bleaching of corals reefs (Bosire *et al.,* 2006; Arthurton *et al.,* 2010; GoK, 2014). These changes have negatively impacted the subsistence fisheries across the country along the entire coastline (Fulanda *et al.,* 2011).

Despite government efforts in enacting necessary laws and empowering institutions to manage the marine ecosystems for the well-being of the coastal communities, significant gaps still exists in understanding the management of the complex processes and trends in coastal and marine environments (GoK, 2007). Nevertheless, there is consensus among several scholars that scientific knowledge alone is not adequate to achieve the management goals and objectives of sustainable fisheries (Faulkner & Silvano, 2001; Muthiga & Kawaka, 2010; Rocliffe *et al.,* 2014). Therefore, integrating scientific knowledge with indigenous knowledge generates a holistic approach in the management of marine resources, hence the need to integrate indigenous knowledge in management and conservation of marine resources (Crona, 2006; Dimech *et al.,* 2009; Popova, 2014). Consequently, there is a need to evaluate how various management initiatives based on indigenous knowlegde have impacted coastal and marine resources in Kenya, with case studies of Kuruwitu and Mkunguni fishing communities.

2.3 Perceptions and Attitudes on Marine Resource Management

Numerous studies on attitudes, perceptions, beliefs and preferences related to management of marine resources have highlighted varied community behavior as a result of management initiatives by different resource-user groups (Tonder & Jurvelius, 2004; McClanahan *et al.,* 2005; Pullin & Stewart, 2006; Gelcich *et al.,* 2008). Such studies have attempted to understand various issues in these indigenous communities, such as attitudes and perceptions in decision-making processes, identification of preferences, compliance and enforcement of rules and regulations (Gelcich *et al.*, 2008).

According to Cheung *et al.,* (2008) and Gorris (2016) varied opinions among different resource-users is very common and is dependent on the value accrued from the resource. For example, in Philippines, most fishers whose fishing grounds are far away from MPAs have negative attitudes towards the implementation of simple marine reserves because they perceive the benefits of the spillovers occurring at very small distances and argue that the spillovers are outweighed by the opportunity costs of reduced sizes of the fishing grounds and thus; of the total catch from these fishing grounds (Chaigneau *et al.,* 2008; Allegretti *et al.,* 2012). The community conservation areas in Kuruwitu, an LMMA in nature, applies similar principles of reserving an area of fishing like an to a Marine Protected Area (MPA) as guided by the Wildlife Conservation and Management Act, 2013 of the Laws of Kenya which governs the operations of MPAs and the Kenya Wildlife Service (KWS, Kenya). Therefore, it is imperative to examine the perceptions and attitudes of the community and residents around north-coast area of Kuruwitu village towards such management initiatives and any other initiative whose perceptions and attitude have not been determined.

In Panama, the older fishers noted that within a period of 15 years, the shallow water lobsters species which were initially distributed in waters of 1-3 m depth has shifted to deeper waters (6 m and deeper) due to the use of Clorox bleach in lobster caves by young

divers (Hoehn & Thapa, 2009; Harper *et al.*, 2010). On the other hand, the success of the customary management systems in Indonesia has largely been due to the fact that most fishers have understood the positive impacts of the fisheries on household and community well-being (Cinner, 2005; Setiawan *et al.*, 2012).

In Madagascar, fishers around the Andavadoaka regions had the perception that "over-harvesting" of finfish species by commercial companies in 2002 caused the degradation of the reef health and put the sustainability of all fish stocks in the areas under risk (Epps & Benbow, 2007). Therefore, in view of this, the fishers created of rules and regulations to curb the perceived overfishing and support sustainable fisheries resource management. The Mkunguni village in south-coast Kenya presents a scenario similar to the Andavadoaka region in Madagascar, given that the village is frequented by foreign fishers from the neighbouring Pemba and Mafia Islands (McClanahan *et al.*, 2005; Okeyo, 2010). Consequently, studies to assess the resident's perceptions and attitudes with regard to the foreign fisheries and the overall impacts on the coastal and marine resource in the south-coast Kenya, is long overdue.

Along this coast, beach seines and spear guns present common fishing gears, despite their illegal status, and the spirited campaigns by the government through the State Department of Fisheries & the Blue Economy to eliminate such deleterious fishing methods (GoK, 2007). McClanahan *et al.* (2005) attributed this to the fact that these fishing gears and equipment are cheaper than the convectional legal gears, and are also perceived to be more competitive/effective in catching fish. Further, the low compliance to fishing area closures is to a larger extent perpetuated by fisher's attitudes and perceptions that the government reaps all the benefits while they lose the fishing area (McClanahan *et al.*, 2005).

While studying the small-scale fisheries in Wasini Island in Kenya, Ogada (2013) observed that increased fishing pressure over the fisheries resources was driven by the perception of the fishermen that the resources were the property of the government and that the

government was trying to limit the fishers from fully exploiting the resources through licencing. Similar to the fisheries, the wanton harvesting of mangroves, and even clearing of young mangrove forests in some parts of Shimoni-Gazi mangrove ecosystem in south-coast Kenya was triggered by similar perceptions. This is evidenced by the popular phrase "*Anayekata mikoko ni mpwa, anayesimamia mazingira ni mjomba*" (whoever cuts mangroves is a nephew, and the one responsible for conservation is the uncle); an accepted norm which has led to a drastic reduction of the mangrove forest cover in these areas (Mwaipopo *et al.,* 2011). Understanding the attitudes and perceptions of the local community towards marine resource management may help predict their likely behavior in the face of programmes geared towards enhancing the success of resource-management initiatives (Cheung *et al.,* 2008).

2.4 Context of Indigenous Knowledge in Management of Marine Resources

Moving into a historical perspective, it is important that global environmentists understand the historical relations between man and the marine environment (Manez *et al.,* 2014) and then use this understanding, from a local level upto the global scale to implement resource management strategies for different regions. Generally, from the local level, taboos, beliefs and customs of local communities have been indirectly used to manage and protect coastal and marine resources (Berkes, 1999; Masalu; 2010; Rim-Rukeh *et al.,* 2013). The taboos, beliefs and customs constitute what is commonly referred to as the "culture", which a functioning factor in the management of the coastal and marine resources (Levine *et al.,* 2015).

For example, to reinforce the conservation efforts in Madagascar, the community barred the offenders of taboos from the fishing grounds for a defined period of time (Cinner, 2007). On the hand, in order to enhance the sustainability of fish stocks in Pemba Island in Tanzania, the local Muslim elders employed the religious doctrine stating that "animals should be allowed to reproduce before they are killed for human use" to prohibit the harvesting of

juveniles, and this approach ensured that larvae, post-larvae and juveniles, as well as all sized small-fish were not fished, and were thus lleft to reproduce and replenish the target fisheries (Khalid & Thani, 2008).

Therefore, these practices associated with traditional norms and customs have provided an effective management strategy in places where biological and social information guided resource management is underdeveloped, or is completely inexistent, and governance structures are weak (Cinner *et al.,* 2007). Consequently, the documenting this form of knowledge is important because it can be used as a basis for decision making especially in areas were resource management is run by the community, or where co-management structures are fairly well developed and thus provide the communities with an active role in resource management and conservation (Berkes, 2008). Such an approach and documentation would also strengthen management and ensure continuity of the legacy of sound co-management approaches especially in areas where modern scientific approaches are first replacing the use of indigenous knowledge (Mpofu & Miruka, 2009). Evidently, indigenous knowledge is important for the sustainability of species and habitat diversity, as well as the livelihoods of communities that exploit these resources, where such knowledge has been used to establish ideal periods of harvest, the quantities to harvest and the suitable seasons for closure (Leopold *et al.*, 2014).

Over the last few decades, the decline in the use of indigenous knowledge, with resultant deterioration in management approaches, has been noted as a key driver of the degradation of marine resources (Langley, 2006). This decline has partly been due to the reduced authority of the village elders over resource management, as wel as the declining population of the elders, augmented by clear lack of adequate transfer to young generations through peer education, and/or the lack of documentation before the death of these elders (Masalu *et al.,* 2010; Waweru, 2012). Furthermore, majority of the younger generation is more inclined towards formal education and spends a better part of their time away from the

company of these knowledgeable elders, thus missing out on knowledge associated with traditional customs and taboos (Cinner *et al.*, 2007; Waweru, 2012). According to Rocliffe *et al.* (2014), this lack of interest in indigenous knowledge has contributed to breakdown in the old belief systems and this may explain the increasing deleterious impacts on both the coral reef and the marine environments associated with young fishers and youthful resource-users. Therefore, there is a need to re-evaluate the benefits associated with the incorporation of indigenous knowledge in the efforts geared towards sustainable utilization and management of coastal and marine resources (Uprety *et al.*, 2012).

2.5 Institutions Involved in the Preservation of Indigenous Knowledge

Studies by Santha (2008) and Jasmine *et al.* (2016) and have shown that, local communities who are dependent on natural resources for their survival often develop appropriate institutional arrangements for the management of these resources. The communities may work together in developing rules on resource-use aimed at enhancing the sustainable utilization and management of the marine resources. Elder-Vass (2008) defines institutions as codes of conduct that define practices, assign roles and guide interactions or the set of rules that are actually used. These social institutions are important in understanding and informing environmental policies and management practices (Leenhardta *et al.*, 2015).

Many societies that are based on cultural and traditional systems have authoritative figures such as chiefs, village councils and Kings (Cinner, 2007; Levine *et al.*, 2015; Levine, 2016). Furthermore, these authoritative figures are thought to have some sort of "supernatural" connections in addition to the responsibilities bestowed upon them, which range from overseeing ceremonies, punishing offenders who break community norms and taboos, making sacrifices on behalf of the community when needed, and making spiritual consultations with the ancestors for guidance from time to time (Levine, 2016).

For example, before the arrival of the Christian missionaries in Taiwan, the Aboriginal fishing community the Island was mainly regulated by traditional laws in the form of taboos,

often under the enforcement of a village council (Natcher & Davis, 2007; Tang & Ching-Ping, 2009). In these scenarios, the village council would use their indigenous knowledge to invoke evil spirits, who would cause death to offenders to, enforce compliance to the rules and regulations guiding the sustainable exploitation of marine resources, thereby ensuring the maintenance of social order.

Among the Kosi Bay fishing community of the north-coast of Kwa Zulu Natal Province, South Africa, tribal authorities were used to oversee rules relating to access, ownership and use of coastal and marine resources (Sunde, 2013; Krause, 2015). Sunde (2013) further adds that these rights were exercised depending on the position of one's membership and the status of his standing within the community group. Such an approach was shown to promote accountability and responsive behavior on the exploitation on the coastal and marine resources (Sunde, 2013; Krause, 2015).

On the other hand, the Vezo fishers' communities of southwest Madagascar adhere to traditional local laws, known as *dina,* which are recognized by the government and have been confirmed to represent some valid and viable fisheries regulation mechanisms (Langley, 2006; Cinner, 2007). The traditional local laws are enforced by a village president and other stakeholders who are responsible for raising awareness within their community, on the importance of sustainable exploitation of marine resources (Cinner, 2007). Consequently, assessment of the role of local institutions in the preservation of indigenous knowledge at the village level would provide crucial information for managers as they gear the marine resources to sustainability using the currently advocated approach of co-management of natural resources.

According to Kajembe *et al.* (2001), institutions are made up of formal constraints such as rules, laws and constitutions as well as informal constraints such as norms, behavior, conventions and self-imposed codes of conduct together with their enforcement characteristics. The various ecosystems and species located at grassroots levels are often

managed by way of local-level institutions that regulate access and resource-use rights on spatio-temporal scales (Bennett & Dearden, 2014b). Local institutions facilitate capacity building, participatory decision-making and sustainable management approaches, without which there would be numerous issues in resource exploitation processes (Orchard *et al.*, 2015).

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the study sites, research design, study population, sample size and sampling procedures, data collection instruments, data collection procedures, data analysis and ethical considerations taken into account in the present study.

3.2 Study Sites

3.2.1 Kuruwitu Fishing Village

Kuruwitu village is located in Kilifi County along the north coast Kenya, some 27 km south of Kilifi town, off the Kilifi-Mombasa highway. The villages covers an area of 56 km^2 with an estimated population of 3,870 persons and household sizes ranging from 5-6 persons per household (KCWA, 2010; Rocliffe & Peabody, 2013). It is endowed with various marine resources such as mangroves, marine life including fish, sea turtles and coral reefs. Kuruwitu Conservation and Welfare Association (KCWA) is a community based organization focused on environmental and marine conservation in Kuruwitu and its environs. The CBO operates in a total of six landing sites, from Vipingo, Kuruwitu, Kijangwani, Kinuni, Bureni to Mwanamia (KCWA, 2010; Abunge, 2011; Yusuf, 2011).

The communities living in the area are of mixed origin; however the Giriama and the Chonyi from the Mijikenda community are the largest group (Middleton, 2000; Cinner *et al.,* 2009). Community livelihoods in the village are heavily dependent the natural resources, from fishing, peasant farmers, tour guides and traders, with some of the villagers employed as casual labourers in the Vipingo sisal plantation farm on the mainland side of the Kuruwitu coast (KCWA, 2010).

3.2.2 Mkunguni Fishing Village

Mkunguni village is found in Msambweni sub-County in the south-coast of Kenya. The village has a population of 4,125 persons and an average household size of 6-7 persons per household (CRA, 2012). Like Kuruwitu in the north, the village is endowed with numerous marine resources including mangrove forests, fin and shellfish and marine turtles. There is a resident community based organization also focused on marine conservation i.e. the Msambweni Turtle Conservation Group (MTCG). The CBO covers a total of four landing sites namely; Mwaembe, Mkunguni, Mwandamo and Munje (Tondwe *et al.*, 2015). The main tribe dominating the community in Mkunguni village is the Digo, a sub-tribe of the Mijikenda community (Lehmann & Kioko, 2005). Majority of the Digo people strictly adhere to traditional practices (McClanahan *et al.*, 1997; Okeyo, 2010). Fishing is the largest income generating activity in the area, while farming, trading and tourism related activities also provide some substantial support to the community livelihoods (Tondwe *et al.*, 2015).

3.2.3 General characteristics of the study sites

Both Kuruwitu and Mkunguni villages experience two distinct monsoon periods reminisce of the Kenya coast. The North East Monsoons (NEMs) or "*Kaskazi*") winds dominate the September-February season and present the high fishing season in terms of frequency of sea going fishers and vessels, as well as the fish catch. The South East Monsoons (SEMs) or "*Kusi*" dominate the months of March through August; the low fishing season along the eastern coast of Africa due to fewer numbers of fishers going out to sea. There is a bimodal rainfall pattern associated with the monsoons, with the long rains running between April to July and the short rains between October to December (Camberlin & Philippon, 2002; GoK, 2009; Okeyo, 2010). The location of the study sites is shown on the maps in Appendix I.

3.3 Research Design

The study adopted a descriptive survey design involving administration of questionnaires to selected households, use of Focused Group Discussions (FDGs) followed by Key Informant Interviews (KIIs) for the collection of data. In all cases, the study ensured that all key informants were small-scale fishermen and village elders who were well conversant with the indigenous knowledge and resource use in the selected villages.

3.4 Study Population

The study targeted members of conservation groups who are fishermen or engage in the exploitation of marine resources in the two selected villages. The conservation group in Kuruwitu (KCWA) has a total of 60 members (Abunge, 2011), while the Mkunguni turtle conservation group (MTCG) has 22 group members (Tondwe *et al., 2015*). The total number of households is very similar in the two villages, with 774 in Kuruwitu village (KCWA, 2010), compared to Mkunguni village which has 687 households (CRA, 2012). The study also consulted elders from both villages, who have a wealthy of knowledge in application of indigenous knowledge in the exploitation of coastal and marine resources. The household-heads who are involved in marine resource-use were also part of the selected participants from the two conservation groups.

3.5 Sample Size Determination

A sample size of 99 and 82 households in Kuruwitu and Mkunguni fishing village respectively, was selected using the formula adopted from Ross (2002) for calculating sample size.

A sample size of 99 and 82 households in Kuruwitu and Mkunguni fishing village respectively, was selected using the formula adopted from Ross (2002) for calculating sample size.

$$n = \frac{NZ^2 \times 0.25}{d^2 \times (N-1) + (Z^2 + 0.25)}$$

where, n ↔ sample size

N ↔ Target population

D ↔ precision level normally expressed in terms of 0.05

Z ↔ number of standard units of sampling distribution correct to desired confidence level

The total number of households in Kuruwitu= 774

N= 774; d= 0.05; Z= 1.96

$$\frac{774\times1.96^2\times0.25}{0.05^2\times(774-1)+(1.96^2\times0.25)}$$

= 99 Households Units in Kuruwitu

The total number of households in Mkunguni= 687

$$\frac{687\times1.96^2\times0.25}{0.05^2\times(687-1)+(1.96^2\times0.25)}$$

= 82 households Units in Mkunguni

3.6 Sampling Procedure

Kuruwitu village was purposively selected as it presents one of the pioneer locally managed marine areas (LMMA) in Kenya. The Mkunguni village has very minimal conservation initiatives except for the sea turtle conservation group (MTTG) and was therefore selected as a non-conservation area for purpose of comparison with LMMA in Kuruwitu. Purposive sampling was used to identify the village elders and elderly fishermen who are rich in indigenous knowledge application for inclusion as key informants.

Simple random sampling was used to select the households interviewed. All households in each study area were given numbers and Stat Trek's Random-Number Generator and then used to pick the selected samples from the total household data. According to Kothari (2004), the random-number generator is a quick, cost effective and an easy tool for selecting random numbers.

3.7 Data Collection Instruments

3.7.1 Questionnaire

A semi-structured questionnaire was administered to the household heads of the total of 181 household in the two villages, to capture both qualitative and quantitative information on use of indigenous knowledge in the management of coastal and marine resources. Due to the high illiteracy levels in the study areas (KNBS, 2010), the questionnaires were formulated in the national/local language, Swahili, and administered by the researcher and/or research assistant during the interviews. A sample of the questionnaire is shown in Appendix III.

3.7.2 Focus Group Discussions (FGDs)

Focus group discussions (FDGs) involving members of the conservation groups, fishers and other residents are involved in the exploitation of marine resources, were conducted in each village using methods adapted from Gill *et al.* (2008). The FGDs comprised a maximum of only 6-10 persons per group, with majority of the groups having ≈9 members who were selected based on their knowledge, active participation and experience on issues captured the thematic areas of this study. The FGDs were composed of all categories of the resources-users and conservation group members including women, men and the youth, who were involved in the exploitation and management of the marine resources (Appendix IV). FGDs allow deeper examination of complex issues by triggering the informant's minds or ideas to issues that they never thought about before hearing the contribution from other informants (Bhattacherjee, 2012).

3.7.3 Key Informant Interviews (KIIs)

In-depth interviews with key informants were conducted at each study site. The key informants were BMU leaders and elders from the villages. The KIIs were done to supplement the information collected through the questionnaires and simple observation methods (Appendix V) (Abbott & Bordens, 2011).

3.7.4 Simple Observation

Observation was used on various occasions, e.g. in identification of local fishing gears and how they were assembled, and other related activities so as to gain more understanding on existing knowledge. In addition, this method helped in gathering additional information that was not captured in the questionnaires. Observation provides an opportunity for the researcher to have a better understanding of what is happening on the ground (Sekeran & Bougie, 2009). The technique ensures information gathered is free from respondents' bias (Kothari, 2004). Simple observation was done and photos of the study fieldwork taken in order to pictorially present the images in this report.

3.8 Piloting of the Research Tools

A pilot study was conducted for four (4) days to test the data collection tools. A sample of 15 respondents was used to test the questionnaire and Key Informant Interview Guide. The pilot study was used to estimate the time required to administer the tools and to ensure that the research instruments were valid and reliable. Piloting was also used in planning for the field logistics of the main study thereafter.

3.9 Data Collection Procedure

The area heads (village chiefs) in both villages were contacted for administrative authorization to contact the research in the village, and to enable administration of the instruments in their areas of jurisdiction. To facilitate the study, the chiefs convened meetings comprising of village elders and BMU leaders, to familiarize the researcher with the village setups and to establish rapport. The researcher, with the help of trained field assistants then proceeded to administer the questionnaire and interview guides to the households. Focus Group Discussions were conducted with the help of field assistants who were also used to take notes during the meetings. In all cases, the respondents were assured of strict confidentiality in the research and an "informed consent" form then availed to the respondents to sign before participating in the study.

3.10 Data Analysis and Presentation

Both qualitative and quantitative data were gathered for the study using the questionnaires, interviews and FGDs. The collected data for objective 1, 2 and 3 was organized and analyzed using descriptive statistics in MS Excel® to determine statistics such as mean, ratios and percentages. The results were presented using bar graphs along with tabular data. Chi-squire tests were conducted for objective 4 to determine the significance on the views of survey respondents across the two villages using Statistical Package for Social Sciences (SPSS). Open ended questions and interview data were sorted into themes and any interviews inconsistencies and unique statements noted and given particular attention in the analysis.

3.11 Ethical Considerations

A number of ethical issues were addressed before conducting the study. These included informed consent, age, access and acceptance, as well as, confidentiality and anonymity of study participants. The principle of informed consent was accorded the required attention by explaining the purpose of the study to participants and making sure that they understood that participation in the study was optional, and that they had a choice of not answering some or any of the questions in the course of the interview. In recognition of the ethical requirement that personal information obtained from a participant during research was confidential, no disclosure of the same was made after the interview or during the analysis and subsequent writing of this thesis.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of the analyses in line with the purpose and objectives of the study. The first section presents the demographic characteristics of the study respondents, while the subsequent sections report the findings of the study based on the research objectives and questions.

4.2 Socio-Demographic Factors in Kuruwitu and Mkunguni Villages

Socio-demographic characteristics of the participants were surveyed by use of questionnaires, FGDs and KIIs. These included the age of the resource users, ethnicity, religion, household size, residence patterns, education levels and socio-economic activities in the two villages

4.2.1 Age Distribution among the Resource-users

The age-distribution of the participants in the present study shows that 35% of the resource-users in Kuruwitu village were aged 31-40 years compared to 20% in the same age bracket at Mkunguni village (Figure 2). In Mkunguni village, 32% of the resource-users were in the age bracket 18-30 years. This implies that most of the resource-users in both villages were below the age of 40 years. These results are in agreement with the findings by Awiti and Scott (2016) who observe that a greater percentage of the Kenyan population lies within the youthful age bracket.

Figure 2: Age Distribution of Resource-users in Kuruwitu and Mkunguni Villages in Kenya

4.2.2 Ethnic Background of the Resource-users

The Giriama were the dominant ethnic group at 56.6% in Kuruwitu village while the Mkunguni village was dominated by the Digo at 80.5% (Figure 3). Other ethnic groups recorded included the Chonyi, Kauma, Jibana and Rabai in Kuruwitu village, and the Pemba migrant fishers from the Zanzibar archipelago, Tanzania, while the Duruma were recorded in both villages. This implies that majority of the resource-users in both villages were from the Mijikenda. These results are in agreement with other studies along the coast which have reported the Giriama, Digo and Duruma the most populous among the coastal and marine resource users and who are also known for their strong application of indigenous knowledge in conservation e.g. of *Kaya* forests as well as marine resources (Wangila & Shauri, 2009; Ongugo *et al*., 2012).

4.2.3 Religious Affiliations of the Resource-users

In terms of religious affiliations, Christianity accounted 84% of the respondents in Kuruwitu village, while Islam dominated the Mkunguni village at 93% (Figure 4), implying that majority of the resource-users in Kuruwitu were Christians while in Mkunguni, majority were Muslims.

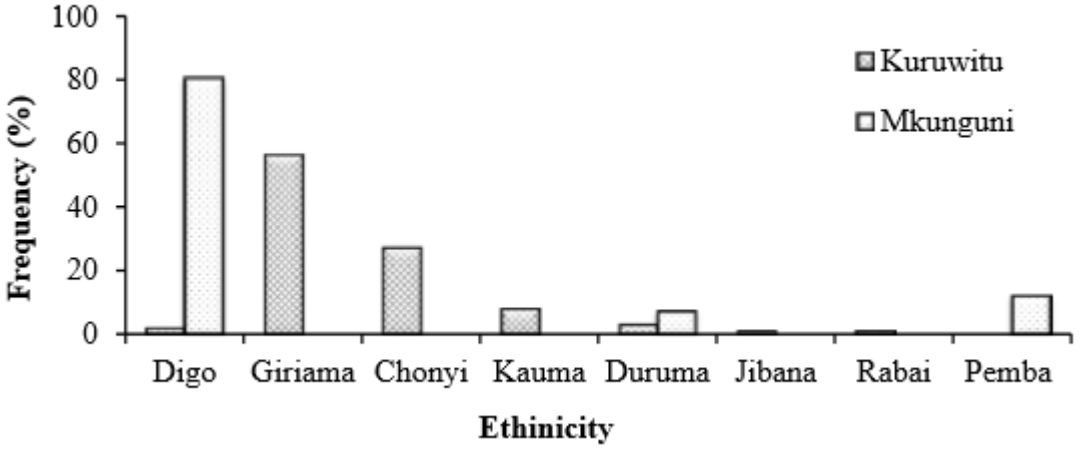


Figure 3: Ethnicity of the Resource-users in Kuruwitu and Mkunguni Villages in Kenya

According to Brown (2008), religion has been shown to influence people's values and behavior which are of interest on environmental concerns. Brown (2008) argues that all major religions have some influence on the way resource-users value the environment and natural resources. Consequently, religious beliefs can impact some behaviour (good or bad), in relation to sustainable exploitation of marine resources thereby influencing management.

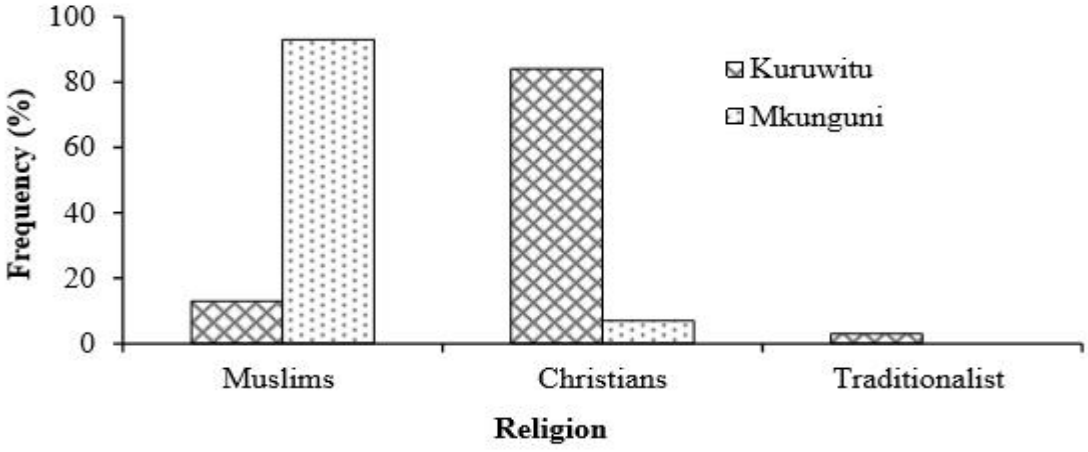


Figure 4: Religious Affiliations of the Resource-users in Kuruwitu and Mkunguni Villages in Kenya

4.2.4 Household-sizes in Kuruwitu and Mkunguni Villages

In the two villages, household-size varied widely, with an average of seven (7) persons per household. Kuruwitu recorded bigger household sizes, with 50% of the households ranging in size from five (5) to eight (8) persons per household, compared to 43% in Mkunguni village with similar household size (Figure 5). The largest households recorded 14 persons

per household indicating that both villages were fairly densely populated, with majority of the households dependent on the marine resources as the major source of the livelihoods with economic activities ranging from fishing, tourism and trade.

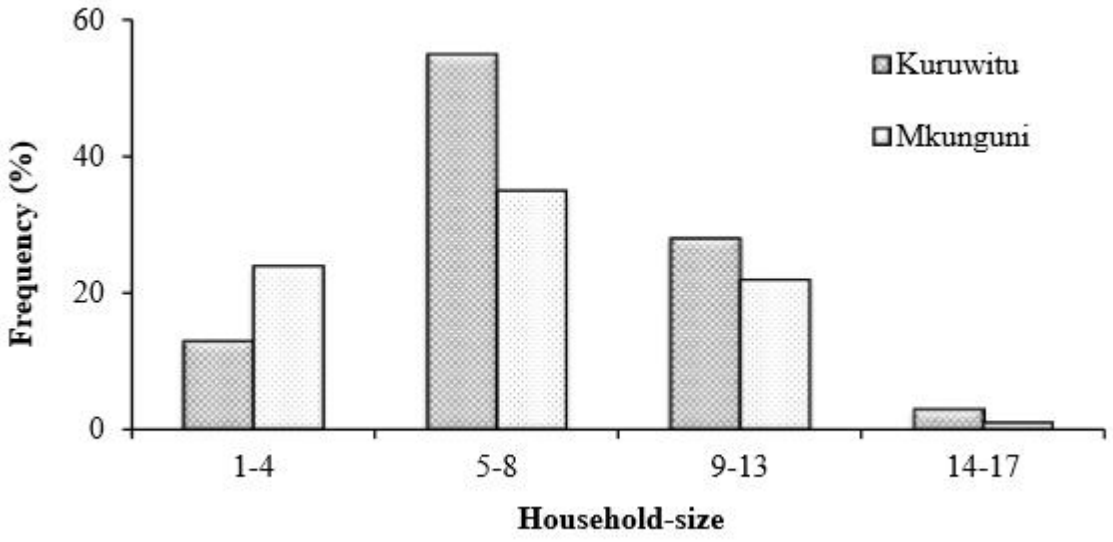


Figure 5: Household-size in Kuruwitu and Mkunguni Villages in Kenya

4.2.5 Residence Patterns in Kuruwitu and Mkunguni Villages

All the respondents in Kuruwitu village (100%) and 91% in Mkunguni village were residents, having lived in the village for a period of over 18 years (Figure 6). This indicates that Kuruwitu village is not impacted by migrants and migrant fishers, compared to Mkunguni. Notwithstanding, even the residence rate in Mkunugni was very high with most of the respondents having lived in the village for more than 20 years. The long resident time in both villages implies that the resources-users had lived in the village long enough to get well versed with the marine resources, and gain a good level of understanding the indigenous knowledge held by the local communities. Anton & Lawrence (2014) argue that people who live in an area for long time tend to develop strong attachments to their homes and the local area. Anton & Lawrence (2014) further adds that the strong attachments may push the residents towards engaging in various social affairs, as well as management and conservation of the environmental.

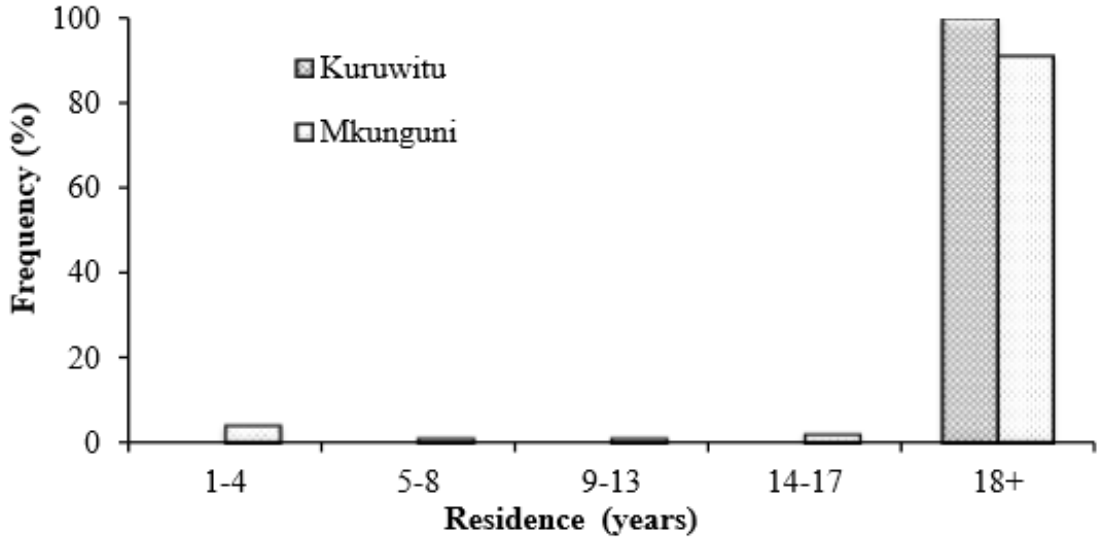


Figure 6: Residence Duration of Resource-users in Kuruwitu and Mkunguni Fishing Villages in Kenya

4.2.6 Education Levels in Kuruwitu and Mkunguni Villages

Education levels in both Mkunguni and Kuruwitu villages were low, with only 32% and 20% of the resource-users in Kuruwitu and Mkunguni, respectively, having no formal education (Figure 7). Those who had attended some Madrassa and Primary school level of education in Kuruwitu village accounted for only 2% and 46%, respectively, compared to 36% and 16%, respectively, in Mkunguni village. In both villages, the low levels of literacy were partly attributed to the low value attached to formal education in the present better returns from fishing where fishing in these villages where fishing was the main occupation. The situation could also be explained by the inadequate number of education infrastructure, from primary and secondary schools, which lay several kilometers away. Generally, the coastal counties have been highly marginalized in terms of available infrastructure and social amenities forcing people to walk for long distances to access these amenities, including basic education schools (KNBS, 2010). According to Chuang (2013), education enhances people's capacity to understand and handle development issues. Chuang (2013) further adds that the level of education also influences one's occupation. Therefore, the respondent's choice fishing as a career maybe have been influenced by the some functional in their educational status.

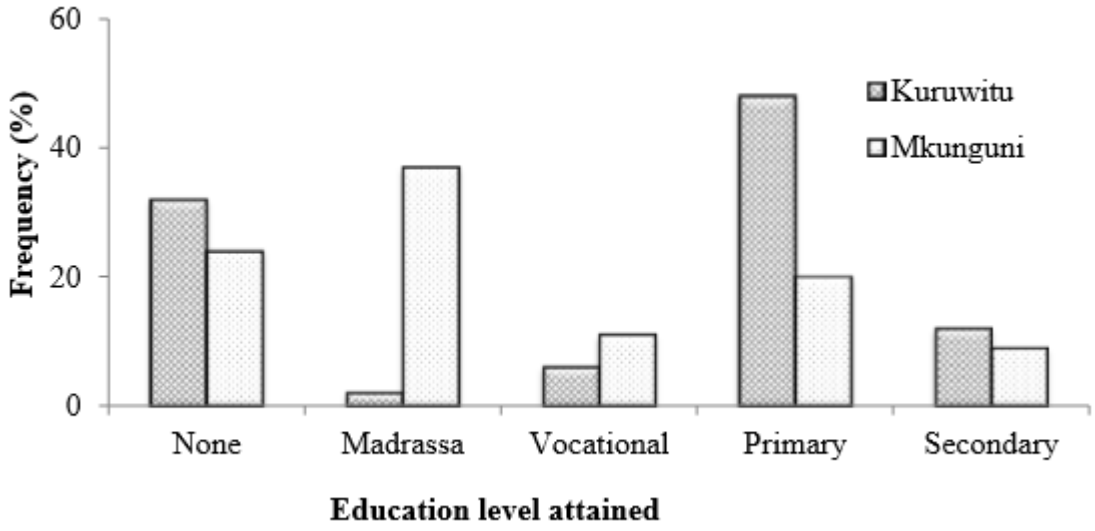


Figure 7: Education Level of the Respondents in Kuruwitu and Mkunguni Villages in Kenya

4.2.7 Socio-economic Activities in Kuruwitu and Mkunguni Villages

Fishing is the main socio-economic activity with about 45% of the resource-users in Kuruwitu and 76% in Mkunguni engaged in fishing and fisheries related activities (Figure 8). Other economic activities recorded in the villages include farming, retail businesses, masonry and woodwork, and livestock keeping. Therefore, fishing and fisheries related activities such as fishing input suppliers, gears and vessel repair, fish mongers are the major economic activities in the two villages, with skills passed on from generation to generation. Statistics from the State Department for Fisheries and the Blue Economy have shown that marine fishing and fisheries form the backbone of the coastal communities' livelihoods (GoK, 2009).

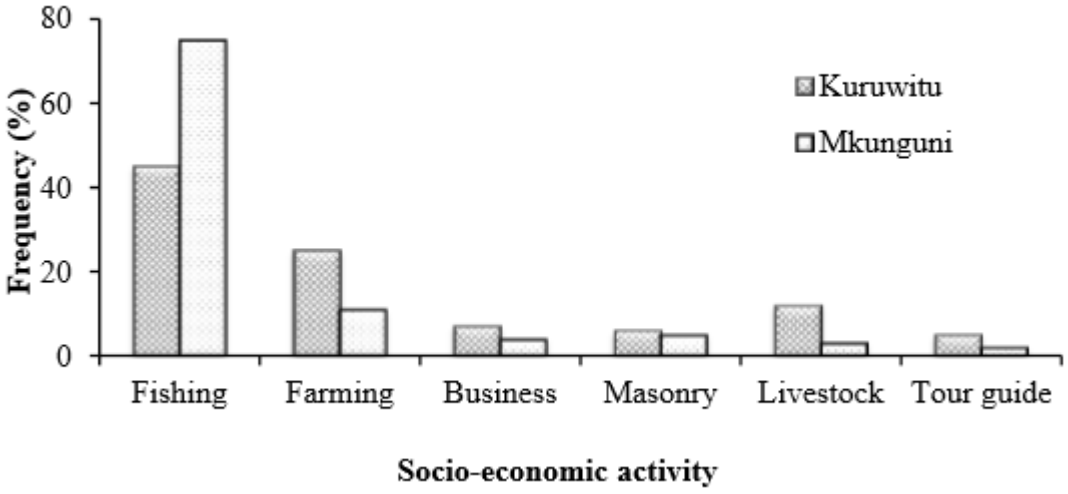


Figure 8: Socio-economic Activities in Kuruwitu and Mkunguni Villages in Kenya

4.3 Types of Indigenous Knowledge on Marine Resources in Kuruwitu and Mkunguni Villages

4.3.1 Indigenous Knowledge in Marine Weather and State of the Sea

Based on the results of the FGDs conducted in the two villages, resource-users showed an in-depth understanding of indigenous knowledge as used on marine weather conditions and state of the sea, and its relation to marine resource-access and use. For instance, the loud sound of waves splashing on the reef was an indication of impending rains and the beginning of a rough-sea period, often associated with the strong South-East Monsoon winds (SEM or *Kusi*). The SEM season is characterized by heavy rains and stormy seas, and resource-users in both villages were able to predict this precise period of the SEM season based on the daily weather changes and the moon calendar. Due to the strong winds, and likelihood of heavy rains, the resource-users exercised extra precaution in their fishing activities, often restricting fishing the in-shore areas and around the reef entrance (*mlango*). This may also be partly attributed to lack of strong mechanized boats to tackle the rough weather during the SEM period as observed during field survey in both fishing villages.

The results show that the residents from both villages associate different weather changes with the behavior or state of the sea. These results concur with those of McClanahan and Mangi (2004), and Okeyo (2010) which reported that that changes in monsoon weather patterns often limited the fishing ventures, especially during the May-August period when the rough SEM weather occurs. The studies also observed that fish catches also tended to decline among artisanal fishers during these SEM weather.

A second form of indigenous knowledge observed in the two villages was the ability to determine with fair accuracy, the state of the sea with reliance on the lunar cycle, and application of such knowledge in planning for fishing activities. The resource-users were conversant with the 14-day lunar cycle (cycle of the moon) which is locally referred to as *bamvua*; meaning "dead waters". The *bamvua* occurs during the period when the sea rises to the highest levels (*kujaa kwa bahari*) in some period of the day, then the sea level drops to the lowest points (*kupwaa*), mostly past the reef after some hours after the "*kujaa kwa bahari*". During the *bamvua* period, there is a "light cycle" (referred to as *mwezi*, meaning moon) and a "dark cycle" (*giza*, meaning darkness). The moon cycle (*mwezi* and *giza*) are linked with the seven-day periods within each lunar cycle which is associated with the spring tide periods in modern science, with calm seas during low tides. The fishers indicated that between the two seven-day periods of each moon or lunar cycle, there were 1-3 days definite days when the low tides fall in the afternoon. During such periods, the sea is rough and therefore most of the fishers prefer to take a break from the regular fishing and use the time to repair the fishing gear and vessels in readiness for the second period of that moon-cycle which, they indicated, begins with early morning high tides. In addition, fishers who used certain fishing gears, e.g. bottom-lines targeting big game fish preferred night fishing to day fishing due to the state of the sea. Thereafter, the next 14-day cycle of the moon would begin with the next phase of *mwezi-giza* period or spring tides (Table 2).

These findings clearly show that the communities have historically accumulated a lot of indigenous knowledge on weather patterns based on their close association with the sea, and this has led to evolution of fishing activities that are responsive to weather changes and state of the sea. This phenomenon of using the moon cycle to guide fishing behavior and patterns has been recorded in several areas of the world (Evans, 2008; Campbell, 2012). In addition, these findings relate well with a study conducted in Brazil where crustacean fishers applied indigenous knowledge of the tidal patterns to plan their fishing activities (Bezerra *et al.*, 2012; Nishida *et al.*, 2016).

Table 2: Phases of the Moon and Resultant Influence on Fishing Activities in Kuruwitu and Mkunguni Fishing Villages in Kenya

Phases of the moon	**Local name (Swahili)**	**Tides**	**Activities**	**Consensus with science**
New moon or Full moon (*mwezi mchanga /giza*	*bamvua*	-high tides: tides rise to highest water-mark, sea is rough -low tides: very low watermark	Line fishers (bottom & pelagic) targeting big fish prefer night to day time-fishing	Spring Tides
Half-bright moon *(mwezi umeandama)*	*maji-mafu*	High and Low tides almost the same	Fishing at all time	Neap Tides

4.3.2 Indigenous Knowledge in Location of Marine Fish Species and Habitats

The fishers in both villages were knowledgeable about different species and habitats of the fish that they exploit for subsistence and commercial purposes. From the FGDs, the fishers grouped the different fish species into three major categories, with examples (Table 3); Category-1, small fish which is abundant in the inshore areas, mostly within the seagrass beds, continental shelf and caves; Category-2 comprised the decapod crustacean species such as lobsters as well as cephalopod including octopus, where the resource-users clearly indicated that the fishing grounds for these species were mostly located found within the coral reefs and around caves where the species are found to feed on organisms including

juveniles of other fish; Category-3 comprised the big fish mostly found off-shore feeding on small fish and other marine species. It was found that fishers with such knowledge were able to determine with fair accuracy, where and how to locate the target fish species, while also incorporating the indigenous knowledge of weather and sea conditions into their fishing operations. These findings are in agreement with the results of Matiru *et al*. (2002) and Tunje & Muturi (2005) who observed that ≈70-80% of the demersal fish catches are mainly harvested from the shallow waters and reefs. Additionally, Tunje & Muturi (2005) observe that the demersal catch within these coasts normally comprises parrotfish, rabbitfish, snappers and goatfishes, as well as decapod crustaceans including lobsters and shrimps, which are common in shallow waters and reef.

Further, the fishers reported that they were able to easily identify migratory behaviors of some sea birds for instance, the White stork *Ciconia ciconia* (*korongo mweupe)* and the African fish eagle *Haliaeetus vocifer* (*mwewe*), and associate these with loation of some good fishing grounds for certain species of fish. Similar observations have been made in fisheries of the Western Indian Ocean where fishers locate areas of schooling of the tunas by watching for the Wedge-tailed Shearwater and the Red-footed Booby birds (Danckwerts *et al.,* 2014).

Table 3: Knowledge of Fish Species and their Habitats in Kuruwitu and Mkunguni Villages in Kenya

Target	Swahili name	Habitats / areas found
Small fish species:		
- Snapper - Parrot fish - Rabbit fish - Goat fish - Mullets	- *Changu/Tangu* - *Pono* - *Tafi/Tasi* - *Mkundaji* - *Mkizi*	Inshore, mostly around corals, caves and seagrass (*Bahari ya ndani sana sana hujificha kwenye matumbawe, mapango na chani*)
Crustacean species:		
- Lobster -Shrimps -Octopus	- *Kamba mawe* -*Kamba* -*Pweza*	In-shores in Corals & caves (*Bahari ya ndani kwenye matumbawe na mapango*)
Big fish species:		
- Shark - Sail fish - Queen fish - Tuna	- *Papa* - *Sulisuli* - *Pandu* - *Kiboma*	Mostly found offshore (*Mara nyingi hupatikana katika bahari kuu/kubwa*)

4.3.3 Indigenous Knowledge on Ecosystem Degradation and Pollution

The respondents were asked to give their views on causes and extend of pollution and degradation of the marine ecosystem and its impacts on their livelihoods. The results show that about 65% of the respondents in Kuruwitu were aware of the increasing incidences of marine pollution and ecosystem degradation saying "*Pollution is a constant problem we face….. The water quality has reduced, and so has the marine environment in which we go fishing*", a clear indication that they understood the connection between marine pollution, ecosystem degradation and the likely impacts on their livelihood sources. Similar views were also expressed by 25% of the respondents from Mkunguni village. These results suggest that the residents of Kuruwitu village were more knowledgeable about the causes and effects of marine ecosystem degradation than the residents of Mkunguni village. The awareness level of respondents in relation to responses on different causes of pollution and

degradation of the marine ecosystems was gauged using a presence/absence (yes/no) score as shown in Table 4.

Table 4: Knowledge of Marine Ecosystem Degradation in Kuruwitu and Mkunguni Villages in Kenya

Type of Degradation	**Kuruwitu**		**Mkunguni**	
	Yes	**No**	**Yes**	**No**
Water Pollution	65	35	25	75
Beach Erosion	42	48	14	86
Domestic effluence	58	42	23	87
Oil spills	29	71	10	90
Fishing Practices	45	55	66	34
Quarrying	72	28	7	93
Sand Harvesting	30	70	83	17

Based on the analysis, 72% of the respondents in Kuruwitu village expressed their feeling that quarrying was a major cause of pollution in the area, compared to only 7% in Mkunguni village. This may be attributed to the presence of a cememnt factory in the Vipingo area of Kuruwitu village, as well as smaller private quarries which produce huge noise pollution, as well as limestone dust, which the fishers felt was impacting adversely on the fishing grounds. These findings may be supported by a study by Daw (2007) which noted the mass migrations of fish from disturbed fishing grounds and neighboring habitats which were more habitable than the current grounds.

In Mkunguni, 66% of the resource-users listed deleterious fishing practices as the most serious causes of ecosystem degradation, compared to 45% of the respondents in Kuruwitu. Further inquiry through FGDs revealed that, fishing practices such as the use of ring-nets in coral reefs was to be blamed for marine-resource degradation. These results concur with GoK (2009) analysis, which established that the increasing use of ring-nets in shallow water in south-coast Kenya, and particularly in Vanga, Msambweni and Gazi was threatening the shallow water ecosystems, and also a major cause of resource-use conflicts

in the area. In addition, the study noted that the emerging global menace of illegal, unregulated and unreported (IUU) fishing along the coast was to blame for the decline of some of the fish stocks as well as destruction of marine habitats.

Sand harvesting was listed by 83% of the respondents in Mkunguni village as a major threat to habitats compared to 30% in Kuruwitu village. The FGD in Mkunguni village revealed that sand harvesting was a major activity in the areas and major threat to the marine ecosystems due to sedimentation which negatively impacts on the seagrass beds resulting in declining fish catches. Otay *et al.* (2004) argued that sand mining on shallow nearshore or beach areas resulted in negative impacts on adjacent coastal areas including sedimentation during heavy rains and even stormy conditions that in the long- run affects the seagrass beds; the key habitats for majority of the demersal species targeted by the small-scale fisheries.

Domestic effluent was highlighted as threat by 70% and 35% of the respondents in Kuruwitu and Mkunguni villages, respectively. Respondents from Kuruwitu village further reported an increase in coastal development along the beachline; an activity that generated a lot of domestic effluents and reduction of the rockeries and breeding grounds for marine turtles. Reports from GoK (2009) suggest that establishment of properties adjacent to the shoreline are associated with release of sewerage and solid waste along the beaches which impacted the fishing grounds, fish landing sites and turtle nesting areas among others.

Oil-spill was listed by 29% of the respondents in Kuruwitu village compared to only 10% of the respondents in Mkunguni village. The resource-users in Kuruwitu village reported that oil spills had become more frequent as a result of increased traffic of marine vessels associating this with the ongoing development of the Lamu Port under the LAPSSET project, and to some degree, the maintenance dredging of Kilindini harbor, although the resource-users in Mkunguni did not associate the increase maritime traffic to marine degradation in the area.

This might be because of the closer proximity of Kuruwitu village to the shipping route and the port of Mombasa at Kilindini, compared to Mkunguni village. According to ITOPF (2010), oil spills have both short and long term effects on the marine ecosystem and high concentration of the toxic components of oil could lead to death of bottom-dwelling marine species.

4.3.4 Indigenous Knowledge in Seasonality and Life cycle of Marine Resources

About 14.6% of the respondents in Mkunguni village stated that the fish species mentioned were caught seasonally compared to 4% of the respondents in Kuruwitu village who held the same view (Table 5). However, majority (96%) of the respondents in Kuruwitu village still held the view that the fish species mentioned were caught throughout the year compared to 84.5% in Mkunguni village. On seabirds, 58% of the respondents in Mkunguni village indicated that the occurrence of sea birds in the area was seasonal compared to 51% of the respondents in Kuruwitu village who held the same opinion. However, about 7% of the respondents in Kuruwitu village compared to 3% in Mkunguni village were not aware whether sea birds were seasonal or occurred throughout the year. Further, 95% of the respondents in Kuruwitu village mentioned that marine turtles could be found in the areas throughout, with 73% of the respondents in Mkunguni village holding the similar views.

Table 5: Availability of Marine Resources in Kuruwitu and Mkunguni Villages in Kenya

	Kuruwitu village (%)			**Mkunguni village (%)**		
Resource	Seasonal	All year	Don't Know	Seasonal	All year	Don't Know
Fish	4	96	0	14.6	85.4	0
Sea birds	51	42	7	58	39	3
Turtles	0	95	5	0	73	27

Knowledge and understanding of the life cycle of different marine species was gauged and analyzed during the FGDs and KIIs conducted in the two villages. For example, one of the KII respondents in Kuruwitu stated that "*kasa huishi baharini mpaka pale anapotaka kutaga*

mayai ndio anakuja ufuoni kutafuta pahali pa mchanga ili atage mayai"; meaning "marine turtles normally stay in the sea until the time when they want to lay eggs, then they come out onto the shore and locate a good sandy area to lay eggs". Resource-users in both villages were in agreement that it takes a long time for marine turtle's eggs to hatch; estimated at six weeks to two months depending on the species. This indigenous knowledge on the biology and ecology of the marine turtles has been affirmed through scientific research, with the findings of one study, Golden (2016) asserting that marine turtles mate in the open waters then the female crawls on the rockeries scattered along many coasts and once it identifies a suitable place, digs up a nest, lays its eggs, covers them with sand, and crawls back into the nearby waters to feed, probably for the same period of the hatching of the eggs she laid.

According to the FGDs, tuna is one of the most preferred fish by the local communities in both Kuruwitu and Mkunguni villages. The participants noted that although the tunas are caught all year round, they were more abundant during August through December. The resource-users also consider tuna as an indicator of the presence of smaller fishes, which comprise the food for the tunas as well as some target species for the small-scale fishers. Scientific research has shown that the tuna stocks of the Western Indian Ocean are more abundant within the coastal waters of Eastern Africa during the months of August through December (Pillai, 2012). The indigenous knowledge relating to seasonality of fish species is useful in guiding resource exploitation patterns within the coastal communities in a sustainable way.

Surprisingly, the resource-users appeared to very knowledgeable on sea urchin– seagrass predation dynamics, the effect of the parrotfishes on sea grass populations and the implications of sea urchin population explosion on the ultimate landings of fish from a fishery. This wealth of knowledge, almost edges on scientifically proven fish ecology, species types, seasonality and life cycle of marine resources and trophic relationships. This

implies that the fishers clearly understood the factors driving the fisheries catches within these ecosystems and could therefore attribute the dynamics to e.g. fishing gears used, habitat degradation, and use of deleterious fishing methods etc.; knowledge which was evidently accumulated across several generations, and passed on from one generation to the next.

4.3.5 Indigenous Knowledge on Sustainable Resource-Use

Field observation revealed that traditional fishing gears such as basket traps (*malema*) were made using different materials; for example some fishers in Mkunguni village used bamboo ruffians; others used metal rods while others blended the two materials in making the traps (Plate 2). Results of the FGDs indicated that the use of bamboo in making basket traps has greatly declined due to reduced availability of bamboo trees in Mkunguni village. Therefore, some fishers have resorted to using wire mesh and other artificial materials indicating an inherent knowledge among the resource users in seeking innovative alternative materials for use in making the malema. The use of wire mesh and similar innovations in replacing traditional materials with alternatives in the making of fishing gears has also been noted in other areas along the south coast include the Diani (Mbaru & McClanahan, 2013). Therefore seeking alternative materials to ensure the continuity of traditional fishing gears such as basket traps is important in ensuring the continued supply of fish food and protein from the marine resources, as well as ensure the continued integrity of the environment (Mbaru & MacClanahan, 2013).

4.3.6 Indigenous Knowledge in Environment-friendly Fishing Methods

Field observation shows that most of fishers in Kuruwitu village preferred the use of spear guns (Plate 3) while the traditional basket traps (Malema) (Plate 2) were more prevalent in Mkunguni village. Other types of fishing gears used in the two villages included hand lines and various types of nets including gillnets, driftnets as well as monofilaments nets.

FGDs revealed that the traditionally fabricated fishing gears were more acceptable to the local community and categorized as “easy to operate”.

Additionally, traditional fishing gears have been known to harvest small quantities of fish compared to modern fishing gears such as trawlers and ring-nets. The fisher communities in the study area demonstrated good knowledge of fishing gear operation and the limitations of the various gears. The respondents in both sites reported that fishing nets with small mesh size were prohibited due to the possibility of catching small fish, which may eventually exhaust the "fish stocks" in the area. The spear gun fishing gear is used selectively, even in Kuruwitu village, taking caution not to injure fish which were not caught or escaped the gear.

The fishers also operated different fishing gear types during different seasons of the year. For example, in Mkunguni village, the fishers indicated that it was forbidden to use gillnets within the reefs during SEM season (*kusi*) since it disadvantaged or became an obstruction to other resource users within the narrow in-shore waters. It was also observed that different types of line fishing gear (hand lines, droplines, bottom lines, as well as pelagic lines) were the preferred fishing methods for demersal (bottom) species in the shallow inshore areas, especially during rough/stormy weathers.

Further, the respondents reported that the use of beach-seines and ring-nets in coral reef systems was a forbidden fishing method because it destroyed corals reefs which act as fish habitats and the associated polyps which act as sources of food for certain species of fish. According to GoK (2009), selection of fishing gears largely depends on the fishers’ levels of interaction with the environment and, by extension the level of understanding of the ecology of the species. Kynoch *et al.* (2015) further confirms that the use of different fishing gear during different seasons was a way of ensuring that there is sustainability in the exploitation of the fisheries resources in different fishing grounds and seasons.

Plate 1: A spear gun fishing gear used in Kuruwitu fishing village, Kenya

Plate 2: Fishermen from Mkunguni Fabricating a Basket Trap (*Malema*) blending both the traditional reeds and wire mesh

4.3.7 Indigenous Knowledge on Marine Mammals Ecology/Conservation

In the Mkunguni village, FGDs with the resource-users reported that dolphins were rarely spotted in the open sea. The respondents believe that the dolphins feed on schools of fish and are social despite regarding them as fish instead of mammals. Therefore when the dolphins are spotted there is a high chance of catching huge quantities of the schooling fish species which form the prey for the dolphins. Therefore, the local community has associated the presence of dolphins in the fishing grounds with impending with good luck in fishing. Scientific research shows that dolphins are apex predators and usually hunt in groups by rounding the smaller fish prey and concentrating them together, thus offering the fishers opportunities of fish aggregation. Moreover, the fishers stated that the presence of dolphins

in most times signifies the absence of sharks in an area. Barney *et al.* (2005) argues that dolphins use echolocation to search for food and maintain awareness of potential predators.

4.3.8 Indigenous Knowledge on Fishery and Catch Trends

The issue of fish species and fish catch elicited a lot of debate from fishers in Kuruwitu village and Mkunguni village. Based on the type of fish caught some of the fishers stated that fish catch had declined; e.g. in Kuruwitu village, the fishers reported that the sardines (commonly referred to as *sim-sim)* were becoming increasing difficult to find, compared to previous years, as illustrated in the following statement "*zamani mababu zetu wangevua sim sim baada ama hata kabla ya kila msimu lakini sisi twaeza kaa hata misimu minne bila kuona sim sim*"; translated as "In the years of our grandfathers and great grandfathers, they could catch a lot of sardines at the beginning or end of every sardine season but today, the species have become so rare such that we often run through even up to four seasons without seeing sardines"

In Mkunguni village, the FGDs reported that there was a reduction in the availability of majority of the main demersal species including rabbitfish (*tafi*) and kingfish (*kolekole*) among others. According to the respondents, the decline was attributed to the degradation of the seagrass habitats due to increased populations of sea urchins (locally called *mafumo*) and partly due to changes in the weather patterns. As a result, this has resulted in lower and lower incomes, and declining living standards due to dwindling livehoods sources among the fishers in the two villages, and especially in Mkunguni village which has fewer alternative livelihood opportunities. Evans (2008) confirms that fish catches in the small-scale fisheries of the Western Indian Ocean have been the decline based on data for several years.

4.3.9 Indigenous Knowledge on Exploitation Levels of Different Habitats

The residents of both villages demonstrated possession of indigenous knowledge on the exploitation levels of different fish habitats and their impact on fish catches. The FGDs

reported that in the previous years, the fishers would alternate between the in-shore and off-shore fishing grounds to allow the fish stocks to replenish. However, the fishers were concerned about the current trends where fishers continuously exploited both the in-shore and off-shore waters without guided harvest strategies or fishery plans. Field observation showed that majority of fishers in these the local communities still dependent on traditional fishing vessels, often non-motorized, including dhows (Mashua), outrigger canoes (*Ngalawa*), wooden plank boats (*Dau*) and canoes which limited the fishing activities to within the inshore waters.

The fishers further reported that, they were incapacitated in terms of resources and hence could not make the best out of fishing off-shore. This point is illustrated by a quote from one fisher in Kuruwitu village *"tukiwa na vyombo na zana tutaenda bahari ya nje",* which translates to "given the right vessels and gears, we can venture into the off-shore areas". This shows that the villagers were aware that they faced resource limitations within the inshore waters and that poverty disenfranchised them from sustainable use of the marine resources. Masalu (2010) notes that traditional fishing vessels without engines cannot withstand harsh conditions of the sea thus indirectly serve as a regulation towards resource-use. However, field observations during this study showed that the the technological limitation of the vessels restricting them to the inshore waters acted as a trigger to increased fishing pressure in the in-shore waters which majority of the fishers can access.

4.4 Perception and Attitudes towards Management of Marine Resources in Kuruwitu and Mkunguni Villages

The residents of Mkunguni and Kuruwitu villages exhibited varied perceptions and attitudes that influenced the way in which they interacted with the marine environment. These perceptions and attitudes have been found to shape the way local people were likely to conserve and manage marine resources.

4.4.1 Perceptions and Attitudes on Taboos and Beliefs Associated with Marine Resources

The respondents gave mixed reactions about the efficacy of taboos and beliefs in regulating marine resources-use by the community thereby enhance management practices and efforts. About 42% of the respondents in Mkunguni village agreed that taboos and beliefs were important in regulating marine resource-use compared to only 11% of respondents with the same view in Kuruwitu village.

In Kuruwitu village, 31% of the respondents, compared to 4% of the respondents in Mkunguni village strongly felt that taboos and beliefs were ineffective in regulating marine resource-use (Figure 9). This implies that the residents of Mkunguni village perceived taboos and beliefs as a strong tool for regulating marine resource-use, as opposed to Kuruwitu village resource-users. This may partly be attributed to the proximity of Kuruwitu village to urban centres such as Kilifi and Mombasa, a signal that urbanization may be contributing rapidly to the decline in indigenous knowledge especially related to traditional believes. Further, proximity to urban centers plays a big role in dilution of the use of taboos and beliefs that deal with management and conservation of marine resources as observed by Wangila and Shauri (2009) who noted that modernization can be blamed for the erosion of culture. Findings by Masalu (2010) confirm that the erosion of cultural beliefs has caused tremendous impacts on coastal and marine resources management.

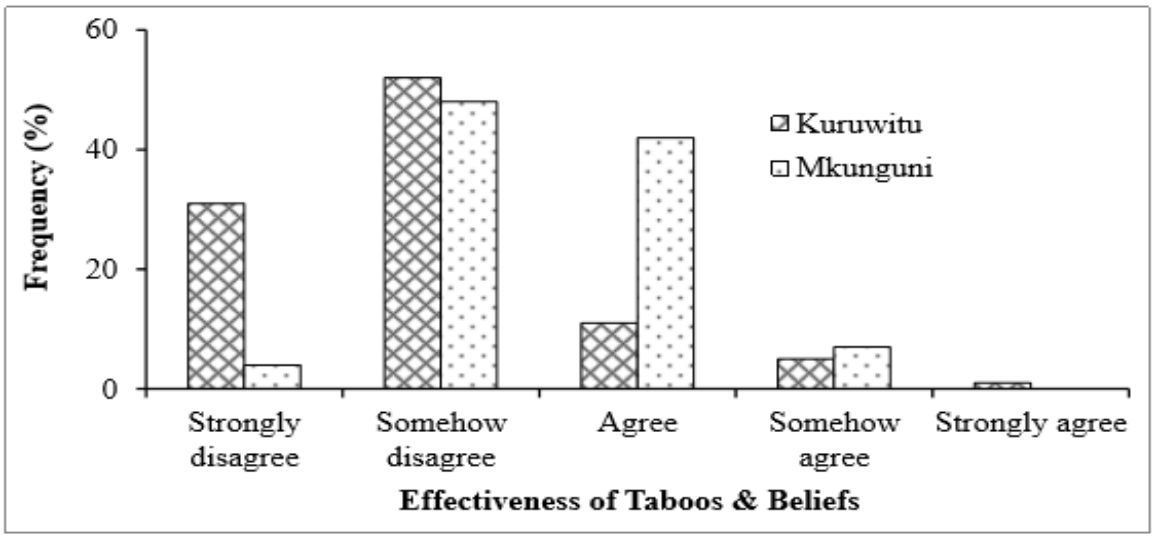


Figure 9: Perceptions on effectiveness of Taboos and Beliefs in Marine Resources Management in Kuruwitu and Mkunguni Villages

4.4.2 Perception and Attitudes on Status of Fishery Resources

In both villages, the respondents expressed their feeling that overall conditions of marine resources had changed in the last 10 years. About 76% of the resource-users in Mkunguni village felt that there fish catches had declined, compared to 42% of the users in Kuruwitu village holding the same perception. Studies have reported that fish catches by artisanal fishers who exploit the near-shore resources on the continental shelf have declined and catch rates dropped drastically over the years (Fondo, 2004; Wamukota & Okemwa, 2009; Mbaru, 2012). Damasio *et al.* (2015) also observed that fishers who had been fishing for a long time held facts and memories that may be accurate when compared to statistical data on landings as well as scientific studies. Such information could provide better management resolutions on the target species exploited by the resource users (Damasio *et al.*, 2015).

Table 6: Perceptions on Status of Fishery Resources in Kuruwitu and Mkunguni Villages in Kenya.

Perceived change	**Kuruwitu (%)**	**Mkunguni (%)**
Improved	8	2
No change	15	6
Fluctuates	33	11
Declined	42	76
Don’t know	2	5

4.4.3 Perceptions on Factors Impacting the Fishery Resources

Examination of factors influencing the fish catches and trends in Kuruwitu and Mkunguni villages revealed multiple causal factors. About 58% of the respondents in Mkunguni village were of the view that migrant fishers (*Pembas*) were to blame for the decline in the fish catches because of their invasion of the indigenous fishing territories. In Kuruwitu village, destructive fishing gears and practices were seen as the major cause of the reduction in fish catches as reported by 31% of the respondents, whereas only 11% of respondents in Mkunguni village were of the same view.

Other causes identified included weather changes, which was expressed by 23% of the respondents in Kuruwitu village and only 5% in Mkunguni village. Masalu *et al.* (2010) is in agreement that, destructive resource extraction practices combined with extreme weather events such as flooding and drought regimes have had deleterious impacts on marine ecosystems resulting in declining fish catches.

On the contrary, 19% of the respondents in Kuruwitu village attributed the decline in catches to increase in the number of fishers, compared to only 9% of the respondents in Mkunguni village who held the same opinion. The establishment of the LMMA in Kuruwitu village appeared to have cushioned the fishers against declining catches by improving spillovers from the LMMA (KCWA, 2010) attracting more fishers in these areas of Kuruwitu and the Vipingo coastal stretch. According to Obura (2005) and Cinner *et al.* (2009), increase in number of fishers who in most circumstances use inappropriate gears has resulted in the destruction of in-shore fishing areas thus decreasing productivity and placing the economic livelihoods of local communities at great risk.

Another factor accounting for the declining catches was modernization in fishery technology, with 27% and 20% of the respondents in Kuruwitu and Mkunguni villages, respectively, blaming modernization of fishing gear and vessels for the declining fishery catches (Figure 10). According to Cinner and Aswani (2007), and Masalu *et al.* (2010),

modernization of fishing technology has led to increased fishing pressure on the fish populations.

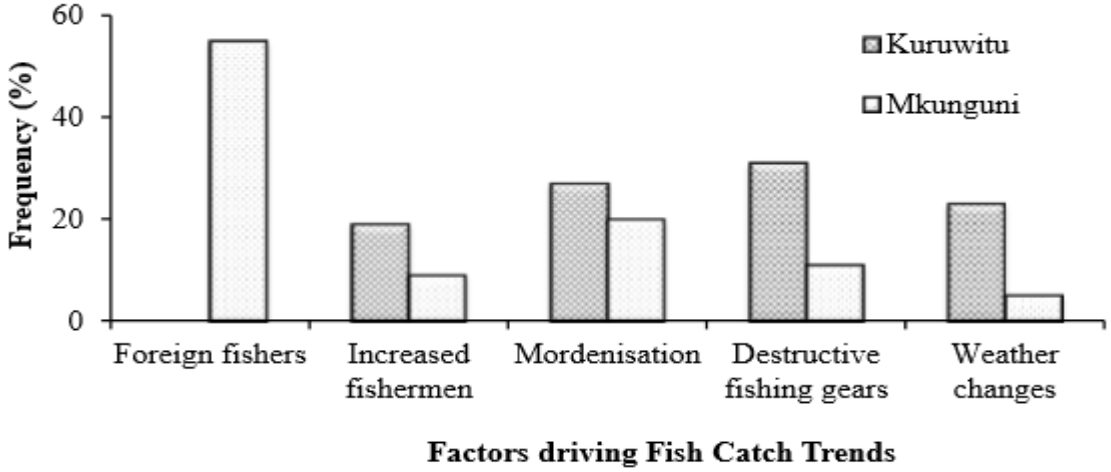


Figure 10: Factors Driving Fish Catch Trends in Kuruwitu and Mkunguni Villages in Kenya

4.4.4 Community Participation in Marine Management

Analysis of the resource-user engagement and activeness in marine conservation activities was conducted in the two villages. Majority, ≈61% of the respondents in Kuruwitu village, were frequently engaged in resource conservation compared to 12% in Mkunguni village. Mkunguni village also appeared less inclined towards marine resource management, with 66% of respondents having rarely or never participated in marine management activities, compared to 10% of the respondents of similar category in Kuruwitu village (Table 7). Further, FGDs revealed that most of the residents in Kuruwitu were involved in the planning and carrying out of beach clean-up exercise, raising awareness on the use of environment friendly fishing gears and sustainable use of fisheries resources. The reasons for high engagement in Kuruwitu was partly because because the resource-users appeared slightly more educated than the residence in Mkunguni. According to Sakari *et al.* (2013), education has been found to enhance the level of awareness on environmental issues and changes perceptions.

Table 7: Community Participation in Marine Conservation in Kuruwitu and Mkunguni Villages in Kenya

	Village	
Frequency of participation	**Kuruwitu (%)**	**Mkunguni (%)**
Very Frequently	20	0
Frequently	61	12
Occasionally	9	27
Rarely	8	56
Never	2	10

4.5 Local Institutions Involved in Preservation of Indigenous Knowledge for Marine Resource Management

4.5.1 Taboos and Beliefs Associated with the Use of Marine Resources in the Community

Majority, ≈99% of the respondents in Kuruwitu and Mkunguni villages were aware of the existence of taboos and beliefs associated with the use of marine resources (Table 8). Analysis of FGDs data revealed that in both villages it was a taboo to fish in caves which were perceived to be hide-outs of dangerous evil spirits (*Majini*). According to the information from one key informant from Mkunguni village, some caves and other parts of the reefs remained untouched because fisher spread rumors that they had seen evil spirits (*majini)* around the caves thereby scaring away other fishers from fishing around those environs.

Another taboo observed in both villages was that fishers refrained from any form of intoxication such as consumption of alcohol when going or while fishing. The major explanation of this taboo was that it makes the body impure. Ideally, this element of making the body impure is based on the Islamic prohibition on alcohol, but one can find an insinuation in the prohibition that when one takes alcohol their judgement may become impaired posing a danger to their own lives as well as likely resulting in deleterious fishing habits. The ban therefore not only ensures the safety of the fisher but also served to eliminate poor judgement and increased ones focus on acceptable fishing habits.

Prohibition of eating certain species of sea turtles is a taboo in both villages. It was believed that eating certain species of the marine turtles such as hawksbill (*kasa mwamba)* can lead to death. In Kuruwitu village, one of the key informant reported that certain fish species such boxfish (*kukumaji*) was only eaten by someone who could locate and remove the "poisonous gland" otherwise one would get rashes if they consumed the fish without removing the gland.

According to the FGDs in Mkunguni village, a fisher would cut short his fishing expedition if he fished for long hours (e.g. 3-4 hours) without catching any fish. This was seen as a sign of bad luck or omen and hence they could not get fish that time, and had to go back home and try their luck the next day. Analysis of the FGDs shows that, generally, there are more taboos and beliefs in Mkunguni village than in Kuruwitu village. This may be due to the fact that fishers in Kuruwitu village have interacted with other communities thereby losing touch with some of their ancient taboos and beliefs.

Secondly, the proximity to urban centres such as Kilifi and Mombasa might also have influenced modernization of the culture in this community with loss of valuable indigenous knowledge. However, in Mkunguni village the strong culture of taboos and beliefs may be attributed to the dominant Digo community fishers who have had very little interactions with urbanization due to the closed nature of the southcoast Kenya. According to Masalu *et al.* (2010) and Rim-Rukeh *et al.* (2013), taboos and beliefs are part of the social institutions that reflect people’s attitude towards resource-use.

Table 8: Taboos and Beliefs associated with Marine Resource-use in Kuruwitu and Mkunguni Villages in Kenya

Taboo	Belief associated	Importance	Village	
			Kuruwitu	Mkunguni
Alcohol consumptions when going for fishing	Makes the body impure	Ensures safety of the fisher and decreases pressure on marine habitats	Y	Y
Fishing in caves	Evil spirits (*Majini*) that led to death	Ensures safety of the fisher, protect breeding grounds and reduce fishing pressure	Y	Y
Dietary restrictions on certain species of marine turtles & fish species	Death	Species growth reduce pressure on sea turtles and avoid extinction	Y	Y
Fishing on Fridays, Maulid and Idi	This are holy days to Muslims to rest and pray	Limit pressure on marine habitats and resources	X	Y
Failure to catch fish within 3-4 hours	Stop fishing since it signify bad luck on that day (*Kitsapi*)	Reduces fishing pressure	X	Y
Making of unfinished fishing vessels without consultation of the former carpenter	The vessel will have bad luck and not catch fish	This controls the number of fishing vessels and thus reducing fishing pressure	X	Y

Key: **X** not practiced in the village **Y** practiced in the village

4.5.2 Role of Village Elders in the Management of Marine Resources

Village elders have been instrumental in the management of marine resources and preservation of culture. In Mkunguni village, the fishers report that they resort to the use of elders who employ religious teachings and their wisdom to resolve the conflicts with the *Pemba* migrant fishers frequenting the area because the *Pemba* fishers are also Muslims. A group of village elders may comprise of a few *Kaya* (traditional shrine) elders who help resolve conflicts arising from the use of marine resources. *Kaya* elders have been known to uphold traditional beliefs and taboos that affect the way the community

members interact and use their resources (Wangila & Shauri, 2009). In other instances when the elders delay in resolving the conflicts, a group of fishers could confiscate the illegal gear used to deter away other potential defaulters, and thus promote compliance to sustainable fishing practices. This was propagated by the fact that though the migrant fishers were legally licensed, they sometimes went against the customs of the village. In cases were the local community and particularly the elders were left out in decision, sense of resource-ownership was often lacking making implementation of management initiatives difficult as the community does not identify with decisions. According to Burns *et al.* (2004), community involvement and integration of community ideas into projects is crucial for success. In fact, Burns *et al.* (2004) adds that when a community is involved in decision making and their contributions are incorporated into the entire process, the community feels valued and takes ownership of the process by promoting its success and sustainability.

According to the FGDs in Kuruwitu village, *Kaya* elders were not included in the village elders involved in resolving marine resource-use conflicts. However, the village elders also involved the area's administrative head (normally the chief) to discuss the penalties and fines of the offenders so that they were in-line with the modern law. In-case a fisher was arrested and taken to the chief for breaking the rules and regulations, the chief would refer him to the elders who would impose the penalties and fines. A key informant in Kuruwitu village admitted that being arrested and summoned by the elders was seen as a disgrace. In addition, penalty such as withholding the right to fish for some time due to infringement of certain regulations would scare away offenders and promote compliance. Furthermore, non-compliance to the orders of the elder led to arrest and subsequent handing over to the police.

An overwhelming majority (99%) of the respondents from both villages indicated that historically, there were local institutions that dealt with marine resource management and resolution of resource-use conflict with undertaking of rituals that were related to taboos and

beliefs. However, such Institutions were almost a thing of the past in these villages. A key informant from Mkunguni village admitted that in the earlier days, there was a committee of elders in-charge of a landing sites; known as *wazee wa bandari* (elders of the landing site). The committee could mediate effectively any form of resource-use conflict and were influential in dealing with migrant fishers operating in the communal fishing zones. However, the situation changed when the system of migrant fishers paying licenses and concession fees directly to the government was introduced, thus weakening the influence of the *wazee wa bandari* in resource-use conflict management. This may partly explain why the residents of Mkunguni village blame migrant fishers for increased illegal fishing activities. Yusuf (2011) also reports that in previous years, there were committees of elders (the *wazee wa bandari)* at landing sites who ensure sustainable management of the resources and mediated conflicts among fishers.

4.5.3 Community Marine Resources Management and Conservation Groups

The study established the different activities undertaken by the residents towards management and conservation of marine resources in Kuruwitu and Mkunguni village (Table 9)

Table 9: Management Activities in Kuruwitu and Mkunguni Villages in Kenya

Kuruwitu village	Mkunguni village
▪ Undertake patrols (*kupiga doria)* to arrest Marine turtle's poachers. ▪ Beach clean-ups through collecting plastics ▪ Attending management and conservation meetings to participate in decision making. ▪ Marine turtle's record keeping on nesting sites, nests and hatching information. ▪ Eco-tourism activities through the operation of conservation area (*Tengefu)*	▪ Undertake patrols (*kupiga doria)* to arrest Marine turtle's poachers. ▪ Beach clean-ups through collecting plastics ▪ Attending management and conservation meetings to participate in decision making

The management and conservation activities were found to comprise of record keeping of nesting marine turtles, beach patrols, eco-tourism related activities, beach clean-ups and participation in management and conservation meetings. The results imply that Kuruwitu community engaged in more activities geared towards management and conservation of marine resources than the community in Mkunguni village. The engagement of Kuruwitu community in management matters can be explained by the existence of BMU and progressive pressure from urbanization and encroaching settlements along the coast. Field observations in Kuruwitu village showed that the community engaged in more non-extractive resource-use strategies including tour guides who brought tourists to the conservancy for recreation e.g. swimming and snorkeling in the *tengefu* as well as sale of artwork which enabled the KCWA to generate revenues. Narayan (2008) asserts that the development of eco-tourism is a potential source of many types of financial gain. It is also a source of more important financial options in areas such as the hospitality industry, transport and restaurant services. For local governments tourism is also a potential source of revenues through taxes.

4.5.4 Rules and Regulations as Local Institutions

Level of awareness level on the different rules and regulations pertaining marine resources was gauged among the respondents in the two villages. About 73% of the respondents in Kuruwitu village compared to 49% in Mkunguni village were aware that harvesting or being possession of live or dead corals was outlawed. In Kuruwitu, the FGDs further revealed that trading in corals would automatically lead to arrest and prosecution under the elders, while the harvested corals were returned to the sea. In Mkunguni village the FGDs revealed that dealers of corals were severely punished by the group of fishers in various ways.

On the other hand, 97% and 73% of the respondents in Kuruwitu and Mkunguni villages, respectively, were aware that poaching turtle or being seen in possession of turtle eggs was outlawed. Further probe into the matter revealed that in Kuruwitu village, one

would be arrested by the members of the KCWA and taken to the elders. In Mkunguni village, the offenders' biggest fear was being arrested by the Kenya Wildlife Service officers.

Further, 75% of respondents in Kuruwitu village compared to 83% of the respondents in Mkunguni village were that the used of destructive fishing gear was an offence under the community laws, the BMUs, as well as the Fisheries Act. In Mkunguni, interrogation through the FGDs revealed that any illegal gears found were confiscated by the other fishers. In the Kuruwitu village, the vigilance of ensuring deleterious gears were removed from the fishery was tasked on the fishers by the BMU, which also confiscated any illegal gears it found. Evidently, proper fisheries management requires among other measures, restrictions on the fishing gears allowed in the fisheries as noted by the Fisheries (BMU) regulations 2007 (GoK, 2007). Obura (2001) noted that fishing gears that did not conform to general accepted principles were normally banned by consensus in the Kuruwitu village and other fishing areas along the coast.

About 89% and 46% of the respondents in Kuruwitu and Mkunguni villages respectively were aware that fishing in restricted areas or community conservation areas (*tengefu*) was outlawed. According to one of the KIIs in Kuruwitu village, *tengefu* were important conservation sites for fish that promoted breeding. The key informants further added that in the previous years, they practiced rotational fishing in order to avoid over-exploitation of fish.

The results show that although there are general rules and regulations under the Fisheries Law that control the use of marine resources in both villages, although the resource-users in Kuruwitu village wre more aware of such rules and regulations than their counterparts in Mkunguni. Rules and regulations play an important role, and influence decision-making on the use of natural resources (Masalu *et al.*, 2010). In fact, McClanahan and Mangi (2004)

assert that imposing appropriate penalties on law breakers tended to promote compliance (Table 10).

Table 10: Level of Awareness of the Resource-users on Rules and Regulations Governing the use of Marine Resources

	Kuruwitu		**Mkunguni**	
Rules / Regulations	Aware (%)	Not aware (%)	Aware (%)	Not aware (%)
Illegal possession of live or dead corals.	73	27	47	53
Poaching / possession of turtle meat or turtle eggs	97	3	73	27
Use of destructive fishing gears	75	25	83	17
Fishing in protected areas e.g. *tengefu*	89	11	35	65

4.5.5 Effectiveness of Local Institutions in Resource Management

About 73.7% and 89.1% of the respondents in Kuruwitu and Mkunguni villages, respectively, believe that local institutions were not effective in resolving conflicts in marine resource-use (Figure 11). This is partly attributed to the fact that modern day fishers do not recognize the authority of the local institutions such as *wazee wa bandari*, taboos and conservation groups and are only controllable to a larger extend by use of the modern legal instruments such as the Fisheries Act. Consequently, many of the resource users in these areas have higher respect for formal institutions such as State Department for Fisheries and the Blue Economy, the Kenya Wildlife Service, the BMUs and the police among other modern institutions that are involved in enforcement of regulations guiding marine resource-use as well as licensing of fishers and fishing crafts.

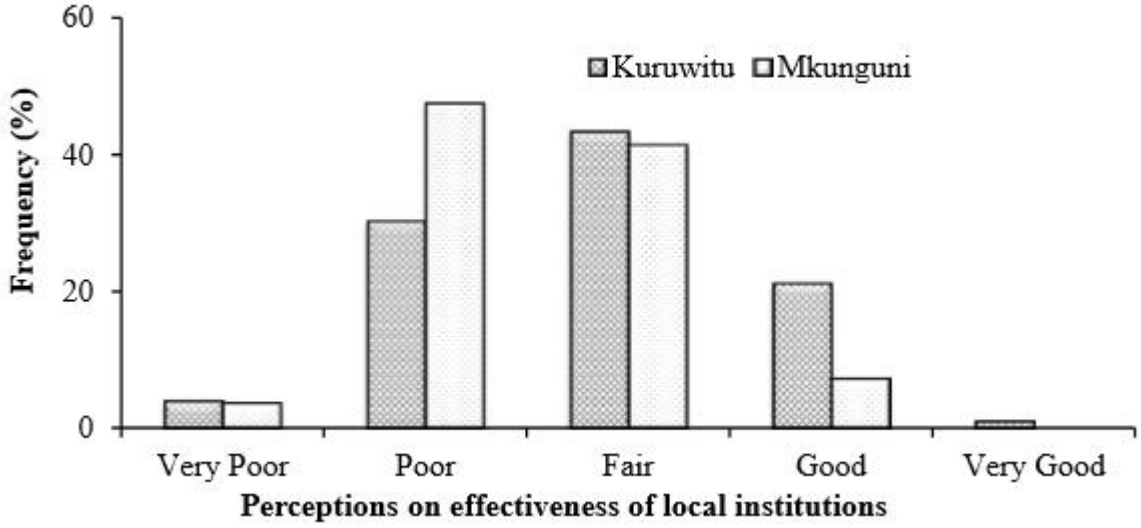


Figure 11: Perceptions of the Effectiveness of Local Institutions in Marine Resource Management in Kuruwitu and Mkunguni Villages in Kenya

4.6 Contribution of Indigenous Knowledge to Marine Resource Management

4.6.1 Perceptions on the Benefits of Indigenous Knowledge

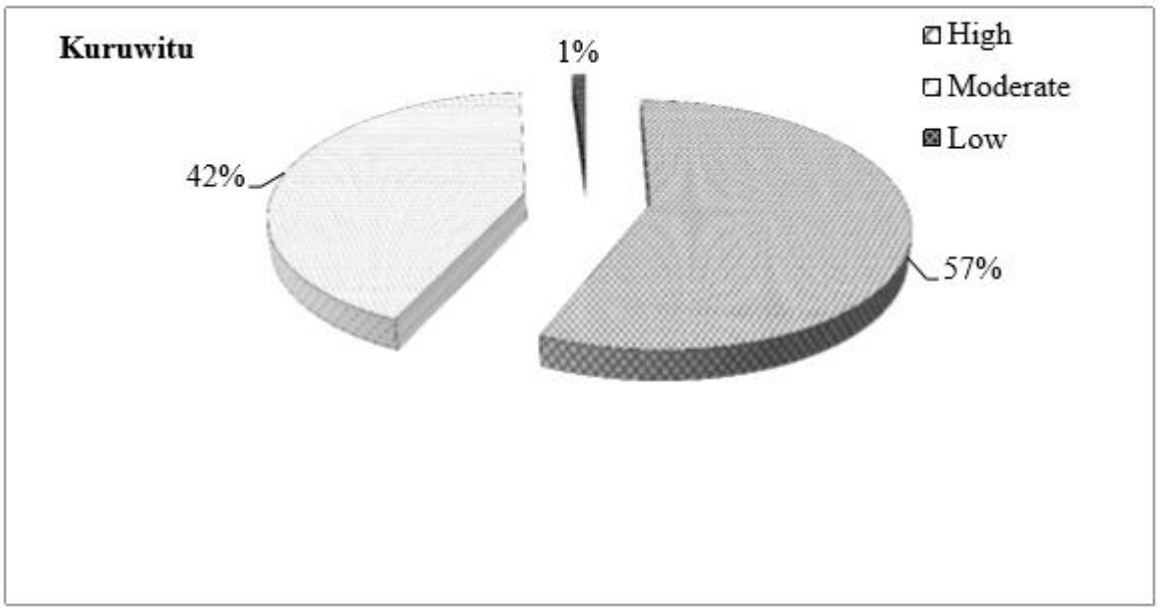
About 73% of the respondents in Mkunguni village and 64% of the respondents in Kuruwitu village perceived indigenous knowledge as beneficial in the management of marine resources. This implies that a greater percentage of the resource users in the two villages believed that the use indigenous knowledge was important in the management of marine resources. However, a sizeable number of the resource-users; 36% and 27% of in Kuruwitu and Mkunguni villages had no idea what benefits the use of indigenous knowledge would bring to the management of marine resources (Table 11). Results from the two villages were compared using *Chi*-square test. There was a significant similarity/association between the responses obtained between the villages [shows χ^2 (1, N=181) =14.194, p=0.001] confirming that many of the resource users in the two villages were aware that indigenous knowledge was important in the management of marine resources. This is may suggest that in these two villages, indigenous knowledge was fairly well communicated from one generation to the other, and was embedded in peoples livelihoods as a safeguard to their livelihood sources.

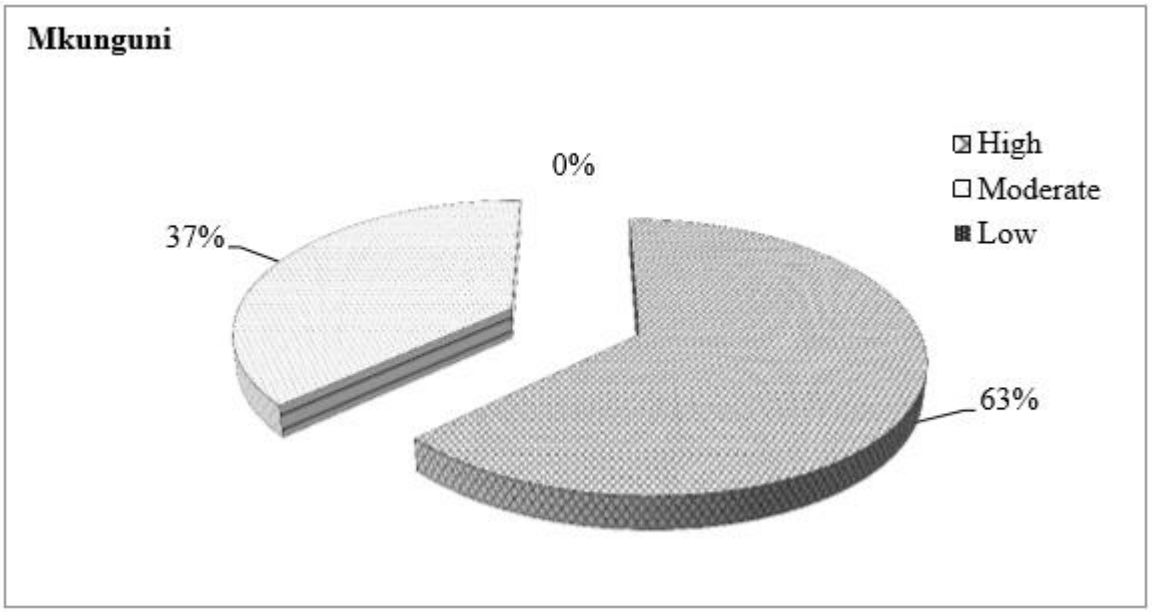
Table 11: Perception of Benefits of use Indigenous Knowledge in Kuruwitu and Mkunguni Villages in Kenya

Perceive benefits	Village (%)	
	Kuruwitu	Mkunguni
Yes	64	73
No	36	27

4.6.2 Influence of Indigenous Knowledge on Livelihoods

The resource users in both villages expressed varying opinions about the extent to which indigenous knowledge affected their livelihoods; 63% of the resource users in Mkunguni against 56% in Kuruwitu felt that indigenous knowledge greatly influenced the livelihood of the local communities (Figure 12). Analysis using the *Chi*-square statistic showed in both villages, resources-users felt that indigenous knowledge impacted their livelihood activities positively [χ^2 (2, N=181)=7.028, p=0.030]. Respondents noted that use of indigenous knowledge in marine resource management has the potential to mobilize resources for tourism, fishing gear and vessel financing as well as improving farming in the villages (Thokozile, 2013).





4.6.3 Importance of Indigenous Knowledge to the Residence

Respondents were asked to name any benefits the community accrued directly and indirectly from the use of indigenous knowledge (Figure 12). About 47% of the respondents in Mkunguni village stated that indigenous knowledge had enabled them to get food compared to 40% of the respondents from Kuruwitu village that were of the same view. Further, 34% and 22% of the respondents from Kuruwitu and Mkunguni village, respectively, revealed that indigenous knowledge had enabled them to secure employment opportunities thus earn an income. In addition, 16% and 19% of the respondents in Mkunguni and Kuruwitu village respectively stated that indigenous knowledge had enabled them to save time when fishing.

However, 15% of the respondents in Mkunguni village compared to 7% of the respondents in Kuruwitu stated that indigenous knowledge had not benefited them in any way. Analysis using Chi-square statistic shows (χ^2 (3, N=181) =54.726, p=0.001) implies that the benefits of indigenous knowledge on socio-economic activities of the respondents across the two villages were in similar proportions.

It is therefore evident that in both villages, the residents felt that indigenous knowledge contributed greatly towards fishing activities and thus provided fish food and proteins. Alabsi & Komatsu (2014) observed that artisanal fisheries are largely labour intensive and

are located in rural areas where there is a high demographic growth. Consequently, there is higher transfer of indigenous knowledge used in resource-use exploitation over generations. Therefore fishing communities greatly benefit from indigenous knowledge through income from fishing, and trade in fish and fishery products.

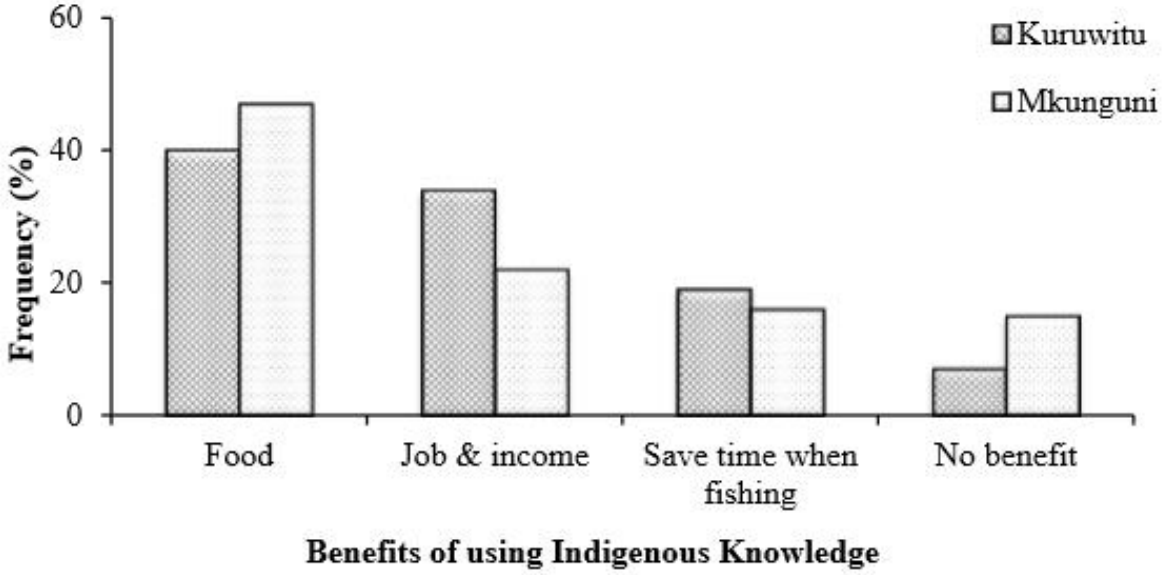


Figure 12: Benefits of Using Indigenous Knowledge on Socio-economic Activities in Kuruwitu and Mkunguni Villages in Kenya

4.6.4 External Support for Indigenous Knowledge in Management Initiatives

The findings of the study revealed that 99% of the respondents in both Kuruwitu and Mkunguni village were of the opinion that the BMUs in the area had received support due to perceived conservation efforts among the resource-users. Therefore, indigenous knowledge is an asset and, recognizing and appreciating it is essential for its existence and promotion of future use by the next generations (Berkes, 2008).

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusion and recommendations on the role of indigenous knowledge in management of coastal and marine resources presenting a comparative assessment of Kuruwitu and Mkunguni fishing villages in Kenya.

5.2 Summary of Findings

In both villages, the respondents demonstrated a wealth of indigenous knowledge in marine weather and state of the sea and how it relates to marine resource access and use. Loud sound of waves splashing on the reef predicts rains and inception of rough sea; hence this knowledge is used to give advice on the right time for fishing. The strong South-East Monsoon (SEM) winds are a stronger indicator of rains and storms signaling unsuitable weather conditions for fishing. The lunar cycle determined the sea-state and subsequently the fishing calendar of events for both villages.

Indigenous knowledge in identification of marine fish species and their habitats was also demonstrated by fishers in both villages. From the FGDs, the fishers were able to categorize fish species into three major categories and identify possible habitats for the fish species in each category. The knowledge provided precision on target species and habitat and saved term for fishing, which would have been otherwise wasted in prolonged search for target species and fishing grounds. Respondents in both Kuruwitu and Mkunguni village also had indigenous knowledge on ecosystem degradation and pollution. In Kuruwitu, the resource-users were more aware with 72% of the respondents pointing out quarrying as the major cause of ecosystem degradation and pollution, compared to 7% in Mkunguni village. In Mkunguni village, about 66% of the resource-users mentioned illegal fishing practices as the major problem, compared to 45% of the resource-users in Kuruwitu who

held the same view. Sand harvesting was cited by 83% of the respondents in Mkunguni village compared to 30% of the respondents in Kuruwitu village. Domestic effluence was reported by 70% and 35% of the respondents in Kuruwitu and Mkunguni, respectively. Oil spills were listed by 29% of the respondents in Kuruwitu as of major concern, compared to 10% of the respondents in Mkunguni village.

Indigenous knowledge on sustainable resource-use was demonstrated in Mkunguni village where fishers had resorted to use of cheaper and more available wire mesh in the fabrication of the environment friendly basket fishing traps *malema* instead of bamboo ruffians which were becoming scarce.

Fishers reported that in the previous years the fishers would alternate between the in-shore and off-shore fishing grounds in effort to control over- exploitation. The fisher communities in the study area demonstrated indigenous knowledge in more environmental friendly fishing methods. For instance, fishing nets with small mesh size were prohibited due to the possibility of juveniles. The fishers also employ different gears in different seasons. For instance, in Mkunguni, it was forbidden to use gillnet within the reef during South-east monsoons (*kusi*) as this would inconvenience disadvantage other in-shore fishers.

Residents of both villages had different perceptions and attitudes towards Management of Marine Resources. Majority of the respondents in Kuruwitu village were of the opinion that the taboos and beliefs were either poor or fair (83%) compared to 14% of the respondents with the same perceptions in Mkunguni village. However, these opinions were sharply contrasted by 17% of respondents in Kuruwitu village who thought that the effectiveness of taboos and beliefs was either good, very good or excellent compared to 86% of respondents who expressed similar opinions in Mkunguni village.

Majority (76%) of the respondents in Mkunguni village felt that there was a decline in fish catches, compared to 42% of the respondents from Kuruwitu village that held the same

view. Most of the respondents in Mkunguni village (58%) were of the view that migrant fishers (*Wapemba*) were responsible for the declining fish catches. In Kuruwitu village, most of the respondents (31%) were of the opinion that destructive fishing gears and practices were responsible for the decreased fish catches, compared to 11% of the same view in Mkunguni village. Majority of the respondents in Kuruwitu village (61%) were actively involved in marine conservation activities compared to only 12% in Mkunguni village, where 66% of resource-users had rarely or never been involved in any marine conservation activities. In Kuruwitu, only a meagre 10% of the resource-users were redundant in marine conservation activities, an indication marine conservation was taken seriously in this village.

In both villages, there are taboos and beliefs associated with the wise-use of marine resources. However, it was evident that the taboos and beliefs were more recognized and actively used in Mkunguni village than in Kuruwitu village. In both villages, village elders played an active role in handling issues related to conflicts in marine resource use; e.g. in Mkunguni, they were used mediate resource-use conflicts between local fishers and the migrant fishers from Pemba. On the other hand, the elders were used to punish resource-uers who failed to comply with the set rules and regulations guiding the use of marine resources under the community conservancy in Kuruwitu village.

About 73% of the respondents in Mkunguni village perceived that indigenous knowledge had a lot of benefits to marine resource use compared to 64% of the in Kuruwitu village who held the same opinion. About 43% of the respondents in Mkunguni village indicated that they used indigenous knowledge to enabled them easily find fish and other resources, compared to 39% of the respondents from Kuruwitu village that were of the same view. Further, 25% and 22% of the resource-users in Mkunguni and Kuruwitu village respectively, revealed that use of indigenous knowledge was crucial in securing them employment opportunities and thus earn them income. In addition, 16% and 12% of the respondents in

Mkunguni and Kuruwitu village respectively, stated that indigenous knowledge had enabled them to save time when fishing, because they are able to locate the fishing grounds, and target fish species easily.

About 17% of the resource-users in Kuruwitu village felt that indigenous knowledge had enabled them to conserve marine resources, compared to only 4% of the in Mkunguni village. In both villages, some resource-users; 15% in Mkunguni and 7% of in Kuruwitu felt that even though they couldn't list the benefits from use of indigenous knowledge, they had not benefited in one way or the other.

5.3 Conclusions

There are various types of indigenous knowledge used in the management of marine resources in Kuruwitu and Mkunguni villages along the Kenya coast; e.g. the loud sound of waves splashing on the reef was indicative of impending rains and the start of a rough sea, suggesting that the weather was likely not good for fishing. Similarly, the start of the South-East Monsoon winds was associated with rains and storms signaling unsuitable weather conditions for fishing. Furthermore, in both Kuruwitu and Mkunguni, the lunar cycle was used to predict the sea-state and subsequently, establish the fishing calendar for the resource-users.

Use of indigenous knowledge in the identification of marine species and their habitats was demonstrated by resource-users in both villages; e.g. fishers were able to categorize fish species into major categories and identify the associated habitats for each category. This knowledge provided precision on target species and habitats, thereby reducing the time spent "searching" for fish. In both villages, the fishers were able to identify various causes of water pollution and habitat degradation in their area, listing quarrying to global such as weather changes as the main drivers. Further, the fishers were able to explain how the different forms of marine pollution and degradation impacted fishing grounds, fish catches and ultimately, their livelihoods.

Perceptions on the influence of traditional beliefs and taboos were poor among the resource-users in Kuruwitu village, compared to Mkunguni where there were strong connection to beliefs and taboos in the effective management of marine resources. These variations can be attributed to cultural erosion due to urbanization; Kuruwitu is in closer to the urban Kilifi and Mombasa, explaining the declining adherence to taboos and beliefs. These results concur with other studies done at both regional and global levels.

In both villages, the residents perceive that fishery resources have been on the decline over the last decades. The presence of migrant fishers was listed as the main cause of decline in fish quantity in Mkunguni, as evident from the resource-use conflicts between the residents and emigrant Pemba fishers. In Kuruwitu, the decline in fish catches was attributed to use of destructive fishing gear. Participation in marine management activities was more evident in Kuruwitu compared to Mkunguni village. This may be explained by the presence of a strong beach management Unit (BMU) at Kuruwitu which has created more aware of the importance of marine resource management and conservation to the communities. In both villages, taboos and beliefs still remain important factors in determining access and use of marine resources, but they were much more adhered to in Mkunguni village than in Kuruwitu.

The influence of the village elder's in the management of marine resources is slowly diminishing as these traditional institutions are eroded by the entry of modern/formal institutions. Benefits accrued from use of indigenous knowledge were evident from FGDs with majority of the respondents in both communities. Fish as food was ranked as the highest benefit followed, by employment opportunities. Other benefits identified, through by fewer respondents, included the reduced time in searching for the resources during fishing and the importance in sustainable conservation of marine resources.

5.4 Recommendations

5.4.1 Recommendations for policy and practice

The government and especially the county governments as well as other environmental agencies should actively get involved in creating awareness on ecosystem degradation and pollution and impacts of marine resources. In particular, the Kwale County government should put more emphasis to should increase community participation in marine management activities in Mkunguni and other villages where this has not been done, so that the communities are involved in decision making to promote sustainable resource-use and active management of the resources. The initiatives in Kuruwitu village should be up-scaled, with emulation of the same in the rest of Kilifi County, as well as other counties along the coast where community participation in resource management is still taken lightly. Additionally, these initiatives should be backed up with the search for more alternative livelihoods to reduce pressure on the marine resources.

Secondly, in harnessing the indigenous knowledge in these local communities, emphasis should be put into documentation and promotion of the use of indigenous knowledge for management of marine resources, as well as possible application in informing climate change mitigation and alleviation of disasters. Disaster warnings stipulated based on use of indigenous knowledge require further interrogation to integrate the knowledge with modern scientific research and access the frequency of occurrence and link this to climate change dynamics.

Lastly, there is need for capacity building in both villages in order to synchronize indigenous knowledge with new interventions in the effort to harmonize management of marine resources. An integrated approach to the management of marine resource is important in addressing concerns by communities with strengthening of the different types of indigenous knowledge in the face of modernization and urbanization.

5.4.2 Recommendations for Further Research

From the results of this study, evidence of the presence of indigenous knowledge, its use in management of fisheries resources, and role in community livelihoods was identified in Kuruwitu and Mkunguni villages in Kenya. However, some data and information gaps were identified as presenting crucial areas for future research.

First, further research should be undertaken to determine and make a comprehensive documentation of the actual role and extent played by indigenous knowledge in management of fisheries resources along other areas of coastal Kenya. Furthermore, there is need to access and document the use of indigenous knowledge in management of other coastal and marine resources such as coconut palms, aquifers and water resources, mangroves, local mining of limestone, shells collection, tourism, sand harvesting among others.

Secondly, there is a need to access the role of indigenous knowledge on other socio-economic aspects of the coastal communities, e.g. the relationship between strength of the indigenous knowledge base and success of modern education systems, given the decades of dismal performance in modern education systems in some of the coastal areas, including gender disparities, role of modernization, governance, politics etc. in conservation and used of indigenous knowledge in the daily lives of the coastal communities.

Efforts should be made to strengthen traditional institutions such as the *Kaya* elder councils, *wazee wa bandari* while integrating the same with modern institutions to ensure that beneficial indigenous knowledge is preserved while exploring how the same can be incorporated as taught subjects in the modern education systems.

Lastly, it is evident that coastal and marine resources are fast declining with resultant increase in the number and magnitudes of resource-use conflicts. Consequently, there is a need to actively explore alternative sources of livelihoods while seeking use of indigenous knowledge on the same.

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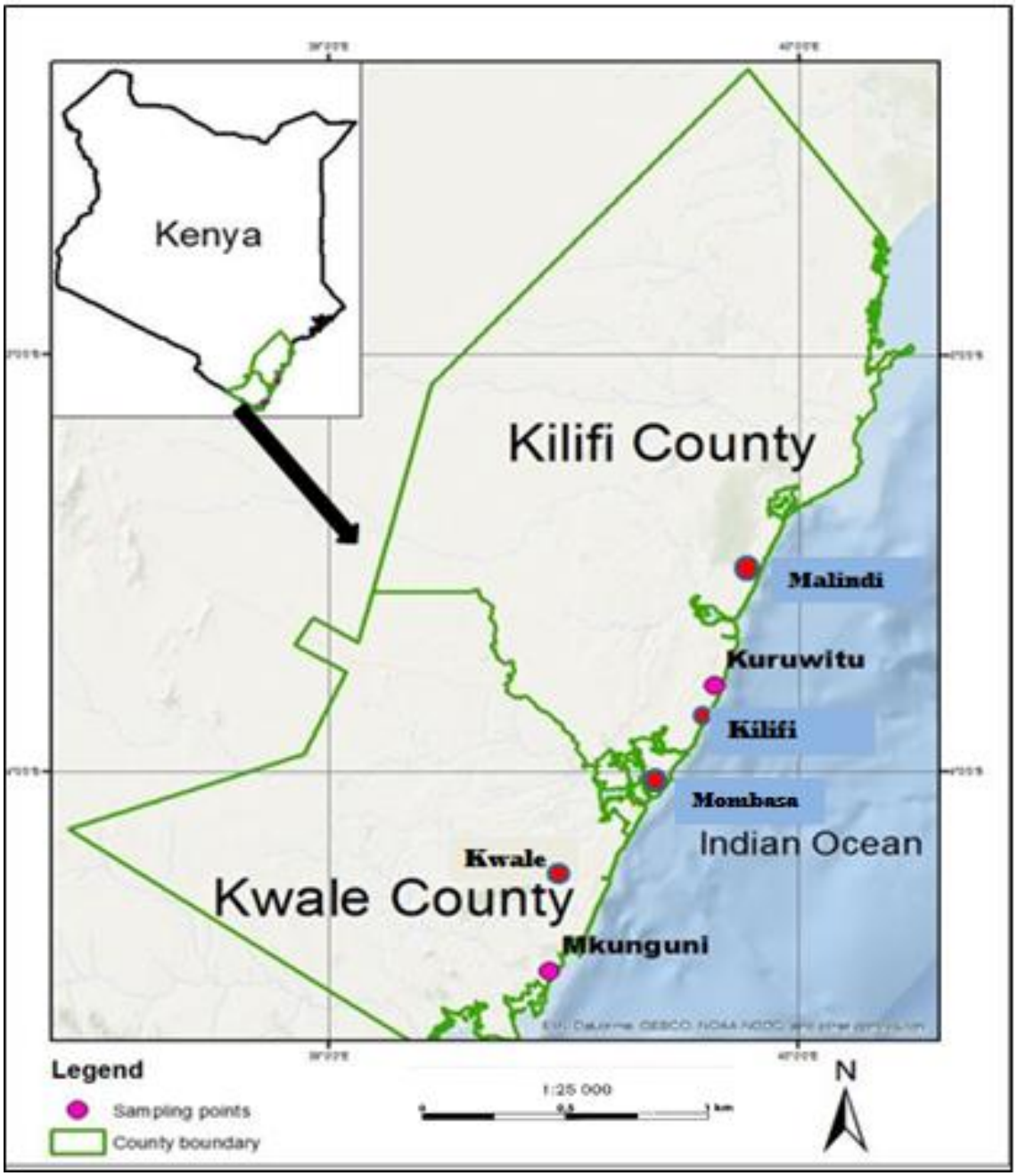
6.0 APPENDICES

6.1 Appendix I: Map of Kenya (inset) showing the Location of the Study Sites; Kuruwitu and Mkunguni



6.2 Appendix II: Research Permit from NACOSTI and University

NACOSTI ACCREDITED

ERC/MSc/054/2015

Pwani UNIVERSITY

ETHICS REVIEW COMMITTEE

ACCREDITTED BY THE NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION (NACOSTI, KENYA)

CERTIFICATE OF ETHICAL APPROVAL

THIS IS TO CERTIFY THAT THE PROPOSAL SUBMITTED BY:

WALTER J. JILANI

REFERENCE NO:
ERC/MSc/054/2015

ENTITLED:
The role of local knowledge in management of coastal and marine resources: A comparative assessement of Kuruwitu and Mkunguni fishing villages in Kenya.

TO BE UNDERTAKEN AT:
KILIFI AND KWALE COUNTIES, KENYA

FOR THE PROPOSED PERIOD OF RESEARCH

HAS BEEN **APPROVED** BY THE ETHICS REVIEW COMMITTEE

AT ITS SITTING HELD AT PWANI UNIVERSITY, KENYA

ON THE 23rd DAY OF NOVEMBER 2015

CHAIRMAN SECRETARY LAY MEMBER

PTO

Pwani UNIVERSITY

Ethics Review Committee

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The ERC: Giving Integrity to Research for Sustainable Development

6.3 Appendix III: Consent Form

Study Title: The role of indigenous knowledge in management of coastal and marine resources: A comparative assessment of Kuruwitu and Mkunguni fishing villages, Kenya.

Program: Masters of Science in Environmental Studies (Community Development)

Names of the Supervisors: Dr. Andrew Wamukota and Dr. Fulanda Bernerd

Researcher: Walter Jabali Jilani

Admission Number: N50/PU/3056/14

Dear Sir/Madam,

You are being invited to take part in a research study being conducted by Mr. Walter Jabali a Masters student at Pwani University. The purpose of the research is to assess the role of Indigenous knowledge in the management of coastal and marine resources in Kuruwitu and Mkunguni fishing villages along the Kenyan coast. Before you decide to participate in this study, it is important that you understand what the research will involve. Please take time to read the instructions carefully. If you need more information, please contact the researcher using the address provided below. There are no risks or discomforts that are anticipated from your participation in the study. You may decline to answer any or all questions and you may terminate your involvement at any time you choose. If you do not want to be in the study, you may choose not to participate and leave your answers blank. The information gathered during this study will remain confidential and only the researcher will have access to the study data and information. You are at liberty to include your name on the questionnaires or not. Information gathered will only be used for academic purposes.

By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to seek clarification. I understand that my participation is voluntary and that I am free to withdraw at any time. I voluntarily agree to take part in this study.

_____	_____	_____
Name of Participant	Signature	Date

Name and signature of the researcher

_____	_____	_____
Name of Researcher	Signature	Date

Walter Jabali Jilani
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6.4 Appendix IV: Household Questionnaire

Questionnaire No. _____

SECTION 1: GENERAL INFORMATION

Village …… Date: ___/____/_____

Name of the interviewee (optional)……..

1. What is the gender of the participant? **Male [1] Female [2]**
2. How old are you (in complete years)? ……..
3. From what ethnic community do you come from? ……..
4. What is your religion? **Muslim [1] Christian [2] (specify) [3] Others**
5. What is the size of your household?
6. For how long have you been living in this community (in years)?

1. Less than 5		**3. 5-10**	☐
2. 10-20		**4. Above 20**	☐

7. What is the highest level of education you have attained?

   None [1] primary [2] secondary [3] vocational [4] college [5] madrassa [6] others (specify) [7]

8. What is your **MAIN** occupation? …….**(specify)**
9. What is the roughly estimate your monthly income ……..

SECTION 2: INDIGENOUS KNOWLEDGE, PERCEPTIONS AND ATTITUDES OF THE LOCAL COMMUNITIES TOWARDS MARINE RESOURCE CONSERVATION

10. List any marine resources that are available in your village (maximum 5)? *Marine resources (coral reefs, fish, sea grass, mangroves, marine turtles, sea birds, sandy beaches, sand dunes and terrestrial forests)*

Sn	Name of resource	Local name	Place available (e.g. in the shorelines, deep sea etc.)	Time of the year available

11. Are marine resources conserved in this village? **Yes [1] No**

12. In your opinion, should these resources be conserved? Why?

Item no.	Resource		No	Reason for the response

13. a). Are marine resources degraded and polluted in this area? **Yes [1] No [2]**

(b) If yes in above, what are the different sources of marine resources degradation?

Item no.	Marine resources	Causes of degradation

14. What has been the status of fish catch trends in the last 10 years? [5]Increased

[4]Fluctuate [3]Constant [2]Reduced [1] Don't know

15. What might be the reasons for the change in the status?

.....
.....

SECTION 4: LOCAL INSTITUTIONS ON THE PRESERVATION OF INDIGENOUS KNOWLEDGE ABOUT MARINE RESOURCE CONSERVATION

16. a). Are there any local regulations being used in managing and protecting the marine resources in this village? **Yes [1] No [2]**

(b) If yes, which are the regulations, target resources, associated fine and the person in-charge of implementing it?

What is the regulation?	**What are the resources?**	**What are the fines/Sanctions?**	**What is the title of the person in-charge of enforcing the regulation?**

17. List the types of local fishing gears used in this village?

What is the name of the fishing gear?	**Is it prohibited? 1. Yes 2. No**	**If yes, what's the reason for the prohibition?**

18. (a).Are there taboos and beliefs associated with the conservation of resources?

Yes [1] No [2]

(b) If yes in q15a. List down the taboos and beliefs

Item no.	**Taboo**	**Associated beliefs**

(b) On a scale of **1-5** (5 – *very poor, 4 – poor, 3 – Average, 2 – Good, 1- Very good)?* how effective are the measures in q15 (a) above in conserving marine resources in this area? *(Tick appropriately)*

Measure	**Very poor**	**Poor**	**Average**	**Good**	**Very good**
Taboos					

19. What are the particular areas e.g. lagoons and reefs that are restricted to fisheryor any other activity and are controlled by the local community?

Area	**Tick if restricted**

20. Do the community members participate in the election of leaders that govern marine resources in this area? **Yes [1] No [2]**

21. Do you normally participate in meetings concerning conservation issues? **Yes [1]**

    No [2]

22. Have you ever participate in any conservation activities? **Yes [1] No [2]**

23. How often do you participate in any such marine conservation activities in this village? **[5]Very Frequently [4]Frequently[3] Occasionally [2]Rarely [1]Never**

24. Could you briefly explain the activities you were involved in when you participated?

    ……
    ……

25. (a). Are there resource use conflicts in this village? **Yes [1] No [2]** (b). If **yes in q17**

    above, who are the parties in the conflict? ..... (c). If **yes in q17 above,** how often

    do these conflicts occur?

    Daily [1] Weekly [2] Monthly [3] Yearly [4]

26. Rate the effectiveness of local leadership in resolving resource- use conflicts

    Very good [5] Good [4] Average [3] Poor [2] Very poor [1]

27. Are there local institutions which used to exist in the past and which now are non-existent? **Yes [1] No [2]**

SECTION 5: CONTRIBUTION OF INDIGENOUS KNOWLEDGE AS A DRIVER OF MARINE RESOURCE CONSERVATION

28. Are you aware of the benefits of using local knowledge in community development? **Yes [1] No [2]**

    (b) If Yes in q25 (a) above, how is it contributing in your daily activities?
    ……
    ……
    ……..

29. How has local knowledge impacted on your livelihood?

    High [3] Moderate [2] Low [1]

30. Have you received recognition from any external agency due to conservation of marine resources? **Yes [1] No [2]** *Hint: award or funding*

    [*Thank you for your time*]

    Interviewer Comments:

    ……

6.5 Appendix V: Focused Group Discussion (FGD) Guide

Village name…… No of Participants male……Female……

1. What is the literacy level of most of the members in the group? What is the marital status of most of the participants? What socio economic activities do most of the participants engage in?
2. What are the marine resources available in this community? How important are the marine resources available here important to the surrounding community? What are the benefits or conserving it?
3. What knowledge do you possess on fish species, their habitat, availability through- out the year, weather conditions for fishing, types and usage of gears while targeting them.
4. What are types of fishery practices do you undertake?
5. What is your opinion regarding the status of fish catch trends in this village now compared to the last ten years? Has it reduced or increased? What can you attribute the current status to?
6. What knowledge do you possess on other marine resources such as turtles, sea grass and corals?
7. Are there any marine resource management initiatives in this area? Who is leading this initiatives (local communities, NGOs, national or county governments etc)? How important are the initiatives for the community here?
8. What specific roles does the local community in this area play in marine resource conservation? What activities are do they carry out? How often?
9. What is your opinion regarding some of the different sources of marine ecosystem degradation in this area?
10. What are the taboos, customs and beliefs in this community related to marine resource conservation? What would you say about the community awareness of this taboos, customs and beliefs among the members of this community? What can you attribute the current knowledge levels of these taboos, customs and beliefs to in this community? Are they threatened or are they being embraced? Why do you think so? What do you think knowledge or lack of knowledge of these taboos, customs and beliefs does to marine conservation efforts in this area? Does it help or derail these efforts?

11. What specific roles has the local leadership played in resolving resource-use conflicts in this community? Who is specifically involved in these efforts by local leadership (village elders, chiefs etc)? What is your assessment of the implementation of the rules and regulations by the local leadership? Have they been effective in ensuring marine conservation in this community? Would you say that local leadership have been an anchor to indigenous knowledge or scientific knowledge in their approach to marine resource management?
12. Are the locals involved in decision making especially targeting preservation of indigenous knowledge on marine resource management in this community? What role do they play if any in the decision making process in the management of these marine resources?
13. Is indigenous knowledge systems incorporated in eco-tourism activities in this community? How has this been done in the community? Has this yielded the desired socio-economic change among members of the community in this area especially with respect to the use of eco-tourism activities?
14. What do you think are the benefits of using indigenous knowledge by the fishing communities in this area?

6.6 Appendices VI: Key Informant Interview (KII) Guide

Name of participant……..Age……. Role…….

1. What is your level of education? What is your marital status?
2. What are the marine resources available in this community? How important are these marine resources to the community living here? What do you think are some of the benefits conserving these resources to the community?
3. What knowledge do you possess on fish species, their habitat, availability through- out the year, weather conditions for fishing, types and usage of gears while targeting them.
4. What are types of fishery practices do you undertake?
5. What is your opinion regarding the status of fish catch trends in this village now compared to the last ten years? Has it reduced or increased? What can you attribute the current status to?
6. What knowledge do you possess on other marine resources such as turtles, sea grass and corals?
7. Are there any marine resource management initiatives in this area? Who is leading this initiatives (local communities, NGOs, national or county governments etc)? How important are the initiatives for the community here?
8. What specific roles does the local community in this area play in marine resource conservation? What activities are do they carry out? How often?
9. What is your opinion regarding some of the different sources of marine ecosystem degradation in this area?
10. What are the taboos, customs and beliefs in this community related to marine resource conservation? What would you say about the community awareness of this taboos, customs and beliefs among the members of this community?
11. What can you attribute the current knowledge levels of these taboos, customs and beliefs to in this community? Are they threatened or are they being embraced? Why do you think so? What do you think knowledge or lack of knowledge of these taboos, customs and beliefs does to marine conservation efforts in this area? Does it help or derail these efforts?
12. What specific roles has the local leadership played in resolving resource-use conflicts in this community? Who is specifically involved in these efforts by local leadership (village elders, chiefs etc)? What is your assessment of the implementation of the rules and regulations by the local leadership? Have they been

effective in ensuring marine conservation in this community? Would you say that local leadership have been an anchor to indigenous knowledge or scientific knowledge in their approach to marine resource management?

13. Are the locals involved in decision making especially targeting preservation of indigenous knowledge on marine resource management in this community? What role do they play if any in the decision making process in the management of these marine resource?
14. Is indigenous knowledge systems incorporated in eco-tourism activities in this community? How has this been done in the community? Has this yielded the desired socio-economic change among members of the community in this area especially with respect to the use of eco-tourism activities?
15. What do you think are the benefits of using indigenous knowledge by the fishing communities in this area?