FIELD ATTACHMENT REPORT

INSTITUTION: **KENYA WILDLIFE SERVICE (KWS) – COAST CONSERVATION AREA, MOMBASA MARINE PARK STATION.**

PREPARED BY: **MWANAKE HOPE WAKIO**
B.Sc. APPLIED AQUATIC SCIENCE
EGERTON UNIVERSITY
REGISTRATION NUMBER: S14/20020/06

PRESENTED TO: **DR. NZULA KITAKA**
PROGRAM COORDINATOR
FIELD AND INDUSTRIAL ATTACHMENT
BIOLOGICAL SCIENCES DEPARTMENT
EGERTON UNIVERSITY.

In partial fulfillment for the course unit AQUA 371 for the award of B.Sc. Applied Aquatic Science.

OCTOBER, 2009

RESEARCH TOPIC: **ASSESSING THE IMPACTS OF ARTISANAL FISHING METHODS ON SEA TURTLES IN MOMBASA.**

PREPARED BY: **MWANAKE HOPE WAKIO**
B.Sc. APPLIED AQUATIC SCIENCE
EGERTON UNIVERSITY
REGISTRATION NUMBER: S14/20020/06

PROJECT SUPERVISOR: **MR. ARTHUR TUDA**
WARDEN/MANAGER
MOMBASA MARINE PARK
KENYA WILDLIFE SERVICE

TECHNICAL ASSISSTANTS DURING THE ENTIRE PROJECT

MR.EMMANUEL YAA – MY ASSISTANT DURING DATA COLLECTION
MR. STEPHEN OKOTH - KWS
MISS JOSEPHINE MUTISO – KWS
MR. TIMOTHY IKIME - KWS

DEDICATION

To my parents George and Rhoda Mwanake, my brothers Ricky, Nickson and Billy Mwanake. My world revolves around you; I am all I am because of your love. I love you

Joel, your inspirations ignite a fire in my brain…

ACKNOWLEDGEMENTS

I would like to thank my supervisor Mr. Arthur Tuda, the warden Mombasa Marine Park/Reserve who gave me invaluable guidance and advice during the entire research and attachment period. He also tirelessly edited my report, I am grateful for his constructive criticisms and contribution that lead to the successful completion of the project.

Special thanks to Dr. Mohammed Omar for introducing me to the world of sea turtles and exposing me to the many meetings about the endangered marine organism.

I am greatly indebted to Mr. Emmanuel Yaa who sacrificed his time to offer me field support in all the seven landing sites that I interviewed the fishermen, without him my project would have been incomplete.

I would like to extend my gratitude to the management Kenya Wildlife Service, Coast Conservation area; Mr. Simon Gitau, the Assistant Director; Mr. Mugo, the senior warden; Mr. Mabruk ,Warden PAC; Madam Grace Wendot , the Assistant Warden; Mr. Timothy and also the entire staff of Kenya Wildlife Service who made my attachment a success.

Lastly I would like to thank my parents Mr. and Mrs. George and Rhoda Mwanake, my brothers Ricky, Nickson and Billy Mwanake for providing me with support, vision and encouragement throughout the entire attachment period.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

IUCN	International Union for Conservation of Nature
KWS	Kenya Wildlife Service
UNEP	United Nation Environmental Programme
SEM	Southeast Monsoon
NEM	Northeast Monsoon
KESCOM	Kenya Sea Turtle Conservation Committee
MMNP	Mombasa Marine National Park
MMNR	Mombasa Marine National Reserve
FD	Fisheries Department
MPAs	Marine Protected Areas
KEMFRI	Kenya Marine and Fisheries Research Institute
CDA	Coast Development Authority
WWF	World Wide Fund
WTW	Watamu Turtle Watch
NMK	National Museums of Kenya

TABLE OF CONTENT

ABSTRACT

Kenya Wildlife Service (KWS) is a State corporation established by the Act of Parliament, Cap 376 with a mandate for wildlife conservation and management in Kenya, and to enforce related laws and regulations. The Mombasa Marine Park is one of the five Marine Protected Areas (MPAs) in Kenya and was gazetted in 1986 and covers an area of 210 sq. km. The park seeks to conserve threatened marine species and acts as a major tourist attraction at Mombasa.

During my attachment period most of my work was based at the research and conservation department but I also got an opportunity to visit several departments including Human Resource, Accounting, Security, Radio, Smart Card, Intelligence and Procurement and Supplies. I also visited other institutions like Wildlife Conservation Society, Kenya Sea turtle Conservation Committee, Kenya Fisheries and Baobab Trust. I did a project on' Assessing the impacts of artisanal fishing methods on sea turtles'

The study objectives in my project were**:** To determine the impact of artisanal fishing methods on sea turtles and the study area was the Mombasa Marine Park and National Reserve. The sampling sites were the seven landing sites which all lie within the marine reserve.

The Survey information was collected using questionnaires administered randomly at the landing sites and the research institutions and recorded the observations and knowledge about fisheries and sea turtles from the various stakeholders including fishermen, Managers (fisheries and KWS) and scientists (KESCOM, WCS and KMFRI) Numerical ranks were assigned to the scores. Rank correlation coefficient analysis was done to test differences between rankings obtained from the three respondents (fishermen, Managers and scientists).

To test if there was significant agreement in ranking assigned by different fishing groups a non parametric test was performed. This was the Kendalls test at 5% of significance level. There were seven sets of ranking and the coefficient of concordance for judging significant agreement in ranking by different fisher groups. The ranking was significant at the 0.05 level (2-tailed). There was significant ranking by the seven fisher groups at 5% level and since there were only two sets of ranking of the four types of gear (Jarife, mkano, maruwara and lasha), the Spearman's coefficient of correlation was used. The results showed that there was agreement in the ranking at 0.01% (significant at the 0.01 level).

This study will provide the basis for the total ban on the use of all beachseines since the nets capture more fish than a person needs in a given day, are indiscriminate and they compromise replenishment, destroy habitats even with best practices, are dangerous to endangered and threatened marine mammals and marine resources that are already stressed especially the sea turtle. The study will document the impacts of artisanal fishing methods on physical and biological habitat and turtle bycatch and also rank these impacts.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Field attachment is an important component of a student's studies in the University. It involves the student being attached to an institution that provides him with extended knowledge in his field of study, as well as introducing him to the real working conditions and situations he expects to encounter after graduating. As result the students are supposed to find an institution to attach himself, adhere to the institution code of conduct, learn from the institution as much as possible and write a report on the institution and activities during the period of attachment, under the supervision of field attachment coordinator and the attachment institution's supervisor. Being a requirement, I was attached at Kenya Wildlife Service, Coast Conservation Area at the Mombasa Marine National Park and Reserve Station.

1.2 Kenya Wildlife Service (KWS)

Kenya Wildlife Service (KWS) is a State corporation established by the Act of Parliament, Cap 376 with a mandate for wildlife conservation and management in Kenya, and to enforce related laws and regulations.

The Kenya Wildlife Service main function include to :-

a) Formulate policies regarding the conservation, management and utilization of all types of fauna and flora (excluding domestic animals)
b) Manage national parks and reserves.
c) Provide wildlife conservation, education and extension services to create public awareness and support for wildlife policies.
d) Strive to achieve the competence and fairness in the care and development of the national parks and reserves through the conduct of research, and the deliberate acquisition, use and dissemination of relevant information from research and other sources.
e) Administer and coordinate international protocols, conventions and treaties regarding wildlife in all its aspects.

.

Kenya Wildlife Service's **Vision** is to be a world leader in wildlife conservation. Their **Mission** is to sustainably conserve and manage Kenya's wildlife and its habitats in collaboration with stakeholders for posterity. At KWS, they conserve and manage Kenya's wildlife scientifically, responsively and professionally. They do this with integrity, recognizing and encouraging staff creativity and continuous learning and teamwork in partnership with communities and stakeholders.

KWS's customers may be involved or participate in, or represent any or all of the critical issues areas namely tourism, recreation, marine and conservation and they include

- Individuals, groups, governments and private organizations that use the parks and reserves for tourism, recreation and research.
- Individuals, groups, governments and private organizations that have any level of interest in or impact on the development and conservation of wildlife.

These customers will be provided with: High quality and secure parks, wildlife conservation education; sustained wildlife; protection of agriculture and animal husbandry against destruction by wildlife: Data and information services on scientific advisory and consultancy services in wildlife; professional services in a friendly, responsive and professional environment.

1.3 Kenya Wildlife Service's Organizing Structure

Kenya Wildlife Service is under corporate governance. Corporate governance refers to the systems of processes and procedures by which corporations are governed and held accountable. The board of trustees is responsible for the governance and long term strategic direction of the service in the discharge of its mandate.

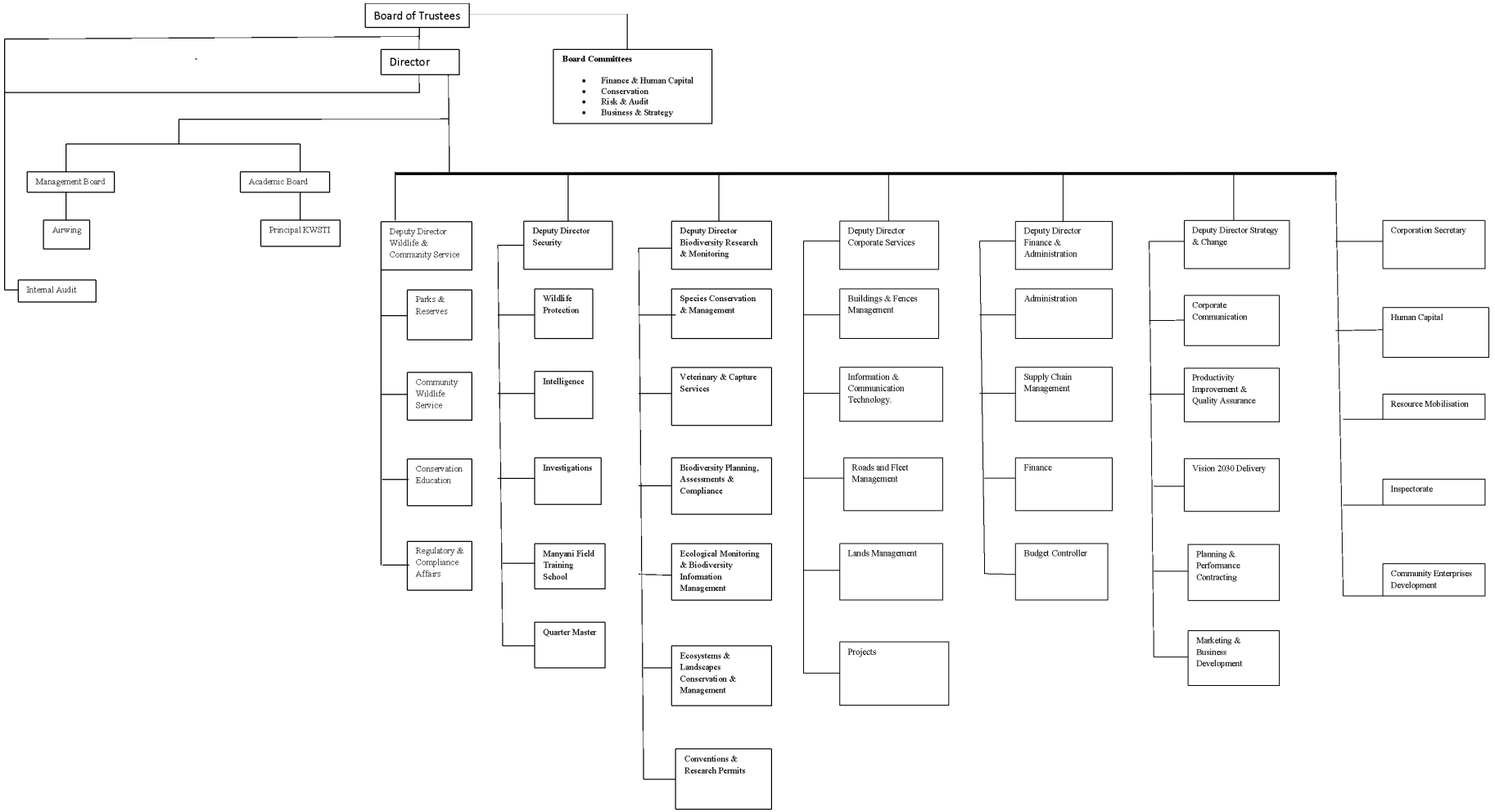

Figure I: Kenya Wildlife Service Organization Structure. Source: Kenya Wildlife Service 2007 Annual Report

1.3.1 Board of trustees

Pursuant to section 3B (4) of the wildlife (conservation and management) Act, the board of trustees is required to meet at least four times in every year. They are given appropriate and timely information so that they can maintain full and effective control over strategic, financial, operational and compliance issues.

The director is vested with the general superintendence of the functions of the service on behalf of the board. The board nonetheless retains responsibility for establishing and maintaining the service's overall internal control of financial, operational and compliance issues.

1.3.2 Committees of the Board

There are four standing committees which meet regularly, as and when required under terms of reference defined and delegated by the Board.

1.3.2.1 Audit and Risk Committee

Comprises of the Permanent Secretary of the parent ministry, Forestry and Wildlife, and trustees other than the Permanent Secretary and government departments heads represented on the board. The committee's responsibility include review of financial information, in particular the annual financial statements, compliance with accounting standards and maintaining oversight of internal control system.

1.3.2.2 Finance and Human Capital Committee

It reviews human resource policies as well as make suitable recommendations to the Board on appointments to senior management positions. It is also possible for consideration of the Service's annual budget as well as recommendations for capital expenditure.

1.3.2.3 Business and Strategy Committee

It is responsible for the considerations of recommendations for capital expenditure, review proposals for the establishment of new business by the Service and the grant of lease.

1.3.2.4 Conservation Committee

The committee is responsible for the main function of the Service, which is the formulation of policies regarding the conservation, management and utilization of all types wild fauna and flora. It also oversees the conduct of research activities in wildlife conservation and management and reviews the process of preparation and implementation of management plans for national parks and reserves.

1.4 Kenya Wildlife Service Conservation Areas

The Service has eight Conservation Areas

Table 1: Kenya Wildlife Service Conservation Areas

Conservation Area	Area Size (km^2)	Park	Reserve	National Sanctuary
Western	107,426	6	4	3
Central Rift	30,832	3	4	0
Southern	36,186	3	0	0
Mountain	49,557	2	6	1
Northern	137,911	3	2	0
Tsavo	73,368	3	2	0
Coast	43,969	5	10	0
Eastern	81,224	2	3	0

1.4.1 Coast Conservation Area

The coast attracts 60% of annual foreign visitors to Kenya. Consisting of a variety of attractions, including white sandy beaches, a breathtaking underwater world of diverse coral and fish species, exotic mangrove wetlands and coastal forests, the region strives to protect and conserve its unique heritage while balancing utilization and conservation.

This area has four marine national parks namely: Mombasa, Malindi, Watamu and Kisite; one terrestrial national park named Arabuko Sokoke; six marine national reserves namely: Mombasa, Watamu, Malindi, Kiunga, Mpunguti and Diani Chale; and four terrestrial national reserves namely: Shimba Hills, Tana River Primate, Dodori and Boni.

1.4.1.1 Mombasa Marine National Park and Reserve

The Mombasa Marine Park and National Reserve lies between Mtwapa Creek and Tudor Creek in the North of Mombasa District located in the Coast province along the Kenyan Coastline which is approximately 500 km long, stretches from 1^0 42' S to 4^0 40' S bordering Somali in the north and Tanzania in the south and the continental shelf covers and estimated area of about 19120 Km^2

The Mombasa Marine Park and National Reserve was gazetted under Cap 376 of the laws of Kenya through legal notices number 315 and 316 dated 9th December 1986 and supplement notice number 88 of 11th December 1986 respectively.

The park is 10km^2 and the reserve is 200km^2 hence the national is encompassed within the reserve area. This protected area lies between latitudes $40^0$43' and $40^0$15' and longitudes $30^0$55' and $40^0$12' North East of Mombasa Island. The basic ecological setup for biodiversity and tourist attraction in the park and reserve include coral reef, coral gardens, beaches, cliffs and lagoon.

Warden

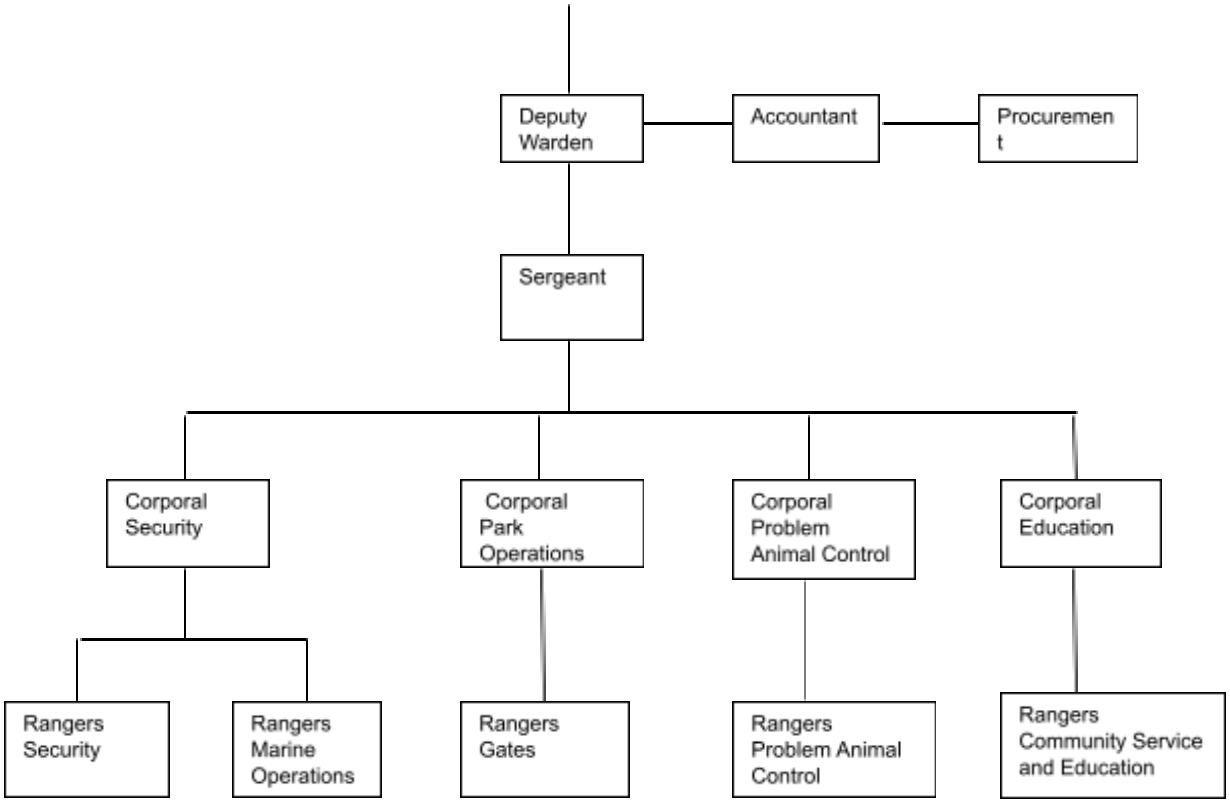

Figure II: Mombasa Marine National Park's Organization Structure

Source: Mombasa Marine Park Management Plan

CHAPTER TWO

2.0 ATTACHMENT ACTIVITIES

2.1 Smart Card Department

During my attachment period, I visited the smart card Point of Issue (POI) and Point of Sale (POS) offices and familiarized myself with the smart card ticketing systems. I issued smart cards to the KWS customers including individuals and tour companies. I also visited some of the tour companies in Mombasa with the smart card officer madam Gladys to listen to their positive and negative issues about the KWS electronic ticketing system. While working at this department I learnt that:

- This electronic ticketing system has significantly increased revenue accrued to Kenya Wildlife Service and has ultimately reduced the cost of managing their revenue.
- Kenya Wildlife Service is the pioneers of this technology in Africa and possibly the world.
- The smart card has reduced administration costs and ticket stocks.
- The smart card has improved revenue management systems and data collection.
- The smart card has improved customer service by reducing processing time at the gates

A smart card is a card that is used at KWS by its visitors to enable them get access to the Nakuru, Nairobi, Amboseli, Tsavo East, Tsavo West and Aberdare national parks. The card can be obtained in all KWS smart card Point of Issue offices upon producing proof of identification which is national Kenyan identity card for citizens, valid passport or alien certificate/work permit for residents. The card is available for persons aged 18years and above and can cater for accompanying children under the age of 18years. Smart cards are issued free of charge but their replacement is at a fee of 1000ksh.

Tour operators can obtain smartcards by submitting applications to KWS smart card manager accompanied by copies of the company Pin, company certificate of

incorporation. The POI offices are found at Nairobi park main gate, Lake Nakuru main gate, Tsavo East main gate and Mombasa KWS offices opened from 6.00am to 6.00pm. The POS offices are located at all smart card offices.

2.2 Tourism Department

I got an opportunity to visit the Mombasa marine park and reserve where I did most of work. The climate is hot and humid. Its vegetation is mostly the sea grasses and marine algae although some part of the reserve has mangrove forest.

I got to see and learn of the different species of the marine life including crabs, corals, sea urchins, jellyfish, sea stars, sea cucumbers, sea grass and sea weeds. I learnt how to use the snorkeling gear and snorkel. This activity really helped me in the observation and study of the different varieties of coral species comprising of the *Acropora sp, Turbenaria sp* and the *Porites sp* which are the major types found here.

I also learnt about the numerous fish species associated with coral species including the parrotfish, butterfly fish, rock cod fish, surgeon fish, porcupine fish, imperial angel fish, flagtail fish, sweeper fish, coachman fish, trigger fish, yellow spotted fish, common angel fish, gatering batfish and so many other types. It is through the MMP and its tourism officer that I got to involve myself in the marketing of the park. This was done through the visiting of the various tourist hotels like Voyager, Serena, Severin and Nyali; issuing out of brochures; and attending some of the ongoing workshops inorder to issue out materials about the park.

I went out for patrols in the park and reserves every two days in a week during my attachment period. The boat patrols are conducted on a daily basis by ranger Abdalla the coxswain and corporal Bocha. These were to ensure that every visitor who visited the park had the certified ticket, collect the tickets, ensure the visitors are safe and also to make sure that the local fishermen do not fish at the park. These patrols ensured a smooth running of the activity at the park.

The park and the reserve are demarcated from the no man's land by use of buoys. I also had an experience of cleaning each and every buoy and the KWS booths at the Voyager, Severin, Nyali, Serena and Travellers tourist hotels.

While in the office at the Coast Conservation Area headquarters I helped to keep a database of the details and revenues of the MMP and all the other parks including the terrestrial parks. During this activity I learnt the status of domestic and foreign tourism and how to manage files with a lot of information.

2.3 Department of Biodiversity, Research and Monitoring

This department is involved in the coordination of research activities that facilitate, coordinate and provide policy direction. This department also carries out species management and conservation. It is also mandated to develop integrated and species specific conservation and management programmes to strengthen capacity to conserve species, population and genetic diversity in natural habitats.

During my attachment period Kenya Wildlife Service Coast Conservation Area research department had developed a national strategy for the conservation and management of the endangered sea turtle species. During this period I got an opportunity to interact with the local communities during the meetings scheduled by the department for the purpose of site committees. We visited committees from Kilifi, Shimoni, Msambweni, Watamu and Malindi to facilitate the formation of the turtle conservation and management site committees. It was during these meetings that I learnt that for the successful completion of a project with the communities one has to listen keenly to their views and that there is a big gap between the stakeholders in the sea turtle conservation.

The terms of reference for the site committee included:

- To ensure cost effective implementation of both short and long site work plans.
- Ensure adequate allocations of monitoring resources.

- Strengthen the link and working relations between research, security and management.
- Coordinate awareness rising.

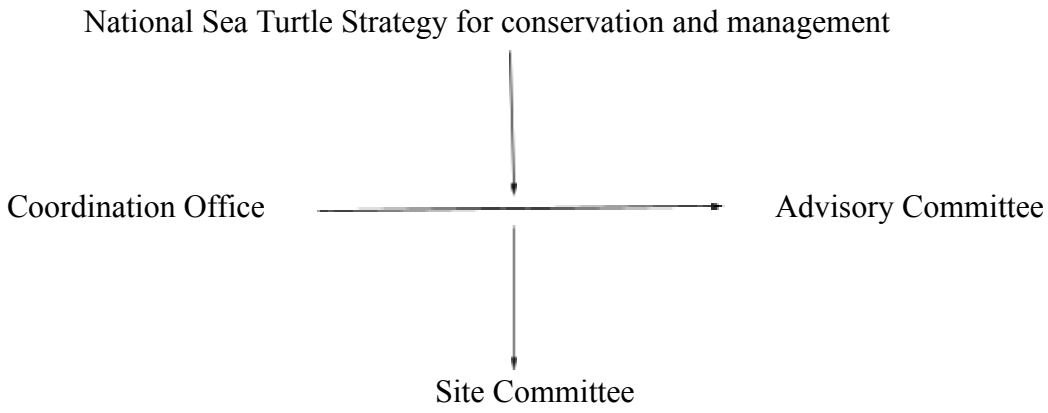

Figure III: Implementation of the National Sea Turtle Strategy for conservation and management.

During these forums with the communities, we would administer questionnaires to them in order to find out their perspectives on the approach of having a National Sea Turtle Strategy for conservation and management. For example what their levels of involvement are in the implementation of the strategy and if they are satisfied with these levels. We would analyze the questionnaires and assign ranks to the levels indicated for every community visited. Since these meetings are still going on and more site committees are yet to formed, all their views and the progress of the implementation would be featured in the final document on the national strategic plan for sea turtles conservation.

2.4 Beach Cleanup

On the second of July, I was involved in a beach cleanup organized by the Wildlife Clubs of Kenya. More than 1,000 participants drawn from schools, community based organizations, government institutions and local Non Governmental Organizations took part. The clean up was held at the Jomo Kenyatta public beach in Mombasa. This

day highlighted that marine debris has become a pervasive global problem and that the world's reliance on organic goods has been replaced with synthetic materials like plastics.

On that day durable and highly buoyant products such as beverage bottles, cigarette butts and fishing nets and lines were among thousands of recovered items. The day ended on a high note with the schools participating in the activity of modeling of important and also endangered marine organisms where the best schools were awarded.

2.5 World Environment Day

The World Environment Day was celebrated on June 6th at the Haller Park. The World Environment Day is celebrated worldwide and it is a day set aside by the United Nation Environment Programme (UNEP) to create awareness on the environment and climate change. The global theme for this year was, "Your planet needs you, unite to combat climate change" and the Kenyan theme for the day was, "Together we can tackle climate change in Kenya."

On that day, various government and non governmental organizations put up stands to educate people on various environmental issues such as global warming, climate change and their effects. In our KWS stand, we displayed posters and banners that mainly highlighted the effects of global warming and destruction of environment on the biodiversity of animal and plant species. We also emphasized on the need of conserving our marine ecosystems and their life forms. I contributed to the success of the day, by explaining the importance of wetlands to the visitors of our stand.

2.6 World Oceans Day

The World Oceans Day was held on 8th June 2009 at the Jomo Kenyatta Public Beach in Mombasa also popularly know as Pirates. The theme of the day was, "One Ocean, One Climate, One Future"

The day was graced by the presence of the Fisheries Development Minister, Hon. Paul Otuoma, his assistant, Hon. Abu Chiaba and the area (Kisauni) MP, Hon. Ali Hassan Joho and representatives from UNEP. Various government and non- governmental institutions involved in marine conservation such as KEMFRI, CORDIO, NEMA and KMA were also present. Other stakeholders such as Hoteliers and Boat Operators were also represented.

The day's activities included a public procession, beach cleaning and displays in the stands of the participating organization. The Minister, during his speech, emphasized on the need to reduce ocean pollution which results in coral bleaching. He also encouraged other research institutions such as KEMFRI to do more research on aquaculture techniques and disseminate the information to the local community. In doing so, they will be contributing towards conservation of various aquatic species and food security.

The KWS also took up this opportunity to emphasize on the need of conserving and protecting endangered marine species such as the green sea turtle and also encouraged people to visit their marine parks which have a wide variety of marine species and some of the endangered species such as the dugongs

CHAPTER THREE

3.0 ASSESSING THE IMPACTS OF ARTISANAL FISHING METHODS IN MOMBASA

3.1 Background Information

Five species of sea turtles (the green turtle, hawksbill turtle, loggerhead turtle, olive ridley and the leatherback) have been documented as occurring within the marine habitats of the Kenyan coast, which include coral reefs, seagrass meadows, mangrove swamps and sandy beaches which provide diverse habitats for them(aerial survey, 1994)

The 200km of beach land available for sea turtle nesting is however under critical threat of erosion and pollution (UNEP 1998). Hotel developments meant for the tourism industry have resulted in extensive modification of the natural shoreline. Where walls have been erected, severe beach degradation has occurred (Kairu 1997; Mwanje 1997). Nonetheless, the most critical threats to sea turtles emanate from fishing activities. Approximately 80% of the estimated 7000 fishermen at the coast are artisanal fishermen who contribute approximately 60% of the 10 - 12,000 tones of marine catch landed annually. The other 40% is derived from commercial prawn trawlers that fish in the inshore waters of the northern coast along the Malindi-Ungwana Bay area (fisheries department statistics)

Artisanal fishermen target the full range of exploitable resources available in the inshore marine habitats using traditional non-mechanized boats (i.e. canoes, dhows and outriggers) or on foot, utilizing simple fishing gears that include handlines, gillnet, seine nets, traps and spearguns. Fishing activities are highly seasonal, with lower catch rates during the rough SEM season when activity is more concentrated on accessible sites (McClanahan & Obura 1994).

Overall, the inshore fishery output at the Kenya coast has declined tremendously due to overexploitation and long-term degradation (McClanahan 1997; McClanahan & Obura 1994). The fishing methods damage the environment taking the juveniles and adults of non targeted species, cause damage to slow growing corals and associated organisms and environment. They are also destructive to the physical structure of the reef

and precipitate major changes in biological communities on the reef. The total catch per fisher is extremely low, varying from 4-6 kg per day during the productive season in some sites with earnings from sales averaging perhaps US $0.20- 1.00 per day (McClanahan & Obura 1994). This illustrates the extremely low incomes and standard of living experienced by fishing families along the Kenyan coast. To supplement the declining catches, artisanal fishermen covet sea turtle catch for sustenance due to their high cultural, nutritional and economic value (described by Frazier 1980; Wamukoya *et al*. 1997). Recent interviews with artisanal fishermen in the Kipini area have disclosed that 1 liter of sea turtle oil can fetch up to 40 US$ in illegal local markets (S. Nzuki pers. comm.).

The impacts of prawn trawling are a subject that has received much attention worldwide. In Kenya, the number of prawn trawlers has fluctuated between 1 in 1975, when trawling was initiated, to 20 (Fisheries Department Statistics). Only 4 are presently licensed. Prawn trawling is prohibited within 5 nautical miles of the coastline; however this regulation is often flouted. Consequently, environmentalists have been concerned about the high incidences of sea turtle bycatch from trawlers, estimated at 500-1000 annually (Wamukoya *et al*. 1995) and the various conflicts that have arisen with artisanal fishermen as a result of trawling activities.

Use of modern fishing gear and materials have dramatically enhanced catches e.g. spearguns are more efficient than traditional spear fishing, hook and line fishing is more efficient with chicken wire mesh of uniform size than with brushwood (British ecological society, 1996) As fishing effort increases stocks of turtles become overexploited then decline e.g. gillnets have several impacts on turtles like block nesting beaches, trap hatchlings, entanglement, drowning and destroy their feeding habitats. Others like the spearguns and handlines cause head and flipper injuries to turtles. In this study we will compare impacts of the five gears classes (handlines, beachseine, traps, spearguns and gillnets) commonly used by fishers then perform a seventy ranking of those impacts and suggest possible policy responses.

3.2 Problem of statement

Sea turtles have over the years been of great value to the coastal people of Kenya. Especially the green and the hawksbill turtles which are the most preferred due to their availability since they are defenseless on the beach and their nesting females are the easiest to capture. Nevertheless, pelagic turtles are frequently caught by harpooning, with the help of sucker fish (remora) and deliberate or incidental catch in nets by artisanal and commercial fishermen, despite this, no systematic studies on the impact of artisanal fishing methods on sea turtles have been documented in Kenya. This study will therefore fill this gap by assessing the impact of different artisanal gear on sea turtles and the results will be of importance to conservationists and fisheries managers on establishing gear regulations.

3.3 Study Objectives

3.3.1 Broad objective

To determine the impact of artisanal fishing methods on sea turtles.

3.3.2 Specific objectives.

a) To identify the level of threats on sea turtles imposed by specific artisanal fishing methods.
b) To document artisanal fishing gear used by fishers in Mombasa.
c) To determine ratings of habitat and bycatch impacts for each gear class.

3.4 Research Hypothesis

a) H_0: No difference in impact rating of different fishing gear.
b) H_0: No difference in stakeholders ranking.

CHAPTER FOUR

4.0 LITERATURE REVIEW

4.1 Effect of bait species and color on sea turtle bycatch and fish catch in a pelagic longline fishery.

The effects of bait species (mackerel and squid) and color (blue-dyed and non-dyed) on the loggerhead turtle *Caretta caretta* bycatch in a pelagic longline fishery in the western North Pacific were assessed in shallow-set longline fishing experiments. The loggerhead turtle catches were analyzed using a generalized linear model (GLM) with a Poisson distribution. The potential factors (bait species, bait color, other species catch, and sea surface temperature) affecting loggerhead turtle catch was incorporated as explanatory variables. The model analysis indicated that bait species affected loggerhead turtle catch, while bait color did not. The model predicted that catch rates of loggerhead turtles were 75% less on mackerel bait to squid bait. (Moses Mug, 2004)

This study demonstrated that fish bait choice was very effective in reducing loggerhead turtle bycatch in pelagic longline fisheries, but that the use of blue-dyed bait was not. Similar model analysis were also performed on target and by-product fish species, such as swordfish *Xiphias gladius*, striped marlin *Tetrapturus audax*, bigeye tuna *Thunnus obesus*, blue shark *Prionace glauca*, and shortfin mako shark *Isurus oxyrinchus*, and other non-target species. The remarkable differences between bait species and color that were found for loggerhead turtles were not found for these species catches. (Moses Mug, 2004)

4.2 Getting marine turtles off the hook in Central America

Hundreds of thousands of marine turtles are accidentally caught and killed in fishing nets each year. To protect these endangered species, WWF and its partners are encouraging local fishermen in a number of Central American countries to move from the "J" shaped hook, which can be snagged or swallowed by turtles, to a new circle hook, which turtles are much less likely to swallow and easier to unhook if caught. Such hooks reduce the capture of sea turtles by 70-90% and do not affect the catch of commercial fish species. (Monica E, 2008)

Bycatch of non-target species and juvenile target species is one of the most important problems fishing industry and managers are facing. Solving marine turtle bycatch in long-line fishing operations is a key challenge which can help save marine turtle species in the Eastern Pacific Ocean. Populations of certain species are threatened with extinction; however, there are promising technologies which could help solve the problem of turtle bycatch. In particular, large circle hooks can reduce marine turtle bycatch by two thirds without adverse impact on target catch in some fisheries. (Monica E, 2008)

The Inter-American Tropical Tuna Commission (IATTC) launched an initiative among its member states to run experiments on the replacement of j-hooks with circle hooks in long-lines of the Eastern Pacific Ocean. The initiative aimed to test by-catch reduction following 2 key principles: no one wants to kill turtles; no one wants to put fishermen out of work. WWF is a committed co-sponsor of this initiative and has provided funds, technical and administrative expertise toward its implementation, which relies on the voluntary participation of fishermen. (Monica E, 2008)

In addition to replacing J hooks with circle hooks, the project included testing experiments, the training of fishermen in best fishing practices - including proper on-board handling and resuscitation techniques for turtles caught by hooks or entangled in branch-lines - and on-board data collection by observers regarding catches and bycatches during long-line fishing operations. (Monica E, 2008)

This approach to fishing technology transformation proved successful and WWF and IATTC started building a database to compile scientific evidence to study marine turtle and long-line fisheries bycatch interactions and test circle hooks and other fishing gear modifications to save marine turtles. Results show that in almost all ports and fisheries circle hooks effectively reduce bycatch and produce a lower rate of ‘bad hookings’, hence increasing the potential survival rate of those turtles still caught in long-line fishing operations. After 3 years, the programme has built up the largest bycatch

network team and the largest artisanal fisheries conservation programme in Latin America. (Monica E, 2008)

4.3 Proposed proscription of gillnets of Orissa, India

In view of the alleged excessive fishing being done in the nesting sites, one of the interim directions of the CEC to the Government of Orissa, dated 7 March 2003, was to ban all gillnets operating within 5 km of the three nesting sites, for a period of three months. Thus, outside the core of the Gahirmatha marine sanctuary artisanal and small-scale fishing vessels using gillnets were also brought under turtle protection measures for the first time irrespective of the type of gillnets they have been using and the relative impact of these units on turtle congregations. The CEC has since made another visit to Orissa from 10 to 14 February 2004 to ascertain if the earlier interim directions were complied by the Government of Orissa (Kosuke Yokota et al 2009)

In their field trip in Orissa, Kosuke Yokota et al noticed about 15 different types of gillnets, including nylon trammel nets, being used in Orissa that catch anything from sharks and rays to sardines and shrimps. These gears are made of nylon monofilament, nylon multifilament, and high-density polypropylene (HDP). According to artisanal gillnet fishers in several coastal villages, while nylon monofilament nets of mesh sizes 20 mm, 50 mm, 70 mm and 90 mm are safe for turtles (turtles can easily break the webbing with their flippers, argue these fishers), nylon multifilament gillnets of 140 mm (to catch sea bass), 250 to 280 mm (to catch sting rays) are not safe for turtles. They said they could agree to a ban on such gears, if necessary. But they are against a blanket ban on all forms of gillnets, which is the mainstay of fishers of Orissa (Kosuke Yokota et al 2009)

The traditional fishers explained the interaction between turtles and fisheries. There is a relationship between flood-water discharge from rivers into the coastal waters, aggregation of jellyfish and *arribadas.* Turtles feed on jellyfish, and it removes one major predator that competes with the fishers, for target species and, therefore, they welcome turtles, said fishermen in two fishing villages (Kosuke Yokota et al 2009).

4.4 Artisanal Fishery

Artisanal fishers in Kenya base their choice of fishing gear on a variety of factors including the fisher's knowledge, ease of use, initial costs, yield and seasonality. Traditionally most fisheries elders trained community members to use the fishing gear which they are approved. They also passed on knowledge of wind tides and current to improve fishing efficiency and decrease the likelihood of injury or loss at sea. Such a knowledge base heavily influenced the fisher's choice of fishing gear and techniques.

In recent times as fish stocks have declined (Kaunda, 1997; McClanahan, 2001; Kaunda et al, 2003), newer competitive gear has been introduced (Glaesel, 1997), traditions associated with fishing gear continue to decline (McClanahan et al 1997) and new economic realities emerge (Obura, 2001; Ochiewo; 2004) Fishers decision to certain gear are no longer solely influenced by tradition. Gear choice has widened and many fishers have adopted less expensive forms of fishing and this poses a great challenge to the conservation and management of sea turtles due increased level of threats.

The artisanal fishery in Kenya is seasonal dominated by the accessibility of fishing sites influenced by monsoon winds.

Currently artisanal fishers do not generate income through alternative activities therefore the communities within the proximity of the Mombasa marine park and reserve have a high dependency on the exploitation of marine resources especially the endangered species like the sea turtles since they are an important source of protein, furthermore the socio economic wellbeing for the fishermen.

CHAPTER FIVE

5.0 MATERIALS AND METHODS

5.1 Study Area

The study area is the Mombasa Marine Park and National Reserve (Figure IV) which lies between Mtwapa Creek and Tudor Creek in the North of Mombasa District located in the Coast province along the Kenyan Coastline which is approximately 500 km long, stretches from 1^0 42' S to 4^0 40' S bordering Somali in the north and Tanzania in the south and the continental shelf covers and estimated area of about 19120 Km^2.

The Marine Park and Reserve borders several hotels like Serena, Travelers, Severin, Voyager and Nyali Beaches making land available for sea turtle nesting under critical threat of erosion and pollution. These hotel developments meant for the tourism industry have also resulted in extensive modification of the natural shoreline. Where walls have been erected and severe beach degradation occurred. Nonetheless, the most critical threats to sea turtles emanate from artisanal fishing activities which support approximately 6,500 people.

There are roughly four important geological features which form the basic ecological set for biodiversity and tourist attraction in Mombasa Marine Park and Reserve namely Coral Reef, Coral Gardens, Beaches & cliffs and Lagoon/Channel

Figure IV: Marine Protected Areas, Source Kenya Wildlife Service 2007 Annual Report

5.2 Sampling sites

The questionnaires would be administered to all the landing sites in Mombasa. These landing sites are seven in total and all lie within the marine reserve. They include Mtwapa, Marina, Bamburi Pirates, Nyali Reef, Nyali Msanakani, Nyali Mkomani and English Point. In each landing site 7 – 8 fishermen will be interviewed and their responses filled in the questionnaires. The managers and scientists that would be reached include the Fisheries department, KESCOM, WCS, Baobab Trust and KWS.

5.3 Procedure and Time frame

Table 2: Work plan

Months	June	July	August
Activity			
Familiarizing with the study sites and the local communities around including talking to the local fishermen.			
Data collection at the various landing sites and research institutions			
Data analysis and report writing			

5.4 Sampling and Analysis Protocol

Survey information would be collected using questionnaires administered randomly at the landing sites and the research institutions in order to record the observations and knowledge about fisheries and sea turtles from the various stakeholders including fishermen, Managers (fisheries and KWS) and scientists (KESCOM, WCS and KMFRI)

The data was collected, analyzed and presented graphically using tables and bar graphs as they enable easy inferences of the results. After sorting out the questionnaires, data was coded and entered in Microsoft office Excel 2003, computed and analyzed using Statistical Package for Social Science (SPSS) computation package. Numerical ranks were then be assigned to the scores. Rank correlation coefficient analysis would be done to test differences between rankings obtained from the three respondents (fishermen, Managers and scientists)

5.5 Assumptions

This research study assumes that the sample chosen represents the entire population, the survey questionnaire used has validity and is measuring the desired constructs and that the respondents will answer the survey truthfully

CHAPTER SIX

6.0 PRESENTATION AND ANALYSIS OF DATA

6.1 Respondents

Out of 100 questionnaires, 70 were usable. This was a response rate of 70%. Unusable questionnaires included missing sections in either expectation or satisfaction and some failed to return the filled questionnaires. Therefore the data from 70 respondents were analyzed in this study.

6.2 Description of the sample

The survey randomly selected interviewers and the sample interviewed comprised of eight fishermen from each of the seven landing sites. Each landing site comprised of about 40 to 50 local fishermen who were registered to the fishermen group under the beach management unit, spend their entire day either at sea or at the landing site and who have their primary occupation as a fisherman. The rest of the entire local fishermen population comprised of seasonal fishermen who do not spend their entire day at sea but fish in shifts/turns. The managers interviewed were from Fisheries Department and KWS. The scientists interviewed were from KESCOM, WCS, KWS and Baobab Trust

6.3 Analysis of Results

6.3.1 Impact of different gear on marine physical habitat, biological habitat and on turtles by catch.

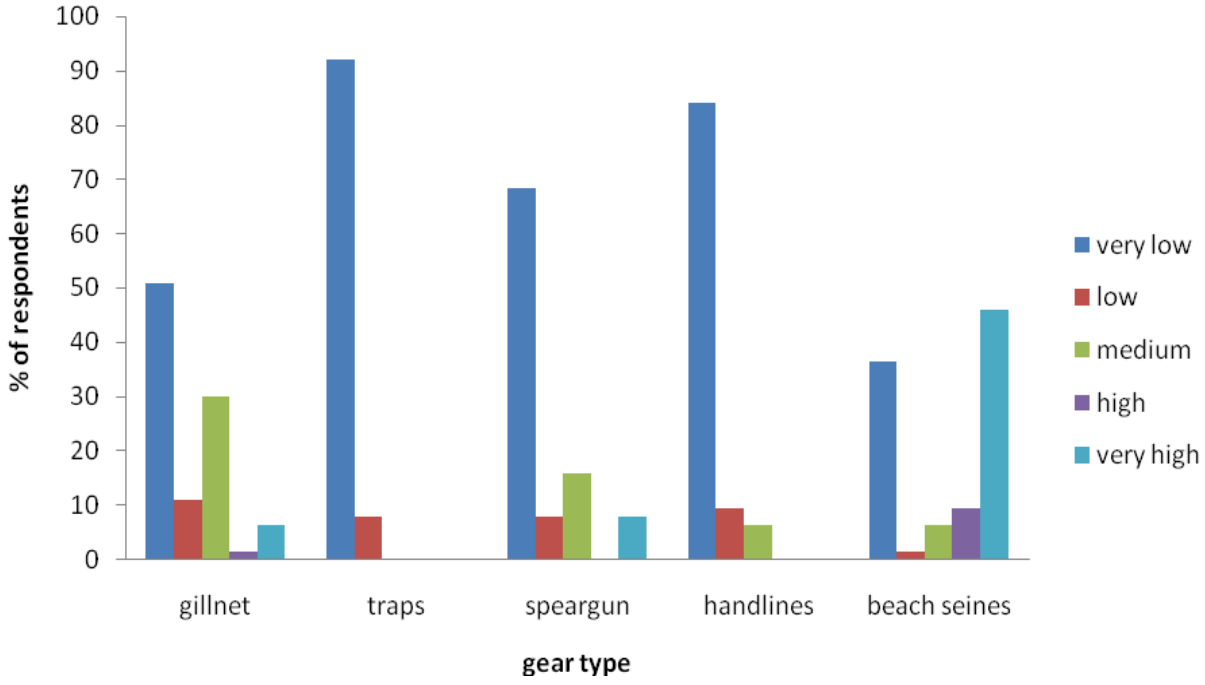

Figure V: Graph showing the impact of different gear types on the marine physical habitat

Figure V shows that traps were ranked very low by over 90% of the respondents (fishers and scientists) while 70% and 85% of the respondents ranked Spearguns and handlines respectively to also have very low impacts on physical habitat. Gillnets were ranked to have a medium rate impact on the physical habitat while Beach seines had the highest impact.

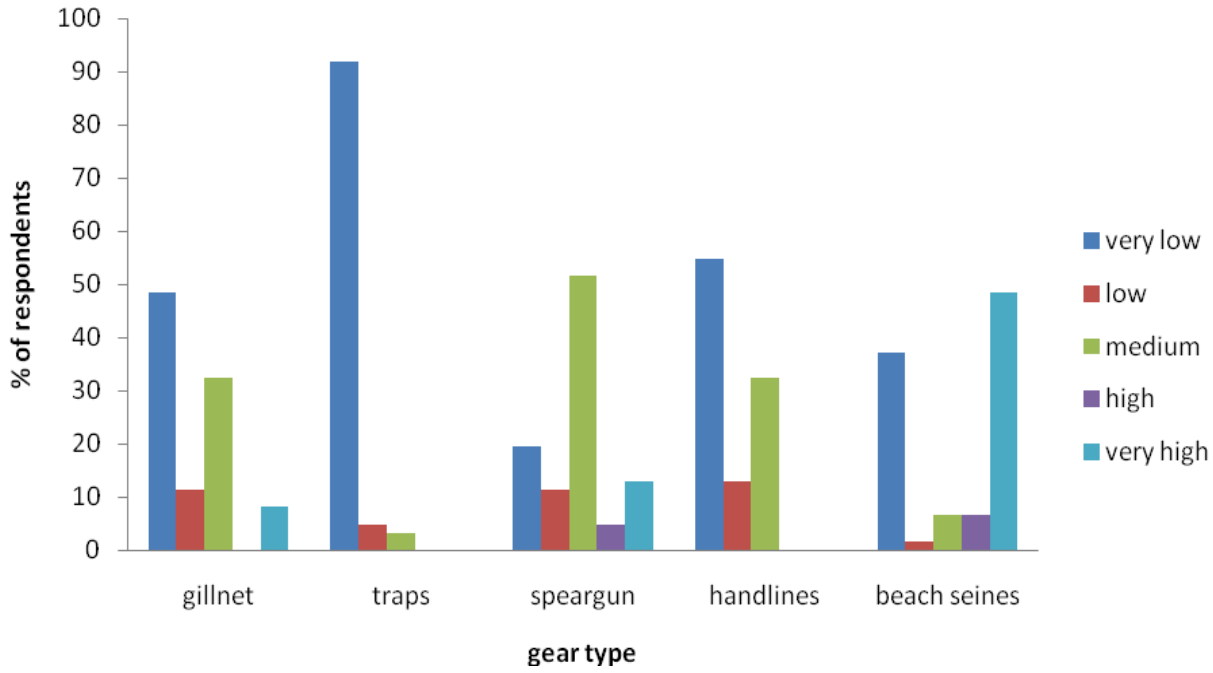

Figure VI: Graph showing the impact of different gear types on the biological habitat

In Figure VI Beach seine still ranked as having the highest impact on biological habitat. 35%, 55% and 35% of the respondents ranked Gillnets, Spearguns and handlines respectively as having medium impacts while over 90% of the respondents ranked traps with lowest impact on biological habitats

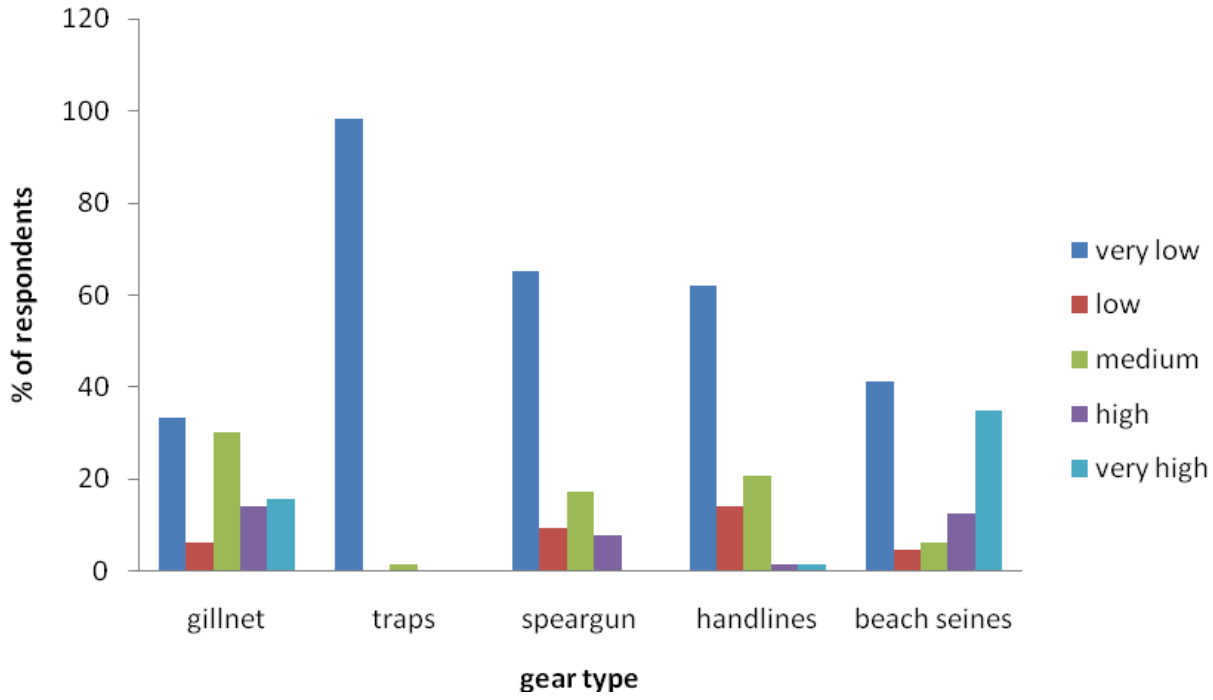

Figure VII: Graph showing the impact of different gear types on turtle by catch

Figure VII shows that Trap fishing has the lowest impact on turtle. Beach seines are ranked as having the highest impact followed by gill nets then handlines and spearguns.

6.3.2 Comparison of ranking by different fisher groups

The null hypothesis to be tested here states that there is no difference in impact rating of different fishing gear. To test if there is significant agreement in ranking assigned by different fishing groups a non parametric test was performed. This was done using Kendalls test at 5% of significance level. There were seven sets of ranking and the coefficient of concordance for judging significant agreement in ranking by different fisher groups. The ranking is significant at the 0.05 level (2-tailed). There is significant ranking by the seven fisher groups at 5% level. The null hypothesis was therefore accepted.

6.3.3 Comparison of ranking between fishers and others (managers and scientists)

The null hypothesis to be tested here states that there is no difference in stakeholders ranking. A non parametric test was used to test the hypothesis. Since there were only two sets of ranking of the four types of gear (Jarife, mkano, maruwara and lasha), the Spearman's coefficient of correlation was used. The results show that there is agreement in the ranking at 0.01% (significant at the 0.01 level). The null hypothesis was therefore accepted.

CHAPTER SEVEN

7.0 DISCUSSIONS OF THE RESULTS

Traps have been ranked by over 90% of the respondents to have a very low impact on the destruction of physical and biological habitats as well as on turtle bycatch. (Fig V & VI) This is because traps are less energy intensive fishing gear which are highly selective and only catch target species. Once set at the correct place they do not interfere with the biological habitats. They are not able to capture turtles (Fig VII) since turtles are stronger than the traps and when they come into contact with them they get destroyed in the process. At the Mombasa Marine Reserve they are only used by the old skillful fishermen.

This study shows that handlines have very low impacts on the physical habitat. (Fig V) This is because they are used from a vessel hence they do not come into contact with the other marine environment except for the water itself. They have medium impacts on the biological (Fig VI) habitat because some of the fauna in the ocean at times swallow the baited hook then manage to remove themselves and escape. This leaves the organisms with a wound which eventually becomes infectious and they may even end up dying. A handline with a monofilament line accounts for the majority of damage to branching gorgonians (69 percent of damage), fire coral (83 percent), sponges (64 percent), and colonial zoanthids (77 percent). This indicated that a gorgonian sponge-dominated reef would be more susceptible to damage from lost hook and line gear than coral-dominated reefs. They have a medium impact on turtle bycatch since most of the handlines used at the Mombasa reserve have a “J” shaped hook, which can be snagged or swallowed by turtles. (Fig VII)

Spearguns have a medium impact on the biological habitat (Fig VI) since at the Mombasa Marine they are used by skin divers especially at night who dive in the water and target the marine organisms. Some of the organisms may be bruised in the process and some even end up dying. They have a very low impact on turtle bycatch (Fig VII)

since the sea turtles are no longer target species for local fishermen and are only caught accidentally.

Gillnets were ranked to have a medium impacts on the physical, biological and on turtle bycatch (Fig. V, VI &VII) this is mainly because at the marine reserve gillnet is the commonest fishing gear used by every fisherman. This is because of the introduction of fine synthetic fibers such as nylon. This material is cheaper and easier to handle, lasts longer and requires less maintenance than the natural fibers. In addition, multifilament nylon, monofilament or multimonofilament fibres become almost invisible in water, so nets made with synthetic twines generally catch greater numbers of fish including other non target species. The negative impacts of the gear include; when dragged along the bottom by strong currents and wind during retrieval, they potentially harm fragile organisms like sponges and corals; those in shallow water with tidal bidirectional flows, can impact benthic environments through smothering, abrasion, "plucking" of organisms, meshes closing around them, and the translocation of sea-bed features; lost nets interfere with normal fishing practices, possibly leading to further gear loss, and that reefs are smothered to the extent that reef fish may have reduced access.

Beachseine was ranked by the respondents to have the highest impacts on the physical, biological and on turtle bycatch (Fig V, VI &VII). This is because they indiscriminately kill huge numbers of fish and other marine life with no regard to species, age, or season; they destroy habitat; they damage coral and sea grass beds, destroy critical nursery, foraging, spawning, and refuge areas for fish and shellfish; at times they drift away with the current or are forgotten, entangling endangered sea turtles and a range of other marine life. The common practice of the local fishermen at the reserve is to leave the nets unattended in nearshore waters for long hours and often overnight. This practice has severely damaged our coral reef ecosystems and depleted fish stocks.

In this study the non parametric Kendalls test at 5% of significance level showed us that 95% of the different fisher groups in the seven landing sites; Mtwapa, Marina, Bamburi Pirates, Nyali Reef, Nyali Msanakani, Nyali Mkomani and English Point ranked the fishing gear (Beachseine, Gillnets, Spearguns, Handlines and Traps) the same way.

The fishermen interviewed each had an experience with all the fishing gear in this study. They all agree that Beachseine has the highest negative impacts on the physical, Biological and turtle bycatch and feel that the government through fisheries department should ban the gear completely. Spearman's coefficient of correlation was used and this showed that 99% of the stakeholders including the fishermen, scientists and managers agreed that the nets with the highest probability of catching sea turtles are the Jarife also known as the Shark gillnet made of cotton fiber with a mesh size of 4 to 10 inches and Lasha which is a gillnet made of cotton fiber with a mesh size of 10 to 12 inches. These gillnets catch sea turtles because of their large mesh size which in turn trap them by their limbs and neck. The turtles then struggle and end up dying and when they escape they have injuries which may also cause death. Mkano which is a monofilament gillnet made of synthetic fiber with a mesh size of 0.3cm to 3 inches and Maruwara a gillnet made of cotton fiber with a mesh size of 1 inch were ranked to have least impact on turtle bycatch this is because of their small mesh size. The nets also get destroyed when they come into contact with the sea turtles because they are small in size and are also weak.

CHAPTER EIGHT

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

8.1.1 Overcrowding

The inshore fishing grounds at the marine reserve have experienced increased use by fishermen. Technological and economic considerations limit fishermen to certain areas around the island, where the resultant crowding may directly drive fish away. Moreover, repeated use of some fishing gear over a short time interval can easily damage the environment and may result in overfishing and turtle bycatch

8.1.2 Destructive Fishing Methods

The most destructive method in the Mombasa reserve is the Beachseine "Juya" It damages the environment, taking of juveniles as well as adults of target species and non target species like the sea turtle and also the killing of any other animals in the fished area, causes damage to slow growing corals and the associated organisms and the environment. The other destructive method around the reserve is the speargun and the gillnets. Such destructive methods evolved and persist mainly for economic reasons. The increasing unemployment rate and cost of living has resulted in overcrowding of the fishing grounds and conventional artisanal gear is no longer adequate to compete successfully. Consequently any method that works is used regardless of its ecological effects and stocks become fully exploited or even overfished.

8.1.3 Poverty and the Lack of Environmental Awareness

With the growing population at the Kenyan Coast and in the absence of suitable alternative employment on land, fishing effort and undesirable fishing methods are likely to proliferate. The poor fishermen around the Mombasa marine reserve have large families and they are naturally more concerned with the short- range problem of subsistence than with the long term of his methods. They are also unaware of their destructive potential. This problem requires immediate action because of the great effort needed to convince such fishermen to be environmentally conscious.

8.1.4 Deficiencies in the Fisheries Management and Research Sectors

Current landing statistics are not informative enough to be used for monitoring or planning when it comes to the management of sea turtles. The emphasis is on total catch of other fish species with little attention paid to individual turtle species, their local distribution or time series data on them. Efforts to improve fisheries data collection on sea turtles have been hampered by financial constraints, with a resultant lack of manpower and equipment.

Not enough scientific observations of fishermen's activities has been done, making them feel neglected and non important in the strategy to conserve and manage sea turtles. This makes it difficult to predict their behavior under differing socio-economic and environmental situations. The present data collection procedures are not geared towards monitoring their conditions and so will not improve this situation.

8.2 RECOMMENDATIONS

The fisheries department should eliminate the use of all beach seines on the inshore waters of the Mombasa marine reserve and the much depleted areas in the Indian Ocean. Prohibit the use gillnets at night, limit their length and mesh size this will require the nets to be registered and constantly attended, except for brief intervals. I totally support an immediate and total ban on the use of all beachseines since they nets capture more fish than a person needs in a given day, are indiscriminate and they compromise replenishment, destroy habitat, even with best practices, they are dangerous to endangered and threatened marine mammals and marine resources that are already stressed especially the sea turtle

The fisheries department should document the history of the local fishing industry in detail, tracing the changes in gear, boats and methods. Also the reasons for these changes. With an understanding of the factors involved, it would be possible to predict and guide the future of the industry. It should also describe the industry's present status to all its stakeholders, including the cost and lifespan of different boats and gear, the buying and selling prices of fish at various locations, the problems with current fishing strategies and possible alternative methods. This will make the fishermen feel that they are also protected and this will enhance in built sea turtle management and conservation.

Kenya Wildlife Service should demarcate and map the fishing grounds so that observations and research can be area specific.

The scientists and managers should assess and monitor the sea turtles on a continuous basis, noting changes in species abundance, composition and age structure. This could be accomplished through direct observation or planned resource surveys. They should also monitor the environment and associated parameters regularly, including physical observations to assess damage caused by destructive fishing methods, basic biological research on reproduction, food webs and species interaction, and assessment of the quality of the environment as a habitat.

The managers and scientists should improve data analysis and dissemination. This is necessary not only to direct research, but also to determine management strategy and regulations. The establishment of an institution with the legal mandate to collect and store information concerning artisanal fisheries would ensure an accessible, comprehensive database.

9.0 REFERENCES

Gilman, E. (Ed.). 2009. Proceedings of the Technical Workshop on Mitigating Sea TurtleBycatch in Coastal Net Fisheries. 20-22 January 2009, Honolulu, U.S.A. Western Pacific Regional Fishery Management Council, IUCN, Southeast Asian Fisheries Development Center, Indian Ocean – South-East Asian Marine Turtle MoU, U.S. National Marine Fisheries Service, Southeast Fisheries Science Center: Honolulu; Gland, Switzerland;Bangkok; and Pascagoula, USA.

Glaesel H. 1997 Fishers, Parks and Power: The social environmental dimensions of marine resource decline and protection at the Kenyan coast. PhD Thesis, University of Wisconsin. Madison. USA

Kairu, K.K. 1997. Vulnerability of the Kenyan Shoreline to Coastal Instability. In: Sustainable Coastal Development through Integrated Planning and Management Focused on Mitigating the Impacts of Coastline Instability. Whitesands Hotel, Mombasa, 23-25 June 1997. UNESCO, Nairobi, Kenya. Pp 13 – 25.

Kaunda - Arara B, Rose G.A Muchiri M.S, & Kaka R. 2003 Long term trends in coral reef fish yields and exploitation rates of commercial species from coastal Kenya. West Indian Ocean J. Mar. Sci. 2:105-116

Kaunda - Arara B. 1997 Analysis of fish catch data from 1985- 1994 in the Kenyan inshore marine waters. Afr. J. Hydro. Fish 7:126

Kenya Wildlife Service Mombasa Marine Park Management Plan

Kenya Wildlife Service, 2007 Annual Report

KMFRI. 2002. Current Status of the Trawl Fishery of Malindi-Ungwana Bay. KMFRI Unpublished Report 12pp.

Kohari C. R 2004. Research Methodology: Methods and Techniques. New Age International Publishers pp 401

Kosuke Yokota, Masashi Kiyota & Hiroshi Okamura, 2009. National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Orido, Shimizu, Shizuoka, Japan Report

Mbendo J.R. & Mbwana F.H 1995: Survey of sea turtles nesting beaches and foraging habitats in Kenya. 15 pp

Mc Clanahan T.R & D. Obura. 1994. Status of Kenyan coral reefs. Coastal Management 23: 57-76.

Mc Clanahan T.R & Mangi S. 2001: The effects of a closed area and beach seine exclusion on coral reef fish catches. Fish. Mgmt. Ecol. 8:107-121

Mc Clanahan T.R, Glaesel H., Ruebens J & Kiambo R. 1997: The effects of traditional fisheries management yields and the coral reef ecosystems of southern Kenya. Environ. Cons. 24: 105-120

Mc Clanahan T.R. 1988: Seasonality of East Africa's coastal waters. Marine Ecology Progress Series. 44: 191199.

Mc Clanahan T.R. 1997: Effects of fishing and reef structure on East Africa coral reefs. Proceedings of the International Coral Reef Symposium 8: 1533-1538.

Moises Mug Journal, 2004 WWF Central America Regional Programme Office San Francisco de Dos Rios San José / Costa Rica /

Monica Echeverria, 2008 World Wildlife Fund (WWF), and the Inter-American Tropical Tuna Commission (IATTC). Press Release

Mueni, E. & J. Mwangi. 2002: Trawler survey along the Kenyan coast. KWS report 11pp.

Mwanje, J.I. 1997. Socio-economic impacts of coastal instability (Erosion) in Kenya: A Case Study. In: Sustainable Coastal Development through Integrated Planning and Management Focused on Mitigating the Impacts of Coastline Instability. Whitesands Hotel, Mombasa, 23-25 June 1997. UNESCO, Nairobi, Kenya. pp 26-40.

Obura D. O, 2001 Kenya. Mar. Pollut. Bull 42:1264-1278

Ochiewo J. 2004 Changing fisheries practices and their socio-economics implications in south Coast Kenya. Ocean Coast. Mgnt. 47:389-408

Sebastian Mathew International Collective in Support of Fishworkers 27 College Road, Chennai 6000006, India

UNEP. 1998. Eastern Africa Atlas of Coastal Resources: Kenya (EAF/14) United Nations Environment Program, Kenya 119pp.

Wamukoya, G.M. & J.R. Mbendo. 1995: Incidental capture of sea turtles in Shrimp trawl fisheries in Kenya. KWS Technical Report Series. 6 pp.

Wamukoya, G.M., F.P. Kaloki & J.R. Mbendo. 1997. Sea Turtle Recovery Action Plan for Kenya (STRAP). KESCOM Technical Report Series. 69pp.

Wamukoya, G.M., J.M. Mirangi & W.K. Ottichillo. 1994: Marine aerial survey; marine mammals, sea turtles, sharks and rays, KWS Technical Series Report 1:22pp.

APPENDICES

APPENDIX II
QUESTIONNAIRE FORM NO……

Dear Respondent,
My name is Hope Mwanake, a student at Egerton University. I am attached at KWS (Mombasa Marine Park) and carrying out a study aimed at assessing the impacts of artisanal fishing methods on sea turtles. The findings from this questionnaire will purely be used for academic purposes. Please fill in parts 1, 2 and 3 of the questionnaire.

PART ONE

1. Primary occupation……
2. Institution/organization/company……..

PART TWO

Using the scale 1-5 provided please rate the impact of each gear on the following three parameters listed below (a, b and c) 1-Very low, 2-Low, 3-Medium, 4-High and 5-Very high

a) Marine Physical Habitat

Gillnets	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Traps	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Spearguns	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Handlines	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Beach seine	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

b) Biological Habitats

Gillnets	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Traps	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Spearguns	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Handlines	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Beach seine	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

c) Turtle Bycatch

Gillnets	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
Traps	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

Spearguns	1	2	3	4	5
Handlines	1	2	3	4	5
Beach seine	1	2	3	4	5

PART THREE

Gillnets are known to cause more turtle deaths from incidental catches. There are at least 4 types of gillnets used by local fishers as listed below. Using the pair wise comparison approach on the given 6 pairs of gillnet types, please pick the type that has a higher impact on turtle by catch, then rate its impact on the scale of 1-5.

Description of Gillnets

Mkano- Is a monofilament gillnets made of Synthetic fiber with a mesh size of 0.3cm to 3 inches.

Maruwara- Gillnet made of cotton fiber with a mesh size of 1 inch.

Jarife- Known as the Shark gillnet made of cotton fiber with a mesh size of 4 to 10 inches.

Lasha- A gillnet made of cotton fiber with a mesh size of 10 to 12 inches.

(a) Jarife Vs Mkano

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

(b) Jarife Vs Maruwara

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

(c) Jarife Vs Lasha

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

(d) Mkano Vs Maruwara

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

(e) Mkano Vs Lasha

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

(f) Maruwara Vs Lasha

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

TURTLE BY CATCH LOW				HIGH
1	2	3	4	5

THANK YOU

Appendix III: Kendalls test

		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Group 1	Correlation Coefficient	1	1	0.333333	1	1	0.666667	1
	Sig. (2-tailed)	.	0.04154	0.496906	0.04154	0.04154	0.174231	0.04154
	N	4	4	4	4	4	4	4
Group 2	Correlation Coefficient	1	1	0.333333	1	1	0.666667	1
	Sig. (2-tailed)	0.04154	.	0.496906	0.04154	0.04154	0.174231	0.04154
	N	4	4	4	4	4	4	4
Group 3	Correlation Coefficient	0.333333	0.333333	1	0.333333	0.333333	0.666667	0.333333
	Sig. (2-tailed)	0.496906	0.496906	.	0.496906	0.496906	0.174231	0.496906
	N	4	4	4	4	4	4	4
Group 4	Correlation Coefficient	1	1	0.333333	1	1	0.666667	1
	Sig. (2-tailed)	0.04154	0.04154	0.496906	.	0.04154	0.174231	0.04154
	N	4	4	4	4	4	4	4
Group 5	Correlation Coefficient	1	1	0.333333	1	1	0.666667	1
	Sig. (2-tailed)	0.04154	0.04154	0.496906	0.04154	.	0.174231	0.04154
	N	4	4	4	4	4	4	4
Group 6	Correlation Coefficient	0.666667	0.666667	0.666667	0.666667	0.666667	1	0.666667
	Sig. (2-tailed)	0.174231	0.174231	0.174231	0.174231	0.174231	.	0.174231
	N	4	4	4	4	4	4	4
Group 7	Correlation Coefficient	1	1	0.333333	1	1	0.666667	1
	Sig. (2-tailed)	0.04154	0.04154	0.496906	0.04154	0.04154	0.174231	.
	N	4	4	4	4	4	4	4

Correlation is significant at the 0.05 level (2-tailed).

Appendix IV: Spearmans Correlations

Spearman's rho	VAR00001	Correlation Coefficient	1.000	1.000(**)
		Sig. (2-tailed)	.	.
		N	4	4
	VAR00002	Correlation Coefficient	1.000(**)	1.000
		Sig. (2-tailed)	.	.
		N	4	4

** Correlation is significant at the 0.01 level (2-tailed).

APPENDIX V: ATTACHMENT PROGRESS

The attachment progress started on the 27th of May 2009. However, during the attachment, the work plan was deviated due to the work available at the station.

Field Attachment Work Plan

Date	Duration	Activities	Descriptions
27th to 31st May, 2009	1 Week*	Orientation	To be familiarized to the institution, its activities, code of conduct and staff
1st to 7th June, 2009	1 Week*	Project proposal development	Develop a proposal on a project to do during the attachment period
		Development of a questionnaire	Develop a questionnaire for data collection of my project
		Table proposal to my supervisor	Give my supervisor the project proposal and make necessary corrections on it
8th June to 5th July, 2009	4 Week*	Work in the biodiversity, research and monitoring department	Involve myself with the activities of the ongoing project of national strategy for the sea turtle conservation and management
6th to 19th July, 2009	2 Week*	Work in the tourism department with Mr. Timothy Ikime the tourism officer	Do the boat patrols around the Mombasa Marine National Park and reserve Snorkel in order to observe the various coral species and the type of fish associated with them.

			Visit the various tourist hotels in Mombasa for the purpose of marketing the Mombasa National Park.
20th July to 2nd August, 2009	2 Week*	Data collection	Visit the seven landing sites to collect data from the fishermen and the various institutions to administer the questionnaires to the scientists and managers.
3rd to 9th August, 2009	1 Week*	Data analysis	Analyze the data collected based on the project objectives
		Assessment	Expecting assessment from the University assessor
		Preparation of project and attachment report	Prepare a report on the project for the institution supervisor and the University's attachment coordinator
10th to 16th August, 2009	1 Week*	Attend the Agricultural Society of Kenya (ASK) show	Held at the Mkomani show grounds Mombasa.

*during this period, apart from the planned project work, other duties as directed by the institution supervisor were done.

Week	Activity Description
One	Given a tour of the station including the research department, smartcard, tourism, library, human resource, security, radio, intelligence and accounting department.
Two	- Met Dr. Mohammed and his research department colleagues. I was given an orientation of the national strategic plan of the turtle conservation. - Started to develop a proposal for my project. - Visited the Mombasa Marine Park offices at the Bamburi Pirates for the orientation of their daily activities. - Entered data from various parks at the Coast Conservation Area in the tourism database. - Attended the World Environmental day celebrations held at the Dr. Haller's park.
Three	- Attended the World Oceans day activities at the Jomo Kenyatta public beach - Continued with my proposal writing. - Went for a boat patrol and snorkeling. - Visited turtle nesting sites along the beaches at the park and reserve. - Interviewed local communities about their take on the sea turtle conservation
Four	- Had a group discussion with the other students and the tourism officer about the Mombasa marine park and reserve, its functions, importance, management practices and its challenges. - Visited the turtle nesting sites at the Vipingo beach in the North Coast. - Visited Kilifi fisheries department. - Did some work at the radio department.
Five	- Went for boat patrol at the park and reserve - Snorkeled to observe the coral and fish species

- Visited nesting site of turtles at the Serena beach where natural nests that are in danger are translocated.
- Recovered a baby Sykes monkey, which was being kept as a pet at Likoni as part of KWS's problem animal control programme
- Recorded information in the tourism database.
- Went to Arabuko Sokoke National park to hand over the two and a half old baby Sykes for rehabilitation before release into the wild.
- Went to meet Watamu and Malindi turtle stakeholders including the community to facilitate the formation sea turtle site committee.

Six

- Worked at the smart card Point of Issue and Point of Sale department.
- Visited the Southern Cross Safaris with the customer care officer at the Point of Sale as a follow up visit and a marketing strategy for the smartcard electronic system.
- Went for boat patrol at the park and reserve.
- Snorkeled to observe the coral and fish species.
- Attended a beach clean up event organized by the Wildlife Clubs of Kenya at the Jomo Kenyatta public beach.

Seven

- Went to work at the security department.
- Went to work at the intelligence department.
- Went to a meeting hosted by Ms Shamsa who was part of the exchange program between KWS and the Uganda Wildlife Association.
- Went for boat patrol at the park and reserve.
- Snorkeled to observe the coral and fish species.
- Attended a meeting at Serena beach hotel where members of the Mombasa community and other stakeholders in turtle conservation met to select their site committee

Eight - Went to work at the Human resource department.
- Went to work at the Accounts department.
- Analyzed questionnaires issued to the communities and complied reports at the research department.

Nine - Finished my proposal.
- Developed the questionnaire for my project.
- Met my field assistant Mr. Emanuel Yaa who is a fisherman.
- Worked on the final logistics on my field work scheduled for the following week.

Ten -Went out to the field for data collection of my project.

Eleven -Analyzed my data.
-Went to Kisite/Mpunguti at Shimoni for a meeting on site committee formation for sea turtle conservation.
- Went to Kilifi for a meeting on site committee formation for sea turtle conservation.

Twelve -Finalized my report and handed it to the Warden, Mr Arthur Tuda who was my supervisor.
-Attended the Agricultural Society of Kenya show as a presenter at the Kenya Wildlife Stand.