

**CONTRIBUTIONS OF FISHING TO THE HOUSEHOLD INCOME IN MAFIA  
DISTRICT, TANZANIA**

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## ABSTRACT

Fishing sector is responsible for providing critical income for many families within fishing communities. Fishing activities explain the levels of income in which at the end indicate whether a given fishing household is benefiting. This study was undertaken to assess the contribution of fishing to the household income in Mafia District. The data were collected from random sampled 120 household heads using several methods such as questionnaire survey; Focus Group Discussions (FGD), checklist and field observation. These were the main tools used in the collection of socio-economic data. The collected data were analyzed by using inferential statistics, descriptive statistics and Content analysis. Box plot was used to establish the significant relationship between contributions of household income from fishing with other economic activities. On the other hand, Content analysis was used in the analysis of qualitative data. The result revealed that several economic activities are conducted in the study area, where 41.47% of the respondent indicated that fishing is the major economic activity in their households. The results further showed that household average incomes received from household conducting fishing alone as the main economic activity was 51 250 TZS, fish related activities was 15 000 TZS and other economic activities was 5000 TZS per day. Since the study has revealed that fishing contributes higher income in household than other activities, therefore the study recommends that most of the households in the study area do not have access to credit for improving their activities especially fishing it is better for the government to provide improved fishing gears for fishers with low interest rate.

**DECLARATION**

I, ANTHONIA MPEMBA do hereby declare to Senate of Sokoine University of Agriculture that this dissertation is my original work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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.....  
Date

The above declaration is confirmed by;

.....  
Dr. F. Mombo  
(Supervisor)

.....  
Date

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## **DEDICATION**

This work is dedicated to my parents Mr. (late) Martin and Mrs. Angelita Mpemba who laid the foundation of my education. Also it is dedicated to my sister Faraja who used to take care of my lovely son Ian Mmbaga during my absence.

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## LIST OF ABBREVIATIONS

AIMS	Assessing the Impacts of Microenterprise Services
BOT	Bank of Tanzania
df	Degree of freedom
DFID	Department for International Development
DF <sub>s</sub> O	District Fisheries Officer
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
MCAT-	Millennium Challenge Account-Tanzania
MLDF	Ministry of Livestock Development and Fisheries
Mt	Metric tones
NE	North East
OECD	Organization for Economic Co-operation and Development
PCA	Principle Component Factor Analysis
SE	South East
SPSS	Statistical Package for Social Sciences
TANPESCA	Tanzania Processing and Exporting Seafood
TZS	Tanzanian Shillings
URT	United Republic of Tanzania
USAID	United States Agency for International Development
$\chi^2$	Chi square



## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background Information

##### 1.1.2 State of world fisheries

From earliest time, fishing has been a major source of food for human and a provider of employment and economic benefits to those who are engaging in this activity. Although, with the increased knowledge and the dynamic development of fisheries, it has been realized that aquatic living resources, though are renewable, are not infinite and need to be properly managed, their contribution to the nutritional, economic and social wellbeing of the growing world's population is sustained (FAO, 2005).

Many millions of people around the world find a source of income and livelihood in the fisheries and aquaculture sector. For the last five decades global fish production has grown in an increasing of food fish supply at an average of 3.2 percent annually, outpacing world population growth by 1.6 percent (FAO, 2014). World Bank, FAO and World Fish Center, reported there is an estimated annual production of 48 million tons of fish originating from small-scale fisheries (De Graaf *et al.*, 2011). Basically the world per capita apparent fish consumption has increased from an average of 9.9 kg in the 1960s to 19.2 kg in 2012. This impressive development has been driven by a combination of population growth, rising incomes and urbanization, and is facilitated by the strong expansion of fish production and more efficient distribution of channels (FAO, 2014).

China has been responsible for most of the growth in fish availability, owing to the dramatic expansion in its fish production, particularly from aquaculture. Its per capita apparent fish consumption also has increased at an average annual rate of 6.0 percent in

the period 1990 -2010 to about 35.1 kg in 2010. Annual per capita fish supply in the rest of the world was about 15.4 kg in 2010 (11.4 kg in the 1960s and 13.5 kg in the 1990s (FAO, 2014).In Tanzania the average per capita annual fish and shellfish consumption is estimated to be 5.5 kg(USAID, 2015).

By the year 2012 about 58.3 million people engaged in the primary sector of capture fisheries and aquaculture, where 37 percent engaged in full time, 84 percent of all people employed in the fisheries and aquaculture sector are in Asia, followed by Africa which has more than 10 percent (FAO, 2014).

Employment in fisheries sector has grown faster than the world's population. Overall, women accounted for more than 15 percent of all people directly engaged in the fisheries primary sector in 2012. The proportion of women exceeded 20 percent in inland water fishing and up to 90 percent in secondary activities especially processing. FAO estimates that, overall, fisheries and aquaculture assure the livelihoods of 10 to 12 percent of the world's population (FAO, 2014).

World Bank (2012) found that in Africa, the total employment in the whole fisheries sector at 25.4 million people, 7.8 million were employed in fishing and 17.6 in post-harvest. MLDF (2010) reported that, in Tanzania more than 4 million people engaged in fishing and fisheries related activities, while more than 400 000 fisheries operators are directly employed in the sector.

### **1.1.3 Fisheries in Tanzania**

Tanzania is among of the Country in Africa which is endowed with water resources, sharing three of the largest inland lakes in Africa, namely Lake Victoria, Lake Tanganyika and Lake Nyasa, diverse river systems, numerous wetlands, and the Indian Ocean. The

country is reasonably rich in marine and inland fishery resources making the fisheries sector important in the economy (Sobo, 2012). Both fish culture and capture fisheries has contributed much in Tanzanian economy.

The contribution of the aquaculture to national food security and economic development is extrapolated at 1522.80 tones. This is about 0.435 percent of the average annual fish landings which is around 350 000 tones. At present aquaculture is largely a subsistence activity practiced by poor households in the coastal and inland areas but the benefits arising from it are several, it contributes to people's requirements for animal protein, particularly in the rural areas where there are no capture fisheries, and it provides employment opportunities and is a source of income (FAO, 2010).

It is also reported by FAO (2012) that, Tanzania is among of the main producer of fish for inland fisheries in Africa where mostly fishing in the Lake Victoria and Lake Tanganyika. The major commercial species in Lake Victoria are Nile perch (*Lates niloticus*); *Rastrineobola argentea* commonly known as “Dagaa” and Nile tilapia (*Oreochromis niloticus*); while the major commercial species in Lake Tanganyika are the Centropomidae (*Lates stappersii*) (commonly known as “Migebuka”). Tanzania was ranking in the top 10 worldwide as a producer of inland waters capture (FAO, 2014) and was amongst top 10 countries in Africa in terms of total capture fisheries production (FAO, 2003).

For marine fisheries, the commercial marine fisheries are mainly concentrated in the Exclusive Economic Zone (EEZ) targeting the tuna and tuna-like species. The major tuna and tuna-like species contributing to the catches include Yellow fin tuna, Skipjack tuna, Big eye tuna, Long tail tuna, and Kawakawa (Anon, 2005). Small scale fishing however is conducted by artisanal fishers who fish for fin fish, mollusks and crustaceans within the

inshore. Tanzania as the Eastern Africa Region, among 13 African countries and 57 countries in the world produced over 200 000 metric tons in 2010 (FAO, 2012).

The total annual fish production in Tanzania was 347,157 metric tons in 2010 (MLFD, 2010) and reported as the main source of protein to nearly 9 million people living along the coast, and provides source of employment and livelihood to a substantial number of people (MLFD, 2010).

The contribution of fishing activities has remained fairly constant over the last decade ranging between 4.4% and 5.7% per annum and a period average of 4.6%. Starting from a low 2.9% annual growth in 2000, the sector's growth rate increased to around 6% between 2002 and 2005, and has since steadily dropped to 1.5% in 2010. The decrease in growth between 2009 and 2010 has been attributed to illegal fishing, and destruction of nursery grounds. Currently, the sector accounts for about 10% of the national exports (Planning Commission, 2012; MLFD, 2014).

Small-scale or artisanal fisheries is still developing rapidly through export markets and adopting new technologies like satellite positioning systems which make easier for fishers to search fish (Hamidu, 2012). In fact, a large number of the people in Tanzania who are living in coastal zone are surrounded by rich marine resources. They utilize the resources for subsistence and as a source of income in the households. Among of the resources, fish being the most important compared to others, (Jidawwi and Ohman, 2002). Different fishing gears are being used to capture those marine resources though they are none sophisticated. At least each household is engaging in fishing activity either direct or indirect often benefits from such resources. Although fishing has been conducted for

several years, still continues to be an important source of household income and food as well.

## **1.2 Problem Statement and Justification of the Study**

### **1.2.1 Problem statement**

Tanzania is gifted with water resources, and is sharing with other three countries of the largest inland lakes in Africa, which are Lake Victoria, Lake Tanganyika and Lake Nyasa with diverse river systems, abundant wetlands, and the Indian Ocean. The country is rationally rich in marine and inland fishery resources making the fisheries sector important in the economy; thus it cannot be understated (Sobo 2012).

Fisheries provide substantial employment, income, livelihoods, recreation; foreign earnings and revenue to the country (Sobo, 2012). Marine and inland fisheries are very significant in household in terms of food security and nutrition. Fish provides a significant contribution to animal protein consumption (FAO, 2008). Fisheries also provide both direct and indirect employment. Through employment the income earned from both fisheries and associated activities such as fish processing, fishing agreements, license fees, and from the activities of distant water fishing fleets which are serviced at regional ports contribute to government budgets and to the gross domestic product (FAO, 2008).

According to FAO (2005) majority of households in developing countries are involved in fishing activities either fishers or in fishing related activities whether fulltime, temporary or occasional however there are no clear distinctions between those who are fishing for subsistence and those for income. Moreover, even where fishing is the main livelihood activity within the household, it hardly ever accounts for the entire cash income. Allison and Ellis (2001) also reported that in most developing countries fisheries have often been

described as a last resort occupation in household. In the fishing communities, fisheries have a direct link to household incomes. These household incomes explain the levels of income in these fishing communities which in the end indicate whether a given fishing household is poor or otherwise. In Lake Victoria, the household engaged in fishing (fishers) received net income that ranged between \$1300 and \$2100, while for gear owner earned \$5200 and \$8400 per month (Bilame, 2012). It is also reported that about 40–55% of the income of coastal fishing households in Tanzania is generated by fishing, (Ninnes, 2004).

Similarly Mafia Island is among of the District in Tanzania where the dwellers are practicing fishing and the activity is being supported by the fish processing industry which is located at Kilindoni village where some of the fish products are being sold. Despite the fact that fishing seems to be the main economic activity as explained in the district profile, there is no reliable information that explains the contribution of fishing to the household income. It is therefore appropriate to determine its contribution to the household income.

### **1.2.2 Significance of the study**

The study provides more information on the importance of fishing and its related activities within the household for the people living in Mafia District. It raises awareness on the importance of small -scale fisheries not only because their livelihoods depend on sustainable natural resources base but, because fisheries provide vital local nutritious food and a safety net for many poor household around the community.

Fisheries are of immense scale and economic importance, which also means they have a significant environmental impact that must be managed effectively to ensure sustainability. The coastal fishing communities in Tanzania are particularly sensitive to

climate change due to their high dependence on fisheries for food security and livelihoods. Conservation and adaptive management strategies that foster sustainable fish populations and equitable distribution of resources are urgently needed to mitigate the negative consequences caused by challenges. Furthermore, the findings of the study are useful for future reference to other researchers who are interested to work further in fisheries studies.

### **1.3 Objectives of the Study**

#### **1.3.1 Overall objectives**

The overall objective of this study was to assess the contribution of fishing to the household income in Mafia District.

#### **1.3.2 Specific objectives**

The specific objectives of the study were to;-

- i. Determine household income contributed by fishing activity.
- ii. Determine household income contributed by fishing related activities.
- iii. Examine determinants of fishing income.

#### **1.3.3 Research questions**

- i. To what extent does the fishing contributes to household's income of Mafia community?
- ii. What are the fishing related activities carried out in the study area?
- iii. How much does each fishing related activities contribute to household's income?
- iv. What are the determinants of fishing income?

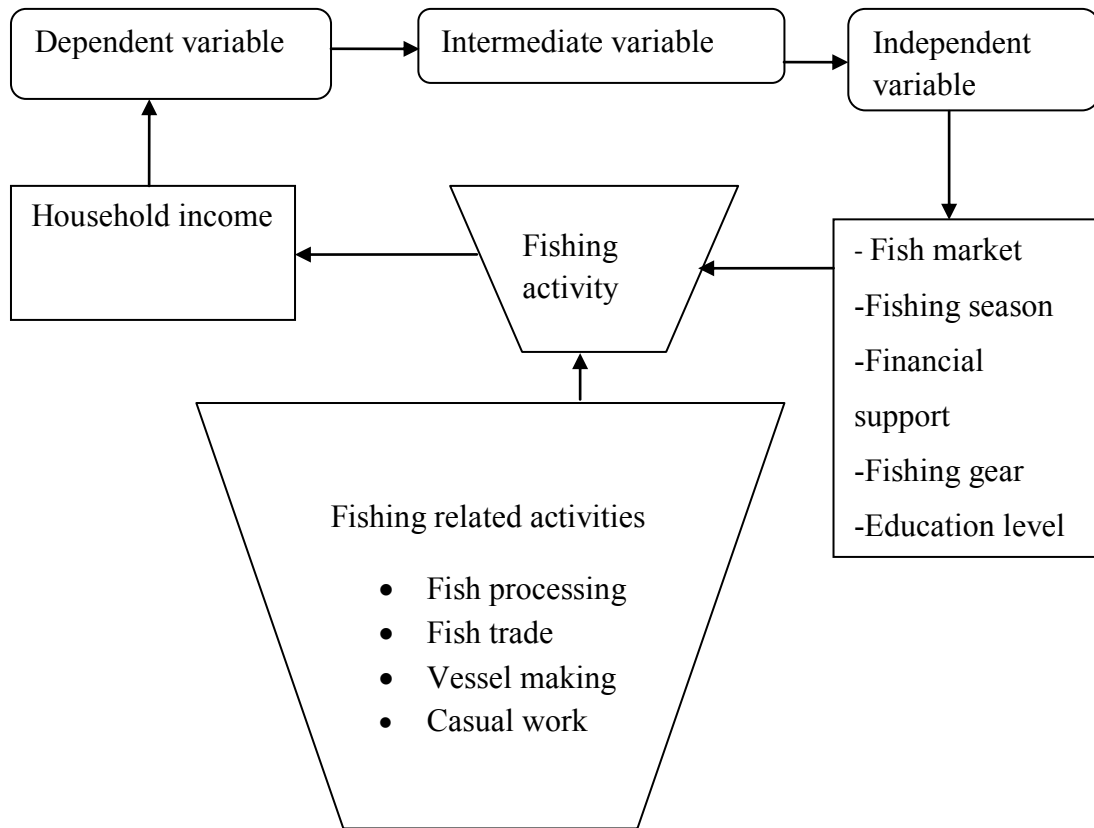
#### **1.3.4 Conceptual framework**

The conceptual framework underlying this study (Fig. 1) is based on the fact that, household income is the function of fishing and its related activities. Income as the output of activities measures both cash and in kind contributions. Fishing activity contributes in

household income directly through selling fish. This activity also depends on several factors including availability of market, favorable fishing season, financial availability, type of fishing gear and the level of education.

Davis (2012) comments that fishermen are constantly faced with making decisions where the financial gain or loss is highly uncertain, such as the choice of species to fish, type of gear to use, and optimal fishing location. His findings indicate that there is relationship between the incomes accrued from fishing with fishing ground, and the gear that has been used to increase fishermen's income in household. Saarrankan (2013) also found that the knowledge and skill of fishing methods, fishing gears, and marketing, particularly skill of identifying fish shoals, changing weather, ocean currents, and winds are vital to the fisherman to be successful in fish catches. Through fishing related activities, households receive their income by practicing these activities including fish trade, making of fish vessels and fish processing, casual work like carrying fish from the vessel to the market, ice making and distribution.





**Figure 1: Conceptual framework of the study**

#### **1.4 Limitations of the Study**

##### **Lack of willingness to disclose income information**

The study encountered several limitations particularly during the data collection exercise. Some households' were not willing to disclose their income level information due to the fear that their information would be exposed to the community in spite of the researcher's effort to explain the purpose of the study. The problem was minimized by changing the questions and the way of justifying questions. This made them (households) to disclose their information unknowingly.

##### **Poor memory of the respondent**

Some of the respondents were unable to recall their exact daily income. This was thought because of the nature of markets for their product especially the fish markets which were

based on bargaining modalities. There were no formal or standard measurement which were used to measure fish which were sold in landing site; some used tray, buckets, etc. Therefore not only that they failed to remember monthly income generated from fishing, but also the amount they sold was difficult to recall. This was minimized by asking the respondents the number of fishing days and the average income they obtained daily.

### **General election**

Some of the respondents were not ready to answer some of the questions presuming that the researcher was collecting information that could be used for campaign, but the researcher assured them that the study is only for research purposes.

### **In appropriate measurement unit**

During data collection respondents were using different means of measuring their catches. Some used bucket of 10 to 20 litres, others uses tray which is equivalent to 5 bucket of 20 litres also others used weighing scale. For that case, it was not easy to calculate the quantity of catch being caught.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

#### 2.1 Fisheries Concept

According to Panayotou (1982) a fishery is typically defined in terms of the "people involved, species or type of fish, area of water or seabed, method of fishing, class of boats, purpose of the activities or a combination of the foregoing features". The definition often includes a combination of fish and fishers in a region, the latter fishing for similar species with similar gear types. Fisheries are activities leading to harvesting fish; it may involve capture of wild fish or raised fish through aquaculture (Blackhart *et al.*, 2006).

#### 2.2 Role of Fisheries in Household

Marine and inland fisheries are very significant in household in terms of food security and nutrition where fish provides a significant contribution to animal protein consumption. Fisheries also provide both direct and indirect employment. Through employment the income earned from both fisheries and the associated activities such as fish processing, fishing agreements, license fees, and from the activities of distant water fishing fleets which are serviced at regional ports contributes to government budgets and to the gross domestic product (GDP) (FAO, 2008).

#### 2.3 Overview of Fisheries in Tanzania

Tanzania has both marine and inland fisheries potential. The marine water covers 64000 square (sq) km which includes the Indian Ocean and the Exclusive Economic Zone which covers 223000 sq km. The fresh water includes the shared waters of East African great lakes namely Lake Victoria, Tanganyika and Nyasa. The country has also other small natural lakes, manmade lakes, river systems and many wetlands with fish potential. All

these water cover 58 000 sq km. The country has coastline of about 800 km declared as its Exclusion Economic Zone but has not yet exploited (DFDI, 2005).

Tanzania has potential to produce over 730 000 metric tons of fish from both captured and aquaculture whereby Lake Victoria have 200 000 mts, Lake Tanganyika 300 000 mts, Lake Nyasa 100 000, marine waters 100 000 mts and other lakes 30 000 mts (DFDI, 2005). Fresh water fisheries accounts for 80% of the landed catch of about 280000 to 320000 tons annually and aquaculture contributes only a very small amount estimated at about 1200 to 1500 metric tons annually (DFDI, 2005).

Fish production and value in the country have indicated oscillating increased trend over the recent past years with the highest quantity of 375534.6 metric tons of fish landed in 2005. For the last five years fisheries sector has been estimated to contribute between 1.6% to 3.1 GDP (BOT, 2013). For example in the year 2013 fish production was 367 854 metric tons valued at TZS1 444 432 520, during the same period, the country earned over 6117769193.74US \$ million as foreign exchange from export of fish and fishery product (MLFD, 2014).

### **Marine capture fisheries**

The marine fishery in Tanzania consists of two categories namely artisanal and industrial. The artisanal and industrial fishing differ in their social and economic perspectives, and to a large extent they serve separate markets or economies. Due to that artisanal fishers supply local or informal markets important for food security, and the industrial fleets supply more affluent domestic or export markets, important to Gross Domestic Product (GDP), (Groeneveld, 2015). Artisanal operates only within the territorial waters (12 nautical miles stretch) and catch is mostly of pelagic fin fish used for domestic and

commercial. The marine industrial fleet included both the territorial waters and beyond in the Exclusive Economic Zone (EEZ). The main target species in the territorial waters are shellfish (shrimps and lobsters), cephalopods and crabs. In the EEZ industrial is exclusively industrial fleet and the bulk of the catch is exported. This fishery is mainly conducted by licensed foreign vessels flying the flags of major fishing countries. The fishing vessels used usually is purse seiners and long liners (FAO, 2007).

## **2.4 Types of Fisheries**

Fish are being caught in several ways which include commercial, recreational and artisanal. These types normally vary from region to region and estimated for the number of fishing trips and fish caught in recreational fisheries (Hanna *et al.*, 2000).

### **2.4.1 Commercial fisheries**

Commercial fishing also known as industrial fishing, is the activity which includes catching of fish and other seafood for commercial profit in both aquaculture and wild fisheries. The activity is mostly practiced as an industry often pursues fish far into the ocean under adverse conditions. The major fishing industries are not only owned by major corporations but, by small families as well. It has a wide range of harvest from tuna, cod, shrimp, lobster, clams, squid crab and other various fish species. The activity also includes processors, brokers, transporters, suppliers and retailers (Sean and Joanna, 2005).

Different methods have been used effectively to catch a large variety of species including the use of pole and line, trolling with multiple lines, trawling with large nets and traps. Environmental friendly gears have been used to eliminate or minimize catching non-targeted species. These gears are designed and updated to avoid catching certain species of

an animal that is unwanted or endangered this is also called fisheries sustainability (Carr, 2000).

It is also reported that through commercial fisheries overfishing occurs because fish are captured at a faster rate than they can reproduce. Both advanced fishing technologies and increased demand for fish have resulted in overfishing. The Food and Agricultural Organization reported that "about 25 percent of the world's captured fish end up being thrown overboard because they are caught unintentionally. Basically these are illegal market species, or are of inferior quality and size. It should not go unnoticed that overfishing has caused more ecological extinction than any other human influence on coastal ecosystems (Carr, 2000).

#### **2.4.2 Recreational fisheries**

Recreational fisheries are those pursued for pleasure and relaxation. The activity includes fish that are retained as well as fish that are released. It is useful since it is a form of business that provides recreational fishing for a fee and business such as marine supplier and hotels that exist to support recreational fishing (FAO, 2012).

#### **2.4.3 Artisanal fisheries**

Artisanal fisheries include all fishers employing low or medium technological equipment, fishing in territorial waters and simple fishing chain operation (Freire and García-Allut 2000). FAO (2011) referred artisanal fisheries as the traditional fisheries involving fishing households using relatively small amount of capital and energy, relatively small fishing vessels, making short fishing trips, close to shore, mainly for local consumption.

Favero *et al.* (2014) reported that there are some common features that explain on artisanal fisheries worldwide. Many people usually use multi-target and a range of gears and

vessels, which are having low capital, invest, and they perform activities along the coast. Therefore, artisanal fisheries provide an important source of employment, while its trade is extremely dependent on intermediaries due to low capital committed and the limited power of fishermen to influence the market not only that shows inadequate access to capital, credit sources and social-welfare, among others, but the one that is out of such challenges.

## **2.5 Household Income**

Schwarze (2004) defined income as the output of activities which measures both cash and in-kind contributions. All the goods and services produced in activities are valued at market producer prices regardless of their use. According to AIMS (2001) household income, levels and diversification of income sources are critical determinants of household welfare. Income levels affect a household's consumption and investment options. Diversification of income sources is a household strategy that can increase income, lower risk by lowering dependence on a single income stream, or smooth income fluctuations over time.

Generally household income, rather than personal income, is the preferred measure for analysis of people's economic well-being. This is because the major determinant of economic well-being for most people is the level of income they have and other family members living in the same dwelling receive. While income is usually received by individuals, it is normally shared with other household members (Canberra Group, 2011). Household income covers from employment (both paid and self-employment), property income, production of household services for own consumption and current transfers received (Canberra Group, 2011).

### **2.5.1 Households income from fishing**

Artisanal fishing is responsible for approximately 90% of all fishing jobs worldwide and it provided critical income for millions of families (Batista *et al.*, 2014). In any fishing communities, fisheries have a direct link to household incomes. This household income explains the levels of income in which at the end indicates whether a given fishing household is benefiting or not (Bilame, 2012).

### **2.5.2 Household income from fishing related activities**

The overall fisheries and aquaculture sector employ more than 3.7 million people in African countries. Female employees represent 19 percent of the total workforce. It has been observed that women are of more importance in fisheries processing activities, but they seem to be low, since they are underestimated processors working as part-time (Graaf and Garibaldi, 2014). However, since women are associated with reproductive work, gender inequalities in access to fisheries resources affect not only the livelihoods of women, but also the entire household (Weeratunge *et al.*, 2010). In Tanzania, Jiddawi and Othman (2002) also reported that women, and sometimes children, play a significant role in collecting seashells, sea cucumber and octopus in the intertidal for a few hours each day usually during low spring tides, using hands and sticks or rods.

Middlemen and traders play an important role in the artisanal fishery, by providing opportunities for fishermen who cannot afford to buy their own gear or vessels (Jiddawi and Othman, 2002; Ochiewo and others, 2010). Middlemen usually own gear (seine or gill nets) or vessels (dhows or boats with engines), which they rent to fishers. Fisheries activities have multiplier effects that manifest through the indirect fishing activities. During high catch season both fishers and other people who engage in fishing related activities they both generate high income; this is true for the low catch season. This is to



say that sustained fishery activities have a significant impact on reducing poverty through both direct and indirect fishing incomes (Bilame, 2012). According to FAO (2005) majority of households in the developing countries are involved in fishing activities either fishers or in fishing related activities whether fulltime, temporary or occasional. These households have not generated high economic returns instead have helped them to sustain their livelihoods and have prevented them from falling deeper into deprivation.

## **2.6 Determinants of Fishing Income**

It has been revealed that fishing is the main family business for the people who are living along the coastal zone since it requires minimum skills, and has a readily available market although it require a little bit huge amount of initial capital, (Acquah and Abunyuwah, 2011).

### **2.6.1 Socio-economic characteristics**

Socio-economic characteristics that determine fishing income include age, education level and family size of fishers. Age is an important criterion that normally influences the working ability of an individual. Productivity increases with age and decreases with late life cycle (FAO, 2012). Individual's education helps to add the required skill for a person to find some alternatives means that will help to acquire more production. Jabil *et al.* (2014) found that majority of small scale fisheries have a primary level of education, few with middle and less with advanced level of education.

Also size is considered as an important indicator that affects the income of the fisher. Family size determines the income and expenditure of the family. Many studies reveal that the average family size of small-scale fisheries households ranges from 4 to 7, (Jeyarajah,

2015). Income is the most important factor to understand the status of the Socio- economic situation and the livelihood of the fishermen (Jeyarajah, 2015).

### **2.6.2 Fishing seasonality**

Tanzanian coastal winds prevail from November to March NE and SE winds from April to October. Generally, the months of June through September experienced strongest wind speeds during the SE Monsoon, with peaks in July smaller peaks in January. There are also two minimum monthly means generally occurring during the months of March and November during the NE Monsoon (Mahongo *et al.*, 2011).

Generally Mafia is experiencing tropical oceanic climatic conditions with varied seasons that favor fishers to participate in different types of fisheries like octopus, finfish, shellfish and dagaa common known sardines. From March to May and August to October conditions are very ideal for fishing activities which benefiting a large number of fishers community (Kamukuru, 2003).

#### **2.6.2.1 Effect of season on the operability of fishing vessels**

Usually heavy weather induces boat motions and boat motions, and has an obvious impact on the ability to fish. Effect of motion appears to interfere the operation of fishing, causing the fishing vessel to stop fishing at sea. These are danger to the vessel, gear does not fish, and vessel cannot stay on gear, loose gear on deck, and water on deck and motion impact on crews' ability to work (Yaakob and Chau, 2005).

#### **2.6.2.2 Effect of season on fishing effort and landing**

Yaakob and Chau (2005) reported that as the mean wave height increased, the fish landings decreased. Also, the effect of monsoon on fish landings was in November and

ended by February where by June and July was low even though the wave heights were not that high. Also the water was too clear for successful fishing.

### **2.6.2.3 Effect of season on fish availability and price**

Fisheries research in Kenya and Tanzania show that there are distinct seasonal changes in fish catches. Catch is low during the SE monsoon and high during the NE monsoon with a peak at March at the end of NE monsoon. The factors that are observed in seasonality include reduced effort by fishermen during the SE monsoon wind due to rough sea conditions, fish migration and decrease of density and activity due to deeper thermocline and cooler waters in the SE monsoon. This resulted into the rise in demand and the price increases (McClanahan, 1988).

### **2.6.3 Availability of market**

Fish market is among of the fishing input since fishing income depends not only on the amount of catch, but also on its unit price at a the market (landing site) as well as on the cost of inputs used in the production process (Panayotou, 1982). In many areas, fish market is imperfectly competitive and approaching oligopoly, where the numbers of sellers are small relative to that of buyers. The product is also differentiated according to species, size and freshness. The most common marketing practices are auction sales, contract sale and sale on a first come first served basis (James, 1983).

Sobo (2012) reported that in Tanzania there is no effective central marketing agency in the villages. The fish traders visit different fish landing sites daily to buy fish and transport them to markets in major towns. Price is set depending on the demand for fish and distances of villages from the major coastal towns. Hence the price of fish is influenced by the variable costs of transportation. Prices tend to be lower farther away from the major urban centers.

#### **2.6.4 Number of fishers per vessel**

Fish catching and trading are labour intensive activities therefore large supply of labour is required. According to census of 2012 the district has a population of 46438 whereby more than 80% of the population is engaging in fishing and its related activities (URT, 2013). Being an important daga fishing along the coastal area in Tanzania there is a large influx of people from neighboring districts avail employment and business opportunities. Thus the migration of people is solving labour problem. It has been noted that as the number of crew increases in a vessel also the income decreases simply because the catch must be divided according to the number of crew (Jabri *et al.*, 2014).

#### **2.6.5 Financial support**

All forms of support have an impact on key aspects of the fisheries sector; their impacts are reflected in the economic operations of fishers by reducing costs, raising prices or increasing income. Generally economic impacts affect both environmental and social aspects of the sector and, because the fisheries system is dynamic with many feedback and interactive mechanisms, there are likely to be further rounds of economic, environmental and social effects (OECD, 2006).

Financial institutions are of very important in supporting fishing activities since people who are involved in the fishing activities and operating such activities are to be provided the loan facilities from the financial institutions and invest for this activity, banks, Co-operative Banks and Credit Societies, encouraging investment of such kind (Financial institutions, 2010).

#### **2.6.6 Frequency of fishing**

Number of trips in fishing determines the catch as well as the income. Increase in fishing frequency may be an indication of dwindling fisheries resources and possible depletion of

resources in nearby fishing grounds, while in other ways the frequency determines the available stock (Inoni and Oyaide, 2007).

### **2.6.7 Fishing gear**

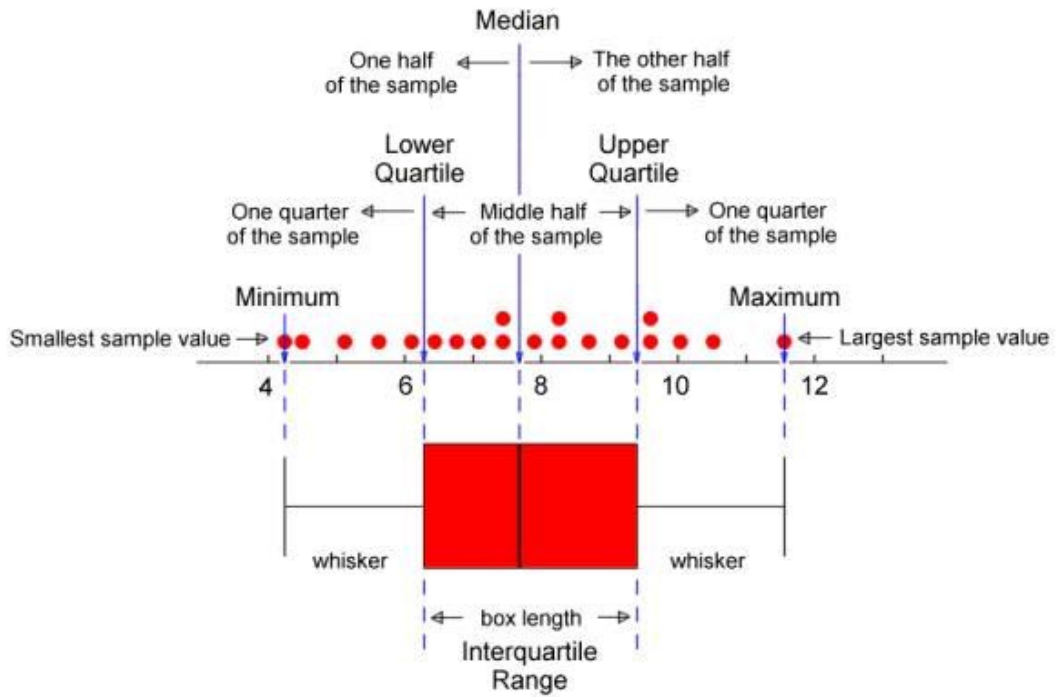
Aghazadeh, (1994) reported that the variability of catch among fishermen is based on the quantities of input they use, the type of fishing gear they employ, and the location of fishing ground in which they operate. There are may be wide differences in fishing incomes among fishermen operating the same type of gear in different locations as well as among fishermen operating different types of gear in the same location. Even fishermen who are operating the same type of gear in the same location may have diverging incomes. These income differentials may be attributed to some factors including quantity of catch and differences in fish prices received and input prices paid.

### **2.6.8 Box plot analysis**

According to Annkuch (2006) box plot is a measure of variation within a sample in a statistical population which shows the median, quartiles, minimum and maximum value for a group in a visual display. It is also useful for identifying outliers and for comparing distributions.

The box length gives an indication of the sample variability and the line across the box shows where the sample is symmetric or skewed, either to the right or left. For a symmetric distribution, long whiskers, relative to the box length, can betray a heavy tailed population and short whiskers, a short tailed population (Figure 2). The box plot also gives the idea of the shape of the sample, and by implication, the shape of the population from which it was drawn (Hogarth and Belcher, 2013). The analysis is then used to find the

distribution of income within a population. Hamidu (2012) used box plots to find the mean values in relationship with fishing gears and average income.



**Figure 2: Box plot (Source Administrator, 2006)**

## CHAPTER THREE

### 3.0 METHODOLOGY

#### 3.1 Description of the Study Area

Mafia District comprises a chain of small islets, with the main island centered at 7°50'S and 39°45'E some 20 km off the Tanzanian coastline east of the Rufiji Delta. It is approximately 50 km long by 15 km across, and is surrounded by a barrier reef teeming with marine life. The study area also has a protected area which is dominated by hard and soft coral reef, sheltered back reef systems, inter-tidal flats with hard and soft substrate, mangrove forests, extensive sea grass beds, algal sponge and soft coral sub tidal beds. The area is critical for the dugong (*Dugong dugong*) vulnerable and sea turtle (*Chelonia mydas*, *Eretmochelys imbricate*, *Lipidochelys livaceae*, *Dermochelys coriacea*) which have been recognized as critical site for biodiversity. It is popular for marine tourism especially scuba diving (MCAT, 2008).

##### 3.1.1 Climate topography and soil condition

The island consists of Pleistocene reef covered by a sandy and loam soil. It experiences two monsoon seasons, the north-east (NE) (*Kaskazi*) and south-east (*Kusi*) (SE). NE Monsoon wind season starts at the end of November to March. The SE is the longer and windier period, running from early July to mid-September. This is reported to be more variable than NE Monsoon which brings strong winds. Mafia has a relatively dry tropical climate with approximately 1,800 mm of rain each year divided into two seasons of long rains in late March-May and short rains in November-early December (Kamukuru, 2003).

##### 3.1.2 Population and ethnicity

According to URT (2012), the overall district population was 46 438 inhabitants living in 20 villages. The island inhabited by different ethnic groups whereby majority being from Kilwa Chronicle as the Mwera from Songo Songo Island.

### **3.1.3 Accessibility**

The study area is accessed by using boat where it takes about three to four hours from Mafia to Rufiji; Islanders also use jahazis, widely referred to in English as dhows, to commute between Kilindoni and outlying villages on Mafia and for inter-island travel. Flights flying into and out of Mafia every daytake only 45 minutes from Dar es Salaam and 1 hour from Zanzibar or the Selous. Appendix 1 shows the map of Mafia District with the study sites.



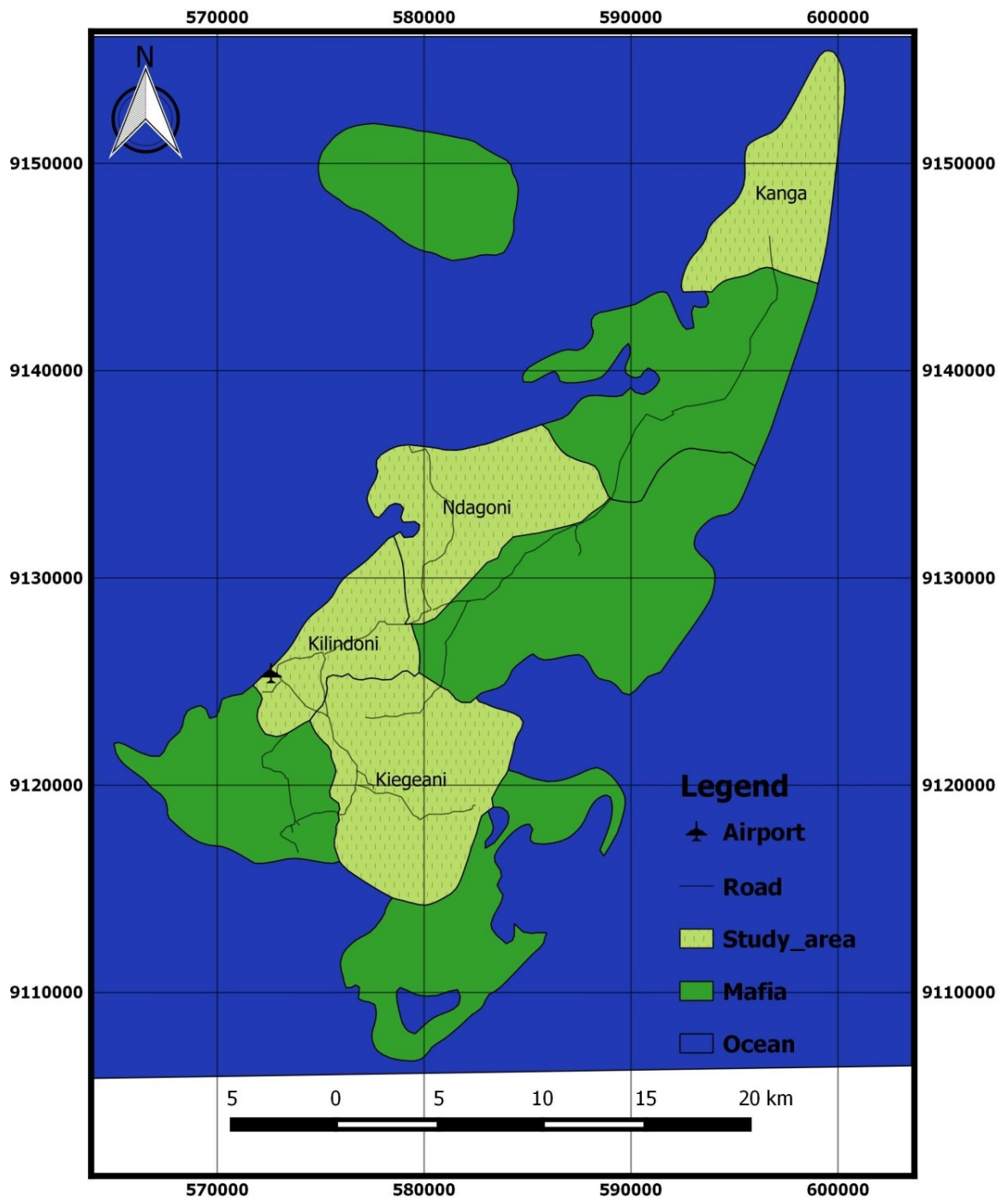


Figure 3: Map of the study area

## **3.2 Data Collection**

### **3.2.1 Primary data**

The primary data was collected through questionnaire survey, checklist, field observation and Focus Group Discussion.

#### **3.2.1.1 Research design**

The research design for this study was cross sectional. This design allows data to be collected at a single point in time from a sample to represent a large population. This is appropriate for descriptive study and for determination of relationship between and among variables. Not only that the design is economical in terms of time and financial resources (Babbie, 1993). By using this research design a subject population was selected and from these individuals, data were collected to answer questions of interest.

#### **3.2.1.2 Sampling procedure**

Both purposive and simple random sampling procedures were adopted in this study. Four wards were selected purposively in the district (Kilindoni, Ndagoni, Kiegeani and Kanga) then a random sampling procedure was adopted to select 4 villages namely Kilindoni, Kiegeani, Chunguruma and Bweni.

#### **3.2.1.3 Sample size**

Sampling units for the study was the household. According to TANGO international (2004) a household is a core analytical unit that defines regular roles, rights and responsibilities across gender and age. A total of 120 households were randomly selected to obtain 30 household per village. 30 respondents is the minimum number recommended to represent a population under study (Yurdugul, 2008).

#### **3.2.1.4 Questionnaire survey**

Semi-structured questionnaire were used to obtain primary data. Questionnaire was designed to collect demographic characteristics of the households, household income from both fishing and its related activities and determinants of fishing income (Appendix 1).

#### **3.2.1.5 Checklist of questions**

Checklist of questions (Appendix 2) was used to guide interviews with key informants. The key informants included village chair person, village elders and district fisheries officers.

#### **3.2.1.6 Field observation**

Supplementary information was collected through personal observation in the field for the purposes of cross checking some of the information obtained through questionnaire especially on the type of fisheries resources harvested, type of fishing gears used, fishing related activities conducted. According to Kimberley (2002), observation and interaction within the society enable a researcher to discover discrepancies between what participants say and what is believed it should happen and what actually happen or between aspects of the formal system.

#### **3.2.1.7 Focused Group Discussion (FGD)**

FGDs were conducted in each village with 10 people, where 8 were from members of household, 1 fisheries officer and 1 village elder. A set of questions used to guide the discussion including the history of fishery in the study area, different fish captured with their contribution in household income, types of fishing related activities conducted, contribution of fish related activities to household's income and determinants of fishing income (Appendix 3).

### **3.2.2 Secondary data**

Secondary data were collected through relevant literature reviews (published and unpublished documents). Relevant sources used were Mafia District fisheries office, internet and Sokoine National Agriculture Library.

### **3.2.2 Reconnaissance**

Prior to the main survey, preliminary survey was conducted to pre-test the questionnaire. This was important since it helped to check and identify weakness and ambiguities before embarking on detailed interview.

## **3.3 Data Analysis**

### **3.3.1 Qualitative data analysis**

Qualitative information was analyzed by using content analysis. Using this method, the information collected through verbal discussions with key informants and focused group discussion was analyzed. This method enabled the researcher to include large amount of texture information and systematically identify its properties (Kimberley, 2002). Textual information was categorized to provide meaningful information; the basic idea was to reduce the total content of communication to a set of categories that represent some characteristics of research interest (Singleton *et al.*, 1993).

### **3.3.2 Quantitative data analysis**

Both descriptive and inferential statistics were used during data analysis. Questionnaires were coded, cleaned and data from both open and closed questionnaire were categorized. Information such as socio-economic characteristics, income sources, contribution of each economic activity to household income, were analyzed descriptively into frequencies, percentages and mean and presented in tables and graphs.

### **3.3.2.1 Household income contributed by fishing activity**

Household income from fishing activities was analyzed and plotted by using box plot to obtain the distribution of income from household involved in fishing only. Mean, median and mode were obtained and presented in box plot (Fig. 2).

### **3.3.2.1 Household income contributed by fishing related activities**

Dimension of fishing activities was measured as household's involvement in fish processing, vessel making, fish trade and fishing supporting activities. Descriptive statistics was used to capture the contribution through percentage, mean and standard deviation.

### **3.3.2.3 Determinants of fishing income**

Household questionnaire was used to capture information on determinants of fishing income. Data collected to answer this objective were socio economic and demographic factors which were age, sex, family size, education level, marital status, fishing gear, fishing season, number of labour per vessel, financial support and type of where fish are sold. Garoma *et al.* (2013) used also multiple regression approach to determine quantitatively the amount of income earned from fish catch and factors affecting fish income.

A stepwise regression method was selected as it enables in identifying the most suitable factors for determining fishing income. Thus, principal component factor analysis (PCA) was applied to identify internal structure behind variables represented to a research concept by examining correlation among variables and also reduce number of variables (George and Mallery, 2010). This application was further ensured as minimizing of Multicollinearity effect on regression analysis (Nishantha, 2011). Selection criteria for

extracting factors were fixed as firstly communality is greater than or equal to 0.5 (Costello and Osborne, 2005; Yong and Pearce, 2013). Secondly, Eigen value is to be greater than 1.000 according to Kaiser criterion and then factor coefficient is to be greater than 0.5(Shapiro and Wilk, 1965).

Later, extracted factors identified by PCA were analyzed using stepwise method of linear multiple regression and then path coefficients were measured by standard coefficients of regression model in order to understand direct, indirect and correlated impact of predicted determinants of fish income. The criterion was set at significance level at  $\alpha=0.05$  and 0.01 for selection of regression coefficients and path coefficients. Details of each step of the statistical process were interpreted along with analysis of results.

$$Y_{Income} = \beta_0 + \beta_1 F_{gear} + \beta_2 N_{labour} + \beta_3 F_{season} + \beta_4 E_{level} + \beta_5 F_{sup\ port} + \mu_1$$

$F_{gear}$  = fishing gear,  $N_{labour}$  = number of labour per vessel,  $F_{season}$  = fishing season,  $F_{sup\ port}$  = Financial support,  $E_{level}$  = Education level, coefficient  $i=0,1,2,..5$ ,  $\mu_1$ =stochastic error term,  $\beta_1-\beta_n$  = are independent variable coefficients( $\beta$ ) showing marginal effects (negative or positive) of the unit change in the independent variables on the dependent variables,  $Y = i^{th}$  is the income of the fishing activity in study area.

#### **3.3.2.4 Justification of the multiple regression model**

Multiple regression model which is also known as Ordinary Least squares Regression which is the often used modeling method for data analysis and has been successfully applied in many studies Garoma *et al.* (2013) and Gujarat (1992) supported that the method is useful in analyzing the data with numerical (quantitative) dependent variables.

### 3.3.2.5 Variables description

The study assumes that household income is influenced by number of socio economic factors used in this study as the explanatory variables. The basis for the assumption was theoretical considerations found in the literature. The variables used in the model are summarized in Table 1.

**Table 1: Variables in the multiple regression model**

Variables	Description	Types	Values
<b>Dependent variable</b>			<b>Number of options</b>
Fishing income			Available to choose
<b>Explanatory variables</b>			
$F_{gear}$	Fishing gear	categorical	Categorical based on kind of gear
$N_{labour}$	Number of labour	continuous	Number of fishers
$F_{season}$	Fishing season	categorical	Categorical based on fishing season
$E_{level}$	Education level	categorical	Categorical based on number of years
$F_{support}$	Financial support	categorical	Categorical based on type of credit received

#### Education level of household head

Education level of the household is a categorical variable and was measured by the number of years of formal schooling of the household head. Education plays a major role in adapting a new innovation. It is also believed that a person with higher education level is expected to use sophisticated gears that can make an improvement in fishing practice hence increasing income (Jabir *et al.*, 2014). It is therefore expected that a positive relationship should exist between the household that has gone to school to have higher income.

#### Fishing gear

Fishing gear is a categorical variable which was measured by a kind of gear used by fisher. Efficient and effective use of any gear on a water body with success, the fisher needs a kind of mobility to enable him/her reach both near and distant fishing grounds or markets.

This necessitates the acquisition of a craft (Ogundiwin, 2014). It is expected that a household which uses modern fishing gear is likely to have more income.

#### **Number of labour per vessel**

The number of labour per vessel is a continuous number which was measured by the number of crew per vessel. An increase in the number of crew per boat may lead to negative marginal returns for the small-scale fishermen. Any increase in the number of fishermen may result in a decrease in output hence, income accruing to each fishermen declines because the revenues have to be shared by more people (Canback *et al.*, 2006). It is expected that minimum number of crew per vessel the more income received.

#### **Financial support**

Financial support is a categorical variable which was measured by the number of credit received to support the fishing activity. All forms of support have positive impact on fishing operations which helps in reducing costs, raising prices or increasing income.

#### **Favorable fishing season**

Fishing season is a categorical variable which was measured by the type of fishing season which are NE and SE monsoon wind. It is expected that during SE monsoon there will be low catch while in high catch in NE monsoon season.



## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSIONS

This chapter presents findings based on the analysis of information obtained from the communities in the four villages on the study area and various stakeholders, own experience and literature consulted. The information include identification of various economic activities, assessment of economic contribution of fishing activities to the household income, contribution of fish related activities in household income and determinant of fishing income.

#### 4.1 Socio-economic Characteristics of Household Head

Socio and economic factors play an important function in utilization of various resources with the aim of improving economic status. If done without consideration of the environmental impact can lead to unhinged natural resource utilization resulting into depletion. The socio-economic characteristics of respondents that were included are sex, marital status, age, education level and marital status.

##### 4.1.1 Sex of household

Gender expresses the social relationship between male and female and has influence in socio-economic activities. The result shows that 87% of respondents were male while 13% were female (Table 1). The results also showed that there is significant different between the sex in a study area  $p < 0.01$ . Gender determines the nature of activity performed, in fishing activities; male are more involved due to the nature of a work since it involves more energy (Béné *et al.*, 2003). Although the results show the dominance of the fisheries sector by men, the contribution of the women in active fishing cannot be undermined.

Williams (2002) reported that women have been restricted in fishing activity due to socio-cultural factors, low technical know-how and lack of credit facilities.

#### **4.1.2 Marital status**

Findings shows that 89% of the household were married, 10% single and 1% widowed. It is also observed that there is no significant different between marital status and household income from fish in a study area  $p < 0.05$ .

#### **4.1.2 Age of household head**

Most of the heads of household age (38%) ranged between 34-41 years. 28% ranged between 42-49 years, while 15% ranged between 26-33 years. Others 12% ranged between 50-57 years. 4% ranged between 18-25 years as well as 3% of respondents were above 58 years. It is also observed that there is no significant different between age group in the study area between the village when  $p < 0.05$ . Age is an important criterion that normally influences the working ability of an individual. Productivity increases with age and decreases with late life cycle (Jeyarajah, 2015). Fisheries act of 2003 and its regulation of 2009 allow a man with more than 18 years to participate in fishing activities. Age is also considered to affect experience, wealth and decision making (Singh *et al.*, 2003; Hoppe, 2002).

#### **4.1.3 Education level of household head**

Findings in Table 1 show that 63% of the respondents have attained primary education, 25% secondary and 12% have non-formal education. Results also show that there is significant different between education level in a study area when  $p < 0.01$ . These findings imply that education level for most households was still low because primary education is still considered to be basic education and this might have direct influence in the utilization

of natural resources especially fisheries in the coastal area. Priya and Sreeranganadhan, (2015) reported that fisheries as the open access natural resources in coastal areas does not need high education and specialized skills since fishers have their traditional way of learning and is handled over from generation to generation.

Findings of Yuerlita *et al.* (2010) show that percentage of primary school education to households among fishing community was higher than other level of education in West Sumatra, Indonesia. It could be argued that education is an important factor in providing better livelihood option as it offers opportunity of better paid jobs and hence better livelihood outcome that can reduce dependence of fishing.

#### **4.1.4 Households size**

Findings show that 38.3% of households had the average household size of 4 people (Table 1). This average household size is within the national average household (URT, 2012). It is also observed that there is no significant different between household size in the study area when  $p < 0.05$ . Large household size has an implication in resource utilization because large household size means high consumption units within the household (Hatibu, 2010). This can lead to more extraction of the resources.

**Table 2: Social economic characteristics of respondent (n=120)**

Social attribute	economic	Village (%)				Total (%)	$\chi^2$
		Kilindoni	Kiegeani	Chunguruma	Bweni		
Sex	Male	83.3	80	90	93.3	87	S
	Female	16.7	20	10	6.7	13	
Marital status	Single	6.7	13.3	10	8.3	10	NS
	Married	90	86.7	90	90.8	89	
	Widowed	3.3	0	0	0.8	1	
	18-25	6.7	0	0	3.3	4	
Age	26-33	30	13.3	10	6.7	15	NS
	34-41	20	46.7	43.3	43.3	38	
	42-49	20	30	30	33.3	28	
	50-57	23	3.3	10	13.3	12	
	Above 58	0	6.7	6.7	0	3	
	None	26.7	10	3.3	10.8	12	
Education level	Primary	63.3	46.7	76.7	63.3	63	S
	Secondary	10	43.3	20	25.8	25	
	One	3.3	3.3	3.3	3.3	3	
	Two	3.3	13.3	3.3	5	6	
	Three	10	16.7	20	15.8	16	
	Four	33.3	40	43.3	38.3	39	
Family size	More than four	50	26.7	30	37.5	36	NS

S = Significant at  $\alpha < 0.01$

NS= Not significant at  $\alpha < 0.05$

**Source: Field survey, 2015**

#### 4.2 Economic Activities

Economic activities involve the production, distribution and consumption of goods and services at all levels within a society and they can be assessed currently and forecasted to measure the significance impact of a particular activities (NACE,2008). Findings in the study area show that the main economic activities conducted were fishing, fishing related activities and agriculture while petty business and animal keeping were subsidiary activities. Also findings (Table 2) shows the respondents' economic activities conducted in the study area. Almost all respondents mentioned fishing as one of the daily activity

conducted within the household with the following main distribution 41.47%, 14.85% are fishing and agriculture respectively.

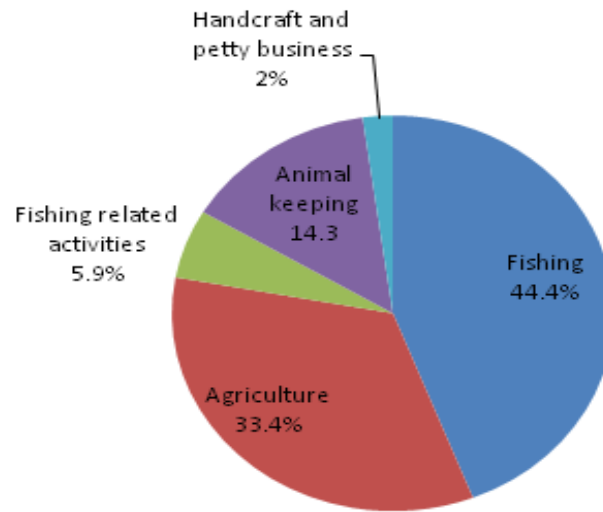
**Table 3: Percentage of respondent in economic activities conducted in study area**

<b>Economic activities</b>	<b>%</b>
Fishing	41.47
Agriculture	14.85
Fishing and agriculture	12.5
Fishing with related activity	11.58
Fishing related activities	9.54
Fishing and livestock	8.6
Fishing and handcraft	0.83
Petty business	0.63
<b>Total</b>	<b>100</b>

#### **4.2.1 Household income from different sources**

The findings show that 44.4% (Figure 3) of the income from households were from full - time fishing, 33.4%, in agriculture, 14.3%, in animal keeping, 5.9% in fish related activity and 2.0% was household which were engaging in handcraft and petty business. These findings imply that any activity affecting fisheries is also affecting the livelihood of the great proportion of the community in the study area. It has been seen that fishing is the activity that is the easiest to perform since it is the commonly accessed natural resources compared to others.

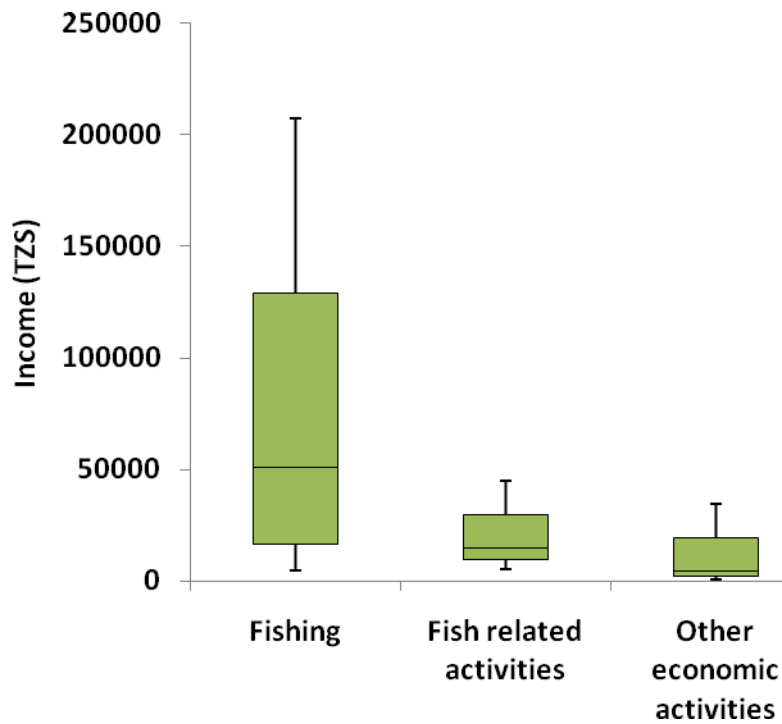
The findings of this study are in line with different studies conducted in coastal areas on fisheries. FAO (2013) reveals that fishing is the activity that contributes large percent compared to other activities in coastal communities.



**Figure 4: Household income from different sources**

#### **4.2.2 Contribution of fishing income**

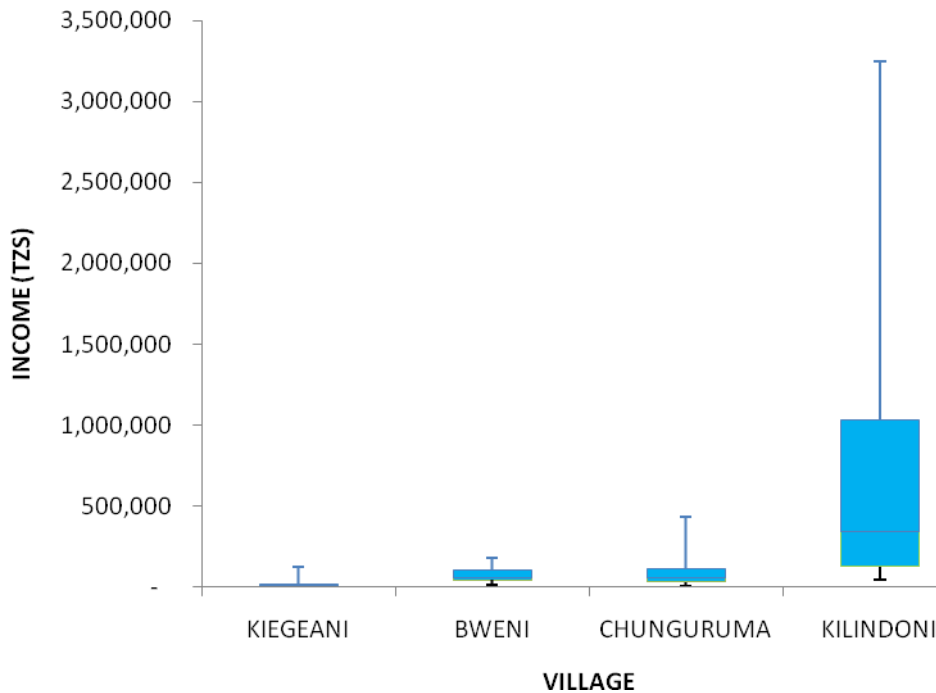
The study found that the average estimated income obtained from household engaged only in fishing was 51 250 TZS per day which gives an estimate of 9 225 000 TZS per annum (Fig. 4). In the figure 5, the distribution of income shows that, there are some exceptions for the minority who receive much higher than others. This might be due to the fact that they possess their own fishing gears compare to the majority who act as workers. At the end of the day, they must pay back to the owner; this was explained by both four FGD.



**Figure 5: Distribution of fishing income in the study area**

#### 4.2.2.1 Contribution of fishing income by village

Full time household fishers in the study area showed different income that is received per household per day. In figure 5, it is illustrated that Kilindoni village received the biggest amount of all that is, 340 000 TZS whereas, Bweni received 57 200, Chunguruma, 52 000 and Kiegeani 5 950 TZS. It is also observed that in Kilindoni majority of the households received income that ranged from 213 500 to 694 500 TZS in Chunguruma 21 600 to 62 250 TZS, Bweni 16 450 to 47 200 and Kiegeani 2 350 to 6 225 TZS.



**Figure 6: Distribution of fishing income by village**

#### 4.2.2.2 Contribution of income by fish type

There are more than 460 fish species found in Mafia Island, few of them are mostly harvested due to their accessibility during fishing and marketability in and outside of the Island. The study found that, 84.8% of the income is contributed by fish species (tuna species, groupers, emperor, mackerels), 11.5% by dagaamcheli (*Stolephorus commersonii*), while squid contributed only 0.1% of the total fishing income. It has been observed that majority of the fish harvested were pelagic, epipelagic and estuary simply because most of the fishers have no advanced fishing gears hence they only fish in territorial waters (McClanahan *et al.*, 2009). The findings of this study are in line with different studies conducted in Unguja which found that fish contributed high income in fishers household; example of these fish were like tuna, kingfish, sword, octopus, lobster and shark, while those of low value were octopus, mackerel, rabbit fish (Frocklin *et al.*, 2013). Also FAO (2008) reported that most of the common catches in coastal communities in Indian Ocean are small and large pelagic species including herrings, tuna like species



followed by demersal species like lobsters, shrimps that make a significant contribution of income.

**Table 4: Contribution of income by fish type**

Fish type	Fish Income (TZS)	
	Average mean	Std
Fish (all species)	423 000 (84.8)	90 900.21
Dagaa	243 344 (11.5)	51899.53
Lobster	90 500(2)	37361.89
Ray	72 500(1.1)	14 446.4
Octopus	6800(0.5)	8 300.85
Squid	12000(0.1)	5 047.67

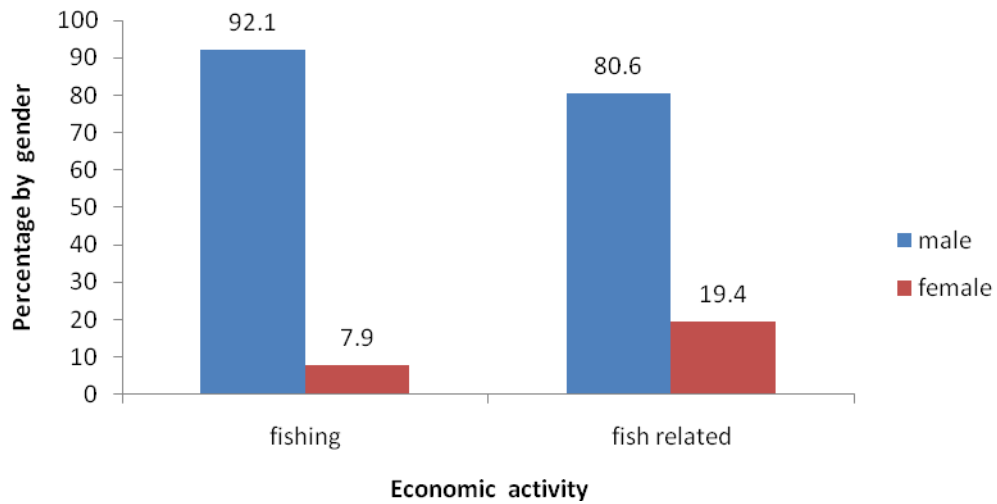
**In brackets is percentage**

#### 4.2.2.3 Fishing activities by gender

The roles of women in world fisheries have increased (Bennett,2005), but traditionally, fisheries have been associated with men with focus primarily on capture fisheries, rather than women-dominated pre- and post-harvest activities, such as processing and marketing the catch (Weeratunge *et al.*, 2010). This study has reveals that, more than 90% of fishers were male while less than 10% were female (Fig. 6).

From direct observation during the study, female fishers were found in Kiegeani village only and they specifically harvesting octopus. It is then observed that more than 80% of fish related activities were conducted by male while less than 20% were conducted by female. Among of these related activities are fish and dagaa processing (drying, packaging and transporting), vessel making and repair.

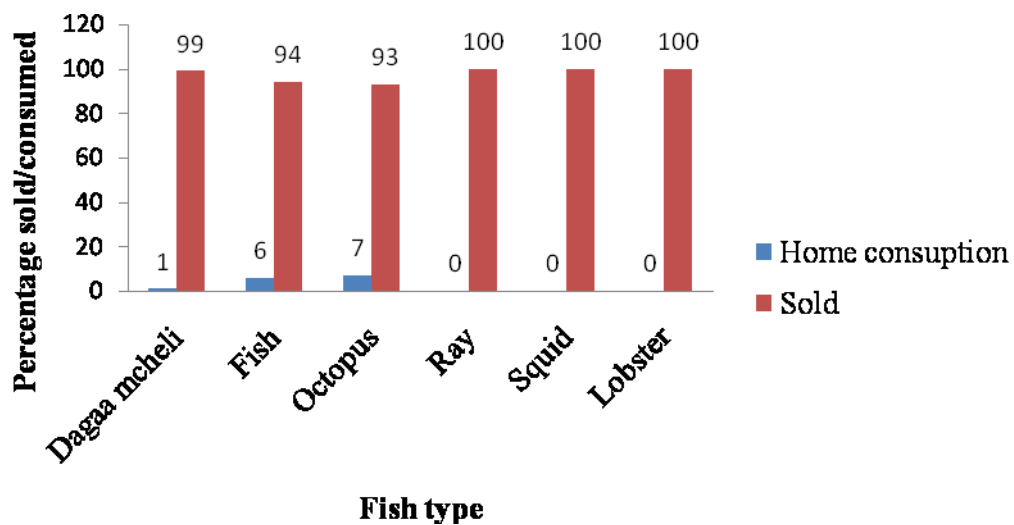
The findings of this study are in line with studies conducted by Williams (2008) who reported that women also perform diverse unpaid tasks such as mending nets, collecting bait, preparing food for fishers, and keeping accounts, which are unacknowledged or undercounted as employment. Therefore this activity is dominant men.



**Figure 7: Showing fishing activity by gender**

**4.2.2.3 Different uses of fish in the study area**

The study found that there were different uses of fish in the study area. Ray, squid and lobster were harvested purposely for commercial, while dagaa, fish and octopus were used for both home consumption and commercial purpose. It has been also observed that, dagaa was used in small percent in the households compare to fish and octopus.

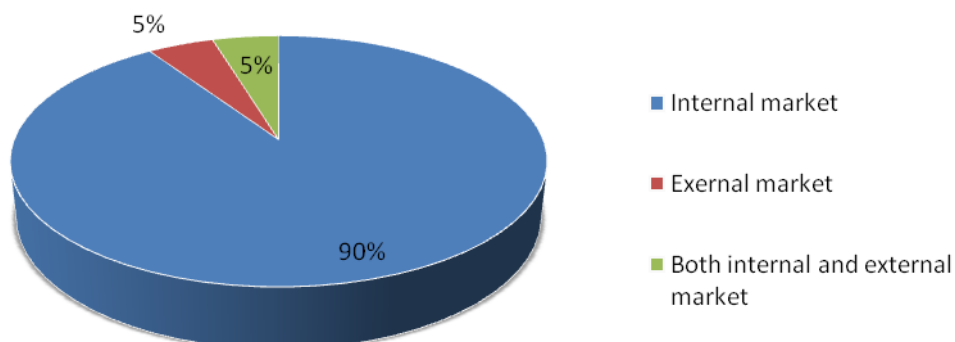


**Figure 8: Showing the uses of fish in the study area**

#### 4.2.2.4 Fish market

The study found that fishers have three options of selling fish. First they sell within Mafia, second outside of Mafia and the third they do sell both within and outside of Mafia. 90% of fishes are being sold within the study area, 5% outside of the study area and 5% in both within and outside Mafia Island (Figure8). The large amounts of fishes which are sold within the study area are taken by processing industry which is located at Kilindoni village. This fish processing industry sell its fish in other areas of the country not only that, but exporting to Portugal and France this is specifically for lobster and octopus. Also dagaa market is largely sold while processed (salt drying) in Mtwara, Dar es Salaam, Kilimanjaro and Singida and sometimes in Malawi and Congo.

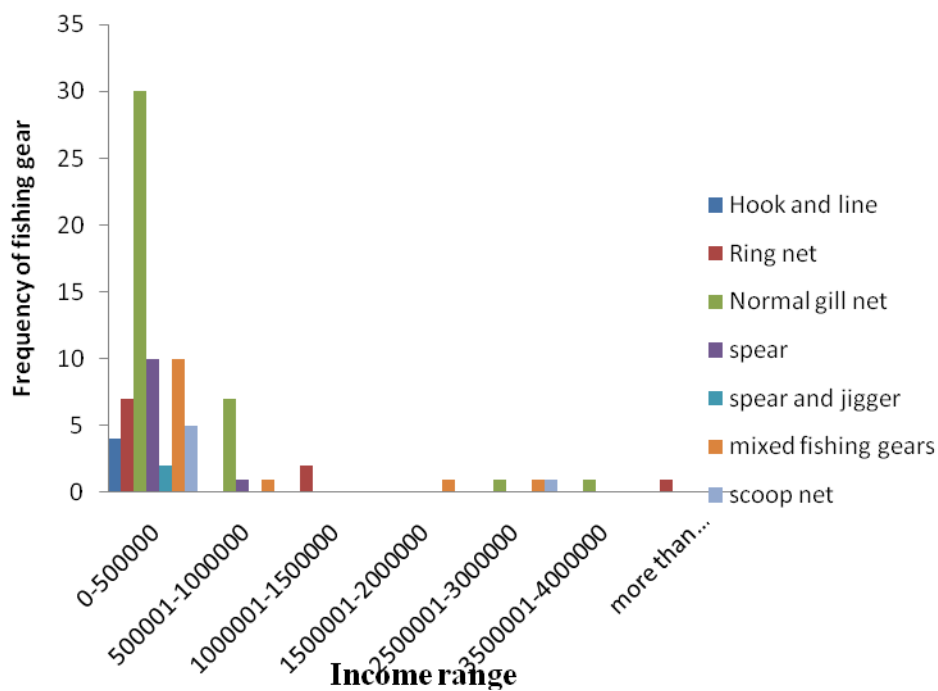
The study done by Sobo (2012) found that in most coastal zones including Tanzania there is no effective central marketing agency in the villages. Fish traders (mongers) usually visit different fish landing sites daily to buy fish and transport to markets in major towns. Price is set depending on season, demand for fish and distances of villages from the major coastal towns. For this reason, the price of fish is influenced by the variable costs of transportation. Prices tend to be lower farther away from the major urban centers.



**Figure 9: Shows type of market**

#### 4.2.2.2 Contribution of income by fishing gear

Results from the study show that fishers normally use different fishing gear for catching various fish species (Fig. 9). Among of the gears used by fishers in the study area were hook and line, spear and jigger, ring net, normal gillnet, scoop net and others used a mixed of different gears at a time. Fishing gears have impact on fishing income. Normal gill nets were preferred mostly, since they capture almost all types of fish species. It has been observed that ring net contributed a wide range of income from 1 000 000 to more than 5 000 000 TZS per catch per crew.

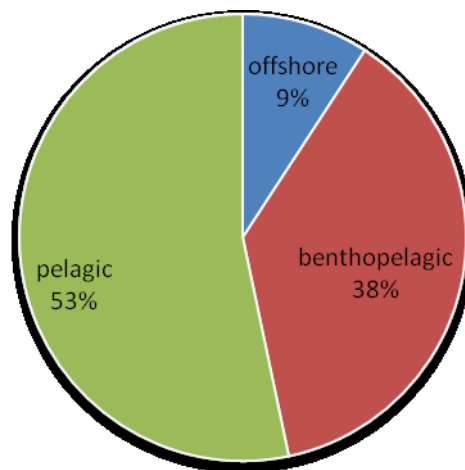


**Figure 10: Income contributed by the type of fishing gear**

#### 4.2.3 Fish species captured at different water level

Fish species are captured by using different gears at different water levels. There is a relationship between fish species, gear used and water level. Fig. 10 shows the water levels with the kind of fish species captured. Pelagic waters contributed 53% where 38% are benthopelagic species and 9% are offshore dweller. The pelagic species included *Anchoviella spp* (dagaa), *Lethrinus spp* (changu), *Siganus oramin* (Tasi), *Restrelligerspp*

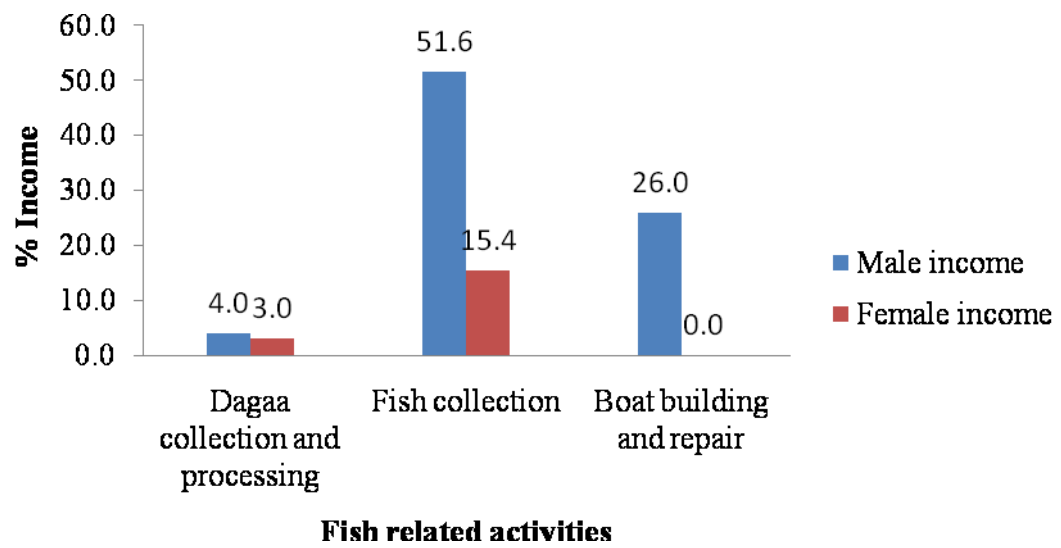
(vibua), *Carcharinus spp* (papa). All these species are being captured by almost fishing gears, benthopelagic species included *Cephalopholis spp* (chewa), *Aluterus spp* (kikande), *Palinurus spp* (kambakoche) *Pastinachus spp* (taa), *Octopus spp* (pweza). These species are captured by normal gillnet and hook and line. Off show dwellers included Tuna (jodari) and *Gymnosarda spp* mostly known as King fish (nguru); these are captured by ring net and hook and line.



**Figure 11: Water level with fish species capture**

#### 4.2.3 Contribution of income from fish related activities

Findings revealed that there were several activities conducted that related to fishing, and those activities were performed by both sex (Fig. 11). Daga fishery involved a chain of activities including carrying of daga from the vessel to landing site, drying and packaging. Other beneficiaries from fishing including fish mongers, (middle men), fish processor (salt drying and smoke drying) as well as vessel makers and repair. Fish collection contributed 67% where the activity done by middle men, vessel building contributed 26%, daga collection and processing contributed 7%. A fish trader generally earns more than any other people involved in other coastal activities (Frocklin *et al.*, 2013).



**Figure 12: Income contributed by fish related activities**



**Plate 1: A-fishmonger buying dagaa, B-fishers selling fish**

### 4.2.3 Comparison of fishing income with other economic activities

Results from the study showed that the average income from house hold that conducts fishing is much higher than other household which practice other economic activities in the study area (Table 5).

**Table 5: Comparison of fishing income with other economic activities**

Economic activity	Mean	Std	Std. Error Mean	t	df	Sig.
Fishing	61 550	36078.28	5245.58	3.575	118	0.048
Other activities	17 000	7821.37	1541.63			

The results above show that there is significant difference between households income received from fishing with those received from other economic activities,  $p < 0.05$ .

### 4.2.4 Contribution of income from agriculture

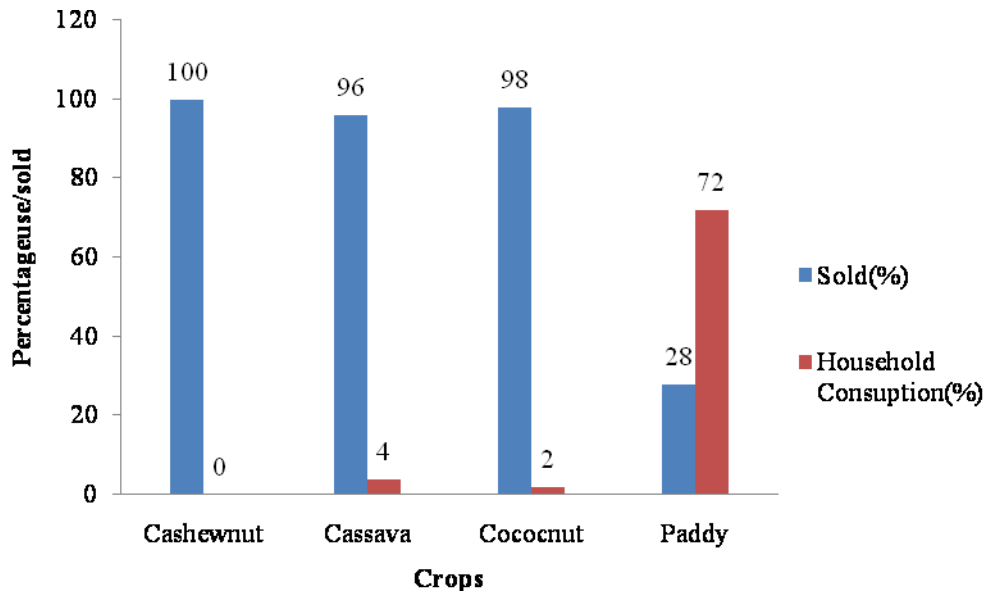
Findings showed that coconuts followed by paddy were the main crops that contributed more in household income. Coconut contributed 24 times higher than paddy simply because almost each household was having a coconut tree and in each three months, they are being harvested. Results in Figure 5 revealed that, the standard deviations of coconut, paddy and cassava are higher than their average mean. This could be due to the fact that there was none normal distribution of income among the household simply because some of the households interviewed were possessing large amount of coconut trees, big farm of paddy and cassava compare to the majority; that made a big variation amongst them.

**Table 6: Contribution of income from agriculture**

Crops	Agricultural Income(TZS)	
	Average mean	Standard deviation
Coconut	2 459 416.67	3 987 031.21
Paddy	69 687.5	165 918.23
Cashew nut	600 000	24 860.97
Cassava	110 000	153 215.53

#### 4.2.5 Uses of agricultural crops

The findings from the study observed that, cassava, coconut and paddy are both used commercially and domestically, while cashew nuts are used for commercial only.



**Figure 13: Uses of agricultural crops in the study area**

#### 4.2.4 Determinants of fishing income

The determinants of fishing income in Mafia district were fishing gear, number of labour, fishing season, education level and financial support. However the independent variable such as education level and financial support were negatively influencing fishing income, whilst the other independent variables were positively influencing fishing income. Linear regression analysis results show that fishing gear, the number of labour and fishing season significantly influenced the fishing income ( $p < 0.01$ ). On the other hand, some factors that would be thought to influence fishing income were not significant (Table 6).



**Table 7: Linear regression results for determinants of fishing income**

Variable	B	SE	$\beta$	t-value	P-value	Significance
Constant	0.398	0.157	0.041	1.023	0.031	S
Fishing gear	0.437	0.125	0.447	3.509	0.001	S
Number of labour	-0.055	0.028	-0.18	-1.95	0.054	S
Fishing season	0.242	0.121	0.258	2.008	0.048	S
Education level	0.007	0.127	0.005	0.055	0.957	NS
Financial support	0.092	0.148	0.056	0.625	0.534	NS

S= significant at  $p < 0.01$  NS=Not significant at  $< 0.05$

Adjusted  $R^2 = 76.4\%$        $R^2 = 73.4\%$

#### 4.2.4.1 Fishing gear

The findings from the study showed that the relationship between fishing gear and fishing income was positive and statistically significant ( $P < 0.01$ ). This implies that fishing gears have impact on increasing fishing income, as the fisher uses modern gear likely to have more income (Table 6). The findings of this study concur with the study conducted by Canback *et al.* (2006) who found that fishermen might be in a diseconomy of scale situation, which can be turned around by offering bigger boats or other productive technologies. This means that with an increase in output, this results into average cost in the long run increases by a greater amount and is proportional to the increase in the input.

#### 4.2.4.2 Number of labour per vessel

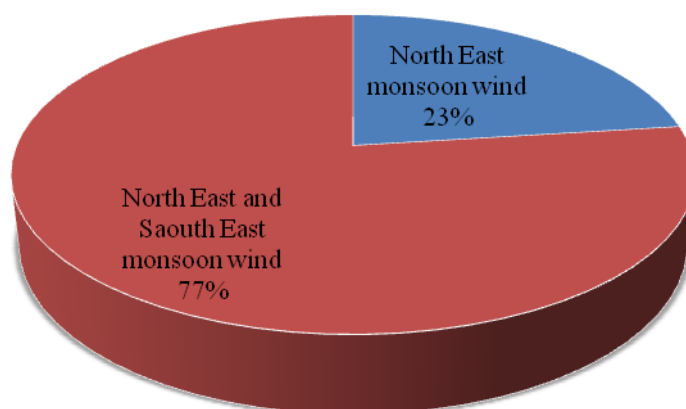
The study found that the relationship between the number of labour per vessel and fishing income was negative and statistically significant ( $P < 0.01$ ). This implies that for a vessel with less number of fisher per vessel has less income (Table 6). Inoni and Oyaide (2007) found comparative results in Delta state in Nigeria that labour input was the factor around which small-scale fishing revolves, without an adequate number of men ready to undertake a fishing trip there will be no catch. Therefore the result implies that as the

supply of labour increases, other things being equal, and fish catch will increase as the income increases.

#### **4.2.4.3 Fishing season**

Findings from the study showed that the relationship between fishing season and fishing income was positive and statistically significant ( $P < 0.01$ ). This implies that the type of monsoon wind prevailing was influencing fishing income. From the findings (Fig. 15) it is shown that, 77% of the fishers were fishing in both NE and SE Monsoon and 23% of fishers was fishing during only in NE monsoon. During SE monsoon, the catch is low, while in NE is high. The variation of catch due to reduced effort by fishermen during the SE monsoon wind was caused by rough sea conditions, fish migration and decrease density and activity due to deeper thermocline and cooler waters in the SE monsoon. Generally, the findings of this study support the findings by McClanahan (1988) that catch was low during the SE monsoon and high during the NE monsoon with a peak at March at the end of NE monsoon.

Also, the study conducted by Yaakob and Chau (2005) reported that there was a close relationship between weather and fishing operation as well as fishermen's income. The economy, of the artisanal fishers is closely linked to cycles of the moon and tides, seasonal changes in the climate and the breeding patterns of the fish and other species on which they depend (Vieira *et al.*, 2013).



**Figure 14: Shows the fishing season**

#### **4.2.4.4 Education level**

The findings from the study revealed that education was insignificant in explaining the influence of education level in fishing income. The results are not in line with that of other studies which reported that education had positive significant impact in fisheries activities through finance management which helped in improving general fishing activities including fisheries businesses, methods of fishing and fish processing, to sustain and develop fisheries resources (Mensah *et al.*, 2014).

#### **4.2.4.5 Financial support**

The findings from the study revealed that financial support was insignificant in explaining the influence in fishing income. Artisanal fishing seems to be attractive activity for poor who are living along the coast since it has very low startup cost (Silva, 2006). The research done by Frocklin *et al.* (2013) reported that capital is needed in fishing activities. It doesn't matter in which sources it comes from either in micro credit, savings or lent. This shows that access to initial capital is a key factor for income enhancement, which in turn increases the quality of life.

## CHAPTER FIVE

### 5.0 CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

This study has attempted to show the incomes generated from fisheries and how those incomes contribute to household general income. The study has further showed how the incomes to those fishers and other people who engage in fishing activities are received. Fishers received higher income from fishing compared to other activities. Alongside with the incomes that were generated from fisheries, there were none fishing activities which also played a great role in increasing household's income. Therefore, there is a need to strength fisheries in a sustainable manner in a way that it enables both fishers and other people who benefit indirect through fisheries to attain a win-win solution in order to raise household incomes that could raise the standard of living.

#### 5.2 Recommendations

Based on the findings, discussion and the conclusion above, the following recommendations were drawn:-

- i. Since the study has revealed that fishing contribute higher income in the households than other activities, fishers who do not use weigh scale in their business are advised to use weigh scale in measuring at market instead of using local measurement which are not realistic.
- ii. Credit facilities that are accessible and affordable to poor household should be extended to coastal people specifically in the study area to influence livelihood diversification, since this study has revealed that most of the households in the study area do not have access to credit for improving their activities especially fishing. It is better for the government to provide improved fishing gears for fishers with low interest rate.

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## APPENDICES

### **Appendix 1: Contribution of Fishing to the Household Income in Mafia District, Tanzania**

#### **Socio-economic part**

#### **Household Questionnaire**

Questionnaire no.   
 Date of interview.....  
 Name of respondent.....

Village: .....

Ward: .....

Division: .....

District: .....

Region: .....

#### **CONTENTS**

- 1. Purpose**
- 2. Introductory information to the respondents**
- 3. Part I: Socio economic characteristics of the respondent**
- 4. Part II: Determinants of income**
- 5. Part III: Determination of household income contributed by fishing activity and its related activities**

#### **1. PURPOSE**

The general purpose of this questionnaire is to supplement the information in a quantitative term on the qualitative data obtained during the PRA. Specifically, the questionnaire has been designed to collect wide range of contribution of fishing to the household income. The following is the structural arrangement of the questionnaire.

- (i) Part I: Socio economic characteristics of the respondent
- (ii) Part II: :Determinants of income
- (iii)Part III. Determination of household income



## 2. INTRODUCTORY INFORMATION TO THE RESPONDENTS

My Name is Anthonia Mpemba, a student from Sokoine University of Agriculture, doing a research for a Masters in Environmental and Natural Economics. I have come to your household to discuss with you some issues regarding fishing activities contribution in household income. I kindly request your time to make this discussion possible.

### 3. Part I: Socio-economic characteristics of the respondent

#### 1. The respondent (s) and household assets

<i>Position in household (Put ✓)</i>	<i>Age</i>	<i>4. Sex (0=male; 1=female)</i>	<i>5. Education<sub>1</sub> (highest level attained)*</i>	<i>Main economic activities</i>	<i>Family size<sub>2</sub></i>
<i>Head</i>					
<i>Spouse</i>					
<i>Both</i>					

\* **CODES:** 1= none; 2= primary school; 3= secondary school; 4=college/university; 5=other (spec)

2codes: 1=one, 2=two, 3=three, 4=four, 5=more than four

#### 1. Part II: Determinants of income

<i>Activity</i>	<i>Season<sup>1</sup></i>	<i>Age<sub>2</sub></i>	<i>Sex<sub>3</sub></i>	<i>Marital status<sub>4</sub></i>	<i>Market<sub>5</sub></i>	<i>Labour<sub>6</sub></i>	<i>Financial support<sub>7</sub></i>

1 Codes: 1=short rains raise (Oct-Dec), 2=short rain transition (Jan-Feb), 3=long rains raise (March-April), 4= long rain recession (May-June) 5= early dry season (July-Aug), 6= late dry season (Sept)

2 code: 0=male; 1=female

3 code: 0= male, 1= female

4 code: 1= internal within Mafia district in local market, 2= external outside Mafia district

5 code: 1= internal within Mafia district in local market 2= external outside Mafia district

6code: 1= bank, 2=VICOPA, 3= SACCOS, 4= Government, 5= Self support

### 1. Part II: Determination of household income

2. List the quantities, uses and values of crops your household has harvested during the past 12 months.

Crop	Area of cultivation <sup>1</sup>	Season of cultivation <sup>2</sup>	Cultivated by whom <sup>3</sup>	Unit of product-ion	Total product-ion (a)	Uses		Type of market <sup>4</sup>	Price per unit (b)	Total value (a*b)
						Own use (kg)	Sold (kg)			
Maize										
coconut										
rice										
Sunflower										
others										

1 Codes:

1=uplands, 2= floodplains

2 Codes: short rains raise (Oct-Dec), 2=short rain transition (Jan-Feb), 3=long rains raise (March-April), 4= long rain recession (May-June) 5= early dry season (July-Aug), 6= late dry season (Sept)

3 Codes: 1= men, 2=women, 3= both men and women, 4= men, women and children

4 Codes: 1= internal within Mafia district, 2= external outside Mafia district

2. List the quantities, uses and values of cultivated vegetables and cultivated fruits your household has harvested during the past 12 months

Product	Cultivated area <sup>1</sup>	Season of cultivation <sup>2</sup>	Cultivated by whom <sup>3</sup>	Unit of product-ion	Total product-ion (a)	Uses		Type of market <sup>4</sup>	Price per unit (b)	Total value (a*b)
						Own use	Sold			
Cultivated vegetables										
Cultivated fruits										

1 Codes: 1= valleys, 2= uplands 3=wetland

2 Codes: short rains raise (Oct-Dec), 2=short rain transition (Jan-Feb), 3=long rains raise (March-April), 4= long rain recession (May-June) 5= early dry season (July-Aug), 6= late dry season (Sept)

3 Codes: 1= men, 2= women, 3= both men and women, 4= men, women and children

4 Codes: 1= internal within Mafia district, 2= outside Mafia district

4. List the number of adult animals your household has now, and the ones you have you sold, bought, slaughtered or lost during the past 12 months.

Livestock	Present number	Sold (incl. barter), live or slaughtered	Slaughtered for own use (or gift given)	Lost (theft, died)	Bought or gift received	New from own stock	Number (12 months ago)	Price per adult animal	Change in stock value	Total value
Cattle										
Goats										
hens										
Others										

5. What are the quantities, uses and values of fish you have harvested for the past 12 months?

Fish type	Fishing gear <sup>1</sup>	Season <sup>2</sup>	Freq. of fishing <sup>3</sup>	Labour <sup>4</sup>	Unit of production	Total production	Uses		Freq. of consumption at household <sup>5</sup>	Price Per Unit	Type of market <sup>6</sup>	Total value
							Own use	Sold				

1 Codes: 1= hook and line, 2= shark net, 3= ring net, 4= normal gill net, 5=spear (uchokoo) 6= long line

2 Codes: SW monsoon (May-October), 2= Northeast Monsoon (Nov-March),

3 Codes: 1= everyday, 2= once in a week, 3= once in a month, 4= i cannot tell

4 Codes: 1=one, 2= two,3= three, 4=four,5= more than 4

5 Codes: 1= everyday, 2= once in a week, 3= thrice in a week, 4= once in a month

6 Codes: 1= internal within Mafia district in local market, 2= external outside Mafia district

6. What are the quantities and values of fish related activities you have conducted for the past 12 months?

Activity type	Season <sup>1</sup>	Freq. of activity <sup>2</sup>	Unit of measure	Total production	Own expenditure	Price Per Unit	Type of market <sup>3</sup>	Total value

1 Codes: short rains raise (Oct-Dec), 2=short rain transition (Jan-Feb), 3=long rains raise (March-April), 4= long rain recession (May-June) 5= early dry season (July-Aug), 6= late dry season (Sept)

2 Codes: 1= everyday, 2= once in a week, 3= once in a month, 4= i cannot tell

3 Codes: 1= internal within Mafia district in local market, 2= external outside Mafia district

**Thank you for your cooperation**

## Appendix 2: Checklist for Key Informants

Ward.....Village.....Name of respondent .....

Age.....Gender.....

Job title.....

Years at current job.....

### Village Leaders

1. Awareness on the importance of fishing in a respective area.
2. Groups of people who are engaging in fishing.
3. Availability of fish market.
4. Existence of fishing related activities and who performs the activities?
5. Is there any financial support that facilitates fishing?
6. Are there any people coming from outside the district to perform fishing, why?

### District Fisheries Officer

1. What are the factors that influence fishing activities in your area?
2. Is there any relationship between fishing activities and household income, how?
3. What are the activities performed in relation to fishing?
4. Who supports the fishing activities financially (both fishing and its related activities)?
5. What is the condition of fishing in your area?

### Elder/Old people

1. Oral history of the area and changing in household income.
2. Contribution of fishing activities on household income

**“Thank you for your cooperation”**

### Appendix 3: Checklist for guiding Focus Group Discussion

1. What are your socio- economic activities relating to fishing, ice making, boat repairing, net making, sardines/dagaa drying.
2. Who perform the activities

Socio -economic activities	Performers (Gender)	
	Women	men
1.		
2.		
3.		
4.		
5.		
6.		
7.		

3. Which season in a year are these activities performed?
4. Why are these activities performed specifically in a specified season in a year
5. Are you receiving any financial support in your activities?
6. Which financial supports?
7. Are there market available for
8. Selling your fish
9. What are the types of fish species harvested?
10. Which species have more value?

**“Thank you for your cooperation”**