THE IMPORTANCE OF ARTISANAL FISHERIES OF LAKE TANGANYIKA TO THE LIVELIHOOD OF THE FISHERS IN KIGOMA REGION - TANZANIA

(A socio-economic Case study of the "Dagaa" fishery (*Limnothrissa miodon* and *Stolothrissa tanganyicae*)

By

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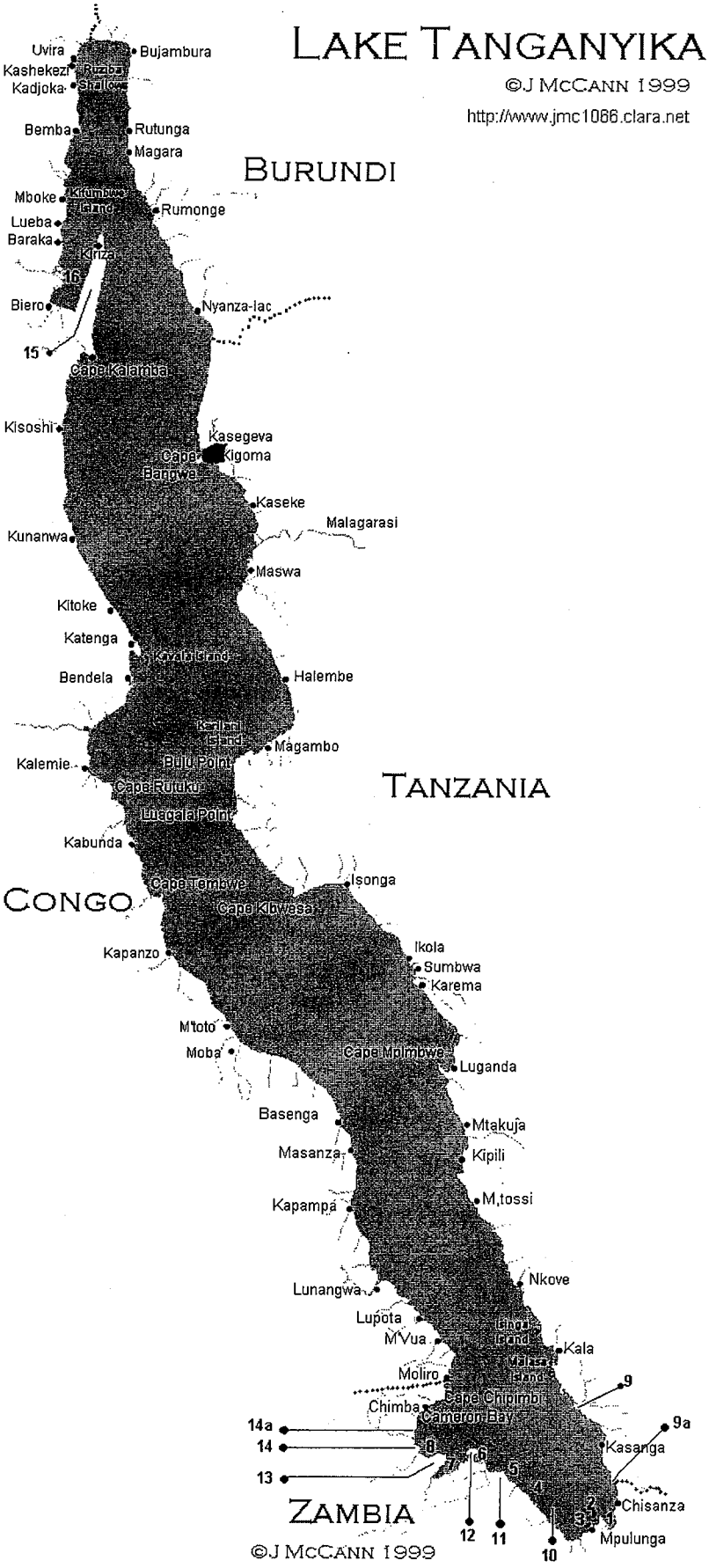
Landing sites • Katonga and Kibirizi (Kigoma region- Tanzania)



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ABSTRACT

The thesis documents the significance of the dagaa fishing for the population in Kigoma district on Lake Tanganyika. While the fishers are engaged in a number of different livelihood activities, such as agriculture, trading and small business, fishing is the main activity both in terms of providing food and income.

In the study area more than 85% of the respondents eat dagaa daily and selling dagaa locally, regionally or for export to surrounding countries generates most cash income. With relatively few other alternatives, fishing is "an employment of last resort", acting as a buffer for the poorest in the population.

The dramatic increase in catches and effort in the Lake Tanganyika fisheries over the 20 years is not due to any technical improvement of gear and boats.

On the contrary, most fishers still operate traditional gears and boats, so the increase is mainly due to population changes, that is, to the influx of refugees from surrounding countries Democratic Republic of Congo, Rwanda and Burundi.

While most inland fisheries in southern and eastern African seem able to accommodate such fluctuations in effort, there are signs that certain management measures should be employed in the case of Kigoma. They should encompass limited entry (through co-management arrangements) and minimum size regulations. The most important measure is to create alternative livelihood possibilities to take some pressure away from the fisheries.

Finding from the problems mentioned by the fishers, better transport, improved processing and better infrastructure facilities could contribute significantly to reduce post-harvest losses and increase the value of the current catches. However, in their strategies government authorities should not focus only on the fishing sector, but on all sectors involved in creating viable livelihoods for the local population

Key words: Livelihood strategies; Lake Tanganyika; Dagaa fisheries; Effort expansion; Socio-economic conditions.

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CHAPTER 1

1.0 Introduction

What is general evident in Lake Tanganyika basin is the great reliance by the majority of the population in the exploitation of natural resources for both basic necessities of life and economic gain. Most of these resources such as land, forest and fisheries are already under stain from exploitation, The imbalance between population growth and dwindling natural resources poses the greatest challenge to the economy and alleviation of poverty in particular. As the population grows, the number of people relying on these natural resources will also grow and over use will likely be more and more prevalent.

The lives of all Tanzanians depend on natural resources for both the present and future generations. The country is endowed with significant natural resources, which include forests and woodlands, wild animals, rivers, lakes and wetlands. All these resources play an important role to the economy in terms of the social and economic goods and services, which they provide. The depletion of these resources will positively undermine the ecological sustainability of various economic activities.

1.1 The importance the "Dagaa" fishery (*L.miodon and S.tanganyicae)*

"Dagaa" (*Stolothrissa tanganyikacae* and *Limnothrissa miodon* (lumbu) is an important food item in Tanzania and is mainly supplied by artisanal fishers and processors. Sun drying, smoke drying, salting or fermentation are used to preserve fish that cannot be marketed fresh. Dagaa is the collective name in Tanzania for various types of sardine-like fish eaten in a dried form by poor and middle-income groups throughout eastern and southern Africa. Dagaa is a reliable source of food for the people in the Kigoma region and ranks first as the most important staple food. The majority in Kigoma area rely on dagaa as their major source of protein compared to other sources of protein such as beans, and meat.

This fishery provides direct and indirect employment to the people. Besides the fishermen, women often sell their dagaa. Fish brokers, whole sellers and retailers (middlemen) occupy stalls in urban markets selling dagaa in Dar-es-Salaam, Morogoro and other major cities. Suppliers of fishing gears, also represent an important economic activity in the fishing communities. (FAO, 2000), documented

important economic activity in the fishing communities. (FAO, 2000), documented that fish harvesting, processing and trade is often "an employment of last resort" for the poor, and in many situations fishing and fish processing may be the only income earning opportunity available to poor women, particularly those who are the heads of households.

Pauly (1997), argues that even if the production methods in many small-scale fisheries hardly change, an uncontrolled entry by poor people who have been marginalized from other economic sectors in particular from agriculture will lead to human overpopulation and to overexploitation of the biological resources. Hence, the question of livelihood in general and fishing effort in particular plays an important part in assessing the situation around the lake.

1.2 Objective of the study.

The main objective of this study is to examine the direct and indirect importance of "Dagaa" (*Limnothrissa miodon* and *Stolothrissa tanganyicae)* to the livelihood of fishermen of the Kigoma region. This will be shown in two aspects, economic importance, (employment and income generation) and social importance (organisations and gender aspects). In addition this study is intends to examine problems experienced by the fishers and how these problems are addressed. My research questions can be summarised as follows:

1 What is the significance of the Dagaa fishery on Lake Tanganyika for the population in Kigoma region (Tanzania)?
2 What are the incomes generated by the fishers from this fishery?
3 What are the main problems facing the artisanal Dagaa fishers?
4. How are the problems being addressed by the government?
5. What other means of livelihoods do the fishing population have?

1.3 Research problem

The fishermen do not employ modern fishing gears and fish processing activities to secure the health of consumers. The fishing techniques are simple (dugout canoes with paddles) and the fishers complain about lack of markets and facilities for transport. Poor handling and lack of fish receiving stations where the fish can be

stored and properly processed, further aggrevates the situation. The availability of appropriate and modern fishing gears and storage facilities, transport and appropriate methods would help improve the living condition of the people and alleviate the poverty of the community by increasing their income. Reliance on a very limited range of fish captures techniques thus limits yields, fishing range and the potential for generating more income. Low incomes and poor or non-existent access to credit reinforces the tendency to employ only a limited range of fishing techniques.

Low quality fish processing, inadequate fish processing and marketing techniques leading to high levels of post harvest losses and restriction of the range over which fresh and dry dagaa is marketed. This also reduces the value of the Dagaa from Lake Tanganyika,

Movements of refugees have increased the pressure on the fishery. According to UNHCR (2000) around 285,000 Burundians and 118, 000 Congolese have sought refuge in Tanzania. Many refugees not reflected in these figures have settled along the Tanzanian coast and many live in camps within the Kigoma region. These population movements have had repercussions on society, the regional economy and the environment

1.4 Rationale of the study

The artisanal fishermen produce about 90% of the total fish catch in the country; while only 10% is derived from industrial fishing. Most of the fish caught is consumed locally while Nile perch, sardines and prawns are for export. Fish contributes about one third of the animal protein or 30% of the total intake of the Tanzanian population. It is an important source of employment, livelihood to the people, recreation, and tourism (generate foreign exchange). The direct contribution of the fishing sector to GDP for the past five years has been between 1.6 and 3.1%. (Tanzania fisheries policy, 1997).

The artisanal fishers use primitive fishing gear and crafts in carrying out their fishing activities. Due to the nature of fishing equipment the fishers are forced to operate near the shores, leaving the offshore areas untouched and causing some local over - exploitation of the near -shore fishing grounds.

This study will examine the direct and indirect importance of " Dagaa"(*Limnothrissa miodon* and *Stolothrissa tanganyicae)* fishery to the livelihood of fishermen of Kigoma region .In the end I hope to come up with proposal and suggestions in order to improve the situation for the fishers in the lake. The following pages describe research methodology for data collection that was necessary to conduct this work.

1.5 Research methodology

1.5.1 Study area

Kigoma district is one of the three districts in Kigoma region. This region has three districts, Kigoma, Kibondo and Kasuru district. Kigoma districts composing of two local councils namely Kigoma town council and Kigoma Ujiji.The district has an area of 19,684km^2, out of this 11655 km^2 is land and 8,029 km^2 is covered by water. It has a population of 358,037 people (URT, 1988), of which 5,899 are fishermen (Kigoma district frame survey, 1999). Kigoma is the largest transit point for goods and people entering / exiting the lake region and it has a rail link to other towns such as Dar-es-salaam, Tabora, Mpanda and Mwanza

Economic activities here are agriculture, fishing and small businesses. Agriculture utilises the arable land but fishing has a comparative advantage. According to available records the majority of people live in poverty and the per capital income is about Tsh 30,000 (URT, 1994). The poorer hired fishermen have fewer options and tend to continue fishing but sometimes they diversify into agriculture. The potential to improve the economic condition of Kigoma region is high if a suitable policy is formulated regarding fishing and connected activities.

1.5.2 Location

Research work was conducted in the period of June - July 2003 along the coast of Lake Tanganyika, specifically in the Kigoma region .Two fishing stations / beaches were visited; Katonga beach which is about 10 km away from Kigoma town and Kibirizi beach which is located in the Bangwe area .

1.5.3 Sample

Of the several fishing stations in Kigoma region Lake Tanganyika (on the Tanzanian side) two beaches were selected as a sample: Kibirizi and Katonga .On the two

beaches 56 respondents were interviewed. This includes fishermen and processors and traders with 28 respondents from each station. Fishing boats were chosen randomly, and then the leaders were picked for interviewes. This was done due to the fact that leader have more information than other crewmembers. That means that the sample is not representative in statistical terms.

The data was collected by the use of the following techniques; random sampling and direct observation. Regarding direct observation, I spent some time with the fishermen, processors/ traders and some of the gear owners in order to collect background information. I also collected some information from local fisheries officers.

A structured questionnaire was used to interview each respondent individual. The questionnaire were both in English and the Swahili language. The English questionnaire was used to interview fisheries officers. The interview questionnaire was of three types; type one for fishermen, and type two for the processors /traders and type three for the fisheries officers. The respondents were also grouped into three categories, Category 1, Fishermen, Category 2, Processors / traders and Category 3, Fisheries officers. (see appendix 3)

My study have benefited from the findings of various other studies, made by Tanzania Fisheries Research Institutes (TAFIRI), Lake Tanganyika Research Projects (LTR[1]), Lake Tanganyika Biodiversity Projects (LTPB[2]), FAO (Food and Agriculture Organisation of the United Nations) and other previous research and information from non-government institutions (NGOs).

Tanzania Fisheries Research Institute (TAFIRI) carried out the research activities in both fresh and marine waters. The institute conducts research on fishery resources and disseminates research findings for fishery development and sustainable management of the resource. The institute also trains and conducts research on fish technology and on fish stock assessment.

[1] The research for management of Fisheries in Lake Tanganyika. LTR; was carried out in 1992- 1997. The project was funded by the Finnish International Development Agency (FINNIDA) and executed by the Food and Agriculture Organisation of the United Nations (FAO) in close co-operation with the University of Kuopio.

1.5.4 Data analysis

The analysis of survey results is done under broad themes like for instance "consumption", "perceptions", "income and earnings"etc

Data analysis was carried out based on the information acquired. Data were entry into Microsoft EXCEL and then analysed in frequencies, percentages and presented in form of pie charts, bar graphs using SPSS.

1.5.5 Data reliability

A point of concern for many African small-scale fisheries, and equally for the cases in this study, is data reliability. Catch and effort data can be completely unreliable, possibly forged, and in most cases useless for closer analysis.

Sample sizes in the two surveyed areas are relatively small about 374 and 329 fishermen and processors/ traders in Katonga and Kibirizi respectively (Frame survey, 2002) .56 respondents on two beaches were interviewed, 28 respondents from each beach (20, fishermen, 8 processors / traders). This limited sample was due to time constraints. During the dark period (three weeks without moon light that is ideal for catching Dagaa) many fishers concentrate on the landing sites. My survey was done at the end of this period. Hence, few fishers were found in the landing site this situation is likely to affect sample size and representativity. Some issue are difficult to obtain information about, such as profits and income.

Some respondents were not willing to be interviewed. During this study some fishers refused to be interviewed as individuals but were willing to speak in large groups. This was probably due to the security situation because some of the fishers were refugees from neighbouring countries such as Democratic Republic of Congo, Burundi and Rwanda and they were not confident to respond

At the time of the interviews most fishermen were tired because they had fished overnight and slept at daytime. In order to reduce some of the limitation above, I alternated between the two beaches, and revisited the beach after two or three days.

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[2] Lake Tanganyika Biodiversity Project (LTBP) is a five-year project that began in 1995 with funding from the United Nations Development Programme/GEF

1.5.6 The structure of the thesis

The rest of the thesis is structured as follows

Chapter 2:

Presents the importance of fisheries to the livelihood of the coastal communities and in particularly the importance of the Dagaa fishers around the Lake Tanganyika-Kigoma district (Tanzania portion) which is the study area. Chapter two explains the background to the study as well as describing the study area – Kigoma district and its historical aspects, population and fishing activities will be given in this chapter.

Chapter 3 covers the theoretical approach, which is related to the general livelihood concepts, various strategies and the role-played by fishing.

Chapter 4 deals with the research findings of the study carried out in Lake Tanganyika (Tanzania portion) in Kigoma district. This chapter analyses the findings in two fishing stations; Katonga and Kibirizi stations, in relation to other previous studies.

Chapter 5 tries to answer the research questions. The discussion will cover the importance of Dagaa fishery to the livelihood of the Kigoma fishers. The problems faced by the fishers also will be discussed in this chapter. Finally I will try to explain how fishing effort in Lake Tanganyika expands.

Chapter 6 offers conclusion and recommendations.

CHAPTER 2

2.0 Backgrounds and Introduction

This chapter gives the general over view of the Tanzania fishing industry, including both marine and inland fisheries, harvest, processing and marketing and export. Different types of fisheries on Lake Tanganyika and their historical backgrounds are highlighted. The importance of the livelihood to the communities around the Lake Tanganyika as well as to Tanzania economy is focused.

Tanzania is a coastal state endowed with some of the largest freshwater lakes in the world, with substantial fish resources The total area of the mainland Tanzania is 883,749 km, ^{2} of which 53,480 km^2 (or 6%) are freshwater lakes, together with large and navigable rivers such Rufiji, Kagera, Ruvu, Pangani and Ruvuma where fishing is undertaken. Tanzania, owns 51% of Lake Victoria, 45% of Lake Tanganyika, 20% of Lake Nyasa .The country has also other small natural lakes, man made lakes, dams, reservoirs, swamps, rivers and small ponds suitable for aquaculture, All these waters covers 58,000 km^2. The marine water covers 64,000 km^2, which includes the Indian Ocean, and the Exclusive Economic Zone, which covers 223,000km^2.

The fisheries sector has great economic and social significance to the country. The sector contributes around 10 % of the national GDP. It is the main source of protein to nearly one third of the country population, URT; (1997) .It provides a source of employment and livelihood to a substantial number of people, it is also a source of recreation, tourism and foreign exchange The number of fishermen who are permanently employed is 80,000 and few others obtain their livelihood from the sector by being employed in the fishing and fishery related activities. Artisanal fishermen obtain 90% of the total catch while only 10% is derived from industrial fishing. Most of the fish caught is consumed locally while Nile perch; sardines and prawns are exported URT, (1995).

In Tanzania the main potential for immediate increases of production and supply for local markets depends in low value small pelagic species inland fisheries important in

food security providing over 80% of the domestic catch. FAO, (1996). Freshwater production is, however, close to its estimated potential. Therefore the major challenge for the fisheries sector will be to maintain current levels of utilisation. This will require significant efforts to improve the management of capture fisheries, supports development of aquaculture and promotion of intra-regional trade URT, (1997).

The role-played by fisheries to the livelihood of the community, its significance as a source of food and employment in Tanzania is very substantial. Fish represents 30% of the total animal protein available in the national food supply. In many areas it is of vital significance for the nourishment, and indeed survival, of local inhabitants. Furthermore, in a context where the overall rural economy offers very limited opportunities for gainful employment, fishing activities offers opportunities for at least a moderate level of remuneration. Depending on the job, conditions of entry in terms of skill and investment requirements may be relatively favourable.

It is a growing demand for fish created by population a growth of approximately 3.5% per year (Tanzania Fisheries Policy, 1997). Artisanal fishing is dominant in Tanzania; consists traditional fishers using traditional fishing gears. The fishing crafts in use include the dugout canoes, outrigger canoes and plank boats The common types of fishing gears used include gill nets, cast nets, pole and line, beach seines, hooks, traps, lift net and scoop net. There are few fishers who use engines due to the fact that engines are expensive.

2.1.0 Fisheries Exploitation

Tanzanian fisheries are divided into two components; the freshwater and marine water fisheries, variety of finfish and shellfish species are exploited. Annual catches in 1998 for the whole of Tanzania mainland fishery amounted to 348,000 tones, part of which 48,000 was from marine territorial waters. The small commercial sector contributed 1,933 tones, (0.6%) of the total catch. URT; (1995).

Commercial species available comprises of freshwater finfish, marine finfish and shellfish. The most important specie in freshwater lakes is the Nile perch (*Lates niloticus*) , forms the bulk of exports from Lake Victoria. Others include sardines from Lake Tanganyika - *Stolothrissa tanganicae* and *Limnothrissa miodon*, Nile

tilapia (*Oreochromis* sp.), Cyprinid pelagic sardines (*Rastrineobola argentea*), and *Haplochromis* for aquarium purposes.

2.1.1 Fish marketing

The domestic market of fishery products is the largest. Sun dried sardines, salted and smoked. Nile perch are marketed to neighbouring countries such as Burundi, Rwanda, Democratic Republic of Congo and Zambia. Holothuria and seaweeds are exported to Far East. EU is a primarily the export market of shrimp. The Nile Perch fishery is growingly important. Their exports have surpassed that of marine products. Kullaya et al, (1998) show that about 25 % of the Nile perch landed in the country is exported. Fillets and frozen Nile perch are marketed in EU, Israel and Australia Gibbon, (1997). There is a formal and informal export of dried sardines to neighbouring countries. Fish export is controlled by international regulations on quality. However, an export of processed fish to neighbouring countries is possible which so far has been used only to a limited degree

2.1.2 Marine fisheries

Tanzania has a coastal line in the western side of the Indian Ocean, stretching for about 800 km long. However, the continental shelf is very narrow, a factor that contributes to a low fish productivity. Marine fishers mainly operate traditional outrigger canoes, dugout canoes and small dhows. The marine fish catches contributes about 20 % of the total fish landed in Tanzania. As pointed out by Ssentongo and Jihulia (2000) that the marine sector supports between 11,000- 16,300 full time artisanal fishermen who produce about 80% of marine fish landings. The main fish species exploited are sardinella; Ariidae, carangidae, Leognathidae, Lutjanidae, Mullidae and Scombridae and sharks. Profitable and productive marine fishing grounds are located between the Rufiji delta and the Mafia channel

2.1.3 Fresh water Fisheries

According to the Tanzania fisheries statistical data, total fish production in Tanzania has been varying over time (see appendix. 1). Contribution from marine waters is small. From 1988 to 1995 total marine production was only about 14.1% of the total productions. The low marine production may basically be due to a narrow continental shelf (60 km at the widest part and 3 km at the narrowest part) and the lack of up-

welling phenomenon. (Kullaya *et al,* 1998). Therefore fish production is mainly depending on fresh water fishery, especially from Lake Victoria and Lake Tanganyika.

2.1.4 Lake Victoria, fish production and export

Lake Victoria is the second largest fresh water lake in the world, after Lake Superior in North America. It covers an area of nearly 68900 $km^{2,}$ shoreline nearly 3500 km and occupies a catchment area of 35900 km^2.

The Lake Victoria fisheries are among the world's most important inland fisheries. Between 1975 and 1989 the lake fisheries produced a total value in the order of 280 million U.S. dollars Reynolds *et al,* (1992). This lake has higher fish yield than Lake Tanganyika and Lake Nyasa. Lake. Victoria is shared with three countries, by which Kenya and Uganda hold 6% and 45% respectively. Tanzania has about 51 % of the lake. The lake is rich in terms of biodiversity.

The contribution of Lake Victoria fisheries to the total fish export in the country has increased significantly for example in 1992, the export volume from the Lake was less than 1000 tones but it reached about 113033 tone live weight equivalent, six years later. There is no doubt to the fact that exporting such large volumes while catches have stagnated and population is growing has an impact on domestic fish consumption. URT Fisheries statistics, (1999)

The boom of Nile perch opened a new page of trade in the country in 1993,when 20,825 tones were exported. The export reached 118,855 tones in 1998 URT, (1998). The Nile perch finds a ready international market and an industrial processing and export industry grew up around the lake during the 1980s Reynolds (*et al.* 1992). Large numbers of new fishers have been attracted to the lake, the total number in Tanzania rose from 15,194 in 1983 to 29,816 in 1989 Bwathondi, (1992).

Nile perch was introduced to feed on *Haplochromine*s in the1950ies and1960ies. Many scholars documented that stocks of the introduced species increased rapidly between 1971 and 1983, accompanied by a decline and in some cases total disappearance of some of the native species. Fish landing from Tanzania portion of the lake increased from an average of 50,000 tones in 1970's to about 200,000 tones

in late 1980's.The available statistics suggests that total catches have since then declined between 150,000 tones per annum (See appendix 2). The booming up of the Nile perch has attracted a lot of investors and globally, the Nile perch fishery has been an exceedingly positive development from economic benefit and food resource Reynolds and Greboval (1988). For the fishermen to maximise the catch, many of them tries to employ even illegal methods. The use of small mesh size nets which catch immature fish and non-selective fishing methods such as beach seining and trawling has made a lot of damage. The total landing of Nile perch has declined due to high pressure of fishing to meet the high demand. Okeyo-Owour, (1999).

2.1.5 Processing and Marketing

Fish is landed in various scattered landing sites. According to 2000 survey the number of landing sites was 602, the number of fishermen 56,258, and the number of fishing vessels 15,491. Compared with the 1998 survey it is a big increase in number of landing sites, fishermen, fishing vessels and fishing gears URT, (2000).

Different means of fish distribution are used depending on the type of fish and market destination Some buyers carry fish by bicycles, by basket on their head. Others, whose destinations are far from landing sites, carry fish by car. The most common method is transport boats that ferry the fish to the processing plants. The Nile perch filleting industry in the Lake Victoria region has expanded tremendously over the lasts 10 years. It now offers a major market for the artisanal caught fish .At the moment there are 10 fish processing plants in Tanzania sector of the lake.

Traditional processing methods such as smoking and salting have vitally disappeared.. This new development has drastically reduced employment opportunities, especially for women. As pointed out by Ward, (1996) post harvest fish losses were much higher before the introduction of processing plants. The fishermen are motivated to handle their catches in better way, in order to sell to the factories that offers higher price for a good quality fish

2.1.6 Lake Nyasa

Lake Nyasa is the southern most African Rift Valley Lake shared by three countries, Malawi, Mozambique and Tanzania. It has a total surface area of about 30,000mk^2

Tanzania occupies about 20% of the area. The Lake is not so productive on the Tanzanian side due to the steep shore giving way to deep depth Maembe, (1988). Fish species which are found in the lake include Tilapias, Haplochromines *Lethrinops, spp,Bagrus spp Limnothrisa spp* and many others. As found in frame survey 1998/ 99, Lake Nyasa has about 104 landing sites, 8,216 fishermen, and about 2,324 fishing vessels. Fish landings on the Tanzanian side show that for the period between 1994-1995 ,Haplochromis ssp were the most prominent, constituting about 30% of the total.

2.1.7 Small Water bodies, Dams, Rivers, and Swamps

Lake Rukwa is among other small lakes in Tanzania, which is not shared with other countries. According to the frame survey 1998/99 Lake Rukwa (Mbeya region) has about 25 landing sites, 857 fishermen and 607 fishing vessels. In 1995 landings was 540.6 million tones (Tanzania Fisheries Division). Besides the large lakes, Tanzania have numerous smaller lakes and rivers, which together produces about 30 % of total fish landings in the country.

2.2 General overview of Lake Tanganyika

2.2.1 Lake characteristics

Lake Tanganyika located at 3°20'-8°48'S and 29°03'-31°12'E) is among the East African Rift Valley lakes. It lies at 773 m above sea level; it is 673 km long, has a surface area of 32900 km^2 and a maximum width of 48 km. The maximum depth is 1470 m, making it the second deepest lake in the world average depth is 570 m and the volume is 18800 km3 .The Lake is shared by four riparian states Burundi (8%), Tanzania 41%), DRC (46%) and Zambia (6%) (Coenen *et al.* 1993)

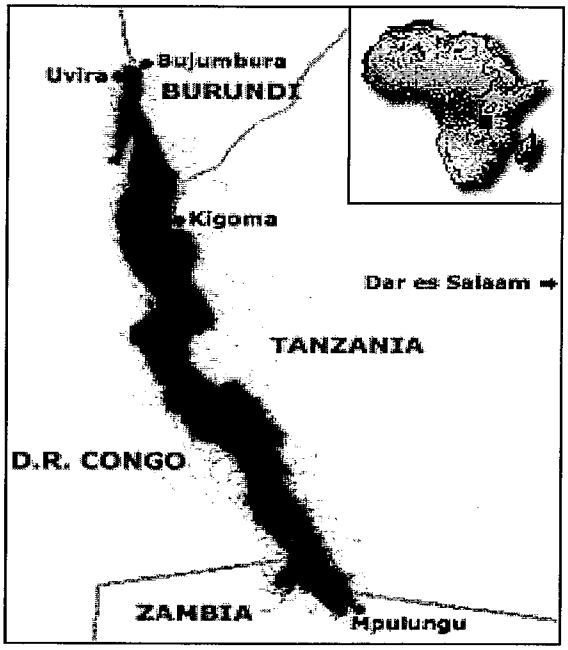

Figure 1: Lake Tanganyika map and countries shares the lake

The lake hosts one of the largest inland fisheries in Africa, second only to Lake Victoria in volume of production FAO, (1995). It represents a significant source of food and livelihood for millions of people residing within and around its basin. Some 45,000 fishers were counted around the lakeshore in the mid 1990`s working out of 786 landing sites. Such figure immediately direct attention to the important social- and economic role-played by the fisheries, Magnet, *et al,* (2000).

2.2.2 Physical characteristics of the Lake

The lake receives water from several rivers. Most important is the Ruzizi river close to Bujumbura in the north, which supplies more than 50 % of the total dissolved salts. The only outlet from the lake is river Lukuga at Kalemie flowing into the Congo river. There are two main seasons in the region occupied by the lake. A dry season lasts four months from May to August and is characterised by cool, dry conditions and strong southern winds during the rain season. The rest of the year winds are generally lighter and mainly northern. In recent years Lake Tanganyika like many other large lakes of the world, has begun to feel the effects of variety of human impacts, including fishing pressures. An increased rate of sediment accumulation along rock coasts caused by deforestation and soil erosion in the lake's watersheds, and climate change has been reported, (Coulter, 1991).

2.2.3 Main fishing gear

Lift net primarily used for dagaa fishery, is either catamaran or trimaran (two or three boats or canoes) boats are connected by connecting poles Lift nets are categorised into three size groups (circumference x depth) 64m x 18m; 72m x 20m and 80 –85m x 24 Fishing method by light attraction by kerosene pressure lamps in darker nights, attract large concentration of plankton and in turn concentration of dagaa, making harvesting easier

Figure 2: Catamaran Lift net fishing units on the shore of Lake Tanganyika Kigoma Tanzania

2.2.4 Status of the artisanal fisheries

Catches of the artisanal fisheries are marketed fresh or processed (sun dried, salted or smoked). The lack of a highly developed cold storage and marketing network makes fresh and frozen fish distribution to the inland population in most areas far from the landing sites difficult.

Lake Tanganyika is an important resource for its riparian country. It provides fresh water for industrial and domestic use. Between 165,000- 200,000 tonnes of fish are harvested annual from the whole lake, representing a significant source of protein in local diet (Reynolds, 1999). The lake is also a source of recreation tourism and foreign exchange. As documented by Reynolds et al, (2002) pressure on the lake and its resources continue to increase by ever expanding human populations and attendant settlement. Cultivation, deforestation, urban/industrial water, extraction and waste disposal become ever more apparent. According to the Lake Tanganyika frame survey 1998, the Tanzanian side of the lake comprises of 8,650 fishermen, and 2,404 fishing vessels (Tanzania fisheries Division, 1998)

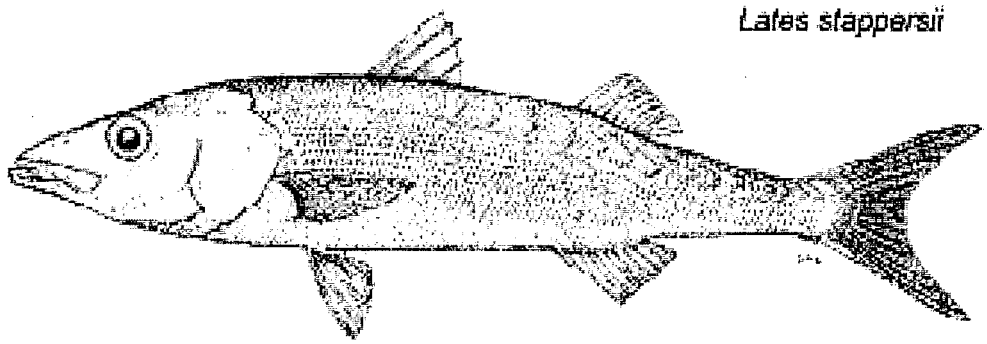

Figure 3: Luciolates stappersii common name Sleet lats, Local name " migebuka " (Tanzania)

Clupeids are generally the most abundant species. (Reynolds *at el*, 2002). The dominating lake Tanganyika fish catches consists of three fish species two of the species are pelagic Clupeids such as *Stollothrissa tanganyicae* and *Limnothrisa miodon* (Dagaa) and *Luciolates stappersii* (migebuka) endemic to the lake. (Reynolds *at el*, 2002).

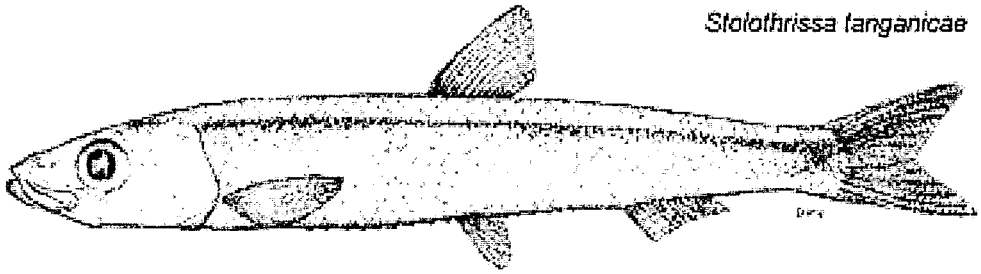

Figure 4: Stolothrissa tanganicae –Common name Lake Tanganyika sprat

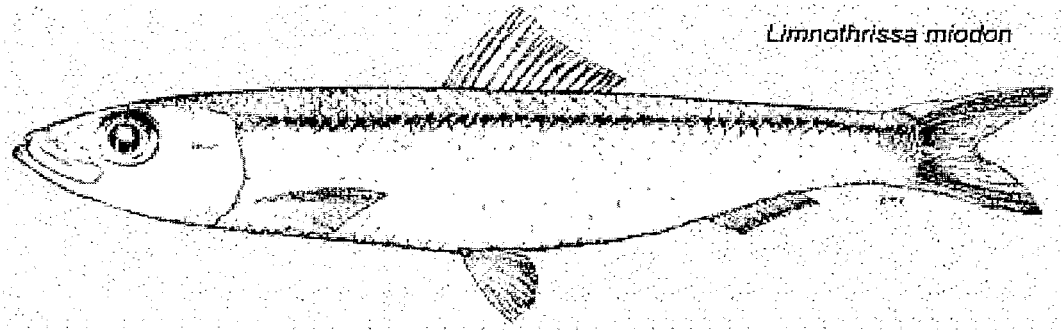

Figure 5: Limnothrissa miodon – Common name Lake Tanganyika sardines

This lake is known internationally for the spectacular variety of its endemic cichlid fish fauna.. The demersal community includes almost 300 fish species of which over two-thirds are endemic, Magnet et al, (2000) Fishing has intensified considerably over the course of the 20th century, reflecting the dramatic expansion of human population and settlements around the lake and the introduction of various technical innovations, such as paraffin oil (kerosene) pressure lamps for night fishing, synthetic-netting material, and motorized craft, Reynolds et al, (1999)

Available data show that certain traditional fisheries are either being fully or near full exploitation, where as others are being little exploited, but can offer a good potential for increased population, Coenen et al, (1998). While efforts are being made to develop new fisheries, the current exploited fisheries need to be managed to sustain production and improve handling and processes to reduce fish resources losses in order to meet the needs of the growing population and the future generations and in this way contribute to the food security.

2.2.6 Processing and marketing

Fish processing is not well developed; clupeids are either sold fresh or sun-dried. An improved method of washing in brine and then drying them on racks has been introduced but is rarely used. External marketing of catches in excess of local needs is difficult and complex due to transportation problems. With the exception of the very north of the lake most roads are tangential. The shores are steep and few roads link the populations around the edges of the lake, particularly the extensive shorelines of Democratic Republic of Congo and Tanzania. TAFIRI, (1980)

LTR SEC survey observations confirm that poor infrastructure and natural barriers impose heavy constraints on fish processing and marketing possibilities Reynolds and Han, (1997). Steep escarpments restrict overland access too much of the shoreline. Roads link the principal towns like Kigoma, Kalemie, Moba, and Mpulungu with their hinterlands, but feeder routes between towns and their outlying areas are not effectively developed. Railway lines exist only at Kigoma, in Tanzania (with service to Tabora and Dar es Salaam). Furthermore, there are few facilities for energy-intensive techniques of fish handling and processing, e.g. chilling, freezing, or canning.

The bulk of fish landed at most sites are processed in simple traditional method in order to extend its shelf life for marketing purposes. Simple sun drying on the beach or ground is easily managed under local conditions; method need little input other than labour. It is by far the most common method of processing clupeids and *L. stappersii*, which constitute the greater bulk of the Lake wide, catch. (See Fig 19)

2.2.7 History of Lake Tanganyika fisheries

The artisanal fishery in Tanzania has undergone a process of transition from scoop net to the lift nets. Scoop net (Lusenga) is a traditional fishery operates during dark nights using light for attracting the small pelagic fish locally known as `dagaa`. Babembe fishermen started fishing with light attraction on the lake.

The artisanal fishery has grown immensely from the late 1950 `s when the technique of lift netting from Catamaran rings was first introduced in the Northern part of the lake, (in Burundi). Lift nets units are equipped with 4 to 8 pressure lamps and operated by 4 to 6 persons. Use of engine is restricted almost entirely to artisanal units. Lake Tanganyika has been an active fishing site since the early1950`s when fishing activities started (Roest, 1988).

As found in the Frame survey conducted by LTR 1995, purse seine units which were operated from large ports throughout the lake, now concentrated in the southern portion. 13 industrial units are active in Burundi, but only two were active in 1995.In Tanzania the industrial fisheries never developed to the same extent as other neighbouring countries While there has been very little development of the industrial fisheries around Kigoma and Rukwa, adequate modification have been observed concerning the fishing gears involved. This fishery is very expensive to establish, because it requires a fleet of boats and large purse nets. (URT, Fisheries Division, 1995).

2.2.8 Types of fisheries in Lake Tanganyika

Both artisanal and industrial fishing is operated at night using light attraction method. Fishing continue throughout the year with a break about 9 nights each month around the time of full moon fishing activities operates 19- 21 days every month Coulter

(1999). The industrial fishery started in 1954, when Greek fishermen introduced the purse seine. A typical industrial fishing unit consists of 16 to 20 m long steel vessel, a purse seine and auxiliary steel boat, 5 lamp boats and a total crew of 30-40 fishers.
The artisanal fishery in the northern part of the lake uses mainly catamarans, 'Apollos' and to a lesser extent trimarans, but the later have total disappeared from Burundi `Apollos`is a large catamaran; 7-9m long canoe, lift net up to 100m of opening circumference, 14 –19 lamps and an average of 8-11 fishers. Artisanal fishery is operated from dugout or planked canoes using lift nets and scoop nets. Outboard engines powers one of the canoes where as the rest of the boats is operated manually

2.2.9 Traditional / subsistence fishery

The traditional/ subsistence fishery is based on the use of Lusenga or scoop nets in (conjunction with fire or lamp light attraction) for the harvest of clupeids, and gill nets, long lines hand lines, traps spears, mosquito-nets, and the use of poison for the capture of demersal species. Although these gears are generally less efficient than artisanal gear, many people are involved in their use around the lake. Subsistence activity undertaken by simple fishing units comprises of one or two persons operating with dugout or simple plank canoes propelled by paddles. According to (Reynolds at el, 1999), traditional fishing with Lusenga nets has undergone substantial decline in recent decades in the face of wide spread adoption of more efficient artisanal gear (lift net).

2.3.0 Summary of fishery statistics Lake Tanganyika 1996 and 1998 (Tanzanian side)

Lake Tanganyika (Tanzania portion), bordered by two regions, Kigoma in the Northern part and Rukwa region in the southern part.

EFFORT	KIGOMAREGION	RUKWA REGION	TOTAL
Total No. of Fishermen	7,644	4,866	12,510
Total No. Fishing vessels	1952	1542	3,494

Table 1: Lake Tanganyika fishery statistics, frame survey, 1996

(Tanzania Fisheries Division Annual statistical report, 1996).

ITEM	KIGOMAREGION	RUKWA REGION	TOTAL
No. Landing site	88	66	148
No. of fishermen	5,594	3,056	8,650
No.fishing Vessels	1,213	1,191	2,409

Table 2: Lake Tanganyika fishery statistics Frame surveys 1998

(Tanzania Fisheries Division Annual statistical report, 1999)

in the future, while not undermining the natural resource base Sustainable livelihoods are achieved through access to a range of livelihood resources (natural, economic, human and social capitals), which are combined in the pursuit of different livelihood strategies such as (agricultural intensification or livelihood diversification and migration).

A livelihood encompasses income, both cash and in kind, as well as the social institutions (kin, family, compound, village and so on), gender relations, and property rights required to support and to sustain a given standard of living. Social institutions are also critical for interpreting the constraints and options of individuals and families distinguished by gender, income, wealth, access and assets. For example, differential access rights to land are often the key determinant of distinct livelihood strategies pursued by poor compared to better-off rural households (Davies and Hossain, 1997). A livelihood also includes access to, and benefits derived from, social and public services provided by the state such as education, health services, roads, water supplies (Lipton, 1993). An oft-stated finding of poverty research is the tendency for public service provision to be biased towards the better off and more accessible locations, communities, and social groups, thus exacerbating the material deprivation already experienced by the poor as a result of inadequate levels of assets and income (World Bank, 1990)

3.1.1 Rural livelihoods and sustainability

Singh and Gilman (1999:540) define sustainable livelihoods as those "derived from people's capacities to exercise increase choice, access opportunities and resources, and use them in ways that do not foreclose options for others to make their living, either now, or in the future". The definition of sustainable livelihoods has led to the development of approaches to analyze livelihood strategies and to develop ways forward to enable them to become more sustainable.

Livelihoods are the ways in which people satisfy there needs, or gain a living Chambers and Conway (1992). A 'livelihood' is a set of flows of income, from hired employment, self-employment, remittances or (usually in developing rural areas) from a seasonally and annually variable combination of all these. A livelihood should be sufficient to avoid poverty, and preferably, increase well being for a typical worker

plus dependants. Well-being as documented by Squire (1991) (cited in Ellis, 1998) is the product of a range of factors, including adequate consumption of goods and services, health, status, achievement, and security.' Livelihood implies systems of how rural people make a living and whether their livelihoods are secure or vulnerable over time.

As documented by Lipton and Maxwell (1992) a livelihood is more than just income. Income refers to the cash earnings of the household plus payments in kind that can be valued at market prices. The cash earnings component of income includes items like crop or livestock sales, wages, rents, and remittances. The in-kind component of income is the consumption of own farm produce, payments in kind (for example, food), and transfers or exchanges of consumption items that occur between households in rural communities. The concept of sustainable livelihoods is a composite of many ideas and interests, the coming together of a number of different strands in the development debate.

3.1.2 Aspects of livelihoods

Livelihoods focus on changes in people's livelihoods – rather than in resources or institutions *per se*. Livelihoods therefore need to look beyond activity-based indicators of progress (e.g. service provision, clinic visits) and resource-based definitions of change (e.g. increased output of energy or crops) to measure achievements from the perspective of partners and beneficiaries. Livelihoods involve the collection of a broader set of data than conventional monitoring, which tends to focus on economic, physical or financial data. However whilst this means that a broader set of data is often needed, this does not necessarily mean that more data needs to be collected. Livelihoods come from a variety of sources and activities, variable over time. They comprise several different activities for each given household - usually even for each working member, and even within a year. Flexibility of households' livelihoods determines the type of strategies that rural households adopt and how they respond to changes. Although some households adopt strategies that rely on few activities, most of them adopt strategies that are complex, diverse and versatile (Chambers, 1989). As rural households derive their livelihoods from different sources, and adjustment measures are expected to affect them in a variety of ways.

3.2.1 Definition of livelihood strategies

The sum of all the different activities that people are doing in the context of their livelihood (Chambers and Conway, 1992). Categories of livelihood strategies as adopted from Devereux (1999), are an accumulation strategy that is strategies that seek to increase income flows and stocks of assets and survival strategies that seek to prevent destitution and death. People who are surviving in marginal situations such as those living in fragile ecosystems, post-conflict or resettlement areas, remote rural areas and urban squatter settlements, utilize survival strategies and they do not initially require growth-orientated financial strategies. They need risk-reduction strategies with a heavy emphasis on social investments such as health care and education. Micro-finance programmes may be inappropriate in areas where there is no access to markets and no infrastructure for basic needs (UNDP, 1999). In these cases, the public sector or donor agencies should target investment to supporting the people's traditional coping mechanisms, as well as in health, education, social mobilization and the strengthening of civil society organizations.

3.2.2 Coping and adaptive strategies

Coping strategies are strategies that seek to minimize the impact of livelihood shocks. They should be able to cope with and recover from shocks such as natural disaster (drought, civil war, policy failure, and sudden failures in production). Adaptive strategies are strategies that seek to spread risk through livelihood adjustment or income diversification. Adaptive strategies entail a long-term change in behavior patterns as a result of a shock or stress. Both have implications on the composition of the assets (i.e depletion, regeneration) from which they are derived. It is important to solicit information about adaptive strategies from men *and* women. An analyses of adaptive strategies conducted on a community basis must take into account the fact that women's adaptive strategies within the household may often be different from mens'. (UNDP, 1999). Adapting to shock and stress is one dimension of rural livelihoods. Some adaptation occurs exante, in choosing activities in the portfolio that take into account seasonality and income generation.

3.2.3 The sustainable livelihoods framework

The concept of livelihood strategies builds on the now widely accepted broad interpretation of poverty. That means that poverty is viewed as including a lack of basic needs, income/consumption, assets (material and non-material), dignity/autonomy, social inclusion, equality (gender and ethnicity) and political freedom/security (Carney, 1999). Broad interpretations of poverty facilitate analysis of the many causes and manifestations of poverty, leading to more creative and effective solutions.

(Scoones, 1998) documented that within the sustainable livelihoods framework there are three broad clusters of livelihood strategies. These are agricultural intensification, livelihood diversification and migration. These are seen to cover the range of options open to rural people. Either you gain more of your livelihood from agriculture such as livestock rearing, aquaculture, forestry through processes of intensification (more output per unit area through capital investment or increases in labour inputs) or extensification (more land under cultivation), or you diversify to a range of off-farm income earning activities, or you move away and seek a livelihood, either temporarily or permanently, elsewhere. Or, more commonly, you pursue a combination of strategies together or in sequence.

Livelihood strategies can also be described at an individual, household and village level, as well as at regional or even national levels. But there are differences evident between scale levels in terms of the net livelihood effects. For an individual it may be best to pursue a particular set of livelihood strategies in combination, but these may have either positive or negative impacts on other household members or the broader community. For instance, a successful agricultural intensification strategy pursued by one person may provide an opportunity for another person's fish culture or fish processing or petty trading livelihood diversification strategy. Livelihood resources may be accumulated so that reserves and buffers are created for times when stresses and shocks are felt; activities associated with different livelihood strategies may be spread over space or over time, such that a particular risk, such as a drought event, does not affect all livelihood activities;

3.2.4 Role of fishing activities in the livelihood strategies of coastal communities

It is usually assumed that most, if not all, small-scale fishing communities, particularly in tropical countries, represent the poorest and most disadvantaged part of rural societies. Smith (1981).

As a result, these populations have been targeted for poverty alleviation by fisheries development programmes since the early 1960's. Unfortunately many of these programmes have been based on sectorial analysis of the economy. With this mono-dimensional perspective, government's or international interventions have frequently failed in achieving their objectives, due to a lack of understanding for the complex livelihood strategies and networks of socio-economic and institutional relationships, which characterise these communities (FAO, 1984) Bailey and Jentoft (1990). By addressing the issues of poverty and rural livelihood strategies for the fishing communities and assess the contribution of the fisheries activities in the development process of the local economy of the Cameroonian floodplains of the Lake Chad Basin Béné et al, (2000), noted that the population is made up of different wealth groups characterized by distinct livelihood strategies. Also Béné et al,(2000), also observed that the poorest rely in a larger proportion on fishing activities while the better off mainly rely on farming. Due this reason the poorest part of the community will depend heavily upon a given combination of crops and or fisheries resources for its food security and income generation, the better-off part of the community, will probably develop a radically different portfolio. Globally, it can be said that both in terms of labour allocation and income generation, the importance of fishing activity in the household livelihood increases with poverty.

Agriculture and fisheries have strictly opposite roles in the livelihood of the community. The determinant factor for this is the difference in tenure system between land and water. While access to water-bodies (and therefore to fishing activity) is not restricted (in the sense is open to every member of the community), the land, on the other hand, is privately owned on a family basis. This has been observed in many African societies. The smaller amount of arable land that can be acquired by the poor hardly produces enough to cover their food requirements. No surplus is extracted from the harvest and the households auto-consume most, if not all of it. The access to

the fishing grounds, which is not limited in this aspect, represents therefore the only way for the poor to generate some cash-income that is used to support consumption and essential current expense in order to survive. Fishing acts therefore as a major component of the poor's livelihood strategy and in that respect, the existence of equity of access to the water-bodies resources has a tremendous importance for the more destitute households of the coastal communities. Consequently, fisheries (and the related activities such as smoking and drying which are usually operated by the fishermen household members) must become a top-priority for poverty alleviation programmes.

Fish resources are often one component of wider household livelihood strategies that adapt to changing conditions. Fisheries may in some circumstances be a temporary or irregular strategy for coping with a production failure. Households may not engage in aquaculture all year, every year but rather when they need to do so. The 'success' of aquaculture uptake must be assessed in the light of such adaptive household strategies. Supporting households' capacity to adapt to change and cope with crisis should itself be an objective of poverty alleviation. Livelihoods approaches have also been useful in monitoring & evaluation exercises to assess what have been reached, what livelihood benefits have been realized, and the types of impacts on different groups within communities.

3.3.0 Why livelihood approaches, security, and livelihood diversification

The livelihood concept is not new, but it is being used as a framework and an analytical tool. Focus on people, and especially poor people, instead of focusing on natural resources and institutional structures. The strength is that the approach provides a "true" picture of rural life and poverty it builds on people and their existing strengths and constraints and recognizes the importance of multiple actors, attempting to understand national and international linkages and their impact on people's livelihoods.

Capabilities, resources and opportunities to pursue individual and household economic goals. Livelihood skills relate to income generation and may include technical/vocational skills (carpentry, sewing, computer programming), job seeking skills such as interviewing, business management skills, entrepeneurial skills such as entrepreneurial skills, and skills to manage money.

Livelihood security means 'secure ownership of, or access to, resources and income-generating activities, including reserves and assets to offset risk, ease shocks and meet contingencies' Chambers, (1988). Thus, it is livelihood security, rather than just food security, that is the focus of rural households because achievement of food security is just one of the objectives of livelihood security (Maxwell and Smith, 1995). The air people breathe, the water they drink, and the qualities of soil they use for farming have huge implications on their livelihoods. Environmental security complements household livelihood security, in that it seeks to give household members access to needed resources while protecting and enhancing the environment for future use

Livelihood diversification is defined as the process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to improve their standards of living Ellis (1998). Diversification may occur either as a deliberate household strategy or as an involuntary response to crisis It is found both to diminish to accentuate rural inequality. It can act both as a safety valve for the rural poor and as a means of accumulation for the rural rich It can benefit farm investment and productivity or impoverish agriculture bywith drawing critical resources (Davies, 1996). It is appropriate to remark in passing that livelihood diversification is neither just a rural nor only a developing country phenomenon. It is well documented as a survival strategy of urban dwellers in developing countries (deHaan, 1997) and is becoming increasingly prevalent amongst farm families in developed countries as agricultural price and other supports to farming are removed. It is also an emerging feature of labour markets more generally in the industrialised countries, being associated with the rise of part-time and home-based working patterns.

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3.3.1 Indicators of sustainable livelihood

Creation of working days is the ability of a particular combination of livelihood strategies to create gainful employment for a certain portion of the year. This may be on or off-farm, part of a wage labour system or subsistence production. Three aspects of employment as indicated by Sen (1975) (cited by Scoones, 1998) that income (a wage for the employed), production (providing a consumable output) and recognition

(where employment provides recognition for being engaged in something worthwhile). In terms of the income/production aspects, various target levels have been suggested, but 200 days a year appears to be widely used as a minimum level to create a livelihood (Lipton 1993). Overall, the number of livelihoods created will be dependent on the proportion of the population available for work.

The poverty level is a key criterion in the assessment of livelihoods. Various measures can be used to develop an absolute 'poverty line' measure based on income or consumption levels (Scoones, 1998). Poverty alleviation requires poor people gaining access to and control over their resource base - not merely their natural resource base but also over political resources and policy-making processes. One of the main reasons that poverty and the importance of fish resources in poor people's livelihoods have been neglected, is that poor people have been excluded from policy-making processes, and have limited rights and capabilities in expressing their interests. The capacity of poor people to organise themselves and represent their own interests must also be addressed.

Policy makers and development institutions must be more aware of poverty alleviation strategies, poor people's livelihoods, and the importance of aquatic resources such as fish resources in rural livelihoods. Advocacy work, including lobbying decision-makers, and improving direct contact between decision-makers and poor people (for example through field visits) is effective and necessary (Friend and Smith, 2002). The poor have many basic needs - food, water, energy, shelter, clothing, transport, health care, education and productive employment. Above all, they need income. Almost all these needs have a close relationship with environmental values, and all have largely been left unmet by past development strategies. The cycle of poverty is made more vicious by the lack of access of the poor to financial capital, to raw materials and, most important, to technology appropriate to their needs and skills, (Khosla, 1993).

3.3.2 Why focus on livelihood?

Poverty alleviation and development are not purely technical and managerial issues. In order to address poverty alleviation and development effectively, we need a better understanding of poverty and poor people's livelihoods, and of what development

means. Any intervention must be based on a sound strategic understanding of the factors that make people poor, and of the ways in which poor people can use and derive benefits from aquatic resources

"Well-being" (Chambers, 1997) and "capability" (Sen, 1987) provide a wider definitional scope for the livelihoods concept. Sen argues that capabilities is 'what people can do or be with their entitlements', a concept which encompasses far more than the material concerns of food intake or income and this represent more than the human capital which allows people to do things, but also the intrinsically valued elements of 'capability' or 'well-being'. (Chambers, 1997) argues that such a well-being approach to poverty and livelihood analysis may allow people themselves to define the criteria, which are important.

Livelihood adaptation, vulnerability and resilience is the ability of a livelihood to be able to cope with and recover from stresses and shocks is the central to the definition of sustainable Livelihoods. (Davies, 1996) states that resilience in the face of stresses and shocks is key to both livelihood adaptation and coping with those who are unable to cope (temporary adjustments in the face of change) or adapt (longer-term shifts in livelihood strategies).

3.3.3 Natural resource base sustainability

Most rural livelihoods are reliant on the natural resource base, at least to some extent. As found by Conway (1985) the natural resource base sustainability is the ability of a system to maintain productivity when subject to disturbing forces, whether a 'stress' (a small, regular, predictable disturbance with a cumulative. The ability to pursue different livelihood strategies is dependent on the basic material and social, tangible and intangible assets that people have in their possession. Based on an economic view, such livelihood resources may be seen as the 'capital' base from which different productive streams are derived from which livelihoods are constructed.

Overall, at subsequent points in time, change in rural livelihoods affects the number of full or part-time fishers and their households. Therefore, in addition to demographic factors, the observed national and sub-national growth rates will be affected by the changes in the main and secondary livelihoods of rural households that

respond to perceived profitability of existing and new livelihood opportunities, including fisheries. Households previously characterised as farming households may become fisher folk households and vice versa. Teitze et, al, (2000).

In the fisheries policy perspective, artisanal fisheries hold a sensitive position because the human dimension is dominant in the analysis of their problems: they concern larger numbers of people, have implications for the livelihood base of large areas, and potentially large population movements hinge on their profitability of existing and new livelihood opportunities, including fisheries (FAO, 2000).

3.4.0 Examples of livelihood diversification

Livestock is an important source of income, especially for upland farmers. Due to the remoteness and inaccessibility of most upland areas (steep slops and mountains) the Government's veterinary and extension services have insufficient resources to reach the area on a regular basis. Basic veterinary services and skills has to be developed within the communities, such as regular vaccination schemes, basic diagnosis of diseases, and establishment of sustainable supply systems for medicines and vaccines

Traditionally poor families maintain small fishponds to cultivate freshwater for their own consumption. These ponds are mostly temporary structures since they are mainly rain-fed or fed from small streams or springs. With relatively small additional investments and training, this technology can be improved and become a sustainable source of income for the poor. That would reduce the pressure in wild fishery, especially if market and storage facilities can be developed in selected areas where markets are required.

Although small ponds may not produce large quantities of fish, they are valuable attention to a diversified livelihood.

The Community Adaptation and Sustainable Livelihoods program is now developing tools to help local people work within the sustainable livelihoods framework, so that they can define their own future. The tools help communities create a vision of the future based on their strengths, which they then communicate to decision-makers. (Khosla, 1993)

3.4.1 Livelihood diversification

Rural livelihood diversification cuts across a number of typically self bounded arenas of policy discussion in development studies including rural poverty, rural growth linkages, rural non-farm activities and rural-urban migration While overlaps occur between these arenas, they each tend to bring rather partial insights to bear on the causes, opportunities, effects and policy implications of diversification (Davies, 1996). Livelihood diversification may take place when rural producers change the composition of fish products they produce. This is a natural starting point for poor rural producers with low levels of capital, who may be able to restructure their production mix more easily than to invest in other non fish cultural areas. Not only can this integration help farmers to maintain pond fertility through the incorporation of crop litter but the pond crops may provide other products as well, in addition to acting as a liquid asset. All of this helps to build up or maintain fish culture

A large and disparate literature, arising from a variety of disciplines, has confirmed that rural people in Africa and Asia do not normally specialise in livestock, crop or fish production to the total exclusion of other income generating activities. Rather, a majority of rural producers have historically diversified their productive activities to encompass a range of other productive areas. Motivations for such diversification are linked with wide range of possible activities, and associated with both positive and negative outcomes. This recognition has lead many researchers to represent rural livelihoods as constructed from a portfolio of resources, or activities (Ellis, 1996).

The attempts by individuals and households to find new ways to raise incomes and reduce environmental risk, which differ sharply by the degree of freedom of choice

(to diversify or not), and the reversibility of the outcome (IIDS, 1996). Livelihood diversification includes both on- and off-farm activities which are undertaken to generate income additional to that from the main household agricultural activities, via the production of other agricultural and non-agricultural goods and services, the sale of waged labour, or self-employment in small firms, and other strategies undertaken to spread risk (FAO, 2000).

It is important to note that what are primary activities for some producers are or may become livelihood diversification strategies for others. The literature on the "homogenisation" of livestock and crop production systems in semi-arid Africa provides one of the best examples of how what is livelihood diversification for some, is primary production for others. Non-agricultural activities are also analysed in the literature on micro-enterprises. Many of the diversification activities pursued by rural people involve micro-enterprises, and the importance of micro-enterprises in generating employment and income in rural areas of Africa has become increasingly recognised.

Rural households, including fisher folk, must not be perceived as stagnant entities, but as dynamic decision-making units. Some households have the capacity to successfully implement income diversification strategies to cope with poverty and income fluctuations, including income failure. However, it is also understood that there may not be enough alternatives locally to fishing and/or farming. In such situations, fisher folk are forced to continue to work in fisheries, or to migrate to urban areas. The lack of access to alternative income sources for fisher folk is of major concern to policy makers (FAO, 2000) It adds to the exploitation of inland and marine natural resources above the level that would occur if alternative livelihoods and income sources were available to fisher folk.

3.4.2 Migration and sustainable livelihoods

Migration forms a central component of livelihood diversification. In Ethiopia, Bangladesh and Mali for example, migration is widespread and in all three cases it is linked to income generation strategies (McDowell and de Haan, 1997). It has been seen how migrant remittances may relieve rural credit constraints, especially important to those living in poor agro climatic conditions. The search for a better and

more secure livelihood drives most migratory movements. When survival is at stake, a common strategy is to move elsewhere.

For the understanding of the link between migration and sustainable livelihoods it is important that it is not only poverty that causes migration, but also inequality. Migrants come from a variety of backgrounds, and different groups concentrate on specific occupations. Migration streams are strongly segmented. There is some evidence that the landless migrate less - because they cannot afford the necessary investment - this seems to be context specific: in some areas they migrate less, but this is not necessarily the case in other areas, or in other periods. Migrants come from a variety of districts, not necessarily the poorest. The poorest in rural areas may find it difficult to migrate. McDowell and de Haan, (1997). Comparison with the non-migration population in urban areas shows that migrants are usually slightly better off (especially when controlled for human capital factors). Some areas have developed a tradition of migration, and once certain patterns of migration exist, they do not change easily.

The nature and level of remittances varies widely depending on the accessibility of the home village, employment opportunities, the costs of living, the ease of remitting, and the' orientation' of the migrant. (David, 1995) found that average remittances were very low but were nevertheless vital to food security, as a way to diversify risks and ensure support in times of harvest. In three of her case study areas very little remitted money was spent on agricultural investment, because of the high price of chemical fertilizers which prohibited all but very few from making this investment.

3.4.3 Government views on livelihood improvement

Improving livelihoods can consist of intensification of agriculture, diversification, and migration. These strategies may be alternatives pursued by households, or households may combine different strategies, and it is likely that the strategies affect each other. Migration is likely to affect the possibilities of intensification and diversification: migrants leaving is likely to affect agricultural practices, and remittances and/or returning migrants are likely to change these practices.

Our current understanding of poor people's livelihoods and poverty alleviation illustrates the need for an integrated approach to address a range of interrelated dimensions of poverty. In order to make institutions more effective and responsive to poor people's needs, it is essential to promote partnerships between government, NGOs and civil society institutions. When promoting these kinds of partnerships it is important to consider the following: NGOs, government, private sector and civil society institutions have different levels of poverty focus due to differing agendas and differing areas of activity. The specific context of each need to be understood Agendas may be quite different, even though objectives are the same. There may be difficulties in getting government and NGOs to have dialogue in some situations .It is important to assist government, NGOs and civil society groups to understand each others' respective strengths and the benefits of working together. Two- way learning and open transparent approach is essential.

As found in the United Republic of Tanzania fisheries policy (1997) that in Tanzania fisheries institutions are traditionally oriented to technical issues, and face serious budget and personnel constraints. The fisheries sector has limited experience in training and extension methods appropriate for poor people. Therefore, it is important to create new learning opportunities for these institutions so that they are able to provide more appropriate services to poor people. It is also important that the skills required to do so are valued and respected within the institutions.

Gaining a deeper understanding of poor people's livelihoods has had important contributions to many interventions. As documented by Friend and Smith, (2002) NGO in Cambodia applied the Sustainable Livelihoods analysis to assess how different poor people have different livelihood strategies, and how groups of poor may change. In some cases this may mean that having benefited from fisheries resource-based intervention to improve their livelihoods, such fisheries resource interventions are no longer the most appropriate to meet their current livelihood needs. The Tanzanian government is taking a number of measures to improve people's livelihood in an effort to fulfill its commitment of serving the community and sharing the common goals. Therefore the government must devote sufficient resources to address the needs of the community, particularly the grassroots and helping the disadvantaged in improving education, and strengthening training.

CHAPTER 4 - Research findings

4.0 Introduction

The objective of my study is focusing on the importance of Dagaa artisanal fishery to the livelihood of the fishers in the Kigoma region and illustrates the problems facing this fishery.

4.1 Fish consumption and preferences

Number of days	Percent
1-2	14,3
3.4	26,8
5-7	58,9
Total	100

Table 3: Dagaa consumption per week

(N=56): Source: Survey results

The people in the Kigoma region consume more Dagaa than meat. Results show that most respondents (58,9%) eat dagaa 5- 7 days per week. As shown in the Table 4 most people also prefer dagaa.

Response	Percent
Yes	91,1
No	8,9
Total	100

Table 4: Fish / dagaa preference

Source: Survey results (N=56)

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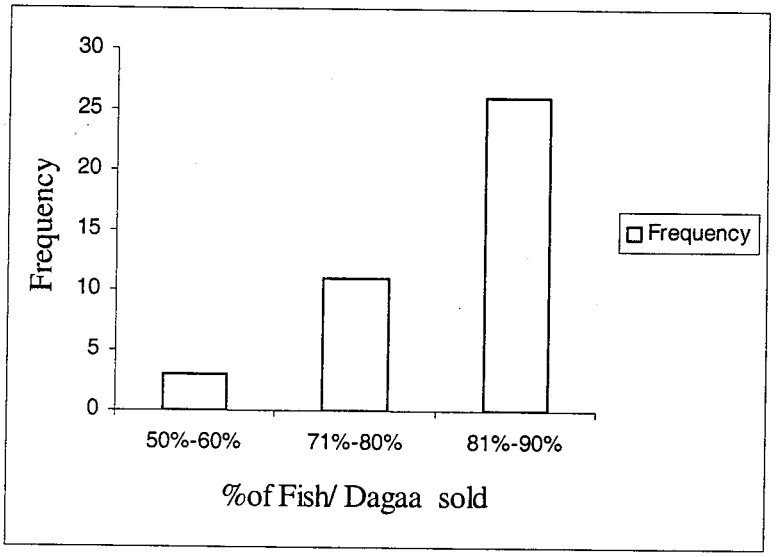


Figure 7: Amount of Dagaa sold to cover the basic needs per day

(N=56) (Source: Survey results).

Fishermen sell a large amount of catch Fig 7 above indicates that 71% -90% of total catches were sold on the landing site to the consumers and to the middlemen in order to cover other basic needs. For example if the fishermen's catch is about 20 kg a day,they normally eat about 2-2.5kg and sell the rest.

Fish /dagaa consumption per day (%)

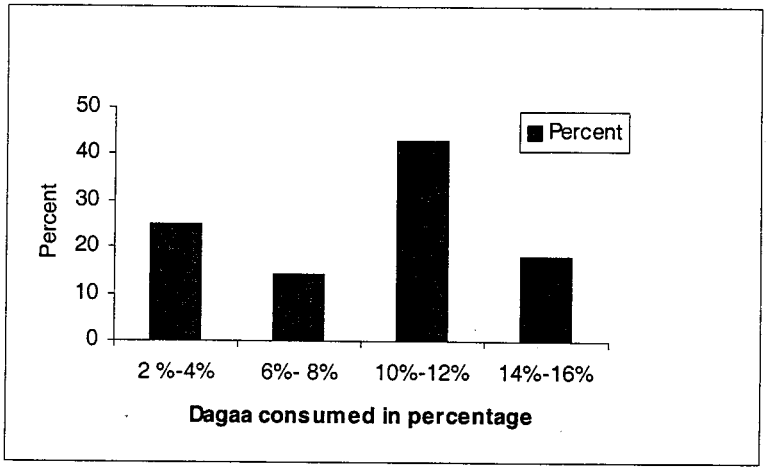


Figure 8: Dagaa/fish percentages consumed per day

(N=56) (Source: Survey results)

Little amount of the catches were consumed directly by the fishermen, while a large amount was sold.

In Kigoma dagaa is normally used for family consumption and for sell to human People tend to regard that dagaa from Kigoma as of higher quality than dagaa from lake Victoria (Mwanza)

Gibbon, (1997) documented that, Dagaa from Lake Tanganyika is not used for animal feed. Even fish with low quality is used for human consumption and still command high price in the market compared to Dagaa from Lake Victoria (dagaa Mwanza).

4.2 Other Sources of protein consumed

Other sources of protein eaten by fishermen in the study area (as shown in Fig 9 below) are beans (87,5%), meat (5%) and green vegetables (7,5%). Respondents said that in Kigoma meat is very expensive (2000Tsh or 2 US$ per kg) and most fishermen cannot afford to buy meat.

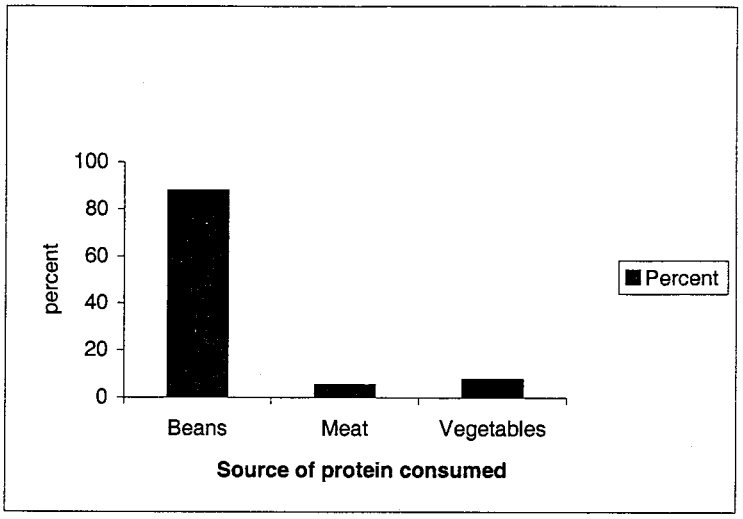


Figure 9: Other sources of protein

N=56 (Source: Survey results)

From the consumer's point of view, dagaa has a distinct advantage being a sardine that is a fish people can easily buy small quantities without any difficulties. Many relatively poor consumers only buy dagaa for 250- 800 Tsh per kg at a time and still the fish contributes an important source of animal protein in their diet. Fish represents close to 30% of the total animal protein available in the national food supply (URT, 1997) and in many areas it is of vital significance for the nourishment, and indeed survival, of local inhabitants.

Fish is an immensely popular food and most of the national catch is absorbed by the domestic market, although an important export market in frozen fillets and some fresh chilled product has developed with the boom of the Nile perch fishery on Lake-Victoria. It is estimated by (FAO, 1998) that about one third of the national catch is consumed in fresh form, and the general consumer preference is for fresh fish when it can be obtained (see Table 5). However, sale and consumption of fresh product are mostly restricted to areas within a short commuting distance from the major water bodies, owing to the lack of adequate communications, insulated vehicles, and cold chain facilities. Survey data in both landing sites shows that about 71,4% respondents prefers fresh fish /dagaa while 16% do like processed (dried dagaa) and some eats both processed and fresh depending on its availability and place.

Form	Percent
Fresh	71,4
Processed	16,1
Both	12,5
Total	100

Table 5: Forms of Fish /Dagaa preferred

N=56 (Source: Survey results)

Various surveys questions such as "Are *fishing activities full time or part time of your work?"* were asked. The results indicate that the communities depend more on fishing activities than on agriculture. There is a high dependency on fishery. Responses on this question show variations among the respondents in the surveyed areas. Full time fishermen depends highly on these activities, while part timers are engaged in small business, agriculture, and shopkeeping. This indicates other alternative sources of livelihood are important both in Katonga and Kibirizi communities, but fishing has been identified as the major livelihood activity and therefore source of income and food.

Figure 10: Women at Katonga landing site selling different products

Fishing model part time or full time bases

Landing site	Fishing model	Type of respondent Fishermen	Processors	Total
Kibirizi	Fulltime	60,7%	25%	85,7%
	part time	7,10%		7,10%
	Missing	3,5%	3,5%	7%
	Total	71,3%	28,5%	100%
Katonga	Full time	60,7%	28,5%	89,3%
	Part time	10,7%		10,3%
	Total	71,3%	28,5%	100%

Table 6: Fishing model in surveyed area (N=56)

Source: Survey results

In survey area, Kibilizi landing site 85,7% of the respondents were engaged in fishing activities on full time basis, while 7,10% were part- time. While in Katonga beach 89,3% of the respondents were full time fishers and 10,7% part- time.

(Table:6). Most fishing is done at night as virtually all-fishing methods (e.g. purse seines, lift-nets, beach seines and scoop-nets) rely on fish/ dagaa being attracted to light. Fishing activities, therefore, practically cease every month during the full moon. Fishing and fishing related activities are the life style of the community and attract significant migrant fishermen who periodically visit the landing sites during the dark period.

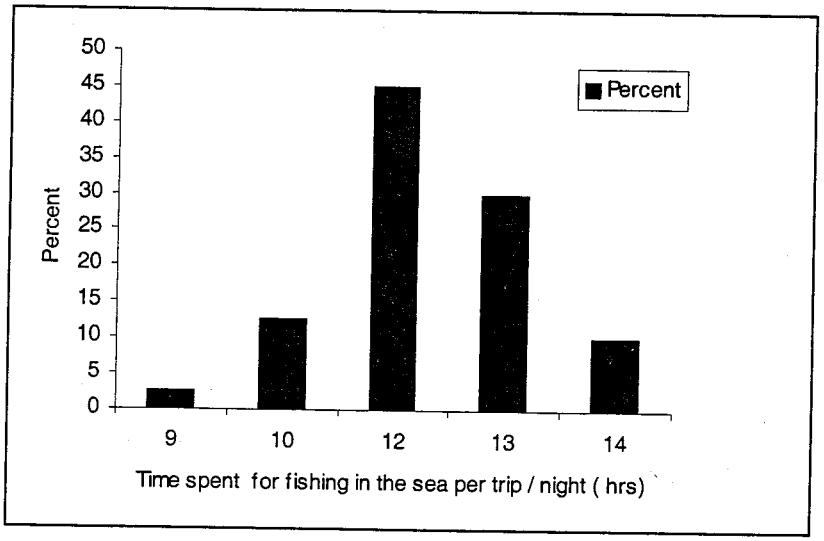


Figure 11: Time spent for fishing in the sea (hours per day / night shift), N =40

(Source: Survey results)

Time spent for fishing activities ranges from 9 hours up to 14 hours a day. According to the research most fishermen spends 12 to 13 hours in the sea night shift. Similar studies done by West, (2001) observed that fishing is hard work (typically a 14-16 hours night shift) and conducted exclusively by men. Women and children are often involved in the processing (sun drying, smoking, salting, or roasting) or marketing of the catch. Unfortunately, tradition has pushed this role into the background for a long time. Even if, the authorities are showing more and more concern about women's role in fisheries, the facilities granted to women are still too trivial to favour them. Stephanie, (2002), documented that women work alone, in groups or in co-operatives. "Fish mammies" dominate the marketing of fish products in the region and they often manage the supply situation and prices. Most of the fresh and frozen fish distributed through the fish mammy system not reach the inland centres due to inadequate handling and cold storage facilities.

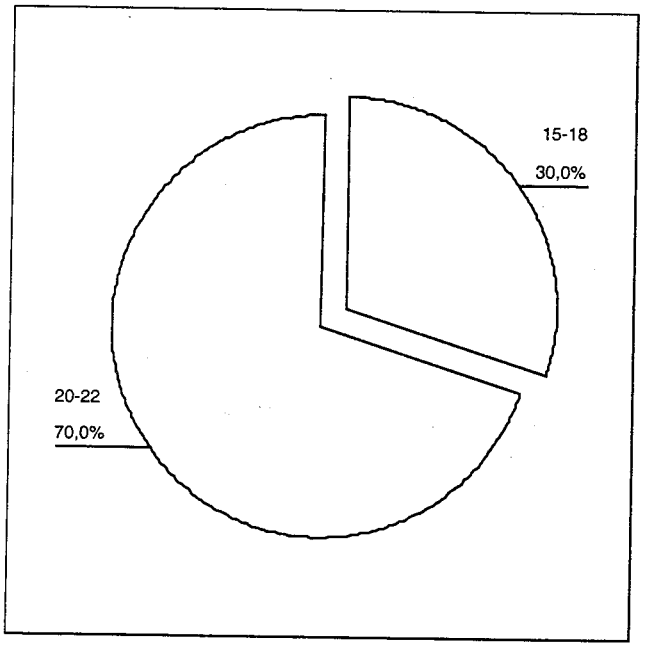
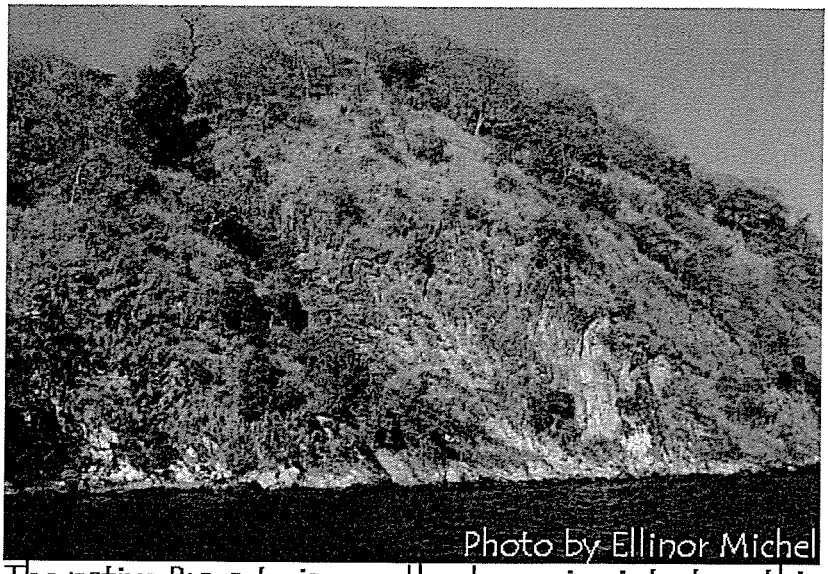


Figure 12: Number of Fishing days/fishing trips per month (N=40)

(Source: survey results)

(Fishermen / crew members only)

During the survey the fishers reported that they normally go fishing 20-22 fishing trips per month (70%) while 30% goes 15-18 fishing trips. In average this fishers make 21 fishing trips per month during the dark period



The native Bracastesia woodland remains intact on this Tanzanian shoreline, perhaps because it is too steep to cultivate.

Figure 13: Hill / mountains becomes barrier for cultivation in Kigoma district Lake Tanganyika - Tanzania side

The limited ability of the other economic sectors such as seasonal agriculture to satisfy these growing human needs, makes the majority turning to fisheries. In this context fishing and other related activities act as " employment of last resort" and an economic safety value to a significant number of people in the Kigoma District. Thus the role of the fishery and its ability to provide daily subsistence to the majority of people on the lakeshore and in Kigoma region is of paramount importance. This also highlights the importance of fishing in the economic lives of most people and brings into sharp focus the need to conserve the resources into the future for the continued socio- economic sustenance of the communities.

4.3 The fishing equipment and its price

Two types of lamps are used for dagaa fishing, standard lamps and normal pressure lamps. Standard lamps have higher penetration capacity than normal pressure lamp that is the light penetrates very deep into the water and hence attracts more fish than

normal lamps. Results show that in both surveyed areas few fishermen have standard lamps (Kibirizi and Katonga, 3 and 4 standard lamps respectively). The fishermen said that they normal buy used (second hand) standard lamps as also standard lamps are very expensive with prices ranging from 50,000- 80,000 Tsh, while normal lamps are in the price range from 15,000-18,000 Tsh

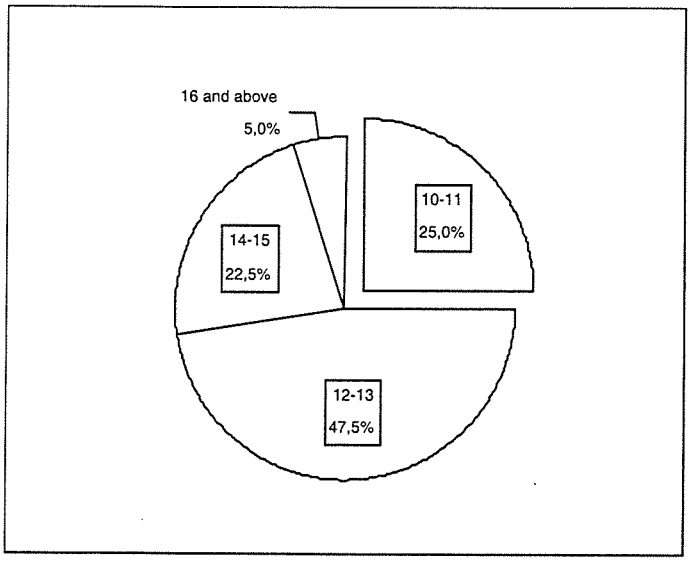


Figure 14: Number of normal pressure lamps used by fishermen in Katonga and Kibirizi landing sites

Most fishers were able to buy many normal pressure lamps, and the majority poses 13 lamps (47,5%) while only 5% of the respondents have 16 or more pressure lamps, The price of the lift nets in the study area varies between 1million Tsh to 2,5 millionTsh which is so expensive the normal fishermen can not afford to buy such nets.

4.4 Employment, prices and earnings

This fishery provides direct and indirect employment to the people in the Kigoma district. It provides a source of employment and livelihood to a substantial number of people. In many cases, fish harvesting, processing and trade are the employment of last resort when other economic opportunities have run out. Processing is particularly important for women heads of households who may be landless.

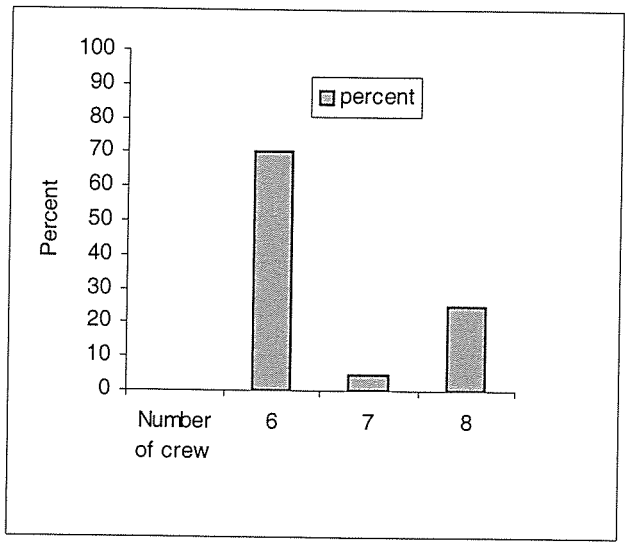


Figure 15: Crewmembers participating in fishing activities per fishing unit (N=40)

(Source: survey results)

Fishing activities for a catamaran-fishing unit, which comprises of two fishing boats in most cases, were done by six crewmembers, (70%) with 3 members for each fishing boat. In most cases, this fishing boat can be operated by 4 crewmembers per fishing vessel as shown in the fig 15 above. Apart from fishermen one fishing unit may accommodate more than 30 peoples were by some are cookers (women), cleaners, some caring boxes to the drying field, gear repairs and net mending (Fishing unit comprises two fishing boats, one lift net, 6 or 8 crewmembers, 10- 14 pressure lamps.

Figure 16: Canoe surrounded with crewmembers and other workers in Kibirizi beach

Figure 17: Fishing Vessels concentration and many people performing different fishing activities in Kibirizi beach –Kigoma

Income of crew members per day `000 Tsh (1US$=960Tsh)							
Landing site	Profitable	5- 10	11- 20	21-30	31- 40	41 - 50	Total
Katonga	Yes	15%	10%	30%	15%	5%	75%
	No	10%	5%			10%	25%
Kibirizi	Yes	30%	15%	25%			70%
	No	15%	10%		5%		30%

Table 7: Crewmembers- incomes a day (N=40)

(Source: Survey results)

In the Katonga landing site 30% of respondents earns 21,000- 30.000 Tsh a day and states that dagaa fishery is profitable, while on the other hand in Kibirizi landing site 30 % of respondents earns around 5000-10000 Tsh a day. This depends on season and catches availability. During the survey 70% and 75% of respondents Katonga and Kibirizi respectively reported that dagaa fishery was profitable while 30% and 25% of

respondents said that it was not profitable (Table 7). On other hand processors income were varies between 2000-3000 Tsh a day. The 1997- Social economic survey data show that earnings amongst artisanal operators are substantially higher in most places than those of either traditional fishing operators or processors/traders, and those artisanal unit owners earn substantially more than the crewmembers and helpers. Post-harvest income levels appear to be generally lower than those of the harvest sector, especially in comparison with levels found in the artisanal fishery Magnet, et al, (2000)

Season	High catches	Low catches
One box of sadines / dagaa	Tsh. 5,000- 15,000/	15,000- 45,000/=
One box of finfish "migebuka"	Tsh. 5000-18,000/=	13,000-25,000/=

Table 8: Average cash incomes vary according to seasons and catch availability

(Source: Gibbon, 1997)

Most individuals become fishers or fish farmers because they expect the activity to provide a means of livelihood for themselves and their families. During the early part of the twentieth century, as a rule, no one interfered with this choice and those who were not directly concerned paid little attention to the activities of fishers and aqua culturists. As reported in UNDP (1999) per capital income of the Lake Tanganyika riparian people ranges from 110- 320 US$ per year with significant proportions of the population living below the national poverty line and at less than 1 US$ per day. These statistics are in many cases several years old but they provide a general idea of the socio- economic situation faced by many citizens of the Lake Tanganyika basin.

The higher the supply the lower the demand and the lower the price. This condition has been observed during this study, when the price of dagaa fluctuated according to the catch availability, which also depend on the phase of the moon. When catches are high, prices drop and this affects the income of the fishers. With higher catches in the study area dagaa was sold 250-800 Tsh per kg and at low catches the price was about 1500 –2500 Tsh per kg. The inadequate communications and lack of transport facilities have tended to create a sensitive market for the fishermen with a low price

elasticity of demand as prices fluctuate with the level of daily catches. The quantity of fish sold in international markets from the artisanal fisheries is extremely limited.
The price of small pelagic captured by artisanal fishers varies seasonally in relation to their abundance. It is cheaper than meat, while higher valued species show a price near to that of meat. In general, as far as the product form is concerned, prices of fresh fish fluctuate more than fish in other forms.

4.5 Additional activities

4.5.1 Agriculture activities

Few respondents in Katonga and Kibirizi carried out agriculture activities. Other activities include small businesses and, brick making.. Following a study done by Lindley et al (2000) it is documented that in the Kigoma region along the lake farming is not as important as fishing and this is due to the lack of hill farming traditions and limited access to the market indicating that farming practices have not been improved or diversified. Suontausta (1992) observed that mountainous landscape puts its limitations on agriculture and soil erosion is a problem in some areas. Small fields can be seen everywhere around the fishing villages, often on steep hillsides.

Fish mongering are petty business people who purchase sardines from fishermen when they land, dry the sardines and they usually sell on retail or on wholesale to other business people who export it across the borders, while sending to Dar es Salaam. Traders claimed that the current market of sardines provided by buyers from the Democratic Republic of Congo has significantly enabled them to raise their incomes, although this market is not officially recognized by the District Trade Officer. Traders claimed that, they prefer the direct exchange or 'cash terms' than the selling on credit system they sometimes experience with middlemen in Dar es Salaam.

Figure 18: Middlemen /Traders purchasing Dagaa at the landing site Katonga beach

4.5.2 Women's activities

Women may purchase fresh dagaa to process, sell and sometimes may be paid in kind for their labour. In my study area women were employed as cookers, cleaners and in most cases they were paid in kind. Stephanie, (2000) documented that activities in the artisanal fisheries are divided between men and women. The men are more involved in the act of fishing itself, while for women, known as "fish mammies", two distinct activities can be noted: one in which women, are involved in the processing and marketing of the fish, often captured by their husbands or other relatives; another in which women finance fishing units and do not necessarily have a family relationship with the boat owners or fishermen.

4.5.3 Women processing co -operative groups Katonga and Kibirizi

Initiatives to improve the welfare and earning of women by means of co-operative activities including micro-credit schemes are being taken in many localities throughout the region and around the Tanganyika lakeshore, often involving partnerships between international and national NGOs and local community groups. My study noted in particular the activity of a local NGO in Kigoma known as the Kibilizi Women Development Trust, which is working with a local group to dry and market small pelagic dagaa. Drying racks have been constructed with the aim of obtaining a cleaner and better quality product with a higher market value. In addition other women's co-operative groups were operating at both beaches involved in this

study, in Katonga beach was Kitwe fishing group, most of these groups were not yet registered.

Ships like ''Mv Liemba'' and ''Mwongozo'' and other small boats are used to transport large amounts of dried dagaa around the lake, and are thus very important to the artisanal fishing industry. Outboards engines of between 40 and 75 horsepower usually power boats, with a 55 hp seemingly being the standard model. Sometimes the boat is used both as transport and sales platform in the landing site

The retailing areas around the landing site in both surveyed areas were universally squalid. One respondent at Katonga landing site argued that in this area there was no adequate clean water supplies, no clean surfaces and no shade and invariably open to flies and dust. Residual contamination from previous days sales contributed to the general lack of hygiene and therefore there is no doubt that if even rudimentary health regulations were enforced on the urban fresh fish markets in the Kigoma region, most markets would probably be closed down. During my research I also visited Kigoma Ujiji fish market where the situation was similar with two places previously mentioned.

4.5.4 Fish/ Dagaa processing

Three processing methods have been identified in both landing sites; sun drying, salting and sun drying and smoking. Sun drying is more popular than other methods and is the one, which is preferred by most fishermen and processors Salting and sun drying (racks) this method were performed by few fishers in the study area compared the sun drying. Smoking method used especial for (*Limnothrissa miodon* and Lates.

4.5.5 Sun drying

The artisanal catch is generally sun-dried before marketing. This process is carried out directly on the beaches, and often results in serious wastage during the rainy season, when fish catches reach their peak. The majority of processing around the lake is sun drying. There is no refrigeration of any sort in the study area .All fish were landed fresh, without ice. This restricts its keeping time fresh to a few hours as fishermen takes many hours in the sea The lack of refrigeration is a real constraint to transport of fresh fish and cooling with ice offers the best opportunity for improving fish quality on the lake. (See fig19)

Dagaa spread on the ground "mbuga" simple sun drying

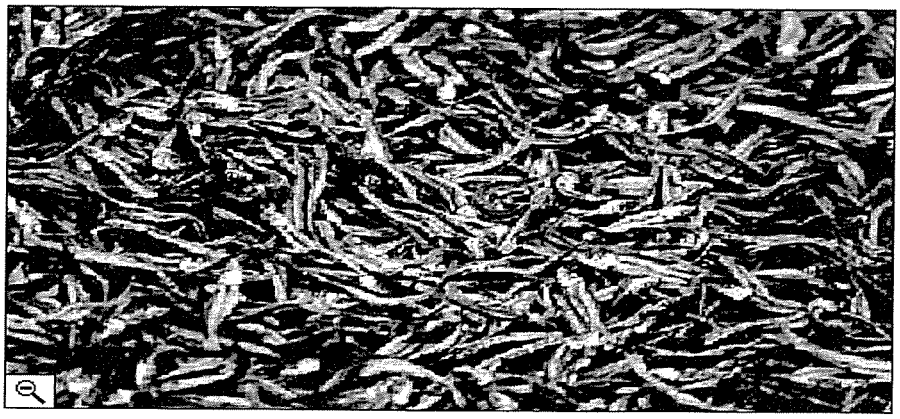


Figure 19: Sardine drying fields at Katonga, near Kigoma in Tanzania

The fishermen normally sell the catch to women and middlemen who proceed to dry it. Special areas of ground are cleared of all vegetation and the fish are laid on the ground ("mbuga") as shown in the fig above. This implies that dagaa most often is contaminated with sand

With respect to the processing methods, research findings show that fish /dagaa not contaminated with sand fetches a premium price and in most cases traders/ processors sell in large cities like Dar es –Salaam, Arusha and Morogoro, where by 1kg is sold for 800- 1500 Tsh, and dagaa dried on ground sold 250- 800Tsh Per kg in the beach . After being suitably dried fishes are collected and marketed in sacks of up to 70kg – 100 kg. Fishermen and processors then sell direct to the consumers and to the traders where the majority are from Congo DRC (formerly Zaire) Burundi, and Rwanda.

4.5.6 Salting

This method is widely used along Indian ocean and Lake Victoria for salting Nile perch. The salting method requires transportation of salts, which could be difficult during the rainy season. There fore salt becomes expensive in areas, which are not reachable. Improved methods of brine washing and rack drying have been introduced but are rarely used in the Kigoma area where by most fishermen complains that racks are very expensive and not sufficient, especial when there are large catches. Salting is done with brine and smoking is done in a typical smoke kiln, (like that used for *Lates stappersii*). Both of these are fallback measures, since the product that is in demand is

a dried one. It also considerably increases the costs, without increasing the return, and neither method can be done in large quantities.

During this study sellers and processors were complaining that dagaa dried on racks is not popular among consumers do not buy due to the high price . The traditional processing methods have consumer preferences and habits on their side

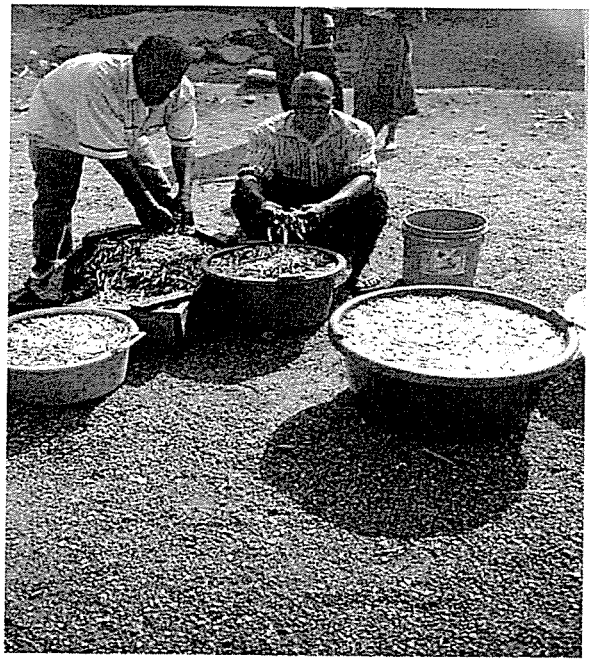


Figure 20:Processors in Katonga washing dagaa in water mixed with salt before sun drying

Fish smoking is widely conducted in Tanzania, but this method has got a negative impact on the environment because smoking involves the use of firewood to smoke fish. As a result, trees in areas around the lakes have been felled down. This problem can be revealed if on go to Lake Victoria in Mwanza and Mara regions, where land is completely bare.

4.5.7 Fish / Dagaa Exports

Unlike in the case of Nile Perch (*Lates niloticus*) and prawns, for which there are active trade in Tanzania, no local dagaa is exported in a processed or unprocessed form to the northern hemisphere, and the only industrial process to which dagaa is subject is milling (generally dagaa of inferior quality) (Gibbon, 1997). Furthermore a significant export market (Democratic Republic of Congo) had opened up, alongside a

large 'supporting' market in Tanzania for dagaa unfit for human consumption, for the poultry feed industry. In the fishing station I visited, the fishermen were selling dagaa to the traders from Democratic Republic of Congo, especially when catches exceeded the local demand and when catches were destroyed by rain. Many authors documented that there is a very important trade in dried sardines round the lake, The networks of the sardine trade extend throughout East Africa, from Lusaka in the south, deep into Democratic Republic of Congo to the west and up to Lake Victoria and Rwanda in the north.

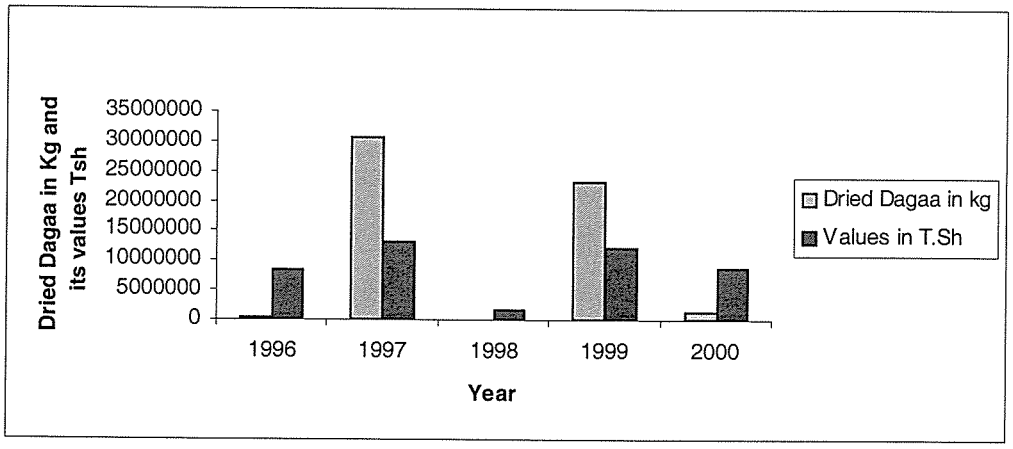


Figure 21: Dried Dagaa exports and its Values in Kigoma region (1996-2000)

(Source: Kigoma District fisheries office)

4.5.8 Fishing related activities

Other activities related to fishing include cooking, which is a female-only activity) sardine/fish mongering and craftsmanship (boat construction, net mending construction of canoes).

Being a cooker entails cooking for fishing groups and additional activities of housekeeping depending on the 'whims' of the fishing group one is engaged to. From experience, when fishing is in boom, a cooker can earn about 8000-10,000/= Tshs worth of dagaa every two days, but usually they earn about 2000 Tshs a day, and sometimes nothing if the fishermen do not catch anything. The period of engagement depends on the fishing periods and in these years, the availability of lift net fishing units. However, most cookers remain on their jobs when they consent to perform activities such as heating water for bathing or washing clothes. Many cookers have also been subjected to sexual abuse since some fishermen have a habit of demanding sexual favors as if it was part of the job agreement.

Fishing seasons largely influence people's livelihoods. Small- scale businesses such as food vending, food crop marketing, charcoal sales all flourish when fishing is at peak between April and early October, or periods of darkness that refer to the three-week period (see Fig 12) (20-21) days per month) This dependence on fishing has also influenced income patterns. To those households that have a low degree of diversification, low fishing seasons have a negative income on their status

4. 6 Problems facing the fishers

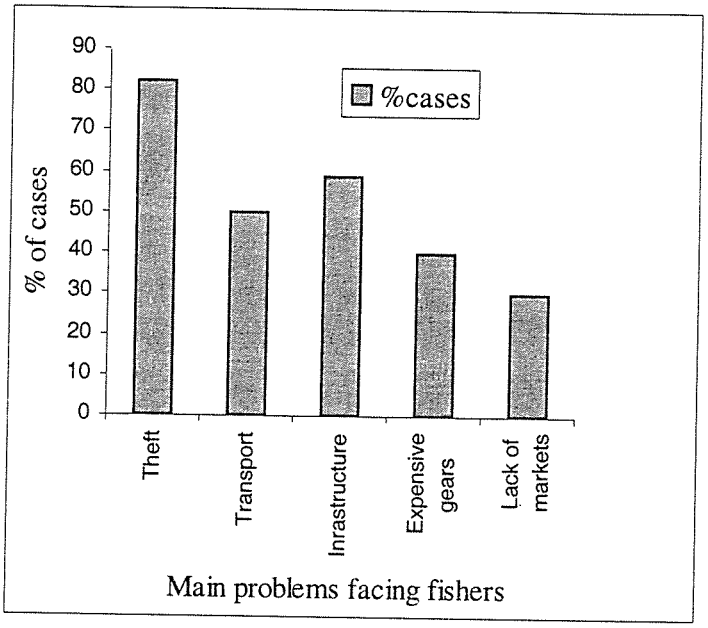


Figure 22: Major problems affecting fishing activities in Kigoma District (N=56)

(Source: Survey results)

Through questionnaire which were conducted during my survey problems facing Kigoma dagaa artisanal fishermen were identified such as low level of fishing technology, inefficient credit facilities, lack of co-operatives, inefficient processing methods and lack of markets.

4.6.1 Theft

Life and asset insecurity caused by robbery, which caused significant loss of property and assets. Robbery has made economic productivity in Kigoma particularly for the artisanal fishers of Kibirizi, Katonga and other areas to stagnate as it has been identified during this study 82,1 % of respondents reported that robbery is a major problem for the fishing activities. Also according to the previous records at Kigoma fisheries district office show that fishing gear/ equipments and its values have been

robbed in Kigoma region. This problem made some fishermen lose their lives and some of them left the fishery. Most respondents complain about robbers and this seems to be a serious problem not only in Kigoma district, but also in other areas along the Lake.

Fishing gears and equipment robbed in Kigoma district

Fishing gear /Equipment	Number	Its Value in Tsh (1US$ = 960 Tsh)
Engine	200	160,000,000
Gill nets	202	153,750,000
Wooden boats	50	25,000000

Table 9: Examples of fishing gears / equipment robbed in Kigoma region 1996-1999

(Source: Kigoma District Fisheries office)

People regard both life insecurity and asset insecurity caused by armed robbery by thugs suspected to come from the Democratic Republic of Congo as the key risk factors to their impoverishment.

A similar study which has done by Mung'ong'o. (2000) also observed the same situation Piracy on the open waters is a major concern of fishermen at Kirando.on the lake Tanganyika (Tanzania side). Theft of nets and engines has been reported in the fishing villages throughout the last few years. The problem only started about ten years ago. To date, the police have recorded incidents of theft worth 80,000,000 - 100,000,000 Tsh in Kirando ward alone. The obvious result has been reduced lift net activity and hence reduced catches and incomes.

4.6.2 Inadequate infrastructure and inefficient utilisation

During my research 59 % respondents documented that lack of infrastructure such, as electricity, seems to be a main problem hindering fishing activities in Kigoma district. The same situation has been identified by West (2001). Except for a few large towns and one city found along the Lake Tanganyika basin, most village lack basic infrastructure in terms of road access and electricity, communication, and little industrialisation has taken place, for example in Kigoma there is no sort of dagaa processing industries. Also West (2001) documented that in this area to date, tourism remains relatively undeveloped because of the remoteness, lack of infrastructure and

regional insecurity. Landing sites surveyed do not have appropriate facilities for receiving and handling fish.

Figure 23: Fresh Dagaa stored in the small baskets 'vitabo' (left) and in box to the

4.6.3 Credit facilities

Despite low capital income of the fishermen which has contributed to a low small capital investment, the donor intervention has boosted the levels of investment by giving small scale facilities .FAO facilitated the credit facility between 1983 and 1995 and later on, was joined by NORAD through Kigoma Integrated Development Programme (KIDEP) .The magnitude of loan was 213,314,8.90 Tsh. (22220, US$) which benefited 916 fishermen and processors (Kigoma District fisheries office, 1983-1995) .

Level of credit facility by phase

Year	Number of Fishers	Loans in US $
1983-1986	53	7715,03
1987-1991	363	4888,553
1992-1993	439	125233,1
1995	61	40359,97
Total	961	222202,9

Table 10: Credit facilities provided to the Fishers and Traders/ processors by phase in Kigoma region

(Source: Kigoma District Fisheries Office)

However compared to the number of the fishers in the region, this credit scheme is only benefiting a small minority. In my sample of fishers the main problem seems to be lack of collateral, that is the ordinary banks will not give loans without collateral

4.6.4 Lack of transport network

There is no-good all-weather roads which connect the landing sites along the Lake Tanganyika particularly in Kigoma area (Katonga and Kibirizi landing site) The only means of dagaa transports is by railway Kigoma – Tabora - Dar es salaam and other place and by limited to other places along the lake shores. (See Fig 22) .The marketing of fish especially for the communities living far from the landing site and far from the lake shore such as Kibondo and Kasuru represents a serious problem with lack of means of transports and large distances to travel.

External marketing of catches in excess of local needs is difficult and complex due to transportation problems. With the exception of the very north of the lake, most roads are tangential. Many authors documented that the shores are steep and few roads link the populations around the edges of the lake, particularly the extensive shorelines of Democratic Republic of Congo and Tanzania. Fish such as clupeids, are thus traded along the coast by 'water-taxis' or by the ferries M/V "Liemba" and M/V "Mwongozo ".

I also tried to have a look on causes of post harvesting loses which have an impact on the fishermen's catches and hence income. The respondents through questioner are identified their main problems causing post harvest losses as indicated in the fig below; rain fall (70 %), time spent for fishing (62.5%) distance from the fishing ground to the beach (42.5 %) and technical problems such as engine breakdowns and boats leakage, (25%)

(Multiple response as one respondents may have more than one answer hence %cases) exceed the actual % of respondents

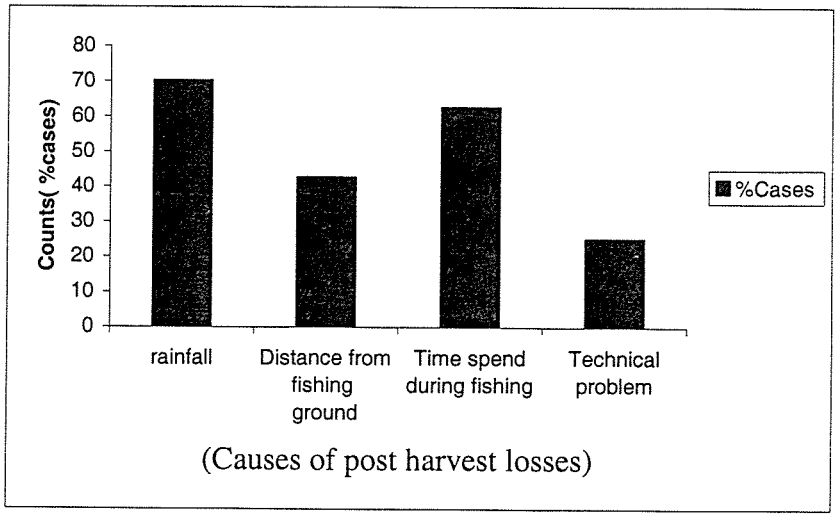


Figure 24: Causes of post harvesting loses (N=56)

(Source: survey results)

4.6.5 Expensive gears and fishing equipments

The national cash economy is unreliable. Inflation is running high but the fish / dagaa prices are mostly not following increased costs for the materials needed. The recent devaluation in Tanzania has made imported outboard engines and lift nets more expensive. Even though some fishing equipment is locally available, it has been observed that respondents reported that gears are available locally but the domestic production is able to supply only a fraction of the materials needed and import is very expensive.

A significant sum of capital is required for one to acquire the fishing equipment needed for the technology currently practiced in the Lake Tanganyika fisheries i.e. lift-net fishing. This equipment includes at least one motor engine (approximately worth 2-2.5 million Tshs), two canoes (approx. 70,000/= Tshs each), a lift net (200,000/= Tshs), 20 pressure lanterns (20000-50,000/= Tshs each (for the used ones) and other equipment (e.g. boxes, paddles, poles). People estimated that one needed 5 million Tshs, for a productive start, a sum that very few people were able to afford. Hence most lift net owners had either inherited the gear from their parents or invested money from other businesses

Lift net price Tsh960=1US$	Percent
1m-1,5m	8,9
1,5-2,0 m	19,6
2,0-2,5 millions	69,7
2,5 and above	1,8

Table 11: Price of lift net in Tsh (N=56)

(Source: Survey results)

4.6.6 Share distribution

The majority of the men who worked, as fishermen were also not able to invest in lift nets fishing because the distribution of shares varied significantly among the participants in a fishing team. Coming from cultural practices, the distribution of shares (in portions) was 4:1 between the owner of fishing equipment and the fishermen even if they are six in number .As it has been observed during the survey some owners were usually deduct all costs and expenditure incurred during fishing trip and divides the rest in two portions, one for him and one for the remaining 6 fishermen. (Suontausta, 1992) argues that in artisanal fisheries of Lake Tanganyika crewmembers are seldom, if ever paid on a fixed salary basis, crewmembers are paid a share of sales after deduction of the operational costs. Also Lendeertse, (1991) cited in Sountausta documented that in general the sharing formula for different gear types in Kigoma region was either 50% for the crew and 50% for the owners (Lift net, or 33% for the crew and 67% for the owners (gill net, beach seine)

CHAPTER 5: DISCUSSION

5.0 Introduction.

In this chapter I would like to analyse the research findings with respect to the research questions. The discussion will cover the importance of the dagaa fishery for the livelihood of the Kigoma fishing populations. In addition this chapter will include a discussion on of how fishing effort is expanding in Lake Tanganyika. This in turn will be used to highlight the choice of management measures in Lake Tanganyika

5.1.0 Fish Consumption

"Dagaa" is an important food item in Tanzania and in East Africa in general. Dagaa that cannot be marketed fresh are preserved by sun drying, smoking and salting. Fish is a major source of animal protein in the country, and in the major urban centres of Dar es Salaam, Mwanza, Arusha and Kigoma. It serves as the most important single source of animal protein. This study found that apart from fish products other sources of protein eaten by respondent were beans (87,5%), vegetables (7,5%) and meat 5% (Fig 9) In the study area people eat fish more than any other source of protein as indicated in survey results (Table 3) that 58,9% of the respondents eat fish products daily. (5-7 days per week). When I asked them about forms of fish preferred, 71,4% of the respondents preferred fresh fish/dagaa (Table 4)

Abila and Jansen (1997) documented that " Despite the use of dagaa Mwanza in the fish meal industry leading to the increase in its price, but dagaa has continued to have a strong demand in many communities around lake Victoria". They also mention that fish consumption in three Lake Victoria basin districts revealed that dagaa is consumed by 89 % of 250 selected households. Therefore the continued use of dagaa for fishmeal will make it scarcer and cause further price increases, since most of its consumers are locals with low income. Abila and Jansen, (1997) claim that the use of dagaa for animal feeds cannot be excused, since the protein content, is an advantage to the human consumers, especially to children threatened with malnutrition. Fish protein has made up approximately one fifth of the animal protein consumed in Africa since 1961, FAO, (1996). However, the contribution from inland waters has raised from less than 25 % in 1951 to 41 %of the domestic fish production in 1994. Africa's inland fisheries are important not only as a source of food, but also as a source of employment and income for resource poor families. Artisanal fishing communities in predominantly rural areas exploit them almost entirely

Jul-Larsen et-al, (2002) Reported that there is no aggregate statistics on the species composition of the catches. However, the catch composition has changed towards an increased share of small and fast-maturing species. They also documented that, at present, the catching of small pelagic or other small-sized fast maturing species is becoming increasingly an important part in the fisheries of all the major lakes in the SADC region. One can mention Dagaa in Lake Victoria, Dagaa in Lake Tanganyika and Lake Kariba and Chisense in Lake Mweru. These species have not always been as important as today in terms of employment generation and nutrition and 40 years ago few of these stocks were systematically exploited. This trend is a major feature of SADC freshwater fisheries at present.

5.1.1 Employment and Earnings

Fisheries play roles in population livelihoods, depending on the poverty level of the populations or that the same diversification strategy is actually be developed to respond to two different objectives (survival or accumulation), depending on the wealth empowerment situation of the households considered. Fisheries provide a source of employment and livelihood to a substantial number of people. In many cases, fish harvesting, processing and trade are the employment of last resort when other economic opportunities have run out, and are often particularly important for women heads of households who may be landless. (FAO, 2000). (Fig16 & 17) shows people performing different fishing activities in the beach. (West, 2001) documented that as the condition of food becomes more difficult more people are attracted to fishing for subsistence as well as potential source of income.

Fisheries play an important part in the social and economic lives of many people around the world. It is estimated that there are tens of millions of people dependent on fisheries for their main source of income for at least part of each year, and these include some of the poorest and most marginalized groups in developing countries (FAO, 1998) Similar situation has been observe in this study for example When I compare between the amount of catch sold (81%-90%) in (Fig 7) and amount of catch consumed (10%-12) in (Fig 8) shows that, catch sold (81%-90%) is extremely large than catch consumed (10%-12%) This figures definitely tells, how Kigoma fishers rely in fishing activities as source of cash income, Respondents were normally said

that is better to sell more fish than eating more (if one catch 20 kg may eat 2.5 kg) and sell the rest in order to have cash in hand.

The roles of fishery in the household livelihood strategy can be illustrated through the computation of the income return to labour for fishing activities. The income return to labour of an activity is the ratio (income contribution / labour allocation) for the activity considered. In absence of qualitative estimates for the income and costs associated with these activities, this index gives a rough idea of the economic efficiency measured in terms of effect on the revenue. Béné et al, (2000) documented that one unit of labour invested by poor households in fishing activity has more impact on their revenue than the equivalent unit of labour invested by better-off people.

As documented by Jul-Larsen et al, (2002) that growth in fishing effort is seen as a result of the artisanal fisheries' ability to absorb superfluous labour from other sectors. Fishing as a last resort tends to assume that once marginalisation has forced people into fisheries, they are forced to remain there until they have undermined their own livelihoods. Empirical evidence, however, shows that poor people in variable and fragile environments tend to diversify their sources of income and that fisheries often is only one of several, or a temporary, income generating activities In the study area respondents were engaged in fishing activities on a full time basis (Table 6). In Katonga 85,7% of respondents were engaged in fishing activities on full time and in Kibirizi about 89,3 % were full time fishers. The limited ability of other economic sectors such as seasonal agriculture to satisfy these growing human needs is an important factor to explain why people take up fishing as an occupation. In this context fishing acts as "life saver" to the Kigoma fishers.

5.2 Problems of the fishers in the study area

5.2.1 Limited markets and price fluctuations

Constraints on commerce imposed by geographical barriers of Lake Tanganyika and weak marketing structures seem bound to produce contradictory effects, depending on location. On one hand, they limit the growth of fishing pressure and the risk of over-exploitation across wide stretches of the lake. On the other hand, however, may encourage basin inhabitants, including refugees displaced by outbreaks of civil conflict, to migrate to the more easily accessible landing sites around the lakeshore.

As has been observed in the study area many respondents did not have their origin in Kibirizi and Katonga beach in Kigoma. The majority came from Burundi, Rwanda and Democratic Republic of Congo. Fish is more readily available to consumers at these places and they further offer the possibility of fishery-related employment. In such instances the effect is to magnify localized fishing pressure and the risk of over-exploitation.

The trade liberalization policies affected the pricing of fish. It has been said that during the1980s the government used to set prices of fish but since the reforms in the management and systems of macro economy whereby the government left price controlling in order to allow the market to decide the prices of commodities. Kibirizi fishermen explained that the buyers have been marginalizing them by setting the prices themselves, without any chance of bargaining. The prices have been changing every day differing from one buyer to another depending on quality and quantity of dagaa. This again increases the fishermen's vulnerability to poverty because it does not take into account that the costs of fuel, and gears are externally given.

Research findings show that respondents in both fishing stations states that there was no specific market for dagaa. Fish were sold in the landing sites to the middlemen (see Fig 18) and some catches were sold directly to the consumers. Reynolds, (1999) argues that some of the dagaa catches are sent to the markets hundreds of kilometers away in Lubumbashi, the Zambian Copper Belt and to Dar-es-Salaam. Jul-Larsen, et al (2002) documented that the inability of producers to link themselves up to the market in order to increase their share of the profits, as well as the inability of market actors to gain control over production seems to be one of the most important direct reasons for growth in effort in most SADC freshwater fisheries. With falling price the natural reaction is to catch more.

5.2.2 Inadequate fish processing

Inadequate fish processing and storage facilities leading to high levels of post harvest losses and restriction of the range over which fresh and smoked fish was marketed. This also reduces the value of the catch. With respect to the fish processing techniques employed are generally inefficient and fuel intensive for smoking/drying operations while Dagaa (sardines) continue to be largely sun dried on sand and grass

which, although an appropriate technique, results in a very low quality product which commands a low price. In the study area Dagaa dried on the ground were sold around 250-800 Tsh per kg while the one which salted and dried on racks price was about 1500-2500 Tsh per kg, (price depends on season and catch availability) (See Fig 20) processors salting Dagaa before sun drying). Dagaa processing techniques employed, ie brine washing and sun drying on racks, appears to be determined by the lack of incentives for producing a better product. Buyers are reluctant to pay a premium price for a better product and the high cost of current alternative drying methods. During this study sellers and processors have complained that dagaa dried on racks most local consumers can not afford to buy due to this is why Dagaa dried is sold in far away places like Dar-es- Salaam, Arusha, Tanga and Morogoro.

5.2.3 Insufficient credit facilities

Another constraint on access to capital in Kigoma district is that, bank and other credit institutions that provide loans to small-scale producers and traders hardly exist. As has been observed by Jul-Larsen et al, (2002) this is one of the reasons why investments in the fisheries have depended upon input of external capital, like in the case of Lake Malombe, where most of the capital came from labour migrations. In this context it is interesting to notice that macro-economic recession often leads to population-driven growth in fishing. Fishers and processors/ traders documented that credit facilities provided by the Government and private organizations such as CARITAS (Table 10) were insufficient. Generally speaking credit and loan facilities are mostly informal. The artisanal fishermen and processors / traders have rarely contact with the national banks .Low incomes and poor or non-existent access to credit reinforces the tendency to employ only a limited range of fishing techniques. Due to this reason most fishermen in my study area were using one fish method, ie light attraction to concentrate fish, hence fishing activities cease during time of the full moon.

5.2.4 Infrastructure

The existence of a physical infrastructure that makes it possible to transport fish from a lake to the market is also of vital importance. (Overå, 2002) documented that some of the lakes in the SADC region (such as Lake Bangweulu) are located in areas that are sparsely populated and remote from the markets. Similar situation was observed in

the study area where infrastructure has been identified by the respondents that as a limiting factor to the development of Lake Tanganyika fishery. Communities bordering Lake Tanganyika clearly share in the conditions that, on the basis of various 'quality of life' indices, have ranked East-Central African countries amongst the world's most poverty-stricken and underdeveloped World Bank, (1999). Lake Tanganyika Research Project, Socio-economic survey findings confirm a picture of weak and deteriorated physical infrastructure around the lakeshore, and of a critical scarcity in basic social services and amenities.

5.2.5 Limited range of fishing techniques

Likewise, low levels of incomes among fishermen are a direct result of very low levels of investment and the employment of fishing techniques with a low level of efficiency. Hand in hand with the problems of low status and poor gear supply it has been almost impossible for the artisanal fishermen to raise the finance to make even the most rudimentary improvements to their gear and thereby improve the efficiency and incomes of their families and communities. Low level of technology among the artisanal fishing community and reliance on a very limited range of fish captures techniques, this limit yields, the fishing range and the potential for generating more income.

5.2.6 Theft

The majority of respondents reported that in recent years robbers have becomes a serious problem in the Kigoma district, stealing of fishing gears and fishing equipments As documented by (Mung'ong'o, 1997), the gangs, which attack the fishing units, comprise six to eight men armed with machine guns. All sources indicate that they come from Congo. However, the gangs have changed tactics. As reported in Mtanga groups of 20 or more armed men have started to land on the shore and attack houses, specifically targeting rich gear owners or traders who are likely to have large amounts of cash on the premises as a result of a lack of banking facilities.

Fishermen would like to see the government show more concern about this problem. A police speedboat has been provided for security, but respondents were of the opinion that the police did not do enough. It was claimed, for example, that when a fisherman is attacked it takes two to three days police to come to the rescue. Armed

robbery of lift nets, fishing equipment, which picked up in 2001 has negatively affected the fishing industry in Kigoma district and consequently people's incomes and life standards. Participants associated this robbery as an outcome of political instability in neighboring countries (in particular, rebel factions of the Democratic Republic of Congo). Respondents claimed that they could identify the origins of these robbers from their accent. According to the Kigoma District fisheries officer, about 142,872,5000.00 Tshs worth of assets has been robbed from Kigoma district between July 1998 and April 2002.

5.2.7 Livelihood diversification in the study area

Livelihood diversification a process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to improve their standards of living. Livelihoods include assets and entitlements as well as all forms of employment (formal, informal and self) which people use to make a living. In the following I will use this concept and show how it has been achieved in my study area. In order to achieve satisfactory livelihood standards, most people and fishers in the study area were engaged in multiple activities at the same time. For example, some decided to leave unprofitable activities and enter new fields (e.g. leaving scoop nets fishing to cultivation of food crops). Others practice diversification of livelihoods into non-traditional activities such as tomato growing; or establishing carpentry marts, and other technical jobs such as masonry.

Apart from fishing there are diverse activities that carried out by household members. Generally men were engaged in trading and women are left home to take care of the family. Single women and widows are the ones who were engaged in trading activities. Respondents were engaged in a range of livelihood activities that have had (in good years) assured them food security and income security throughout the year. Dominant sources of cash income was from fishing and related activities, businesses and petty trades, agriculture, and other activities such as palm oil production, carpentry, masonry etc.

The broad goal of poverty eradication is to develop individual, family and community capacities to improve their livelihood systems. To understand these systems, people's coping and adaptive strategies are important entry points for analysis. A sustainable

livelihood system can only be understood and promoted if the matrix of interactions between policy, science and technology and investment/finance is approached in an integrated manner and used to augment what local people already do well and the assets to which they have access. Besides fishing, farming was a secondary activity for the livelihood diversification in the study area. These two activities were interrelated in the sense that some people were engaged in cultivation during low catch season. Some times farmers were sharing fishing boats among four or five families, which involving approximately 30 people per fishing unit (fishing unit comprises two boats, lift net, 10-14 pressure lamps, an engine as well as crew member), but still farming was a secondary occupation for their own needs. During the rainy season farming activities are at the highest peak. Women are the major labour force doing farming. This study found that women were not engaged in fish harvesting but were engaged in fish processing and in farming activities.

Farming and livestock husbandry is still an important source of income for the fishers in the study area. This study found that some earnings derived from fishing activities were invested in farming, even though respondents documented that farming was a secondary source of income generation. Therefore the continued pursuit of productivity increases in the Kigoma region agriculture remains an important goal. Agriculture itself can play a role in diversifying options, and indeed, new cropping or crop-livestock systems in agriculture can make important contributions to income diversity.

For many residents, crop production is the main economic activity, and its importance is increasing with the perceived decline in fish stocks, and with the influx of the, Sukuma agropastoralists in the area who have introduced the use of manure. Until a decade ago fishing was the main economic activity in the study area. However, in recent years fish catches have declined, and are no longer able to satisfy household requirements. This is probably due to the concentration of artisanal lift nets and fishing in the same area for ages.

Agriculture is a secondary source of livelihood activities According to the previous data this involves about 70% of the population, but its success depends much on fishing. A range of crops are raised, including, cassava, maize, beans, potatoes and

nowadays, tomatoes. Most of the agriculture is small scale and for household food security basically, and some excess for sale. Agriculture is women's domain and a dependable source of livelihood particularly to female -headed households.

Palm oil production is a traditional activity, performed jointly by groups that include men and women. Sales boom during peak fishing periods and therefore producers and traders' income levels depend highly on the successes realized in fishing. Kigoma region generally has a high potential for production of palm oil. Some 'owners' do not tend to their plantations themselves, but hire them out on a seasonal basis to people whose best interests are extraction of the nuts only for palm oil production .By doing that they increase their earnings

Tomatoes growing providing an employment for the male youth who increasingly finds themselves out of productive engagement from the challenges that fishing pose. This production challenges the pre-dominance of traditional fishing activities in the study area by providing a livelihood alternative. A respondent at Katonga site documented that, however, demands a lot ie weeding, application of insecticides, watering But still tomato growing is the one among livelihood diversification in the study area

Based on the precept that historically the progression from low to high standards of living normally involves transition from diversification to specialization, this approach sees diversification as an involuntary backward response to crisis in which the multiplication of activities results from an adaptation necessary to ensure survival in the context of a structural, gap between food production and consumption needs. In this perspective, diversification does not contribute to the achievement of sustainable livelihoods, but to a cycle of impoverishment that may begin with a "normal" hunger season, but which may then possibly lead up to the creation of household indebtedness, low food stocks, sale of assets (like livestock) and an inability to bounce back after temporary setbacks. In that perspective, the diversified activities are used to "'fill the food gap left once production and exchange entitlements have failed to meet minimum food requirements" Davies (1996, p.238) the diversification process itself is seen as a "diversification for survival".

Without the capability to produce enough food on their own account, the fishers must diversify income sources in order to survive. Increasing the survival options of the rural poor is the major reason why the rural sector diversification is regarded by many researchers as an important goal of development policy.

Trading and small business

This study observed that there are also numbers of boat owners who are not fishermen. Fishing were done by fishermen coming from rural areas who has been paid either in kind or cash. In this respect the boat owners were also engaged in other business such as shopkeepers and bar owners in Katonga as well as Kibilizi landing sites. There are numerous small-scale businesses and trades. These engage people across all social groups, including the disabled, women, children etc. These are conducted as alternative cash income generating activities more than sustainable activities on their own. The most salient are carpentry, brick making, food venders etc. Bee keeping is an activity conducted as an additional activity to agriculture and fishing. It cannot be conducted as a dependable livelihood on its own. It is done in small scale. Food vending is an activity done by women. These women were doing other activities such as selling cassava meal at retail, cooked food such as "wali maharage" (cooked rice with beans). Food sales were regarded it as a profitable activity to diversify. This study observed many women and some disabled people at Kibirizi beach involved in selling different products at the market. Charcoal making is entirely male activity in Kibirizi .The demand in Kigoma town has increased the value of charcoal production

A major business in the study area is the processing and selling of fish and fish products. Other businesses differ from one landing site to another. For example, in Kibirizi beach there are businesses characteristic of urban areas, including restaurants, guest houses, large shops, and a hectic market. The other landing site Katonga, on the other hand, has smaller businesses such as small shops and kiosks, which sell basic household items and some fishing equipments i.e. hooks, lopes, lamps spear parts. A popular informal sector business in all beaches was the brewing of traditional beers, which is monopolized by women. The strongest and most popular beer is *wanzuki* made from honey. Other common beers include *komoni* made from maize or cassava and finger millet, which may contribute to food shortages.

Forest and tree

The Game Division of the Ministry of Natural Resources & Tourism controls the forests in the Gombe Game Reserve. Outside the reserve, much of the natural forest exists as common property. In the study area collection of forest resources such as fuel wood or poles was open to all. Most of the timber produced in the area comes from near by forest. Timber were also required for making cargo, passenger, and fishing boats, and *mninga* was the preferred species, as they are durable, comparatively light, and resistant to decay. Due to this *mninga* products were normally sold at higher prices hence increasing earnings to the fishers and others in the study area. Mung'ong'o (1997) documented that, about 350 boards are needed to build a cargo boat, although they are built less frequently than furniture. Increased demand for timber has attracted people to the timber extraction business. These dealers operate under licence, but their activities are often not checked

Miombo (*Brachystegia* spp) species are preferred for fuel wood, which is collected by women for domestic use, for brewing traditional beers, and for sale. Also were used by cookers in both landing sites. Demand for fuel wood has increased with the increase in beer brewing. This has caused the emergence of a group of women who collect fuel wood for sale. This study observed some women at Kibirizi landing site selling firewood to the fishers and other people this small business adds to the women's earnings, which in turn were used to cover other requirements. Infact this is not sustainable livelihood activities on its own but at least women were getting something, "Something is better than nothing" even though it was little. Generally speaking greater share of cash income accruing to women results both in more of the household budget being spent on food and in improvements to family nutrition

5.3.0 How is Lake Tanganyika fishing effort is expanding.

5.3.1 Introduction

From a historical perspective the Lake Tanganyika fishery has always been an open access fishery, although there have been local rules and regulations influencing access and hence effective effort. Under this open access regime, everyone is free to fish. Open access classically leads "to over-exploited resources and declining returns for all participants" because it is 'characterized by a race to fish in which all participants

strive to catch as much of the resource as they can, before their competitors do' (FAO 1997:52) cited in Reynolds, (1999). Rising population pressures within and without the lake basin are bound to exacerbate matters.
In earlier times the catching technology was so simple and the number of fishers was so limited that catches could hardly threaten the resources.

In more recent times there has been a steady increase in effort while there are sign of reduced CPUE, which indicate a harder pressure on the resources. Based on these tendencies many authors have discussed " the tragedy of the commons" and the need for limiting access. If not, there is a fear that fishers will continue increasing effort and fishing down the stocks. According to many scientists and administrators, the future sustainability of Lake Tanganyika fisheries requires a transformation of the present rather loose 'open-access-within-national-jurisdictions' regime into one that allocates fishing rights to local communities and their respective territories. The issue of fishing effort involved in the Lake Tanganyika fisheries is more complex than portrayed by the classical "Tragedy of the commons"

Since both 'managers' and 'co-managers' tend to consider common property rights as an empirical model few of them have seemed particularly interested in empirical investigations about the dynamics of fishing effort, or about its causes and its consequences. Just like the management supporters, the protagonists of co-management accepts the Common Property Theory's assumption that growth of effort in a commons is inevitable, unless effective management measures are put in place (Jul-Larsen et al, 2002). From research and commissioned studies, which has been done in many areas in Africa (marine as well as freshwaters), it is clear that the picture is far more varied. Certain fisheries in Africa have been growing over a long time, it seemed that others have experienced a much more static and less dramatic development. This may even create problems in identifying any effective management measures, which either would be initiated by the state (Government) or by the local community (stakeholders).

From a historical perspective the Lake Tanganyika fishery falls under an open access regime whereby everyone has the rights to exploit the resource. Generally speaking

this may led to the race to catch. And management measures are needed in order to save fishery.

Fisheries are considered as closed systems and it is not considered that people may adapt in unexpected ways to changing circumstances, and that the extent to which they will over- fish often depends on whether they have other and better economic options. In the study area respondents reported that fishing is a major activity and they rely in fishing as a major source of protein, income generator as well as a source of employment.

5.3.2 Dynamics of fishing effort in Lake Tanganyika

A s a social scientist, Brox (1990) is concerned with identifying how different ways of changing effort may lead to very different social results. He therefore introduces the distinction between *'horizontal'* and *'vertical'* changes in fishing effort. According to Brox (1990) horizontal growth is related to the growth in the number of fishermen: "Fishermen's children grow up and establish households that base their economy on participating in fisheries. Fishing communities also absorb people born outside fishing districts, especially through marriages, and young migrants initially looking for temporary employment"(Brox 1990:233). It is important to notice that horizontal growth is different from demographic growth. Demographic growth in the traditional meaning of the concept is understood as a function of birth- and mortality rates, while horizontal growth of effort also includes migration and changes in people's occupations. Thus, with regard to 'numerical growth of fishing effort', it is the total number of units of gear and their employment that matters. Who invests and at what level is irrelevant for the fishing mortality: 10 fishermen owning 100 nets each is the same as 100 fishermen owning 10 nets each. However, in social terms it is a very important difference between the two situations. Investment driven change in effort is more related to 'efficiency' in the sense that it utilises better, more efficient gear (deeper, bigger etc), better fishing equipment such as motor, echo sounders etc. The two concepts will only coincide if the unit of fishing effort is understood to be production units.

The hypothesis is that investment-driven growth of effort represents a potentially much bigger growth in absolute fishing mortality than what demographic processes are expected to cause. This expectation is based on the presumption that investment-

driven growth lead to technological changes towards more effective gear, whereas population-driven growth, just lead to 'more of the same'. In the study area the number of lift nets is increasing but still catch methods are the same as when they started fishing by light attraction some 50 years ago. If effort is increasing it is largely due to the fact that more fishers are attracted to the fisheries.

The population-driven growth by far has been and still remains the most dominant feature. In both Lake Chilwa, Lake Chiuta, and Mweru Wa Ntipa fluctuations in fishing effort over the last 50 years have almost exclusively been related to the number of harvesters where as very little has been caused by more efficient technology or fishermen's accumulation of gear (Jul-Larsen *et al*, 2002). Fishing methods, species targeted, volume of gear per unit and the organisation of production have been relatively stable over time even if they may have fluctuated seasonally or periodically

This is similar to what I observed during this study. Several writers have pointed out that Lake Tanganyika fishing methods have been the same for ages, and the largest amount of fishing effort in Lake Tanganyika is targeting pelagic fish, particularly the two species of sardines *"Dagaa" (Limnothrissa miodon and Storothrissa tanganicae) and "Migebuka" Lates sp.*These are caught with light assisted lift nets. Together these two resources probably make up 90% of the catches from the lake

5.3.3 Factors influencing population-driven growth in effort

Alternative livelihood opportunities influence population –driven growth in effort in the sense that once a community lacks other alternatives for livelihoods they turn into fishery. The same applied to my study area were there are limited sources of income; food and employment opportunities hence the majority are led to enter the fishery.

Fishing is also combined with other occupation. In particular wealthier fishermen tend to combine many sources of income. As has been shown for Lake Malombe and the South East arm of Lake Malawi (Hara and Jul-Larsen ,2002), most of the gear owners combine their activities in the fisheries with also being involved as shop keepers, transporters, bar owners, flour mill managers, carpenters, charcoal producers, etc. Changes in the opportunities in parallel sectors are therefore as important for the

development in fishing effort as changes in the natural productivity of the water bodies being fished. This study found that some of the gear owners were not involved in fish harvesting processes. Instead they were living far away from the landing sites and were involved in different activities such as shopkeepers, landlords, etc.

In Lake Tanganyika there is a less dramatic type of investment-driven growth compared for example to the Lake Victoria fisheries. A part of the artisanal fishery on Lake Tanganyika changed into a more dynamic and more capital-intensive type of production based on lift nets. Lusenga (Scoop nets) were replaced by lift net in the 1970s (Coenen, 1994). It seems as if this more capital-intensive artisanal fishery has been able to a large extent to out-compete the industrial fisheries, which had been established there since in the 1940s. According to Gordon, these changes, were necessary simply in order to be able to remain a fisherman, and did not result in an increased efficiency of fish production per se. He therefore concludes that even if this type of growth in effort often result in technological changes, the changes must mainly be classified as "horizontal" or population-driven changes.

It turns out that most changes in effort are population-driven. Most of the fisheries seem able to absorb a great number of newcomers who mainly continue to fish in the same manner and with the same gear as their predecessors. Nevertheless, fishing effort has grown: the number of fishermen has increased by approximately 160% over a period of twenty years and the number of boats has increased by about 70%. The growth in effort seems stronger in terms of increases in people than in fishing gear (boats). Generally speaking the change in fishing effort in Lake Tanganyika probably is due to the population expansion. Due to the refugee's influx this study observed that most of the lift net owners in the study area were refugees from neighbouring countries. Refugee movements have increased pressure on the fishery, According to UNHCR (2000) about 285,000 Burundians in addition to 118, 000 Congolese have sought refuge in Tanzania. Some refugees not reflected in these figures have settled in the relatively unpopulated areas along the Tanzanian coast and many lives in camps within the Kigoma region. These population movements have had repercussions on society, the regional economy and the environment, and not least, on the fishery.

Fishing effort has largely fluctuated according to the number of people engaged in fishing and these fluctuations reflected the periodical needs of the local population to supplement the production of staple products, such as millet and cassava. As Gordon puts it in his case study: "The fishery was a lifesaver in times of trouble. When warfare interrupted stable farming, the river and the lake provided some sustenance" (Gordon , 2002). There is no doubt that the overall economic crisis which has troubled most of the SADC countries for the last 20-30 years is one of the main reasons behind the very high increase in numbers of fishermen. However, since the crises has lasted for many decades and has been striking in all of the countries, it is difficult to assess the extent to which an economic recovery would reduce the number of producers (Jul-Larsen et al, 2002). Civil war led to the economic crisis in the countries, which border Lake Tanganyika (Burundi, Rwanda and Democratic Republic of Congo). The majority of the refugees enter the fishery as a means of livelihood alternative, thus increasing effort and the pressure on the resources. But when the situation becomes more normal, people move back or take up other occupations and thus reduce capacity and pressure on the resources.

There is considerable mobility of people in and out of the fishery sector. Population-driven growth in effort tends to increase when macro-economic conditions deteriorates the condition of food becomes more difficult and more people are attracted to fishing for subsistence as well as potential source of income and/or the biological productivity in a lake improves. Reductions in the population-driven growth in effort take place when local access regulating mechanisms exclude newcomers, and when investment-driven growth in effort results in rising entry costs for those who wish to join the fishery. People's flexible adaptation to the ecological and economic environment through frequent entries into and exits out of the fishery sector, facilitates freshwater fisheries as a buffer against poverty as it has been observed by many authors on the Lake Tanganyika fisheries (Jul-Larsen *et al*, 2002).

The most important exceptions may be the switch from the use of locally produced fishing equipment to the utilisation of manufactured fishing gear as found during this survey.

The dominant fishing gear as reported by respondents was lift net, even though some Lusenga net still in use by traditional fishers along the lake in Kigoma district. Lake

Tanganyika fishery shift from Lusenga net (traditional fishing gear) to the Lift net, which is more efficient due to its catch capacity, and use of powerful engine. But Lusenga (scoop nets) and lift nets still do operate in the same area. According to studies undertaken in other African freshwater fisheries, this change led to a considerable increase in fishing effort because more time (previously used for production of gear) could be allocated to production purposes (Quensiere, (1994), cited by Jul-Larsen *et al*, 2002). This change, which in most cases took place in the 1940s and 1950s, was general and affected virtually all fishermen. However, it does not mean that locally produced gear has disappeared. A range of various homemade gear is still effectively utilised and have become common means of production among the great majority of fishermen.

The overall level of population-driven growth in effort has been far more predominant in SADC freshwaters over the last 50 years than investment-driven growth. The processes of investment-driven growth are observed in the great Eastern African lake ie Lake Victoria. The rapid development of an export oriented Nile Perch business in Lake Victoria in the 1990s happened as a result of big investments in processing. Lake Malombe is the only case where investment-driven changes in fishing effort seem to have been the dominating trend; in the others it is the population-driven changes which constitute the most important element in effort dynamics (Jul-Larsen et al, 2002)

Following the study done by (Jul-Larsen et al, 2002) documented that there is hardly any examples in their data where fishing effort has developed due to investment-driven growth It seems like the Lake Tanganyika fishery has experienced a similar trend where effort has been developed due to population driven growth. During the catching season you may find many fishers and high concentration of fishing vessels where some fishers are moving from highland to the coast and during low catching seasons, fishers go back and some switch to other activities. Hence, this leads to the effort fluctuations in the fishery. This study observed that some respondents did not have their origins in Katonga and Kibirizi. They normally visited the landing sites during the catching period. On other hand, I can say that most investors are disappointed and discouraged to invest in Lake Tanganyika fishery in particular in Kigoma (Tanzanian side) due to a number of factors such as lack of infrastructure,

remoteness and lack of transport. A similar situation has been observed in some SADC lakes as documented by (Jul-Larsen et al, 2002) On the one hand, investors with capital became less interested in the fisheries: ice plants were closed down, and the marketing of fish was increasingly left in the hands of small-scale traders of dried fish. The fishery thus became a "lifesaver" again, and they assumed that the reduced levels of investment led to a certain "technological recession

5.3.4 Variation in catch per unit effort (CPUE)

The northern and southern extremities of the lake are subject to the greatest fishing pressure per unit of fishing area. In the case of the far north end, this outcome can be attributed to the high concentration of lift net units. For the far south, it results from the combined effects of industrial purse seine and traditional unit operations. As for the greater expanse of the lake that lies in between, a decreasing effort gradient running from north to south is apparent. Annual recorded catches on Lake Tanganyika have shown an upward trend since the 1970's and today stand at 196,570 tones, as estimated via catch-per-unit-effort (CPUE) calculations based on an average of 250 fishing days per annum (Reynolds, 1999). Recent estimates per country indicate a

Although total catches show an increasing trend, CPUE for industrial units (purse seiners) have been declining. Nightly CPUE of industrial units in Burundi dropped from 166kg in 1994 to 111 kg in 1996, and in Mpulungu from 877 kg in 1994 to 535 kg in 1996. The industrial nightly CPUEs in Congo have also decreased to 433 kg from the 780-950 kg of the early 1990s (Coenen et al. 1998). Progressive CPUE decline and increased duration of fishing trips in the industrial fishery in southern waters indicates a decrease of the catchable stock and possible over- exploitation of the *Lates stappersii* in southern waters, owing to uncontrolled growth of the industrial fishery (Coenen et al. 1998). Indications of possibly excessive exploitation pressures on *L. stappersii* have also been noted for the northern end of the lake, as a result of the effects of successive waves of heavy industrial fishing and artisanal fishing.

Bayona (1990), cited by Suontausta (1992), argues that the industrial fishery is contributing very little to the total catches in the Tanzanian part of the lake, and the fishery reflects symptoms of local over -fishing, It is affected by falling levels in total catch per unit of effort (CPUE) and low levels in abundance of dagaa. These problems

are due to the concentration of fishing effort within a small area close to Kigoma town. Generally Lake Tanganyika fishery is dominated by artisanal and traditional fishers who are always moving in and out of the fishery, and this lead to the fluctuations in fishing effort in terms of number of fishers and number of fishing vessels. As indicated in the previous data (see Table 1and 2), the Lake Tanganyika frame survey from1996 shows that on the Tanzanian[3] side of the Lake the total number of fishermen was 12,510, and the total number of fishing vessels 3498. (In Kigoma it was 7644 fishers and 1952 vessels). In comparison with other surveys, the Lake Tanganyika frame survey from 1998, shows that total number of fishermen was 8650 and total number of fishing vessels was 2409. In Kigoma region it was 5894 fishers and 1213 vessels. These changes are due to the investment in more efficient and powerful fishing vessels and fishing gears, but is probably due to population dynamics, reflecting the limited means of livelihood activities in the study area.

5.3.5 Macro-level interactions

In lake Tanganyika fishing is also affected by more macro- level interactions such as war, civil unrest and a large amount of refugees. These larger events, compounded by the ever-growing load of human inhabitants within the lake basin and across East-Central Africa generally, have not only contributed to conditions of food insecurity and placed increasing pressure on the Lake's fisheries resources, they have also helped to create conditions of employment insecurity. This in turn may well have the effect of attracting more rural dwellers to migrate towards the fisheries in search of a means of subsistence and employment.

Probably this is the case in Lake Tanganyika whereby it is an increase in the number of fishers and fishing gears. This is largely due to the migration of people in the lake basin from neighboring countries such as the Democratic Republic of Congo, Burundi and Rwanda. Because of the political instability in these countries, many refugees settle along the coast of Lake Tanganyika. Particularly in Kigoma region is phenomenon has led to increased pressure in the fishery.

[3] Production for Tanzania is estimated at around 55,000 tones during 1994-95, as compared to figures of 72,000 and 80,500 tones in 1992 and 1993, respectively(Coenen et al.1998).

5.4.0 Why management of Lake Tanganyika fisheries?

The rich and diverse resources of the marine and inland waters are being exploited up to and beyond sustainable levels in many areas of the world. Among the results are extinction of species, disturbance of delicate ecosystems, collapse of important fisheries, and destruction of pristine under the aquatic environments. Less dramatic, but of enormous importance, is the decrease in yields, income, and employment from the fisheries. Sometimes the technical expertise and funding necessary to manage fisheries effectively and protect aquatic resources is lacking. In other cases, the government does not consider the problem a priority or there is political opposition to regulation.

Tanganyika fisheries basically operate under an *open access regime*. Under the broad conditions associated with national territorial partitions, everyone is free to fish. This situation is clearly untenable. Rising population pressures within and without the lake basin are bound to exacerbate matters.

At the same time, opinion seems to vary amongst artisanal populations about what sorts of access rights, if any, ought to be maintained. A survey proposition suggests that 'everyone should be allowed to fish anywhere they want in the lake,' s (Reynolds and Hanek ,1997). Consensus on the issue is clearly lacking, yet some form of limited access will have to be established if the fisheries are to be sustained i.e. if the classic sequence of 'free-for-all' exploitation – race to fish – resource over-exploitation is to be avoided (FAO, 1997). But in lake Tanganyika it is not the increase in efficiency that drives the process, but the influx of people, fishing with the same, old type of fishing gear.

5.4.1 Co-management

In the management/co-management controversy it has often been more focused on *who should* manage than on *what should* be managed. Whether the enforcement of management rules are put in the hands of the state, the local community or one promotes a co-operation between these two levels in the management process, both approaches are based on the assumption that fisheries can always be fruitfully managed.

As fishing effort continues to respond to the growing demand for fish, proper inland fisheries management is becoming more and more urgent." (FAO, 1996). Generally co-management has been found to increase the effectiveness of management by increasing the legitimacy of fishing regulations in the eyes of the people in the fishing communities. It reduces and manages the fishery, but does not eliminate the conflicts, which arise over management decisions. It also increases the effectiveness of enforcement by involving the fishing communities and reduces the costs of enforcement activities. Fisheries managers and researchers also begin to recognise that a fishery cannot be effectively managed without the co-operation of fishers and other stakeholders. The formation and encouragement of fishermen co-operation is important for the management of aquatic resources in a sustainable basis.

(Lindley et al, 2000) documented that co-management options may be developed as the most appropriate mechanism to manage fishing activity in the littoral zone with the aim of conserving biodiversity. Co-management also requires a fundamental shift from the traditional `law enforcement `control of fisheries by the government agencies and encourages increasing participation of local stakeholders as experiences from around the world indicate co-management of resources leads to improved sustainability. Apart from that (Lindley et al 2000) also documents that co-management options can be explored for the near shore fisheries of Lake Tanganyika and this should reflect the complex nature of the fisheries (many species, many gears, many different stakeholders with different efforts, and constraints). In Tanzania, the contribution of artisanal fishermen to the national economy and social development has been recognized by the government since the early 1960s when the Fisheries Division was established, but to date little has been done to involve fishing communities in the management of the lake resources through co-management.

Recent investigations on community-based fisheries management systems have shown that when left to their own devices, communities of fishers, under certain conditions, may use fisheries resources sustainable, efficiently and equitably (Pinkerton, 1989) Fishers, the real day-to-day managers, must be equal and active participants in resource management. Generally speaking fishers when they know that they are recognised and taken as equal partners in every aspects of resource use and

management, often develop their own rules for resource management in addition to those created by the government. In 1996 - 1998 the Tanzanian government and the Fisheries Division started a campaign to abolish dynamite fishing, which was a big problem along the coast of Indian Ocean. Government officials imposed bans and restrictions. The Coast communities agreed locally that nobody in their communities would use, dynamite. Dynamite fishing is no longer used in the coastal communities in Tanzania and if anybody are caught fishing with dynamite the community will chase him out from that community without waiting for government decision or advice. This is but one example of successful co-operation with the local fishers.

CHAPTER 6 - CONCLUSIONS AND RECOMMENDATION

6.1.0 Introduction

In this chapter I will draw some conclusions from my limited survey in Kigoma and present a number of recommendations mainly addressing the fisheries authorities and local authorities.

The recommendations are geared not only towards the fishing sector but towards all sectors that can assist in providing sustainable livelihoods to the population along the Lake.

The possible use of licensing and use of land customary rights in the Lake Tanganyika fishery as tool for limiting access effort and capacity, the introduction of co-management arrangements and the delegation of responsibilities into the communities could act to re-imbed management responsibility into the community. Most important would be the broadening of economic opportunities so as lessen the community's dependency on the fishery. This study observed that the majority of the population along the lake rely on the fishery as a means of income generation. Fishing is also the most important source of animal protein. Increased central government budgetary allocation to fisheries research and administrative agencies within the respective states should be complemented by increased involvement of local stakeholders with management decisions and enforcement activities to improve overall compliance and achieve greater cost efficiency.

The active involvement of crewmembers who make most of the operational decisions out on the fishing grounds would be crucial. Peer group monitoring and enforcement could improve reciprocal behavior among this group, resulting in improved responsibility towards regulations. Co-management alone will not provide the solution to the increasing problems of managing the artisanal fisheries in Lake Tanganyika. Co-management should work together with other management measures.

Fisheries and economic diversification through the adoption of integrated development strategies and coastal area management models at the local level, to accommodate complex interactions and possible conflicts between fishing and non-fishing activities, and, at national and regional 'macro-levels,' moves to foster economic diversification to reduce pressure on the fishery resource base. Many authors have observed that expansion in fishing effort on Lake Tanganyika has largely been population driven. Therefore the adoption of other livelihood alternatives, so as

to reduce community dependency on fishery in the study area is of paramount important. Combination of farming and fishing is a fundamental characteristics of a fishing village in the rural areas.

Due to this, it is difficult to distinguish who is a "fisherman" and who is a "farmer" The role of agriculture in fishing communities should also be considered in a local resources management perspective. Fishing is a source of capital that can be allocated to farming activities or vise versa. In Kigoma fishers sold 80%-90%, of the catches and in turn earnings were invested in other small businesses. Labour and capital can be directed towards farming or to other livelihood activities such as timber production, palm oil production, and livestock. Thus long term strategies and permanent settlements are made possible, although the fish resources show great seasonal and annual fluctuations (Reynolds et at, 1999).

Fishery resources are a vital source of food and make a valuable economic contribution to the peoples of the world. Traditional fisher folk, including artisanal, indigenous and small-scale fishers and fish workers are among the poorest and most socially, politically and economically disadvantaged segments of society (FAO, 1998). Fishers around the world face resource depletion, loss of access to resources, competition from industrial and distant water fleets. The resource itself suffers ecosystem destruction from various sources, including industrial and urban pollution, over- fishing and the use of destructive and non-discriminatory fishing technology. This is the same applied to my study area whereby it was generally noted that fish / dagaa catches have decreased and this conforms to records kept by the country's Fisheries Research Institute TAFIRI at Kigoma (Pers. Comm.)

The inland fisheries of Tanzania are by far the most important in terms of fish products and their contribution to the nutritional state of the population (especially the poorest sections), the provision of gainful employment and the acquisition of export earnings. In comparison, the coastal fisheries are of relatively minor importance.

The artisanal fisheries sector of Tanzania has a very low status in terms of its perceived importance in the economy, in spite of the fact that this sector produces some 30% of the animal protein consumed by the country. The very low levels of technical and financial assistance to the artisanal fishermen and their communities

have hitherto accurately reflected this low status (URT, 1997). The problems facing the Kigoma fishers as has been identified during this study and from other related studies are limited markets, expensive gears, theft, and lack of transport, credit facilities, and infrastructure. Most of these problems are manageable. Inputs in relation to the potential benefits that could be achieved with continuing encouragement to the artisanal sector in areas, such as Kigoma are relatively small.

Based on data collected during recent aerial and parallel ground surveys, 1995, Lake Tanganyika presently hosts 44,960 active fishers, 18,240 operational fishing craft, and 786 landing sites (Appendix 4) An estimated 55-60% of active fishers are engaged in artisanal operations involving the use of light attraction in association with lift nets and beach seines. The remainder are engaged in the traditional fishery, involving the use of gillnets, scoop nets, and loglines. Such figures immediately direct attention to the important socio-economic role played by the fisheries. The tens of thousands of boat and equipment owners/operators and crew active in the harvest sector represent a first tier of fisheries employment and income generation. Secondary fisheries-generated employment has also to be taken into account. Local processors and traders, long-distant transporters and marketers, and various others who provide services and support at landing sites and throughout the distribution chains are reckoned to number in the hundreds of thousands (Reynolds,et al,1999).

Priority should be given to artisanal fisheries in recognition of their importance as a source of food for local consumption, income and employment and means of promoting community stability, resource conservation and the environmental protection inland waters areas.

6.1.1 Developing and promoting processing methods

"Dagaa" (*Stollothrissa miodon* and *Limnothrissa tanganicae)* has considerable potential in internal as well as export markets. Results are however restricted by the limited shelf life caused by inadequate fish processing techniques. Processing methods are not well developed, and dagaa were sold mainly as fresh or sun dried. This study observed that the majority were drying on the ground and few respondents were using brine washing and drying on the racks Development interventions to improve local processing efficiency and product quality, including establishment of facilities for smoking salting, drying and packaging, have been attempted through a

variety of projects, but with little success. There is therefore a need to encourage fishers to use these processing methods for obtaining a better quality product. The challenge is to make these processing technologies and to make them affordable, so as to create equal opportunities for both men and women. The best technique in current use, ie brine washing is adequate but few fishers were using this method. Therefore the prime aim of the fisheries programme would be to seek the general adoption of this technique. This alone would ensure a considerable improvement in overall quality and value of the product; hence fisher's income will be improved. Adding value to the existing catch is an important issue around Lake Tanganyika and offers potential to improve livelihoods without adding pressure on the fishery.

6.1.2 Development of the fisheries infrastructure

The existence of a physical infrastructure that makes it possible to transport fish from the lake to the market is also of vital importance in the Kigoma district. These areas that are sparsely populated and remote from the markets, the remoteness of Lake Tanganyika and lack of roads leading to main cities are limiting factors for investments in the fisheries of Lake Tanganyika.

In order to get investors into the area it is necessary to invest in roads, transport and ice plants. Establishment of ice plants in general may lead to an increasing tendency to sell fish captured by artisanal fisheries in fresh form, due to an increased availability of ice. Together with better infrastructure this could make an enhanced distribution towards the hinterland possible. This could probably result in a growing trade among neighbouring countries.

6.1.3 Promoting alternative sources of livelihood

In order to strengthen the artisanal fisheries communities in the study area (Kigoma) the following suggestions should be considered. Promoting alternative sources of livelihood provided by the government for effective management programmes to reduce fishing efforts. Previous studies indicate that fish resources are decreasing due to fishing pressure, so the need for effort reduction is important for this fishery. Respondents reported that fishing is important to their life style and they rely on fishing more than any other activity. This study found that apart from fishing other alternative sources of livelihood are palm oil production, food vendors, tomato

growing and brick making, supporting and stressing the importance of various sources of livelihood, in addition to fishing.

6.1.4 Research and training

Capacity building of the fishermen and processors is needed. FAO (2001) documented that people are considered as one of the most valued resources in any organisation. Therefore, in development of the human resources education plays an important role. Hence educators are one of the important factors in development. Educators are responsible for the training of the coastal communities such as fishermen's stakeholders or resource users and other interested parties. This will contribute significantly in the critical issue of environmental fisheries management. Effectiveness of training depends on various approaches, which will be taken to build awareness and skills of the fishermen. One has to learn from them, and talk about their problems, opportunities, inventory of resources, different occupation in the community (fishermen, farmers, different species of fishes, market information, availability of catches, seasonal availability etc.)

Poor handling and lack of fish receiving stations (" mwalo") is among the problems of Lake Tanganyika fishers. As one respondent reported that in Kigoma there is no "mwalo" like the ones in Lake Victoria .As people improve their incomes and quality of life through education, demand for high quality fishery product will increase. Therefore there is a need for investment in construction of proper fish receiving stations providing ice, freezing and cold storage facilities as found in Lake Victoria.

6.1.5 Poverty alleviation

Fisheries significantly contribute to the supply of food that is high quality protein and nutrients, employ many people and generate substantial incomes Thus development efforts in the fisheries sector have to consider the valid objective to eradicate/ alleviate poverty. Given the situation that the majority of the people in Tanzania live in the rural areas and are poor, the role of the government is to assist the local communities to become aware of their own situation and support them to become responsible for their own destiny by making better use of the fish resources.

In order to promote fish production and generate income through employment creation as a measure to alleviate poverty, encourage the allocation and utilisation of

the fisheries resources in favour of the local community so that they result in human welfare development. Therefore there is a need of improvement of the diet of poor households through the promotion of legume proteins, zero grazed cows if possible, poultry and small animals in order to diversify the supply of protein.

6.1.6 Theft

Theft of fishing gears and fishing equipments has becomes a serious problem in the study area as it has been reported by respondents that theft problems has higher frequency. Government should show more concern about this problem. Guards in the sea should be established but also facilities for security surveillance such as speedboats, and fuel should be provided. During this survey it was claimed that when fishers attacked by theft, police takes two to three days to come to rescue while the thiefs had run away. The government's role of safeguarding people's lives and general security should be an obligation and not a privilege. Sometimes the fishing community was taking self-initiatives to cater for its own security, a situation that illustrates poor governance. Therefore strategies to secure people's lives should be reviewed.

People's physical insecurity and the theft of their assets has been the major shock affecting the well-being of Kigoma fishers. Incidences of theft of fishing nets in particular have been occurring since the late 1980s, but in small spates and scales (Mung'ong'o 1997). The reasons behind the current incidences of armed robbery are related to political instability in the Democratic Republic of Congo and Burundi. These thefts have been felt heavily not only because they occur as shocks, but also because they have rippling effects on all other aspects of the livelihoods of the people and hence the impact felt in almost all fishing communities. All sectors, agriculture, livestock keeping, food venders and petty traders whose development depend on the flow of cash accrued from fishing, have been affected in one way or another.

6.1.7 Empowerment of women

Empowerment of women, regarded as natural resource managers in the society is a critical factor in the effective poverty eradication, promotion of private investment in the sector in order to stimulate fish production, processing and marketing and other related social economic activities. Gender, division of labour, which has been reported

by many authors, is an acute problem in the fishing area. Women have a very limited role in the fishing industry and their economic activities are almost exclusively restricted to agriculture and the selling of small surpluses at local markets (Chando, 2002).

6.1.8 Improvement in road and market infrastructure

The improvement in road and market infrastructure in the Kigoma area is needed so as to reduce the burden on middlemen and traders in their marketing and distribution of fishery products. The improvements would shorten the travel time and transaction periods, which not only make their operations more efficient but also give them more time to be engaged in other livelihood activities such as farming. Investment in the production of the fisheries inputs, such as boat building, production and importation of fishing gears, equipment and spare parts are also necessary in order to create more value of the Lake Tanganyika fisheries.

6.2.0 Formation of Co-operation groups

Formation of fishermen co-operatives and other stakeholder groups should be encouraged. Through co-operatives some of the resources management responsibilities could be delegated to the community. There is a need of formation of co-operation in joint research and training so as to improve the efficiency of research capacity among the four riparian countries sharing Lake Tanganyika. To facilitate, the establishment and implementation of a mechanism enabling governments of the four lacustrine states, to co-ordinate the management and exploitation of the pelagic fishery resources of the whole of Lake Tanganyika.

6.2.1 The active involvement of the private sector and NGOs

Some donors and partners are interested in assisting fisheries development in the country. The private sector, the community, non-governmental organizations and other non-state actors have a very useful role to play in the development, management and useful utilization of the fisheries resources The active involvement of the private sector and NGOs in the fisheries sector would enhance investment, improve business and general management in the fishing industry, and revitalize financing, operations and transportation/marketing of the fisheries products.

6.2.2 Improvement in fishing gears and storage facilities

The present production capacity could certainly be improved with increased investment in the fishing gear as well as in the storage and handling equipment. Some of the fishermen interviewed during the survey had complaints on lack of fishing gears and equipment. Going by the perishable nature of the products, which required high level of quality control, substantial investment for the improvement of storage facilities is required. The development of this sub sector, however, has been slowed down as a result of inadequate financing. Increased foreign investment could be one solution to this problem but this should go hand in hand with increased flexibility on the part of financial institutions in the country to actively participate by making available financial facilitation covering various elements in the development of the fisheries sub sector.

6.2.3 Insufficient credit facilities

Respondents were cited problems limiting fishing activities to include insufficient credit facilities to invest. This is due to that capital available and credits have unfavourable conditions that intimidate fishers. Credits should made be available with favourable conditions for lower income artisanal fishers, in addition to local people with no financial resources.

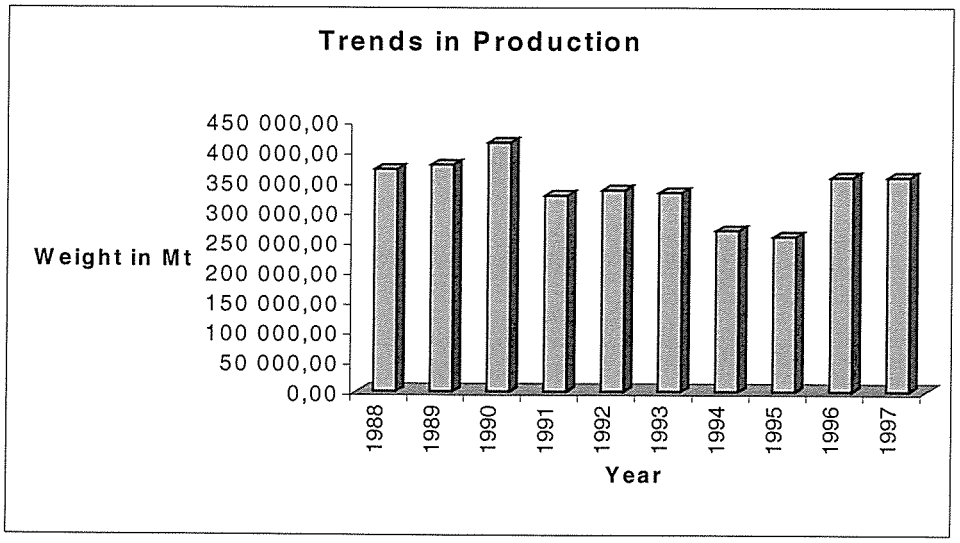
6.2.4 Fishing capacity

While better processing, better transport and better marketing can improve the value of the catches, the main problem of large catches is not addressed. As indicated the increase in fishing effort in the Lake Tanganyika is mainly due to population increase; more fishers using the old established technology. As pointed out by (Jul-Larsen, et al, 2002) the African Lakes have served as a buffer for people having few or no other alternatives. As such it is also evident that many of these lakes manage to absorb this increased fishing capacity without a problems.

In the case of lake Tanganyika the increase in numbers is so large and the indications in terms of reduced CPUE are so dramatic that some form of regulation should take place. Here I have argued in favour of limiting access through various co-management initiatives and introducing a minimum size limit. The Most important issue, however, is to create alternative livelihoods, that is employment possibilities

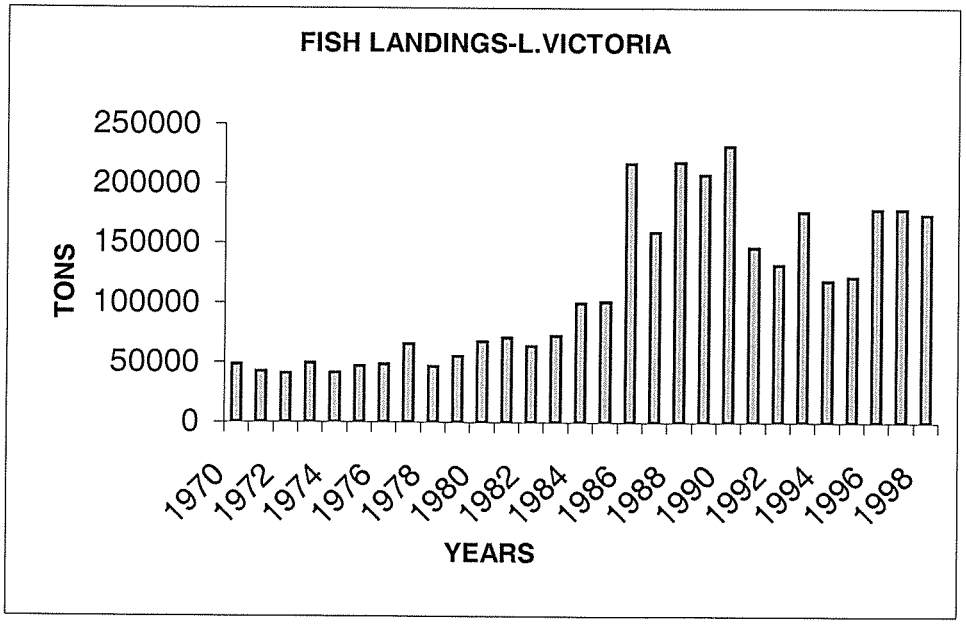
outside the fisheries. Evidence from my research indicates that people are always willing to reduce their input in the fisheries, when more lucrative opportunities arise. Only through alternative employment can some of the pressure on the fish resources in Lake Tanganyika be reduced, thus mainly the fisheries sustainable in the longer run.

Appendix 1: Tanzania Fisheries Production



Source. Tanzania fisheries Division.

Appendix 2: Total fish landings from Lake Victoria (Tanzania portion)



Source: Tanzania fisheries Division.

Appendix 3: Questionnaire

Category 1 Fishers

1 *What types of fishing gears do you use in this fishery*

2 *What methods do you use in catching Dagaa ?*

3 *What are the inputs?*

4 *How many boats do you send in the fishing activities per day?*

5 *How many crewmembers per fishing vessel?*

6 *How many hours do you spend for fishing per day? (Night shift)*

7 *Are fishing gears available locally or imported?*

8 *How many number of fishing trips per month?*

9 *Where do you sell your fish?*

10 *Are fisheries activities year round or seasonal?*

11 *What are the costs of these fishing gears (varieties of fishing gears lift net, 121*

Are the transportation facilities adequate and reasonable priced

13 *How much do you catch per day / week / month (in kilograms*

14 *How many times do you eat fish per week?*

15 *Do people like to eat fish (dagaa) ?*

16 *What other activities are you doing?*

17 *What problems do you face in operating fishing activities?*

18 *Do you get any assistance from anywhere? Yes/No*

19 *How can this fishery be improved?*

20 *To what extent is fishing is the primary or sole of food?*

21 *Are basic fisheries facilities available?*

22 *How much do you earn from catching fish?*

Category 2 Processors /Traders

1 *Are you engaged in fish processing?*

2 *How is the processed fish used?*

3.*What methods do use in processing the catches?*

4. *Do people prefer Dagaa? Yes /No*

5. *What processing methods used in processing?*

6 .*Are they effective?*

7. *Could they be improved?*

8. *Do you have access to credit facilities?*

9. Is processing done on an individual household or on a joint cooperative basis?

10. What are the major causes of post harvesting losses?

11 .Are there adequate storage facilities for Dagaa?

12 Is there any market for the fish?

13 Where do you sell your fish?

14 Is it exported or consumed locally?

15 How do you transport fish to the market?

16 *To what extent must catches be sold in order to purchase food or other necessities?*

17 Are government price policies on fish favourable?

18 Are adequate market available?

19 Are there fishermen cooperatives for fish marketing and processing?

20 What are the problems associated with post harvesting?

21 Are you able to process Dagaa before selling?

22 What percentage of catches is consumed by household?

23 . What percentage is sold ?

24. How is your catch used?

- *For human consumption*
- *Sell*
- *As bait for fishermen*
- *Others*

25. In what form is the Dagaa preferred ?

BOTH (fishers and processors)

1.Do you manage to buy food three times per day?

2. How many people in your family?

3. What other sources of protein do you eat in your house?

4. How many times do you eat fish per week?

5. Do people like to eat fish (dagaa) ?

6. What other activities are you doing?

7. What problems do you face in operating fishing activities?

8. Do you get supports/ aids from the Government ?Yes /No

9 How can this fishery be improved?

10 To what extents are fishing is the primary or sole of food?

11 Are basic fisheries facilities available?

12. Is fishing a part time or full time of your work ?

13. Do you think this fishery is profitable for you?

Yes/ No,

23 How much do you get from processing fish?

24 What are the price of fish per kilogram

- *Fisheries officers*

1 How many people are engaged in fishing activities? By gender(in your district/ region Fishing. Processors Sellers Middlemen

-

2 Do fisheries sector employ lager number of people compared to other sectors?

3 How many peoples are employed in fisheries sector in your region / district

- *Women...*
- *Men..*

4 How many number of fishing vessels / boats operating in this area?

5 How many kilograms of dagaa are consumed by the house holds per month / year

Appendix 4: Number of fishing units by type on Lake Tanganyika in 1995

Active fishers	44.957
Landing sites	786
Vessels total	19.356
Vessels operational	18243
- fishing vessels	13.192
- lamp carriers/ helpers	2.256
- transport boats	532
- motorized vessels	1.264
- fishing lamps	20.379
Traditional gear	
-lines	20.744
- gill nets	6.300
- lusenga(scoopnet)	316
- traps	13
Artisanal gear	
- liftnets	2.976
- beach seine(day)	1.143
- kapentaB.seine(night)	154
- apollo liftnets	128
- chiromila seines	16
Industrial gear	
- P.seine unit total	52
-P. seine unit operational	28
-Zambia	16
- Congo	6
- Tanzania	4
- Burundi	2

Source: Reynolds et al, (1999)

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