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**Distribution of Fishery Income Between Fishers and Gear Owners in Lake
Tanganyika: A Case of Kigoma Urban in Tanzania**

Odass Bilame

First Draft Report

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By

Odass Bilame (PhD)

January, 2010

Table of Contents

Table of Contents	ii
Acknowledgment	iv
List of Tables	v
List of Figure.....	vi
Acronym	vii
Abstract	viii
1.0 Introduction.....	1
1.1 Background to the Study.....	1
1.2 Statement of the Problem.....	2
1.3 Significance of study.....	3
1.4 Objectives of study	3
2.0 Literature Review	4
2.1 Theoretical Literature Review	4
2.2 Empirical Literature Review.....	7
2.3 Literature Gap	9
3.0 Theoretical Framework.....	10
3.1 Hypotheses	10
4.0 Methodology	11
4.1 Location of the study area.....	12
4.2 Data requirements	12
4.3 Data collection instruments.....	13
4.4 Data analysis	13
4.5 General Characteristics of the Respondents	13

5.0	Research Findings and Discussion	16
5.1	Research Findings.....	16
5.2	Discussion on Household Incomes Implications	21
5.3	Indirect Incomes from Fisheries	23
5.4	Challenges facing Lake Tanganyika Fisheries	24
6.0	Summary, Policy Implication and Areas for Further Research	26
6.1	Summary of the Study	26
6.2	Policy Implication.....	26
6.3	Areas for Further Research	27
7.0	References	28

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List of Tables

Table 4.1: Characteristics of Fishers..... 13

Table 4.2: Characteristics of Gear Owners..... 14

Table 5.1: Monthly Variable Costs that were incurred by Fishers and Gear Owners..... 18

Table 5.2: Net Monthly Income Accrued to Fisher and Gear Owners in High Catch Season..... 20

Table 5.3: Net Monthly Income Accrued to Fisher and Gear Owners in High Catch Season..... 20

List of Figure

Figure 5.1: View of Kibirizi Landing Site..... 17

Figure 5.2: Women buying Sardines from Fishing Boats at Lansing Site..... 24

Acronym

DRC	Democratic Republic of Congo
EU	European Union
FAO	Food and Agricultural Organization
KFA	Kigoma Fishermen Association
LTR	Lake Tanganyika Research
PRA	Participatory Rural Appraisal
SPSS	Statistical Package for Social Science
TAFIR	Tanzania Fisheries Research

Abstract

This study has gone a long way in assessing the contribution of Lake Tanganyika fisheries to household incomes with particular focus on Kigoma urban. The study has come up with mixed results that show that both fishers and gear owners generated profit during high catch season (October – March) and experienced low profit and even losses during low catch season. During high catch season, a fisher with the highest income netted Tshs. 5.5 million and that with the lowest netted 0.96 million. With gear owners, the highest income earner netted Tshs. 22.7 million while the lowest income earner netted as much as Tshs. 2.4 million.

On the contrary, fishers were the hardest hit during low catch season (April – September). The highest income earner netted monthly income of Tshs. 1.04 million and the lowest operated under loss. Of the 28 fishers that were covered by this study, 4 fishers each operated under loss and 23 fishers, each earned monthly income that was less than 1 million. Neither was the situation for the majority of gear owners appealing; the monthly incomes generated during low catch season were far below from those incomes generated during high catch season, except for two exceptional cases whereby the incomes generated were far above from those incomes generated during high catch season. Generally, of the 15 gear owners that were covered by this study, 4 gear owners each operated under loss, still 2 fishers each netted monthly income that was less or equal to Tshs. 1 million. Furthermore, 6 gear owners each netted income that ranged between Tshs. 1 million and Tshs. 6 million. The 2 exceptional gear owners, one netted Tshs. 19.6 million and the other one netted Tshs. 28.2 million in a month.

In terms of the expenditure pattern, fishers spent most their incomes generated on household needs such food, house construction and treatment. Gear owners re-invested back the money generated from fisheries by buying more fishing gears.

As to the challenges that were compromising the Lake Tanganyika fisheries, piracy was cited to be the major challenge, followed by high prices for petrol and paraffin.

1.0 Introduction

1.1 Background to the Study

Millions of people dwelling within and around Lake Tanganyika basin derive food and livelihood from it. The lake and its environs support a wide array of subsistence and commercial activity as well as a remarkable assemblage of tropical flora and fauna, including highly diverse populations of endemic fish, all within setting of striking scenic appeal. Reynolds *et al* (1999) points out that local fishers are almost exclusively men; generally fall within an average range of 18-50 years; tend to have low levels of formal education (lack of primary school certificate); often originate from places other than their current landing site bases; and generally engage in fishing as their principal job, though are commonly involved in subsistence or combined food/cash crop farming as secondary occupations.

Fishing in the Lake Tanganyika has been the major source of livelihood for men around the basin. Agriculture is also conducted along with fish fishing, however, women are the major stakeholders involved in the agricultural activities. Thus agriculture is the second income earner for households in the lake basin. The major crops that are cultivated include: Palm oil trees, cassava, beans, maize and bananas. The crops provide the households with food and the surplus is sold to earn money for buying other households needs including paying school fees for the children in secondary schools. The basin supplies palm oil for cooking in various market centres in the great lakes region.

The lake is shared by Burundi, Tanzania Democratic Republic of Congo (DRC) and Zambia. Lake Tanganyika lies at 773m above mean sea level; it is 673 km long, has a surface area of 32900 km² and a maximum width of 48 km. The maximum depth is 1470 m, making it the second deepest lake in the world. The average depth is 570 m and volume is 18800 km³ (Coulter 1966). The percentage surface areas under jurisdiction of the four riparian states are Burundi (8%), Tanzania (41%), DRC (46%) and Zambia (6%) (Coenen *et al.* 1993).

There are three recognizable types of fisheries on the Lake Tanganyika: industrial, artisanal and traditional. The industrial fishery started back in 1954 when Greek fishermen introduced the purse seine. The artisanal fishery uses mainly catamarans

2.0 Literature Review

2.1 Theoretical Literature Review

Definition of Key Concepts

Fishery (plural: fisheries) refers to an organised effort by humans to catch fish or other aquatic species, an activity known as fishing. Generally a fishery exists for the purpose of providing human food, although other aims are possible (such as sport or recreational fishery), or obtaining ornamental fish or fish products such as fish oil. Industrial fisheries are fisheries where the catch is not intended for direct human consumption.

Poverty refers to deprivation, however, it is now being viewed as encompassing both income and non-income dimensions. It is not only the lack of income and other material means but also lack of access to basic social amenities such as education, health, safe water and lack of personal security (Shechambo 2004). Lack of effective participation and vulnerability to shocks are also increasingly recognised as key dimension of poverty in its wider meaning.

Much of the fisheries activities in Lake Tanganyika are strongly related to the local livelihoods, and if one seeks to understand better various relationships that link into fisheries, a clear understanding of livelihood need to be fined. To this end, *livelihood* may be defined as strategies adopted by people in a particular environmental setting to earn their daily living. According to Agbenya (2009), a livelihood comprises the capabilities, assets (both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in future, while not undermining the natural resource base.

Fisheries and Households Incomes

In the fishing communities, fisheries has a direct link to household incomes. These household incomes explain the levels of income in these fishing communities which in the end indicate whether a given fishing household is poor or otherwise. Béné (2003a), showed the role played by fisheries as an “activity of last resort” for the poorest. He showed how the pro-poor capacity of small-scale fisheries to sustain poor people results

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(Bellemans 1991). The traditional subsistence fishery uses many different gears (gill-nets, hooks and line, scoop-net, traps etc.)

The extent of lake-wide fishing pressure was estimated from the density of fishing craft observed during an aerial survey (Hanek 1993). In total 13,976 canoes were observed. The highest density of canoes per km of shore line was recorded in Burundi (11.3 canoes/km or a total of 1802 canoes) followed by DRC (10.3 canoes /km or 7570 canoes), Tanzania (6.0 canoes/km or 3839 canoes) and Zambia (3.6 canoes/km or 765 canoes). During the same study 459 fish landing sites were recorded, 34 in Burundi, 127 in Tanzania, 257 in DRC and 41 in Zambia. However, based on collected aerial and parallel ground surveys by (FAO 2000), Lake Tanganyika hosted 44,960 active fishers, 18,240 operational fishing crafts and 786 landing sites. Despite the lack of current data on fishing pressure, landing sites and the number of canoes, the instability in the great lake region has had far reaching effects on fishing pressure and landing sites. A number of piracy incidents have been taking place particularly on the side of Kigoma and this has significantly affected fisheries in the lake on the Tanzanian side.

The production volume by the year 1999 was second only to that of Lake Victoria (FAO 2000). The lake's commercial fishery has essentially been based on the two *clupeids* and *Luciolate stappersii*. Clupeids are generally the most abundant species, although there is often an inverse relationship in catch numbers between clupeids and *L. stappersii*. The total fish catch for Lake Tanganyika for 1999 was estimated at 178,700 mt, (LTR 2000) shared as follows: Burundi 21,000 mt, Tanzania 55,000 mt, DRC 90, 000 mt and Zambia 12, 700 mt. During the period, the value of the catch was estimated at approximately \$US 26 million. Out of this, \$US 8 million was for Tanzania.

1.2 Statement of the Problem

Lake Tanganyika has active fishers that are engaged in artisanal fishing. Available information suggests that artisanal unit owners in Kigoma earn significantly more than their crew laborers do. Most of these unit owners are residents of Kigoma urban (that includes Ujiji). The tenth of thousands of boat owners and fishers 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 (FAO 2000). Despite fisheries to have been conducted for decades in Tanzania, Kigoma region in particular, household incomes have remained low and the region has been lagging behind in development. Household incomes have remained low and thus compromising the poverty reduction strategies. One would expect the money generated from fisheries to have a multiplier effect through, say, construction of good houses both for residential and commercial purposes, but very little has been done to that effect.

1.3 Significance of study

The significance of this study has to do with addition of new knowledge to the existing ones on fisheries in Lake Tanganyika and in particular on the household incomes generated from fisheries in Kigoma urban. The new knowledge that has been generated by this study will be used by different stakeholders including policy makers. Furthermore, this study has addressed a missing gap that exists in the income earning levels between fishers and gear owners.

1.4 Objectives of study

The general objective of this study was to examine the contribution of Lake Tanganyika fisheries to household incomes and how those incomes contribute to poverty reduction, with particular focus on Kigoma Urban. Specifically, this study sought to:

- Examine the levels of household incomes generated from fisheries
- Examine household expenditure patterns of the income generated from fisheries
- Examine the contribution of the incomes generated to poverty reduction

2.0 Literature Review

2.1 Theoretical Literature Review

Definition of Key Concepts

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Fisheries and Households Incomes

In the fishing communities, fisheries has a direct link to household incomes. These household incomes explain the levels of income in these fishing communities which in the end indicate whether a given fishing household is poor or otherwise. Béné (2003a), showed the role played by fisheries as an “activity of last resort” for the poorest. He showed how the pro-poor capacity of small-scale fisheries to sustain poor people results

in fact from the combination of two distinct mechanisms: first, the distributive dimension of fisheries, i.e. the fact that fishing activities appear very often to be of greater importance to the poor in terms of income, food security and employment than for the non-poor. Within this approach, fishing is considered as a functional pillar on which poor families facing chronic (long-term) destitution rely on to sustain their livelihoods. Second, the ‘safety-nets’ capacity of fisheries, i.e. the fact that in period of individual or collective economic crisis, fishing may also provide alternative or additional sources of income, employment and food for households – poor and less – poor whose livelihoods have been temporarily reduced or affected by the crisis.

FAO (2006) shows further that in situations of economically or institutionally restricted access to other capital (e.g. financial capital such as credit) or production factors (such as private land) the relatively easy and free access to fishing grounds allows poor people to rely more heavily on the local common’s resources to obtain the goods and services they need to sustain their livelihoods, or to gain access to paid employment and thus raise households incomes.

The percentage of total household catch that is consumed by the household varies greatly. However, this may depend on both the level of commercialization in the fishery and the level of poverty in the household (Béné *et al.* 2003). The extent to which poverty determines the percentage of the catch that is consumed, is complex and not always clear or well-understood. While it is often assumed that the poor consume a greater proportion of their catch, field research in the Lake Chad has shown that poorest households may consume a lower proportion of their catch than better-off households, and instead sell most of their fish in order to purchase cheaper foodstuffs (Béné *et al.* 2003). The direct contribution of fish to food security for the poorest households may therefore be lower than generally thought, preventing these households from accessing the nutritional benefits that fish offers.

Fisheries and Poverty Reduction

Béné (2003b), reviewed retrospectively at the perceptions embraced by academics, international agencies and practitioners of the relation between fisheries and poverty in developing countries and then tried to identify the underlying paradigms which have structured these perceptions. The review revealed how the debate focused on the

economic (low income) and biological (overexploitation) aspects of the problem. The review then revisited these perceptions in the light of the conclusions drawn from other sectors and in particular from the new “consensus” on poverty proposed by the international community. The review revealed that the incorporation of the recent research on poverty helps to show how socio-institutional mechanisms governing access by people to fisheries resources—rather than the resources themselves—play such a critical role in vulnerability to poverty.

The majority of the world’s 200 million fisherfolk (fishers and other fishworkers and their dependants) live in areas that are highly exposed to human-induced climate change, depend for a major part of their livelihood on resources whose distribution and productivity are known to be influenced by climate variation (Allison *et al.* 2005). While the climate-sensitivity of major industrial fisheries of shelf-sea and oceanic upwelling zones, such as those for Peruvian anchoveta, are well known, it is the impact of climate change on the small-scale fisheries of inland and coastal near-shore water that are perhaps of greatest relevance to concerns with poverty reduction.

Although small-scale fisheries may contribute to poverty reduction at the household level, it should be recognised at the present time the most important contribution of small-scale fisheries to poverty alleviation is probably through their role in poverty prevention (FAO 2006). Experience suggests that for the large majority of households involved in fishing activities (full-time, temporary or occasional fishers) in developing countries, fishing and related activities have not generated high economic returns but instead have helped them to sustain their livelihoods and have prevented them from falling deeper into deprivation.

Poverty in small-scale fisheries like that of Lake Tanganyika, according to the old paradigm has both an endogenous and exogenous origin (Béné and Neiland. 2004). The endogenous origin of poverty in fisheries stems from the fishery sector itself which can be explained by the overexploitation of the natural resources due to the open access nature of the fishery thereby leading to low catches, loss of resource rent and finally impoverishing the fishing communities. According to Béné and Neiland (2004), this approach is term as the “*Conventional wisdom on poverty in fisheries*”. The exogenous origin of poverty in fisheries is attributed to unavailability of alternative employment

opportunities in other sectors of the economy thereby restricting labour mobility from the fishery leading to the increase in the fishing effort which coupled with limited resources reduce income levels. In this approach, the root cause of poverty in fishery stems from outside the fishery sector. Analysing poverty in fisheries using this two approaches re-echo the general perception that “they are poor because they are fishermen” (Béné *et al.* 2004).

2.2 Empirical Literature Review

Species and Catches that Contribute to Household Incomes

About 300 fish species recorded in Lake Tanganyika, only six are of commercial importance, contributing to more than 99 percent of total annual catches in weight Munyandorero (2002). These are the small-sized, short-lived and schooling clupeid sardine species, *Stolothrissa tanganyicae* and *Limnothrissa miodon*, and the latid Nile perch species, *Lates angustifrons*, *Lates mariae*, *Lates microlepis* and *Lates stappersii*. The first three latids, also referred to as large Lates, are large and long-lived and the first one is mid-sized and is of an average longevity.

Lake Tanganyika has two main fishing zones (Kimirei *et al.* 2006), namely the demersal and pelagic. The pelagic water is mainly inhabited by three pelagic and endemic fish species. These are the two sardines (family clupeids)-*Stolothrissa tanganyicae*, *Limnothrissa miodon* and a centropomid- *Lates stappersii*. The demersal fishery extends from shoreline down to the oxic-anoxic boundary. It includes the littoral, sublittoral, and benthic zones. There is higher fish diversity in this zone (Coulter *et al.* 1991)

O'Reilly *et al.* (2006) study shows that the fisheries of Lake Tanganyika are important source of incomes for its riparian communities. Two categories of fishery exists on the lake, offshore (pelagic) and inshore (demersal). According O'Reilly *et al.* (2006), pelagic fishery has historically been the more one on the lake, yielding over 167,000 metric tons per year. However, because of the influence of climate change that lowers primary productivity of the lake (O'Reilly *et al.* 2003) the pelagic fishery is thought to be in decline (Kemerei 2005).

An aerial survey of the Lake Tanganyika that was conducted by Hanek (1993) came up with number, types and density of fishing craft. The following types of fishing craft were distinguished: canoes; catamarans; trimarans; and industrial fishing. They noted that the number of catamarans and/or trimarans was only indicative and did not reflect the actual numbers since most of fishermen disarmed these fishing units almost as they reached the landing site. Some even disarmed the units once fishing was completed and used one canoe to transport the fish to the market as it is faster.

Fisheries and Ecology in the Lake Tanganyika

Evidence from Lake Tanganyika (Verburg *et al.* 2003) highlights the ecological consequences of a century of observed regional warming in the lake. They associate warming with a sharpened water density gradient between warmer surface water and cooler deep water which has showed vertical mixing and reduced primary productivity. Further warming is hypothesised to continue these trends. These findings for Lake Tanganyika are supported by O'Reilly *et al.* (2003) who show that the rise in surface-water temperature has increased the stability of the water column. This, combined with lower wind speed, has reduced mixing in the lake and primary productivity may have decreased by about 20 percent accounting for a roughly 30 percent decrease in fish yields.

Lake Tanganyika biodiversity project study (2006), points that the lake's unique ecology faces many cross boundary threats including: soil erosion; pollution; over-fishing; and oil and mineral exploration. The most immediate threats to the lake environment are excessive loads of sediments and nutrients caused by erosion in the watershed; industrial and urban pollution, including boat discharges, and intensive fishing with inappropriate methods. The study further points areas around the city of Bujumbura bay (Burundi) to be the most impacted by human activity and richest in nutrients. However, smaller cities, like Kigoma (Tanzania) and Mpulungu (Zambia) were having a significant impact on water quality.

Experience of Fisheries Elsewhere and their Contribution to Household Incomes

A study on Dynamic of exports of traditional fish product in Cote d'Ivoire and Ghana by Mensah and Ouadi (2002) revealed that the socio-economic importance of export-oriented traditional fisheries was actually more substantial than indicated in official figures in both countries. The study revealed further that operational constraints due to inappropriate processing capacity of the export unit limited their ability to meet the increasing demands from the European Union (EU), North America and Japanese markets, generally known as "ethnic" markets. Within the framework of international sanitary regulations on handling and processing of fish, there has been a drastic drop in Ghana in the number of exporter of traditional fishery products. This has led to the fall in the household incomes.

Agbenya (2009) study has showed that lack of employment opportunities and low income coupled with lack of access to credit facilities confronting parents in rural and deprived communities in Ghana forced them to rely on their children to support them economically to supplement their meagre income. This was done illegally by selling their children into bonded labour for their lump sum income or regular monthly income through agents, friends or relatives, who lure them into believing that their children will be properly taken care of and will be working under good conditions which in most cases do not happen.

2.3 Literature Gap

The above literature has reviewed fisheries in Lake Tanganyika and the fisheries that have been conducted elsewhere. However, what the literature lacks is the failure to address fisheries in a broader picture. That is much of the literature focuses on fishers only but these fishers have been employed by gear owners; and therefore the household incomes of these gear owners should be counted as from fisheries. Furthermore, it should as well be known as to whether these incomes from gear owners have a multiplier effect that can have an impact not only on the fishing community but also on the rest of non fishing communities in terms of poverty alleviation. This is a missing gap that this study has addressed.

3.0 Theoretical Framework

Small scale fisheries can be analysed using the Sustainable Livelihood Approach (SLA) which embraces the different dimensions of poverty in fishing communities, such as education, inadequate public services, low living conditions, lack of assets and skills including vulnerability, social networks and more importantly the interaction with institutions which manage systems controlling the fishery sector. According to Allison and Horemans (2006) model of SLA, institutional and processes which are the management system in the fishery sector, influence or hinder the access of poor in the community to capital assets such as physical assets (boats, nets, fishing gears etc.), natural assets (fish, land, water bodies), financial assets (credit facilities, savings, income), human assets (skilled and unskilled labour) and social assets (norms, associations, membership organisation). The SLA framework also incorporates the vulnerabilities faced by the fishing communities in terms of low catches caused by natural factors, as in the case of Lake Tanganyika fisheries which is affected by seasonal fluctuations due to climate conditions, risks at the lake and high price of fuel.

To this end, an understanding of household incomes in the fishing communities in Kigoma has taken into account the SLA model whereby the dimensions of poverty such as levels of education, living conditions, and different sources of household income, have been addressed.

3.1 Hypotheses

This study postulated the following hypotheses:

- Lake Tanganyika fisheries contribute significantly to household incomes that could lead to poverty alleviation in Kigoma urban
- Lack of physical assets (boats, nets, fishing gears etc.), by fishers lead to low household incomes in Kigoma urban.

4.0 Methodology

Participatory Rural Appraisal (PRA) methodology was used. PRA method enables local communities to contribute their indigenous knowledge and experience, skills and labor in planning and implementing their activities that lead to the improvement in their livelihoods (Kanshahu 2000). Three types of data using PRA method were collected: *Spatial data*-that gave a sense of location and a view of community problems and opportunities. *Time related data*-that gave information on connections over time. *Social data*-that were collected through interviews regarding socio-economic activities that were being carried out in the fishing beaches. An interesting characteristic of the PRA method is that it stresses the link between technical and socio-economic issues in defining problems and solutions.

The PRA was implemented in a number of specific stages. These were:

- Site selection: the first step was to select the site where PRA would be carried out
- Preliminary visit by the PRA research team. This was done with the purpose of introducing its approach to the concerned community of fishers.
- Data collocation. The third stage of PRA method was data collection.

The types of PRA methods that were employed by this study were:

- Mapping and modelling: these methods were used to map out key changes over time (on a year-to year basis). They were used to show income-generation opportunities and any other sources of household incomes in the fishing communities.
- Time lines and trends: the methods were used to map out major changes in the fishing beaches. The techniques were useful in showing what has happened over time in a given period of time usually one year. Trends in the level of catches in different seasons were observed using this approach.
- Triangulation: Three points of view were the basis of PRA using triangulation method, they included:

- Tools and techniques: which were the means by which information from the fishers were collected. The tools and techniques included observation of what took place in the landing sites and questionnaires.
- Units of observation: which were the fishing breaches/landing sites. They were observed with view to getting a clear picture of what was happening.
- Team composition; which composed of field researchers. The team included insiders and outsiders.

4.1 Location of the study area

Katonga and Kibirizi beaches in Kigoma municipality were the focus. These beaches were selected because they are the largest landing sites in Kigoma municipality. Furthermore, unlike in other beaches where gear owners may not necessarily live near the beaches, gear owners in Katonga and Kibirizi were residents of Kigoma urban, although they were necessarily not all born in Kigoma urban. The unit of analysis was a fishing camp composed of four fishers plus an owner of the fishing boat.

4.2 Data requirements

Primary data took a centre stage in this study. Primary data, among others, included:

- The performance on the level of catches of both *Luciolate stappersii* and *Clupeids*.
- Gross and net incomes that were generated from fisheries activities
- Befit sharing of the income generated
- Taxes paid by gear owners to the local government
- Production costs
- Technologies used by fishers
- Types of fishing gear and ownership
- Other sources of income apart from fisheries

The income that each fisher accrues reflected the income that went to that particular household. To this end, this study collected information on both gear owners and fishers. It should be noted that fishers are not self employed but rather employed by boat owners.

4.3 Data collection instruments

This study used a combination of data collection techniques as a way of achieving the objectives stated earlier. These techniques were guided by the methodology outlined above and they, among others, included: face-to-face in-depth interviews, focused group discussion and participant observations. Fishers were selected randomly during interviews.

4.4 Data analysis

The quantitative and descriptive analyses took a central place in the whole process of data analysis. Data from field survey were coded and inputted in the compute software--the Statistical Package for Social Science (SPSS) that was used to run the data. However, not all information that was collected could be run by the SPSS, especially the information obtained through participant and direct observations. The outputs from the SPSS were then analysed quantitatively and descriptively.

4.5 General Characteristics of the Respondents

Tables 4.1 and 4.2 below show characteristics of fishers and gear owners respectively. In Table 4.1, all the 28 fishers were males. Of the 28 male fishers: 24 had attained primary education; 2 had attained secondary education and 2 more had attained adult education.

Table 4.1: Characteristics of Fishers

Variable	Number/Frequency	Percent
Sex		
Male	28	100.0
Female	0	0.0
Total	28	100.0
Age groups		
18 – 30 years	12	42.9
31 – 40	12	42.9

41 – 50	4	14.2
Above 50 years	0	0.0
Total	28	100.0
Marital status		
Married	26	92.9
Single	2	7.1
Divorced	0	0.0
Total	28	100.0
Level of Education		
Primary Education	24	85.6
Secondary Education	2	7.2
Adult Education	2	7.2
Total	28	100.0

Sour: Field Survey 2010

With respect to marital status, 26 fishers were married and only 2 fishers were single. The age group of fishers that was actively participating in fishing was in the range of 18 – 40 years. 24 out of the 28 fishers were in this range of years, it is only 4 fishers that had age that ranged between 41 and 50 years.

Table 4.2 shows further the characteristics of gear owners. A total of 15 gear owners were interviewed, out of those, 14 were males and 1 was a widowed woman. Furthermore all the 14 gear owners were married and had children. A fisher household that had the largest number of children had 10 children, while that with the smallest number of children had 2.

Table 4.2: Characteristics of Gear Owners

Variable	Number/Frequency	Percent
Sex		
Male	14	93.3
Female	1	6.7
Total	15	100.0
Age groups		

18 – 30 years	0	0.0
31 – 40	6	40.0
41 – 50	7	46.7
Above 50 years	2	13.3
Total	15	100.0
Marital status		
Married	14	93.3
Single	0	0.0
Divorced	0	0.0
Widowed	1	6.7
Total	15	100.0
Level of Education		
Primary Education	12	80.0
Secondary Education	2	13.3
Adult Education	1	6.7
Total	15	100.0

Sour: Field Survey 2010

In terms of education, of the 15 gear owners, 12 had attained primary education, 2 had attained secondary education and 2 more had attained adult education. Many gear owners were in the age group that ranged between 41 and 50 years. However, there were 2 gear owners that were over 50 years. In fact, the oldest gear owner had 75 years.

The kind of fishing technology that prevailed was either catamaran or trimaran. Catamaran involved two big fishing canoes that were tied together and were engine powered, while trimaran involved three fishing canoes that were also engine powered. In either case, fishing nets and lumps were required. Trimarans were commonly used during high catch season.

5.0 Research Findings and Discussion

5.1 Research Findings

The study has come up with mixed findings on the fisheries activities in the two beaches that were surveyed. In Katonga beach 18 fishers and 10 gear owners were interviewed and in Kibirizi beach 10 fishers and 5 gear owners were also interviewed. It should be noted that each fisher that was interviewed was selected randomly out of four fishers that formed a fishing team. To this end, each fisher selected for interview represented four fishers that formed a fishing team. Incomes that were generated by fishers and gear owners are indicated in Tables 5.2 and 5.3.

The institutional setting in the two beaches was similar. The fisher community both in Katonga and Kibirizi had one organization called Kigoma Fishermen Association (KFA). It coordinated all fishing activities in the two beaches. Leaders of the association were directly answerable to the fishers. Within the beaches there was a local leadership with institutions that were charged with various responsibilities. There were institutions that were charged with overseeing security in the beaches, cleanliness and environment. Furthermore, there was also another institution that was charged with the responsibility of delivering information on various issues such as meetings and death incidents.

On the issue of governance, each fishing camp had its own governance. However, the owner of the fishing gear had a more say on how the fishing camp was to be governed. The camp governance was mainstreamed in the overall beach governance. For example, a fisher was supposed to show respect to his gear owner and abide by the rules and regulations of the fishing camp. Not only was the fisher supposed to show respect to his gear owner but also to the rest of the gear owners in the fishing beach. Rules and regulations for a particular camp were also mainstreamed in the beach rules and regulations. For instance, rules and regulations regarding cleanliness of the camp were directly mainstreamed in the beach regulations. On this aspect of cleanliness, the two beaches were doing well. Indeed the two beaches were clean due to the rules and regulation that held responsible fishers who attempted to pollute the beach. Figure 5.1

demonstrates this fact; not only is the view of water clean but also the view of the beach/landing site.

Figure 5.1: View of Kibirizi Landing Site



Variable costs that were incurred

With regard to household incomes that were accrued to both fishers and gear owners, the study had first to explore the production costs that were involved before arriving at net income of either fisher or gear owner. The capital that was needed to have a complete catamaran-called “Kipe” in Kwahili was Tshs. 14 million. However, this study did not pay much attention to the fixed costs since some gear owners had already recovered the cost for a long period of time. The study just focused at variables costs that were incurred on daily basis. The variable costs were: petrol, paraffin, “*tambi*” and food for fishers. Table 5.1 shows variable costs from the perception of both fishers and gear owners.

Table 5.1: Monthly Variable Costs that were incurred by Fishers and Gear Owners (in Million Tanzania Shilling)

	1.0-2.0	2.1-3.0	3.1-4.0	4.1-5.0	Total
Fishers	-	1	24	3	28
Gear owners	1	6	8	-	15
Total	1	7	32	3	43

Source: Field survey 2010

Variable costs, namely petrol and paraffin were relatively higher for fishers than for the gear owners. What took place on the ground was that gear owners secured petrol and paraffin from oil companies in Kigoma at a market rate price and sold the energy at a higher price to fishers on credit, with view to raising the money at the end of fishing season, usually at the end of dark-moon phase. Gear owners bought one litre of petrol at Tshs. 1850 and were selling the very litre at Tshs. 2200. Again, one litre of paraffin was bought at Tshs. 1250 but was sold to fishers at a price between Tshs. 1300 and Tshs. 1350. However, during survey, gear owners reported market prices for both petrol and paraffin. This explains why fishers seem to have inflated variable costs in month. An interesting issue to note here is that the costs for fishing *clupeids* (sardines) and *luciolate stappersii* (fish) were the same. The same traps used to catch sardines were the very ones that were used to catch fish. Fishers could not establish the kind of catch they could come up with from the water, they could get more sardines and less fish or more fish and less sardines. However, the good thing was that, upon landing, sardines and fish fetched the same market price per kilogram.

Variable costs at the end of each dark-moon phase were deducted from gross income that was generated to arrive at net monthly income that was accrued to both fishers and gear owners.

Monthly Income Accrued to Fishers and Gear owners

Table 5.2 indicates net monthly income accrued to fishers and gear owners during high catch season (October-March). Gear owners took the lion's share of the net income that was generated, but still fishers also netted high incomes during high catch season. The

net income that was generated was either divided into three or two parts. For fishers in the three category case, the owner of the gear took two thirds and one third was shared equally by the four fishers that formed the fishing team. With the fifty-fifty case, the owner of the gear took half of the net income that was generated and the other half was divided equally among the four fishers. A fisher that earned highest monthly income netted Tshs. 5.5 million and that with lowest netted Tshs. 0.96 million. Generally, 13 fishers each netted monthly income that ranged between Tshs. 1 million and Tshs. 3 million. Other 14 fishers each netted monthly income that ranged between Tshs. 3.01 million and Tshs. 6 million. Of the 28 fishers that were covered by this study, it is only 1 fisher who earned monthly income that was below 1 million.

With respect to gear owners, the highest monthly income earner netted Tshs. 22.7 million and the lowest income earner netted Tshs. 2.4 million. Of the 15 gear owners, 11 each netted monthly income that ranged between Tshs. 3.01 million and Tshs. 12 million. It is only 3 gear owners that each earned monthly income that ranged between Tshs. 15 million and Tshs. 23 million. Generally speaking, the gap between the income earned by fishers and gear owners is large. One of the explanations to this emanates from the production costs whereby fishers bought on credit petrol and paraffin at an inflated price from gear owners. But also the ratio that was used to divide the net income that was generated favoured the gear owners. To this end, gear owners realised profit before even the fishing was done.

Table 5.2: Net Monthly Income Accrued to Fisher and Gear Owners in High Catch Season (in Million Tanzanian Shilling)

	Below 1	1 – 3	3.1 - 6	6.1 – 9	9.1 – 12	12.1 – 15	15.1 – 18	18.1 -21	21.1 - 24	Total
Fisher	1	13	14	-	-	-	-	-	-	28
Gear owner	-	1	4	3	4	-	1	-	2	15
Total	1	14	18	3	4	-	1	-	2	43

Source: Field survey 2010

Table 5.3 below shows the monthly income accrued to both fishers and gear owners during low catch season (April-September). Generally, the incomes were very low not only for fishers but also for gear owners. Of course, gear owners were still relatively far better than their fishers in terms of the monthly income. Of the 28 fishers, 4 fishers each operated under loss and 23 fishers each earned income that was less than 1 million. It is only 1 fisher that generated more than one million; in fact this fisher netted 1.04 million.

Table 5.3: Net Monthly Income Accrued to Fisher and Gear Owners in Low Catch Season (in Million Tanzanian Shilling)

	-1 – 0	0.1 – 1	1.1 – 3	3.1 – 5	5.1 – 7	7.1 – 9	9.1 – 11	Above 15	Total
Fisher	4	23	1	-	-	-	-	-	28
Gear owner	4	2	3	2	1	-	1	2	15
Total	8	25	4	2	1	-	1	2	43

Source: Field survey 2010

On the side of gear owners, as shown in Table 5.3, only 4 gear owners operated under loss. 2 gear owners each earned monthly income that was less or equal to Tshs. 1 million, 3 more gear owners each netted income that ranged between Tshs. 1.01 million and Tshs. 3 million. Still other 3 gear owners each netted monthly income that ranged between Tshs. 3.01 million and Tshs. 6 million. It is only 2 gear owners that netted monthly that was above Tshs. 15 million. In fact, 1 gear owner generated Tshs. 19.6 million and the other one generated Tshs. 28.2 million, which was over and above of the highest income that was generated during high catch season. One of the explanations to this paradox could be that, these gear owners might have been lucky to get good prices for the catch upon landing from fishing. The income is not necessarily reflected in the quantity of fish that was caught but rather the prices that prevailed upon landing from fishing.

To this end, one may be tempted to conclude that fishers and gear owners create wealthy during high catch season. This may not be true in all cases because of the losses that are incurred during low catch season. In the first place fishers may accumulate huge debts in low catch seasons; the gear owner has no any other option of recovering his money invested in buying petrol and paraffin except waiting for a good season to come. It is during high catch season a gear owner can recover the accumulated debts from fishers. Thus, the higher net monthly income generated by the fisher during high catch season does not necessarily reflect what actually goes into his pocket. The fisher is supposed to remit the accumulated debts to his gear owner and the money that is left goes into the pocket of the fisher for household consumption. Furthermore, it should also be noted that the higher incomes experienced during high catch season are not necessarily experienced all along the period of high catch seasons. Within the season there are also some variations in the level of catches.

5.2 Discussion on Household Incomes Implications

Household incomes implication has to do with incomes that were generated by both fishers and gear owners. During high catch season, fishers generated higher incomes and the money that went directly to the household was equally high. However, during low catch season the situation was otherwise, very little money went to the fisher's

household. Since both high and low catch seasons had equal duration period for fishing i.e. each season had six months. Therefore household incomes were higher only in half a year and the other half of a year household incomes were very low. This called for proper budgeting of the households in such a way that money generated during high catch season was able to compensate for low incomes in low catch season. But again part of the money generated during high catch season used to pay for the accumulated debts in low catch season. This reduced the money meant for the household.

Generally, gear owners were earning higher incomes for their households. Even during low catch season, except for 4 gear owners, that encountered losses, the other 11 gear owners, each generated money that could cater for both household needs and investments.

Expenditure Pattern of the Household Incomes

Fishers spent their incomes from fisheries mostly on food, medication and house construction. Of the 28 fishers, 13 fishers spent their incomes generated on house construction both for residential and commercial (renting). All of the 28 fishers admitted that the lion's share of the income generated was spent on food for their households. 27 fishers reported further that, they spent part of the income generated on treatments for household members. Although fishers had large families, they did not indicate that they were paying school fees and other associated costs for their children in schools. The highest number of children reported by a fisher in a household was 10 children and the lowest number of children reported was 2 children. This reinforces the fact that fisher communities did not give education for children a priority. As to whether the incomes from fisheries had impact on poverty alleviation, all fishers admitted that incomes from fisheries were helping them to reduce poverty. However, for those whose fishing gears were seized by pirates were of the different views.

Unusual phenomenon with fishers in the two beaches that were surveyed was that, of all the 28 fishers none took alcohol. They all reported to have not been taking alcohol; it was difficult for this study establish the truth as to whether they were not taking alcohol or otherwise.

Direction of the incomes generated from fisheries

Gear owners did not clearly indicate as to where the money generated was directed to. Of the 15 gear owners, at least one had invested in ranching. He had farm with 75 dairy cows. 3 other gear owners had invested in taxi business. However, what this study established was that gear owners were not ready to report as to where they re-invest the money generated from fisheries. All gear owners, in their views, pointed out that the money generated during high catch season compensated for the meagre incomes generated during low catch season. But again this was not a convincing reason since few gear owners got losses during low catch season. They might have failed to report as to where they invest the money for fearing that this study might come up with ways of tracking them on how they avert paying taxes to the government. However, fishers pointed out that gear owners kept on re-investing in fisheries by constructing new fishing canoes. At this juncture, it should be noted that in fisher communities in Kigoma, a gear owner was respected if he owned many fishing boats. This assertion explains as to where the incomes generated by gear owners were directed to.

5.3 Indirect Incomes from Fisheries

There were indirectly incomes that were generated through the spill-over effects of the fisheries activities in the two beaches that were surveyed. Various activities were being conducted in and around the fishing beaches. These activities, among others, included:

- Boat construction and repairing
- Fish and sardine trading
- Morning markets for perishable goods mainly vegetables and tomatoes done mainly by women
- Retail shops
- Restaurants
- Tailoring marts

To this end, fisheries created indirect employment opportunities through the spill-over effects of the fishing activities. Figure 5.3 highlights some of the indirect fishing

activities that were conducted along with fishing at the landing sites. Women were particularly engaged in the indirect activities.

Figure 5.3: Women buying Sardines from Fishing Boats at Lansing Site



5.4 Challenges facing Lake Tanganyika Fisheries

Both fishers and gear owners raised challenges that compromised fisheries in Lake Tanganyika. These challenges, among others, included:

Piracy in the lake: gear owners and fishers had serious concerns that the rate of piracy incidents were increasing at an alarming rate and felt that the government was doing very little to protect fishers while fishing. Fishers were the hardest hit since they risked their life once their fishing boats were seized. Pirates came from the war-torn out country of DRC and had rendered many gear owners bankrupt. Pirates went away with all the fishing gear, once they seized the fishing boat.

Rising prices for fishing gear: this was also another challenge that was facing fisheries sector in Lake Tanganyika. The cost of starting the fishing business was so high and an

ordinary fisher to start his own business was very expensive. It costs Tshs. 14 million to start the fishing business with a catamaran.

Inflated prices of petrol and paraffin: fishers were of the view that gear owners were not doing a fair deal with them. They bought petrol and paraffin at a market rate price but sold to them at inflated prices.

6.0 Summary, Policy Implication and Areas for Further Research

6.1 Summary of the Study

This study has gone a long way in showing what fisheries is all about in the Lake Tanganyika with specific reference to the two beaches found in Kigoma urban. The household incomes for both fishers and gear owners varied substantially, the fishers that did the actual fishing work ended up getting less than what the gear owners netted. This was true for both high and low catch seasons, although during high catch season both fishers and gear owners experienced higher household incomes than in low catch season. As to what was the expenditure pattern of the incomes generated by fishers, this study came up with mixed expenditure patterns. However, all fishers spent part of the income generated for purchasing food for the households. They all reported to have been spending money generated for treating members of the households who were sick. Of course, fishers reported to have been constructing houses and buying land.

Gear owners who took the lion's share of the income generated did not clearly indicate as to where the incomes generated were directed to. They were not ready to report as to where they invested the money generated from fisheries, however, fishers pointed out that gear owners were re-investing back the money generated in fishing by buying more fishing gears. There was a mindset within the fishing communities in Kigoma that for a gear owner to be respected, he should own many fishing boats. Nevertheless, investing in fisheries, in view of this study, was not sustainable because of the security reasons. Investing more in fisheries was associated with high risks of being attacked by pirates from the nearby countries such as DRC. Pirates had rendered many gear owners and fishers in Kigoma into abject poverty.

6.2 Policy Implication

Basing on the kind of mixed results that this study has come up with, mitigating measures in terms of policy formulation was highly needed. Policy implications on Lake Tanganyika fisheries should address the following:

Government curbing the incidents of piracy: fishers and gear owners had all along cited pirates to have affected their efforts to expand their fisheries business. They all reported

pirates in Lake Tanganyika to have rendered many gear owners in Kigoma into poverty. They appealed to the government to take deliberate efforts to stop piracy.

Diversification of investments: gear owners generated a lot of money during high catch season. Instead of the money generated to be re-invested in fisheries, it could be invested in other productive investments. A policy formulation by the government that could motivate gear owners to invest in other projects could be of great help to them. This could reduce the high risks of a rich gear owner falling into abject poverty once his fishing gears are confiscated by pirates. One of the policies could be to improve transport networks that link Kigoma with other regions.

Balancing costs during low and high catch seasons: since the amount of costs during low and high catch seasons were almost the same. There was a need to balance the costs in a way that could enable both gear owners and fishers to use less petrol and paraffin that were very expensive. Local government could develop a policy that could discourage fishing during low catch season. This could even help both fishers and gear owners to use the money generated during high catch season sustainably in such a way that it catered for household needs during the low catch season.

A balanced win-win fisheries business: There was a need for a local government in Kigoma to intervene on the issue of inflated prices of petrol and paraffin. Fishers were forced by their gear owners to buy petrol and paraffin at inflated rates. Gear owners bought the two items at market rates from oil dealers and sold to their fishers on credit at higher prices. Fishers were not happy at all, the local government needed to intervene with view to balancing the situation. Along with the *balanced win-win business*, there was the whole issue of grating subsidies to the fisheries sector. Fishing gears were very expensive; the government could extend subsidies to enable fishers to start their own fishing business.

6.3 Areas for Further Research

What this study has come up with is just a tip of an ice berg. There were still potential areas for further research on Lake Tanganyika fisheries. For example, a further research on the contribution of Lake Tanganyika fisheries to the economy of Tanzania would be highly regarded as a positive move in uncovering the economic contribution of Lake Tanganyika fisheries to the economy of Tanzania.

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