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The Structure and Margins of the Lake Chilwa Fisheries in Malawi: A Value Chain Analysis

THE STRUCTURE AND MARGINS OF THE LAKE CHILWA FISHERIES IN MALAWI : A VALUE CHAIN ANALYSIS

The Structure and Margins of the Lake Chilwa Fisheries in Malawi : A Value Chain Analysis

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Executive Summary

Small freshwater pelagic fisheries in closed lakes are very important to millions of people in sub-Saharan Africa providing livelihoods and nutritional security. However, returns from these fisheries have been shown to fluctuate in response to climatic variability. In order to understand the impact of these fluctuations on the livelihoods of people dependant on these fisheries, there is a need for information on how the fish value chain is organized and how it functions in response to variation in supplies. The results will feed into strategies that build resilience in fishing households against the uncertainties arising from unstable ecosystems.

The Lake Chilwa fishery value chain is composed of fishers, processors, traders, fish transporters, boat owners, owners of fish processing shades, fisheries associations, gear owners, gear makers, firewood sellers, and traders of fishing gear and equipment. The value chain employs many people and local authorities can consider using this information in the design of rural development strategies for employment generation in small-scale fishing communities.

Marketing of Lake Chilwa fish is mostly done within the south east of Malawi but some fish is distributed to distant markets in the Central Region of the country. Most of the fish is sold fresh to either fish processors, wholesalers or retailers. Only a very small proportion of the fish caught is consumed by the fishers themselves, indicating that fish is used as a cash generating commodity.

Fishing is, on average, a profitable activity. Fishers obtain average marketing margins of about US$280 per month. Disparities in the magnitude of the marketing margin are observed among fishers with different attributes. Fishers from beaches that are easily accessible from urban centers, fishers that own fishing equipment, and fishers that sell their fish by auction obtain higher marketing margins than other fishers. Similarly, fish processors obtain higher marketing margins than wholesalers or retailers. However, while some fishers, mainly gear owners, have relatively high incomes , the basin still has higher poverty levels than the national average. Poverty around Lake Chilwa can be attributed to lack of access to services such as health, education, banking, and other public services, including political representation,which would help articulate the need for these services. Access to facilities would allow fishers to maximize benefis from their fish catches.

One of the major constraints stated by fishers was that the buyers offer very low prices while buyers complained about very high prices of fish charged by fishers. This is mainly due to information asymmetry between buyers and fishers, which is common in African small-scale fisheries. Improved availability of marketing information (prices or changes in demand) to fishers through efficient information systems can improve the performance of the value chain by increasing the bargaining power of small-scale producers and traders.
Accessibility of fish landing sites to urban markets was found to improve the marketing margins for fishers. Poor access leads to delays in getting the product to market. Delays reduce the quality (and therefore price), and availability to consumers as a result of increased spoilage. Improvements in road infrastructure which can improve accessibility of the landing sites would potentially increase gains in the fish value chain. The gains can be accrued to fishers, traders and consumers.

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1. Introduction

Africa's lakes are prone to periodic, climate-induced, lake level fluctuation, even to complete drying out in low-rainfall years (Sarch & Allison, 2000). As such, fish production is highly variable. This has resulted in unstable incomes for fishers and others associated with ancillary activities, thereby increasing their vulnerability. The management of small pelagic fish stocks in the African Great Lakes (including Lake Chilwa) needs to be informed by an understanding of how fishers, distribution chains and markets cope with fluctuating supplies (Sarch & Allison, 2000). Such a study in the Lake Chilwa Basin is important since the ecosystem and the livelihoods of the communities living in the basin are threatened by climate change. An improved understanding of fish value chains can contribute to the development of pilot livelihood interventions because it permits constraints and opportunities to be identified and clarifies the governance of the marketing system (Gordon et al., 2011). Furthermore, improvements in fish value chains will improve the resilience of fishing households not only by enhancing the value they accrue from the fishery, but also by reducing the variation in income between good years and bad years due to the unstable ecosystem.

In order to develop strategies for strengthening and increasing the resilience of fishing communities, it is imperative that we understand the structure and the distribution of the margins between the various actors. This paper presents the results of a value chain study for the Lake Chilwa fisheries in Malawi and helps provide an understanding of both the structure of the fish value chain and the disparities in gross margins achieved by the main actors.

The study complements earlier work by Schuijt (1999) that quantified the value of the Lake Chilwa fishery and promoted value addition of Lake Chilwa fish catches through processing. The study was conducted as part of the Lake Chilwa Climate Change Adaptation Program that is being implemented by the WorldFish Center together with Leadership for Environment and Development (LEAD) and the Forestry Research Institute of Malawi, with funding from the Royal Norwegian Ministry of Foreign Affairs. The objectives of this study included:

1. Identifying the marketing channels of fish from the Lake Chilwa Basin,
2. Identifying the actors and describing their functions,
3. Estimating the cost, revenue and margins of producers and traders involved in the marketing chain, and
4. Assessing the prospects and constraints of the fish value chain.

The study used qualitative and quantitative data from focus group discussions and individual interviews that involved 60 fishers, 29 fish processors and 42 fish traders. The respondents were drawn from three of the major fish landing sites, one in each district: Zomba, Machinga and Phalombe (Figure 1).

The paper is organized as follows: Section 2 provides an overview of the value chain analysis, Section 3 describes the Lake Chilwa fishery, and Section 4 presents the findings of the study. Finally, Section 5 puts forward conclusions and discusses the policy implications of the study results.

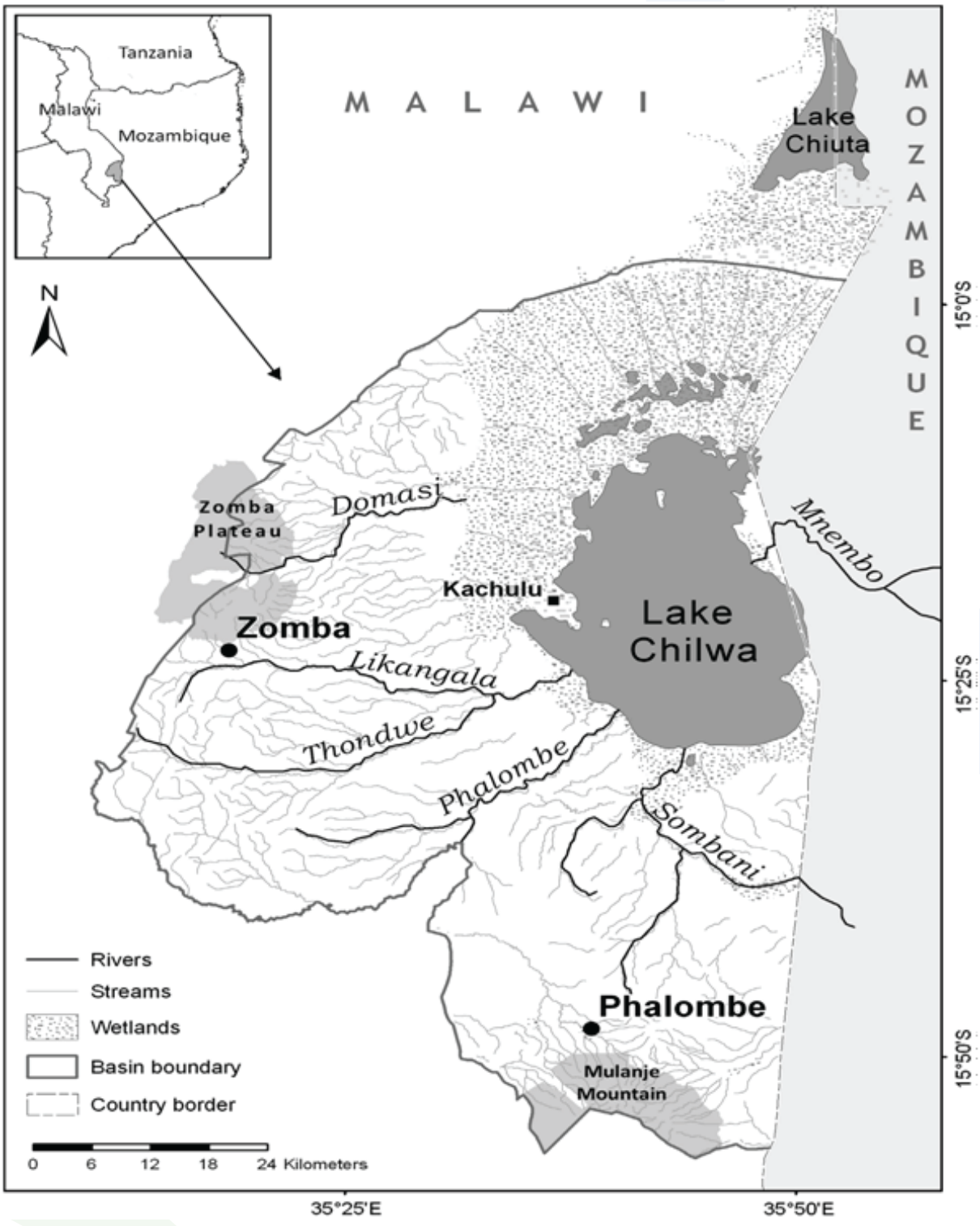

Figure 1 : Map of Lake Chilwa Basin in Malawi.
Source: Njaya et al., 2011

2. The Concept of a Value Chain

Value chain studies attempt to understand an industry from product conception to final disposal. In the fisheries sector, value chain studies have been conducted in a number of countries with a diversity of aims. Some of the objectives of fish value chain studies include: identifying the various actors, their functions and existing linkages; determining value-increasing opportunities; assessing the input-output structure and the distribution of margins and return on investment along the chain; and analyzing the constraints and opportunities in the value chain including the role of different socioeconomic groups such as women and the poor. (Shamsuddoha, 2007; Ardjosoediro & Neven, 2008; Dubay et al., 2010; Gordon et al., 2011).

A value chain describes the full range of value-adding activities required to bring a product or service through the different phases of production, including procurement of raw materials and other inputs, assembly, physical transformation, acquisition of required services such as transport and/or cooling, and ultimately response to consumer demand (Kaplinsky & Morris, 2002; Weber & Labaste, 2009). A typical fish value chain can be represented as shown in Figure 2 below.

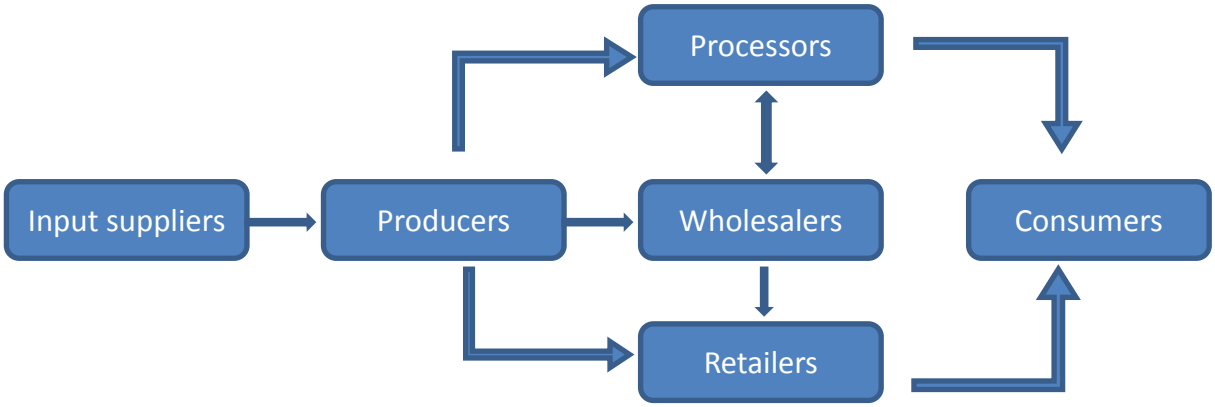

Figure 2 : A typical fish value chain.

The chain presented in Figure 2 simplifies the complex series of activities that can take place as products move from the producer to the consumer. For example, the fish value chain involves different species of fish that follow different chains, both fresh and processed fish, from capture fisheries and from aquaculture. The movement of fish from one stage of the chain to another stage represents a value adding activity.

Value chains can be mapped and analyzed using value chain analysis (VCA) and can include qualitative and/or quantitative tools. A value chain analysis aims to describe the value chain and to assess the value adding activities between each stage of the chain. It is based on a segmentation of the different activities and mapping of interactions that may generate costs or value in the production and sale of a product or service (Weber & Labaste, 2009). The essence of value chain analysis is to improve strategic learning in enterprise development. It treats an enterprise not as a singular entity, but as part of an integrated chain of economic functions and linkages across geographic boundaries. It emphasizes the diverse interrelationships among market opportunities, constraints, and directives at various levels of the supply chain where specific value addition takes place (AsiaDHRRA, 2008). It involves the identification of marketing channels as well as the assessment of value adding activities between different phases of the chain. There are many ways to analyze or evaluate a value chain. Analysis can stem from research of secondary information such as government or industry data, to interviews with industry participants. It can also be derived from participatory market assessments and market observations (Weber & Labaste, 2009).

A value chain analysis can contribute to pro-poor initiatives and improve the linkage of small businesses with the market (Weber & Labaste, 2009). Additionally, it can be a useful analytical tool to understand the policy environment in terms of efficiency in allocation of resources (physical, economic and social) between individuals and organizations engaged in the transformation of raw materials (fish, in this case) into end products (Ahmed, 2007).

3. The Lake Chilwa Basin

3.1 Background

The Lake Chilwa Basin (Figure 1) covers three administrative districts: Zomba, Machinga and Phalombe. Its catchment is bounded to the west by the Chikala Hills, Zomba and Malosa Mountains, the Shire Highlands, and Chiradzulu Mountain. These highlands give rise to the Zumulu, Lingoni, Domasi, Songani, Naisi, Mulunguzi, Likangala, Thondwe, Namadzi and Mombezi rivers. The catchment is bounded to the south-east by the Mulanje and Michesi mountains which give rise to the Phalombe and Sombani rivers. The Sombani River runs into Mpoto Lagoon because the other river runs straight into the Lake without going into the lagoon before flowing into the lake. To the east lie the hills and mountains of Mozambique, which give rise to the Bungwe, Mnembo, Matchimaze, Namajete and Cocole rivers. In the north-east the Mikoko and Naminga rivers rise from the eastern rift (Njaya et al., 2011).

The diverse ecosystems of Lake Chilwa allow it to support a variety of valuable common property resources such as water, fish, forests, and waterfowl (Sambo & Munyenyembe, 1999; Kalanda-Sabola, 2007). The common property resources that are supplied by the wetland are very important for the livelihoods of the population within the basin and beyond. Livelihood strategies within the basin include farming, fishing and fish trading, livestock rearing, hunting, wage labor, and self employment (Kalanda-Sabola, 2007; Njaya et al., 2011). A wetland valuation study revealed that fishing makes the highest contribution to the basin economy and was estimated at USD17 million a year in net benefits; this was followed by grasslands providing USD589,500, open water USD402,557, agricultural land USD385,212 and vegetation USD12,434 (Schuijt, 1999).

The services that are derived from the wetland attract many dwellers, such that the Lake Chilwa Basin is one of the most densely populated areas in Malawi, and indeed in Africa, with roughly 321 people per square kilometer (NSO, 2008). Unfortunately, the high population density exerts pressure on ecosystem goods and services in the basin and reduces the per capita benefits from the natural resources.

3.2 The fishery

Lake Chilwa supplies, on average, about 20% of total fish landings in Malawi, reaching 27% in some years (GoM, 2005). The fishery is also important for sustaining livelihoods of many people living outside the basin. The lake fishery and the whole of the Chilwa plains are an important economic system. Not only are there links between fishing and various ancillary services, but also complementary flows of income between fishing, farming and cattle-rearing (Phipps, 1973; Kalk et al., 1979).

The Lake Chilwa fisheries are exploited by just over five thousand fishermen (boat owners and crew members); many more are engaged in ancillary activities such as fish processing, trading, transportation, firewood selling and other support services. Fish are caught using fish traps, gillnets and long lines (Kanyerere et al., 2009; Njaya et al., 2011). Fish traps are common because they are less expensive. They are made of local materials compared to other types of gear that need synthetic materials. Fish traps and seines are used to catch *matemba (Barbus spp.)* while gillnets and long lines target large fish species such as *makumba (Oreochromis shiranus chilwae)* and *milamba (Clarias gariepinus)* (Njaya et al., 2011). Most fishers use dugout canoes though some have access to plank boats with or without engines (Table 1). The use of *matemba* seines, which now catch over 70% of total fish landings, has shown an increasing trend between 1993 and 1998 (Kanyerere et al., 2009).

Table 1 : Annual Frame Survey (2008) results of fishing craft, gear owners, crew members and fishing gear for Lake Chilwa in Malawi.

Indicator	Number
Gear owners	1871
Crew members	2980
Plank boats with engine	60
Plank boats witout engine	556
Dug-out canoes	1066
Gill nets	10740
Long lines	1115
Mosquito nets / usipa[1] seine	37
Fish traps	6669
Hand lines	18
Matemba seine nets	396
Hook and line (*chomanga*[2])	5814

Source: Kanyerere et al., 2009.

[1] A small pelagic cyprinid, Engraulicypris sardella, endemic to Lake Malawi and associated water bodies.

[2] A baited hook and float set in swampy areas.

Lake Chilwa fish catches are dominated by *Barbus paludinosus* and *B. trimaculatus* which account for more than 70% of the total catch (Environmental Affairs Department, 2000; Njaya 2001). Fish catch varies enormously between years, from a production of 23,000 tonnes (metric tons) recorded in 1990 to just very few fish when the lake dried in 1996 (Figure 3). Records show that reduced catches and increased fish mortalities occur during even minor or moderate drying periods or recessions. Major recessions that interfere with fishing in the lake for 3–5 years can be expected once every 10–20 years, while minor recessions that interfere with fishing in the lake for 1-2 years are expected every 6 years (Lancaster, 1979). The frequency of these recessions is likely to increase with climate change. When the lake water level recedes the fishery collapses, but it rapidly recovers within three to four years after the water returns. For example in 1999, three years after the 1996 recession, fish production from the lake reached about 12,500 tonnes. The Lake Chilwa fishery, and the *Barbus* component in particular, has been quite resilient to cyclical drying of the lake, overfishing and the use of illegal gear (Njaya et al., 2011).

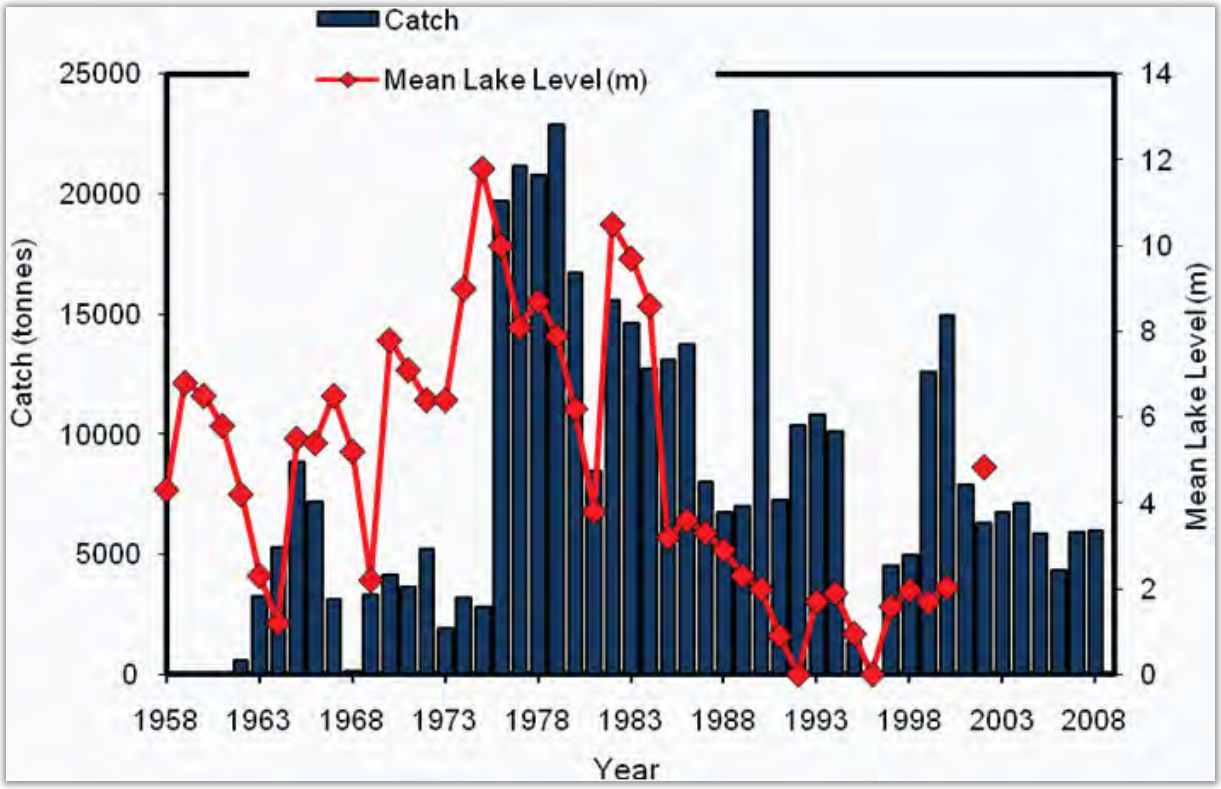

Figure 3 : Historical (1958–2000) mean annual lake level (m) of Lake Chilwa measured at Kachulu and total catch (tonnes) from the lake between 1962 and 2008.
Source: Njaya et al., 2011.

3.3 Governance, policy and institutional arrangements

The governance of fisheries and other natural resources has taken a variety of forms over time: traditional, control from central government, co-management, and hybrids of these different arrangements (Njaya, 2007). Traditional arrangements embrace the use of customs, traditional beliefs and social norms to manage access to natural resources (Lowore and Lowore, 1999).

Traditional authorities such as chiefs are custodians of this arrangement (Jamu et al., 2011). An important feature of local governance is that the two systems of authority, the local chiefdoms and national government, are aligned and run in parallel.

The government centered system is based on a wide range of regulations and restrictions that are applied to manage resource use (Jamu et al., 2011; Njaya, 2009; Lowore and Lowore, 1999). The first fishing regulations in Malawi were introduced in 1930 by adding a section to the Game Ordinance (Section 3: Fishing Rules MP.437 of 1930). The ordinance statutorily enabled the then Ministry of Natural Resources to implement, through the Department of Fisheries, regulations with the aim of maximizing the sustainable yield from fish stocks that could economically be exploited from natural waters. By 1973, a new fisheries act was formulated that took account of (a) the need to conserve fishing stocks for long term optimum catch; (b) new fishing methods based on modern fishing gear; and (c) the need to curb pollution. Later, a new act, known as the Fisheries Conservation and Management Act (1997), was passed by parliament to replace the 1973 Fisheries Act. In 2001 a National Fisheries and Aquaculture Policy (NFAP) was developed. The NFAP aims to maximize the sustainable yield from natural and artificial water bodies in Malawi, improve the efficiency of exploitation, processing and marketing of quality fish products, promote investment in the fishing industry and rural fish farming units, and exploit all opportunities to expand existing aquatic resources and develop new programs to increase fish supply.

In 1995, Lake Chilwa moved to a co-management system in which communities manage access to the fishery and enforce regulations in partnership with local and national government. Within the traditional authorities various sector specific or resource based committees have been formed. These committees have varying degrees of authority, with the Beach Village Committees (BVC) having powers to issue licenses and deliver fines. The other committees serve more of an advisory and monitoring role. The degree of authority can vary according to the location, the influence, and the involvement of the chiefs.

The institutional arrangements for the management and development of the fisheries sector include the relevant stakeholder institutions. The institutional structure comprises the Ministry of Agriculture and Food Security (at central government level), Department of Fisheries (DoF) and Fisheries Advisory Board (FAB) at national level, local communities at the local level and other relevant stakeholders. The Ministry, through its DoF offices, directly controls the operations of the sector and the FAB advises the minister responsible for fisheries on various fisheries issues. Local communities, mainly BVCs, regulate fishing at the local level under the co-management arrangement. Recently, the Lake Chilwa Climate Change Adaptation Program has begun to empower local communities to increase accountability of government and private sector actors through participatory monitoring. BVCs are using logbooks to record catch, sales and incomes at their respective beaches. The institutional framework also provides room for coordination and collaboration with other sectors and NGOs as mechanisms for dealing with environmental impacts that are multi-sectoral in nature.

4. Study findings

4.1 The fish value chain map

4.1.1 Actors

Actors in the Lake Chilwa fish value chain are presented schematically in Figure 4. Fishing in Lake Chilwa is predominantly a male activity. The fisher-community is made up of both resident and migrant fishers. Migrant fishers are defined as individuals who come to the lake for a certain period of the year and then leave for their permanent home after the fishing season. They also include individuals that have left their families elsewhere and have come to settle at the beach to fish. About 53% of the fishers that were interviewed indicated that they had migrated to the beach while 47% were residents. Most of the migrant fishers come from villages within Zomba, Phalombe and Machinga districts , which do not border the lake. Very few reported coming from places outside the Lake Chilwa Basin. The results also showed that for most of the fishers (80%) fishing was their major livelihood activity, while 15% of them were primarily farmers (Table 2).

Table 2 : Characteristics of fishers in the Lake Chilwa Basin.

Characteristics	Frequency	Percent (%)
Education		
None	7	12
Standard 1 to 4	15	25
Standard 5 to 8	30	51
Secondary and other	7	12
Marital Status		
Married	47	78
Divorced / Separated	2	3
Never married	11	18
Residential Status		
Migrant fisher	32	53
Permanent fisher	28	47
Main Occupation		
Farmer	9	15
Fisher	48	80
Business / Petty trading	1	2
Student	2	3

Fishers on Lake Chilwa are categorized into gear owners and crew members. Our survey found that 42% of the fishers were gear owners while 58% were crew members. This distribution is comparable with the findings of the 2008 Annual Frame Survey (Table 1) that recorded 1871 gear owners and 2980 crew members, 39% and 61% respectively (Kanyerere et al., 2009). Crew members are young men employed to operate the gear, especially for seine fishing. They are paid by proportion of the fish catch.

The majority of the fishers have little or no education which confirms earlier studies that showed that literacy levels in most parts of the Lake Chilwa Basin were very low (Environmental Affairs Department, 2000; Kalanda-Sabola, 2007). This is a common phenomenon in fishing communities.

Fish traders are also categorized into resident and migrant traders. A resident fish trader lives in the fishing village while a migrant fish trader comes from outside the fishing village. Most of the time resident fish traders sell the fish within the local area, while migrant fish traders sell the fish at more distant markets. The advantages provided by resident fish traders are that the income realized from fish trading is invested within the community, and fishers that land fish at awkward hours are assured of the availability of fish buyers. However, the disadvantage of resident fish traders is that they offer very low prices.

The main disadvantage of selling to migrant fish traders is that they are not always trustworthy. They may buy fish on credit, or buy other items such as food, and then leave the beach before paying. The major advantages of such traders are that they offer higher prices, bring money into the area and boost local businesses such as restaurants and rest houses.

Other actors in the fish value chain can be categorized as service providers and gear or input providers. Service providers are those who do not transfer ownership of equipment to the primary actors[3] in the fish value chain. These include fish transporters, boat owners, owners of fish processing sheds, fisheries associations, and owners of fishing nets. Providers of gear or inputs include boat makers, gear makers, firewood sellers, and traders of fishing gear and equipment. These enterprises are of different sizes. While some are run by the owners alone, in other instances the owners employ additional staff to work for them.

[3] Fishers, fish traders and fish processors are considered as primary actors in this study because they are directly involved in the value addition activities of the fish value chain.

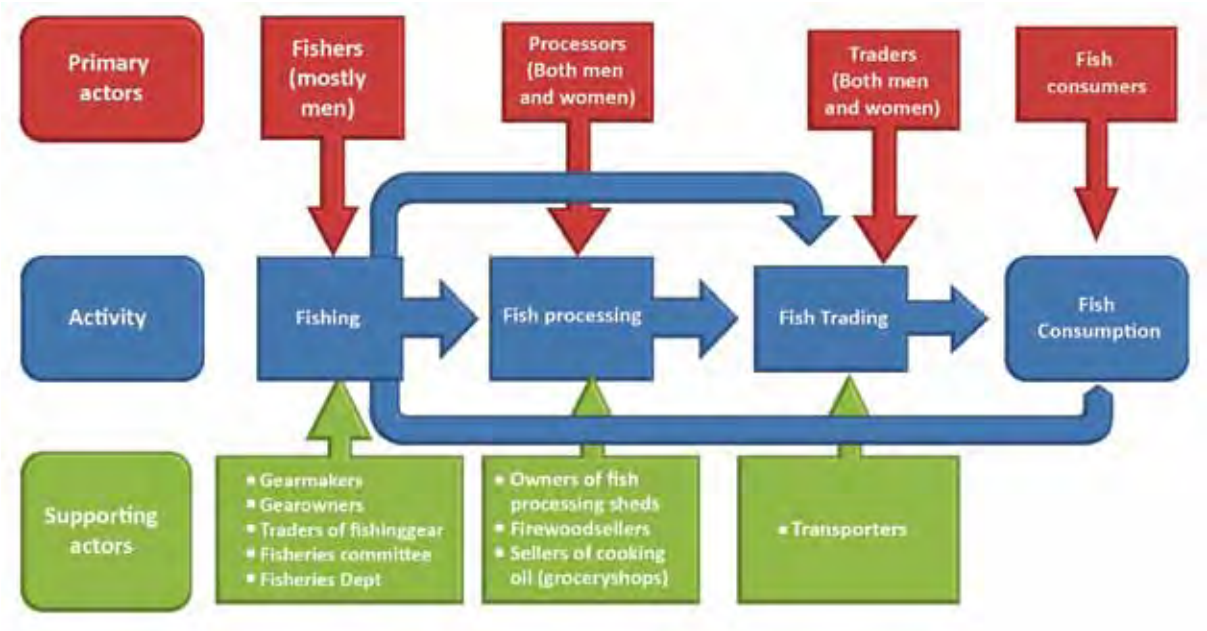

Figure 4 : Schematic view of the value chain map for the Lake Chilwa Fisheries.

4.1.2 Gender roles in the fish value chain

The involvement of men (young and old) and women in the fish value chain varies depending on economics, politics and culture. In many fisheries women have traditionally occupied the pre- and post-harvest sector concentrating on financing the fleet, processing and marketing the catch. Women are involved in many complex networks and alliances that enable them to negotiate access to fish and market them successfully. For example, *usipa* marketing in Lake Malawi and many fisheries throughout the West African region are pre-financed by women who often control the processing and marketing sectors (Kambewa et al., 2009; SFLP 2001; Williams, 2000). There is, therefore, a symbiotic relationship between the women and men in the fishing industry: neither could survive without the other. Discussions that focus on women in fisheries therefore need to be mindful of the implications of relations between men and women and how these explain the position of women. In addition to these tasks, women also have to look after the household unit taking care of the family's educational, health and dietary needs. The reproductive and other domestic roles have been treated as separate activities rather than as complementary, just as in other natural resources sectors (Harrison, 2000).

In the Lake Chilwa Basin, fishing and fish trading are mostly done by men while fish processing is done by both men and women. Respondents in the study indicated that male dominance in fishing was due to the degree of physical labor required for fishing. This is supported by the finding that seine nets and gill nets, which require more physical strength, are the most commonly used fishing gear on the lake. However, in other regions of the world both men and women are involved in fishing. Additionally, other fishing technologies, such as fish traps and hook lines that are also common at the lake, are not labor intensive (Kanyerere et al., 2009). This means that the labor intensity of the technology may not be the only reason for the male dominance in fishing. For Lake Chilwa, the dominance of men can be attributed to tradition (culture). Fishing is normally done at night and with minimum clothing. Women are not expected to be working in such conditions, as some of the women fish processors explained. Other reasons put forward included the hazards associated with fishing such as the risk of drowning in strong currents. Women also have less time and their daily schedule is less flexible because of family responsibilities (Elson, 1992). Although both men and women are engaged in fish processing (73 % male and 27 % female), it was noted that women are more involved in sun drying of smaller fish such as *matemba*, while men are more involved in smoking of both *matemba* and larger species such as tilapia and catfish. It should be noted that fish smoking adds more value than only sun-drying. Men are thus involved in higher value adding processing activities than women. Selling of firewood for fish processing is mostly done by women while transportation of fish is mostly done by men who either drive vehicles to various destinations or paddle boats on behalf of fish buyers.

It has been established that women are not represented in community fishing management committees. Based on the wealth of research on women's participation in agriculture, it is probable that women's weak participation in fisheries is a result of similar conditions, notably women's low access to training, credit, and other resources related to production.

4.2 Marketing chains

The analysis of fish marketing revealed that fish from Lake Chilwa is either consumed by fishers, sold fresh to consumers, processors or traders, or it is processed before it is sold to consumers and traders (Figure 5). Fresh fish is sold at markets that are near to the lake. Apart from markets that are near the lake, processed fish is also sold at distant markets (Figure 6), Mchinji and Kasungu in the Central Region being the farthest. Limbe market in Blantyre was the market most frequently reported by traders and fishers, which implies that this is the largest market for Lake Chilwa fish.

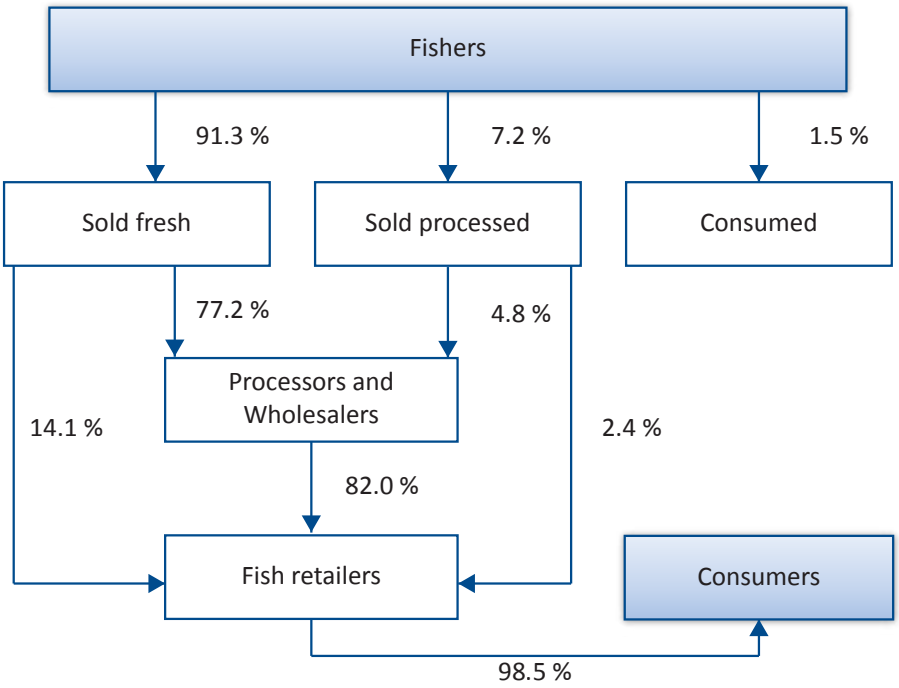

Figure 5 : Utilization of fish from the Lake Chilwa Basin.

Note: Percentages are based on the monetary value of fresh fish.

Figure 5 shows that only about 1.5% of the fish caught is consumed by fishers while 98.5% is sold to traders, processors and consumers. About 7.2% of the fish caught was processed before it was sold to either fish wholesalers (4.8%) or fish retailers (2.4%). The bulk (77.2 %) of the fish caught was sold fresh to fish processors and wholesalers while 14.1% was sold fresh to fish retailers. These findings differ from Njaya (2001) who reported that less than 10% of the catch landed was supplied fresh to the surrounding local markets, including the nearest urban center (Zomba). The difference between the two figures can be attributed to an increased use of ice by urban fish sellers when transporting fish from Lake Chilwa beaches to the major urban centers of Zomba, Lilongwe and Blantyre (Figure 6).

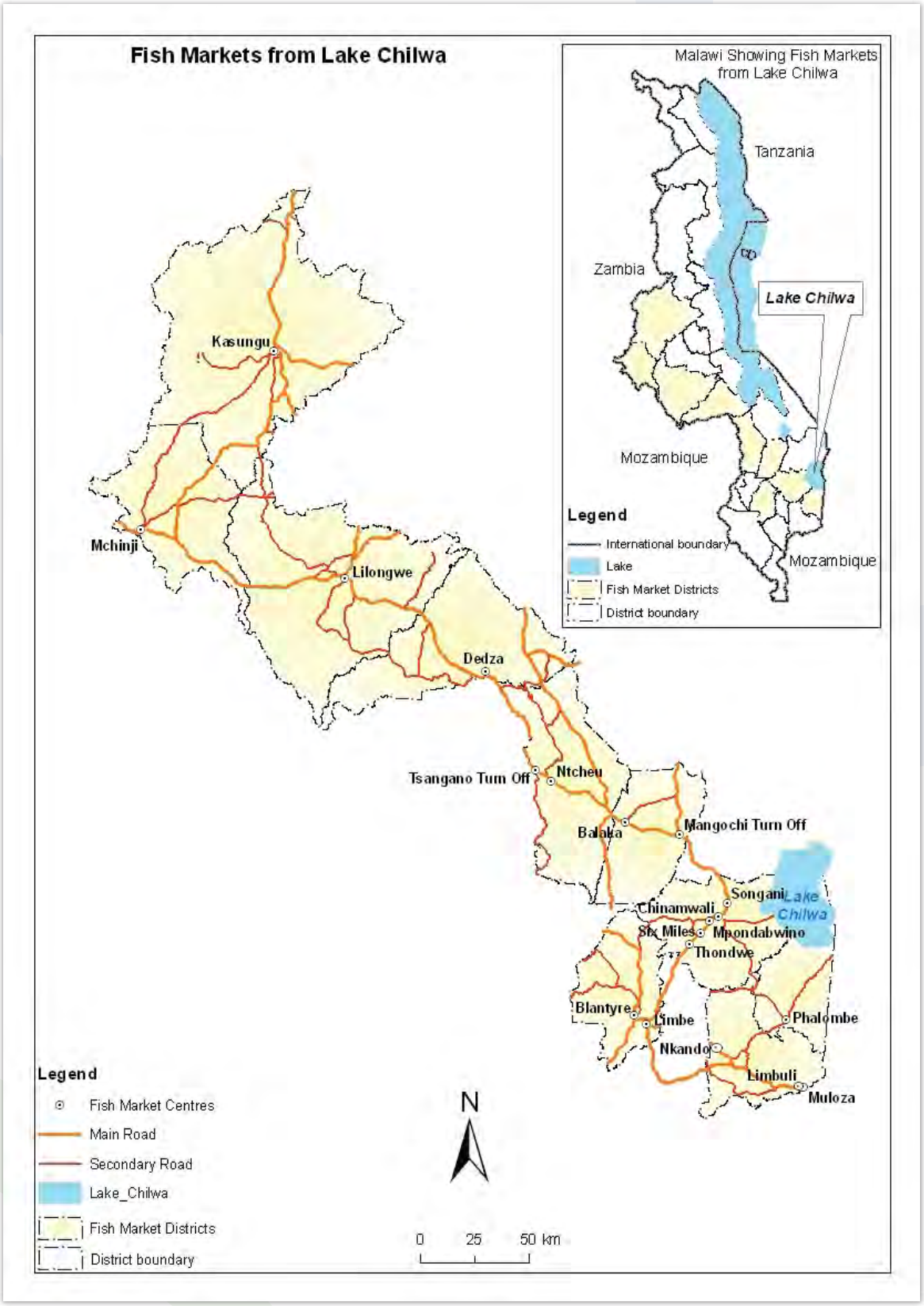

Figure 6 : Map of Malawi showing markets for fish from Lake Chilwa.

The results indicate that about 82% of the total fish catch is sold to wholesalers or processors who sell to retailers, who in turn sell the fish to consumers. There may be other traders between the wholesalers and retailers, which can extend the marketing chain further. The middlemen operate at different levels: vertically by ensuring that fish reaches distant markets as far as Kasungu in Central Malawi (Figure 6) and horizontally reaching more consumers by door to door selling in smaller quantities. It should be noted that there is very little value addition made to the fish after it has left the processor, except than that the fish is attaining place utility. The volume of both fresh and processed fish sold directly to consumers is negligible.

At the sampled beaches *matemba* contributed about 50% to the total catch followed by tilapia (26%) and catfish, which made up the remaining 24%. From the 60 fishers the study interviewed, it was found that the combined monetary value they obtained for *matemba* was about MK44.2 million (US$264,700 at MK167 to the USD) in the year 2009/2010, while the estimated value of their tilapia was MK23.0 million (US$137,700) and the value of catfish was estimated at MK21.5 million (US$128,700). With more than 1800 boat owners found in Lake Chilwa, the current value of fish translates to more than US$16 million, a figure not significantly different from that found by Schuijt (1999). However, with fish production currently three times lower than that of 1999, the similar value of the fisheries is mainly a result of increases in fish prices.

Figures 7, 8, and 9 present an overview of the distribution channels of fish from Lake Chilwa. We observed that different species of fish were not distributed in the same way by fishers, processors, wholesalers and traders. We therefore assessed the individual distribution of each of the three major fish species that are caught from the lake.

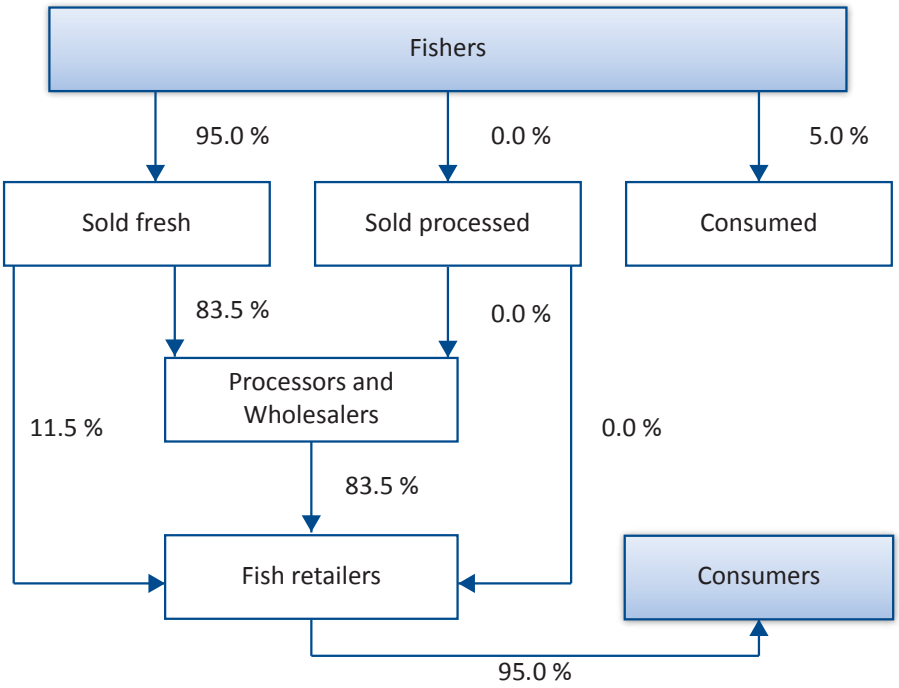

Figure 7 : Distribution of *Barbus* spp (*Matemba*) from the Lake Chilwa Basin.
Note: Percentages are based on monetary value of fresh fish.

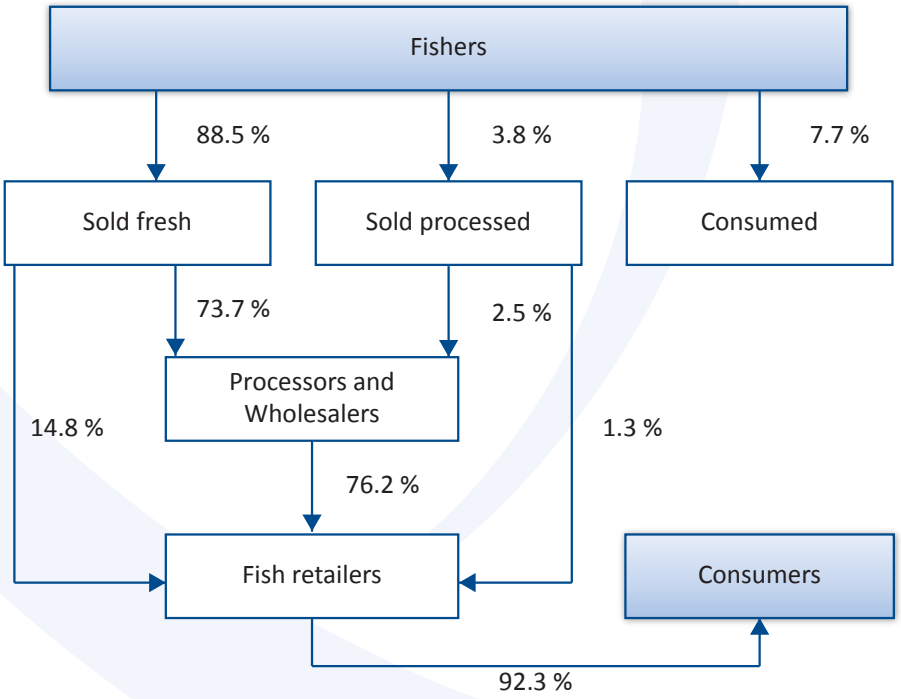

Figure 8 : Distribution of tilapia (*Makumba*) from the Lake Chilwa Basin.
Note: The percentages represent percentages of total catch.

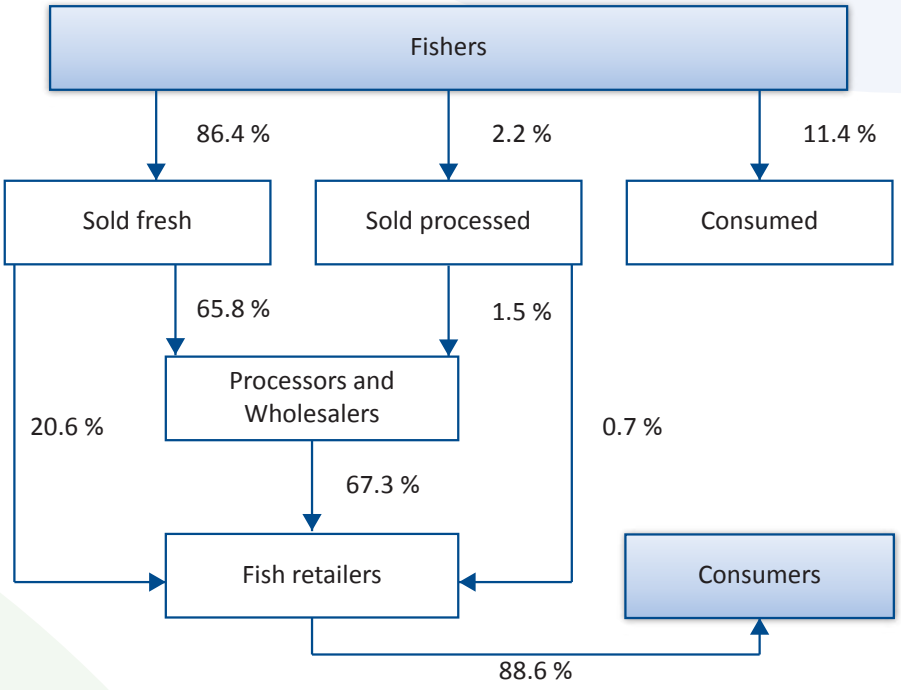

Figure 9 : Distribution of catfish (*Milamba*) from the Lake Chilwa Basin.
Note: Percentages are based on monetary value of fresh fish.

About 5% of the total value of *matemba* caught is consumed by fishers (Figure 7) while 95% is sold to either fish retailers (11.5%) or fish processors and wholesalers (83.5%). None of the *matemba* caught is processed by fishers.

Results in Figure 8 show that about 7.7% of the total tilapia caught is consumed by the fishers themselves. Fishers process and sell about 3.8%, of which 2.5% is sold to wholesalers and 1.3% is sold to fish retailers. An estimated 88.5% is sold fresh, 73.7% to fish processors and wholesalers, and 14.8% to fish retailers.
The results from Figure 9 show that 11.4% of the total value of catfish caught is consumed by the fishers leaving 88.6% to be sold to traders (2.2% is sold processed while 86.4% is sold fresh). It was also estimated that about 86.4% of the catfish caught was sold fresh to either processors or wholesalers (65.8%) or retailers (20.6%). In this case, about 67.3% of the catfish passed through wholesalers before it reached the retailers and finally to consumers.

In summary, the majority of the fish caught from Lake Chilwa is sold fresh to processors and wholesalers. A very small proportion is consumed by fishers. The species that is processed most by fishers is tilapia (3.8%), though fishers are generally not involved in processing.

Of the three major fish species, fishers consume a greater proportion (11.4%) of catfish and the least amount (5%) of matemba. This reflects the relative volumes of the species caught rather than the preferences of the fishers. Since larger volumes of matemba are caught, the 5% of matemba consumed may not be very different from the 11.4% of catfish, in terms of volume.

4.3 Marketing margins

Marketing margin analysis is used to assess the profitability of value added activities in the fish value chain. Markering margins were computed for fishers, processors, retailers, and wholesalers. The estimated average annual marketing margin for fishers are presented in Table 3 below

Table 3 : Estimated average annual marketing margin per fisher from the Lake Chilwa Basin.

Variable		Mean (MK)
Revenue		
	Consumption	63,433
	Sales of fresh fish	588,891
	Sales of processed fish	175,094
Total		827,418
Cost		
	Gearhire	100,529
	Fishing cost	142,662
	Processing and Marketing	22,773
Total		265,964
Marketing Margin		561.454
Mean marketing margin as a percentage of mean gross fishing income		68

Note: Exchange rate US$1 = MK167.

The results show that on average fishers obtain a marketing margin of about US$3360 (MK561,454) per annum, which represents 68% of the gross income. This translates to an average of US$280 (MK47,000) per month. This is much higher than the range of annual income of between zero and US$19 (MK3,000) for 30% of the farming households in the Lake Chilwa basin, as reported by Kalanda-Sabola (2007).

The annual average revenue per fisher is around US$4950 (MK827,418) and most of this is obtained from selling fresh fish which contributes about 71% of total revenue from fishing. The high proportion of the revenue coming from the sale of fresh fish reflects the volume of fresh fish sold rather than price differences. Annual average costs of fishing were estimated at US$1600 (MK265,964).

However, substantial variations were observed when the marketing margins were compared for fishers from the three different districts as shown in Table 4, and also when comparing between fishers that were gear owners or crew members, Table 5.

Table 4 : Mean marketing margins per fisher in the three districts of the Lake Chilwa Basin.

District	Beach	N	Marketing Margin (MK)	Mean marketing margin as a percentage of gross fish income
Machinga	Mposa	19	632,914	87
Phalombe	Swang'oma	21	197,150	39
Zomba	Kachulu	20	819,018	72
Total sample		60	561,454	68

Note: Exchange rate US$1 = MK167.

The highest marketing margin was obtained by fishers from Zomba, followed by fishers from Machinga, while fishers from Phalombe obtained the lowest marketing margin. Differences in the distance to major urban centers as well as the type of infrastructure in each of these districts could offer an explanation for the variation in marketing margins. The farther or more remote an area is, the lower the marketing margin. Mposa and Kachulu are relatively close to major urban centers and fishers from these beaches showed significantly higher marketing margins. The road infrastructure in the Machinga and Zomba districts is also superior to that in Phalombe. Urban markets are thus more easily accessed from Kachulu and Mposa than from Swang'oma. Improving transportation in Swang'oma could therefore be expected to significantly improve the marketing margins of fishers in this area.

The study also found differences in marketing margins for gear owners and crew members as indicated in Table 5.

Table 5 : Mean individual annual marketing margins for different types of fishing professions within the Lake Chilwa Basin.

District	N	Mean (MK)
Crew	29	140,442
Gear owners	31	948,820
Total sample	60	561,454

Note: Exchange rate US$1 = MK167.

The results show that the aggregated marketing margin is heavily influenced by ownership of fishing gear. The owners of fishing gear, operating on their own, are found to generate up to US$5680 (MK948,820) per year, US$470 (MK79,000) per month, which is much higher than the marketing margin that is obtained by crew members. On average, crew members only earn about US$70 (MK12,000) per month—15% of the sum the gear owners realize over the year. This difference is very large and has implications for income distribution in the basin. These are substantial amounts of money for rural communities indicating the potential of fishing for improving the livelihoods of households.

Marketing margins are also dependent on the pricing mechanisms used for the sale of the fish. Different pricing mechanisms were used as indicated in Table 6.

Table 6: Price setting mechanisms for fish in the Lake Chilwa Basin.

Mechanism	Frequency	Percent
Bidding between buyers	5	8
One buyer sets price	15	23
Fisher sets price	45	68
Other	1	2
Total sample	66	100

Note: Exchange rate US$1 = MK167.

In most cases (68%) fishers were found to set the sale price of the fish, while about 23% of the fishers reported that the buyer would set the price. Only 8% of fishers reported that buyers bid for the fish. This would result in a more rewarding pricing mechanism for the fishers, but its frequency is very low. The fact that most fishers reported that they set their own prices should have enabled them to charge higher prices, but it seems that they undercharge because of their lack of information about the prevailing market prices in urban areas. Since buyers are aware of the prices in urban markets, allowing them to bid for the fish would push the prices up closer to the urban market prices. This would be beneficial to the local fishers. Figure 10 illustrates these arguments. It should be noted, however, that bidding is only possible when several buyers are present at the same time. Bidding may also be hindered by the fact that fishers normally form relationships with buyers, which ensures that some buyers are given priority by fishers because of perceived long term benefits.

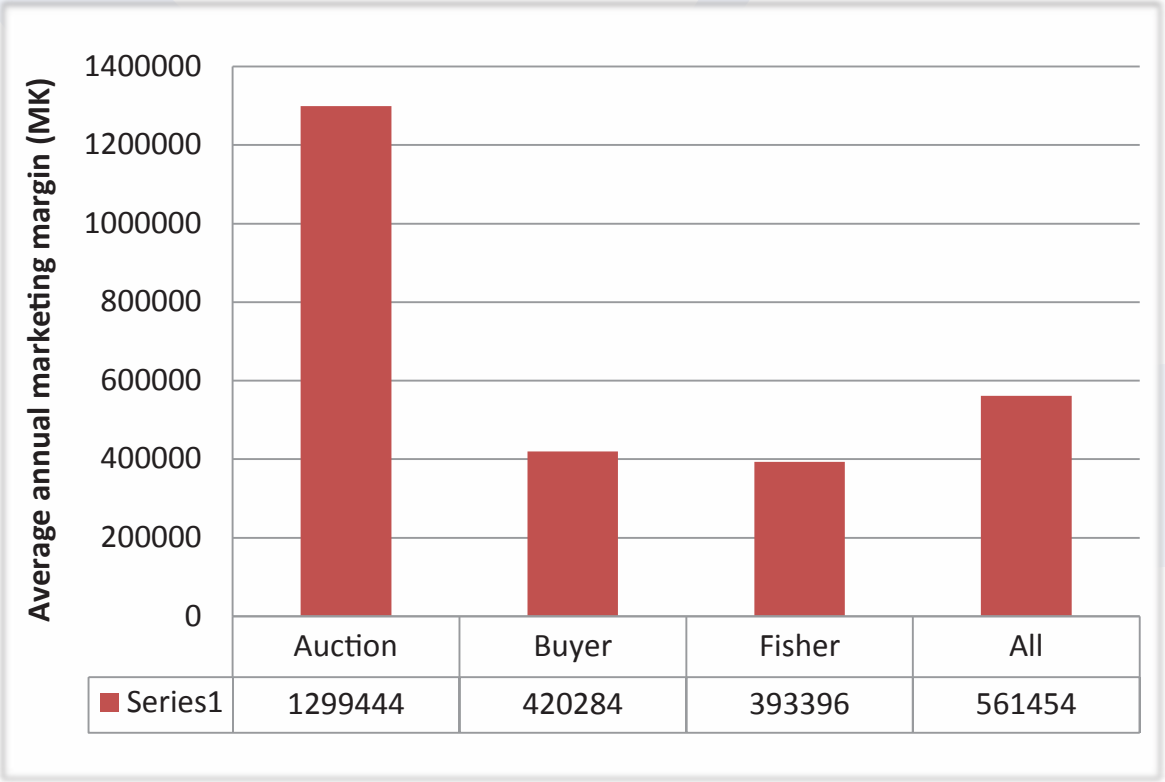

Figure 10 : Relationship between marketing margin (MK) and price setting mechanisms for fish in the Lake Chilwa Basin.

Although these are mere correlations, the results in the figure above show that fishers obtained the highest marketing margin when buyers bid for the fish, and they received the lowest marketing margin when the fishers set the price. When a single buyer offers the price, the fisher gets a marketing margin that is only slightly higher than when the fisher makes the price, but it is considerably lower than when there is bidding. This demonstrates the importance of the price setting mechanism on the actual returns from fishing, since different pricing mechanisms yield different marketing margins. This result is also inconsistent with fishers' complaints that traders offer very low prices. In this case, fishers undercharge themselves. The marketing margins for fish processors and fish traders are presented in Table 7.

T**able 7 :** Average annual marketing margins per fish processor, wholesaler and retailer in the Lake Chilwa Basin.

	Processors (N=30)	**Wholesalers (N=16)**	**Retailers (N=29)**
Total Revenue	**1,949,321**	**2,037,572**	**1,759,033**
Cost			
Fish	1,196,681	1,550,303	1,218,812
Transport	28,642	87,367	17,635
Packing	3,698	4,300	5,751
Firewood	17,352		
Cooking oil	257		141
Food	18,063	37,513	33,724
Market fee	77		497
Rent	708		
Lodging	617		
Labor	5,467	20,281	1,386
Total Cost	**1,271,741**	**1,699,764**	**1,277,946**
Marketing margin	**677,580**	**337,808**	**481,087**
Mean marketing margin as a percentage of mean gross fish income	**35**	**17**	**27**

Note: Exchange rate US$1 = MK167.

The results above show that there are significant differences in the cost and revenue structures for fish processors, wholesalers and retailers which translate into differences in their marketing margins. On average, wholesalers have the highest costs in a year, mainly because they handle fish in large quantities. This is reflected in large amounts of money paid for fish, transport and labor. Although fish wholesalers have the highest annual cost, the fish processors have the highest number of cost items. The annual costs for retailers and processors are of comparable magnitude. In terms of revenue, the results show that wholesalers have highest revenues, whereas fish processors and fish retailers obtain the least revenue. Fish processors have the highest average marketing margin among the three professions. The main reason for this is that fish processors are involved in transforming the fish thereby adding significant value to the fish unlike wholesalers and retailers who mainly buy fish from one point and sell it at another. Wholesalers have the lowest marketing margin. Table 8 presents the marketing margin and mark up percentages.

Table 8: Mark up and marketing margin percentages for different actors in the fish marketing chain.

Category	**Marketing margin percent**	**Mark up percent**
Fisher	68	211
Processors	35	53
Wholesaler	16	20
Retailer	27	38

The results show that fishers obtained the highest profit per unit cost incurred (Mark up percent) as well as the highest profit per unit revenue (Marketing margin percent). A unit cost spent on fishing generates about MK2.11 for fishers while out of a unit kwacha of revenue obtained, MK0.68 is profit. The high mark up percentage and marketing margin percentage for fishers is due to owner-operators of fishing gear who bear the minimum cost of fishing but obtain a significant amount of revenue. The cost of hiring fishing gear forms over a third of the total cost of fishing, which is not borne by gear owners operating their own equipment. On the other hand, crew members share the fish catch with the owner of the gear and then their portion is divided further between each of the crew members, thereby reducing their revenue relative to the revenue of the gear owners operating their own equipment[4].

Among the middlemen, fish processors obtain the highest profit per unit cost and profit per unit revenue while wholesalers obtain the least profit per unit cost and profit per unit revenue. This is because the wholesalers incur major costs for transportation, as well as the cost of the fish. On the other hand, fish processors obtain more profit per unit cost because the actual cost of processing is not high but it allows them to sell the fish at elevated prices.

4.4 Constraints and threats in the fish value chain

The fish value chain faces a number of constraints, which occur at different stages along the marketing channel. When fishing, fishers have to contend with crowded fishing grounds and scarcity of fish and be able to handle strong winds, fast currents and dangerous animals such as hippopotamus, which may sometimes end their life. Other constraints include lack of proper storage and fish handling facilities and improper fish handling practices that result in fish spoilage along the fish value chain. Low and unpredictable prices are the major constraints fishers, traders and processors face when they are selling fish.

Fish traders and processors further indicated that they lack capital. While 66% of fish retailers stated that they had access to credit, only 33% of the fish processors indicated that they had this facility. Non-bank lending institutions, family and friends are common sources of loans.

One of the major constraints identified by fishers was that the traders offer very low prices and this was verified by the high margins accrued by traders. However, traders also complained about very high prices of fish charged by fishers. This is mainly due to information asymmetries between buyers and fishers, which are common in African small scale fisheries (see Gordon et al., 2011). An improvement in the availability of marketing information (changes in prices or demand) to fishers could improve the performance of the value chain. Improvements in information systems can, therefore, increase the bargaining power of small-scale producers and traders (Béné et al., 2007).

[4] Our study did not interview gear owners that rent out their fishing equipment to crew member. This would have been a good comparison group.

5. Conclusions and Implications

5.1 Conclusions

The following conclusions can be drawn from the findings of the Lake Chilwa fish value chain study :

1. The primary actors of the Lake Chilwa fishery include fishers, processors, and traders (wholesalers and retailers), while the secondary actors include fish transporters, boat owners, owners of fish processing shades, owners of fishing nets, boat makers, gear makers, firewood sellers, and traders of fishing gear and equipment. Roles are also engendered such that men are more involved in higher value activities than women. All actors will be affected by climate change, but the primary actors are likely to bear the brunt of the impact.

2. Most of the fish from Lake Chilwa is sold fresh to either fish processors, wholesalers or retailers. A very small proportion of the fish caught is consumed by the fishers, implying that fish is a cash generating commodity. Fishers consume a higher proportion of the catfish they catch than *matemba*.

3. Lake Chilwa fish are mostly marketed in locations within the southeast of Malawi but some fish moves to distant markets in the Central Region. In the chain, it is found that fish may pass through many hands before reaching the end consumer.

4. Fishers obtain a marketing margin of US$280 per month. However, great disparities in the magnitude of the marketing margin are observed between different actors. The margin is dependent on the accessibility of urban markets from the fish landing sites, ownership of fishing equipment, and pricing mechanisms. In general, the findings suggest that fishers from Zomba, who operate their own gear and sell their fish catch by auction, would be expected to obtain very high marketing margins while crew members from Phalombe that decide on the sale price of their fish would be expected to obtain very low marketing margins.

5.2 Implications for rural development interventions

The findings from this study have a number of implications for the improvement of the livelihood of fishers and enhancing their capacity to mitigate against the effects of climate change.

The study demonstrates that the fish value chain supports the livelihoods of many individuals in various capacities. This is supported elsewhere in the literature where a 1:3 ratio in employment is expected between fishers and others that are involved in post-harvest activities (Béné et al., 2007). Local authorities are encouraged to consider using this information for the design of rural development strategies in small-scale fishing communities.

Accessibility of fish landing sites to urban markets is found to improve the marketing margins for fishers. Poor access leads to delays in getting the product to market, which may reduce both the quality and therefore price, and also its availability to consumers as a result of increased wastage (Béné et al., 2007). Improvements in road infrastructure targeted at improving accessibility to landing sites would potentially increase gains in the fish value chainto fishers, traders and consumers. Traders that access better markets would make more profit and they would also buy fish from buyers at higher prices. However, improvements in market access may have negative welfare consequences on the rural poor population that is not involved in fishing.

The increases in the price of fish at the landing sites will make fish more expensive for non-fishing families. This may reduce fish consumption in these households. Another possible implication of the improvements in market access is the increase in fishing effort which may lead to overexploitation of the fishery resources. For example, fishing effort in Lake Chilwa increased around the early 1970s as the region became better integrated into the market economy (Sarch & Allison, 2000). The same may happen if market access is improved.

The dominance of women in producing a low value (sun-dried) fish product suggests that women probably obtain lower incomes than men who predominantly produce high value smoked fish products. Improving the participation of women in fish smoking could increase their incomes and improve their livelihoods. Interventions targeted at increasing the participation of women in fish smoking should be promoted in development activities implemented in the basin.

Although the study revealed that some fishers, mainly gear owners, make relatively more money than others, most fishing villages show indicators of higher poverty than the national poverty rates. This supports the assertion by Béné et al. (2007) who observed that poverty in fishery-dependent communities is not necessarily directly or only related to the resource or catch levels. They noted that extreme poverty can also be observed in remote fishing camps where fishers catch and trade reasonable volumes of fish but lack access to health and other public services and are politically unrepresented. Higher benefits from the fish catch can be obtained if fishers have access to other facilities such as health, education and banking. Some authors have stated that a 'savings culture' rarely exists in fishing communities due to: (i) the perception that there is always fish to catch if they need money (culture element); and (ii) options to save through financial organizations are limited (no supporting environment element) (Ardjosoediro & Neven, 2008).

While the current NFAP advocates for an increased supply of quality fish, so far few institutions have been able to manage trade-offs and competition across sectors. As a result, poor actors in particular are left to seek strategies to cope and adapt as livelihood opportunities shift, disregarding quality issues.

Another complicating factor involves the international character of the lake basin that makes governance of the fishery more challenging, especially in applying uniform policy arrangements such as co-management. However, even if efforts succeeded in strengthening fisheries co-management systems in the entire basin, and if the parallel and conflicting lines of authority between local institutions were resolved, significant challenges will still remain to be addressed—such as the conflicts at the interface between land, water, agriculture and fisheries management.

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