Implemented by

Responsible Fisheries Business Chain Project

Report on the Nile perch value-chain analysis for the local and regional trade in East Africa

By: COMRED Coastal Consulting
P.O. Box 10222-80101,
Bamburi, Mombasa, Kenya,
Email: director@comred.or.ke
Website: http://comred.or.ke/comred-coastal-consulting/

Authors

Patrick Kimani (Team Leader)
Horace Owiti (Kenya)
Joseph Luomba (Tanzania)
Dr. Paul Onyango (Tanzania)
Dorothy B. Namuyiga (Uganda)
Stella Mbabazi (Uganda)

Client: GIZ – Responsible Fisheries Business Chain Project
Transaction number: 83285575
Processing no.: 16.0126.9-002.00
Country: UGANDA

Disclaimer

This report is a product of a study that was conducted by COMRED Coastal Consulting under contract 83285575 between GIZ and COMRED Coastal Consulting. The opinions expressed in this report are those of COMRED Coastal Consulting and do not necessarily represent the views of GIZ or any other institution mentioned in the report.

Acknowledgement

This Nile perch Value Chain Analysis report for Local and Regional Fish Trade in East Africa report is an output for GIZ/LVFO Responsible Fisheries Business Chain Project (RFBCP) through the GIZ contract number No. 83285575 by COMRED Coastal Consulting involving a team of regional experts from Kenya, Tanzania and Uganda.

Special thanks go to the GIZ for funding the entire process leading to development of the report. The team is grateful to the technical support provided by Mr. Adolf Gerstl and Ms. Hilde De Beule, of the RFBC project in final production of this report. We also appreciate the role played by the Nairobi GIZ office for their administrative support. The support provided by LVFO Secretariat led by the former ES, Mr. Godfrey Monor, Dr. Robert Kayanda and Dr. Rhoda Tumwebaze are appreciated.

The team is also grateful to officials in the Ministries of Fisheries Management in Kenya, Tanzania and Uganda. The willingness of the fishers, traders, processors, and other fisheries stakeholders' in the three countries in providing information that contributed to the development of this report is highly appreciated.

Executive summary

GIZ is implementing the Global Program on Sustainable Fishery and Aquaculture in four countries namely Mauritania, Malawi, Madagascar and Uganda. The overall objective of this program is to ensure food security and to reduce poverty by increasing fish supply and income. The Global Program is part of the special initiative "One World-No Hunger" (SEWOH) of the German Federal Ministry for Economic Cooperation and Development (BMZ). This program concentrates on three main areas of activity: (i) Improvement of the artisanal fisheries leading to better access to fisheries products and employment opportunities, (ii) promotion of sustainable fisheries and (iii) reduction of illegal, unreported and unregulated (IUU) fishing. A study was undertaken in Lake Victoria as part of this program. The study focused on Lake's riparian countries of Kenya, Uganda and Tanzania with the purpose of undertaking a value-chain analysis for the local and regional Nile perch trade in East Africa and to identify aspects of local and regional processing and trading. The study focused on fish that is targeted for local including country-level fish supply chain, while at the regional level the study addressed the regional trade in Nile perch fish and its products.

This study employed a mixture of methods including literature review, a survey of fishers, processors and traders as well as fisheries authorities in the three countries sharing the lake. Data collection was undertaken between 19th June and 13th July 2018 in 27 landing sites, several local fish markets (including Kirumba market in Mwanza, Obunga market in Kisumu, Ggaba market in Uganda) and Busia and Mpondwe border points in Kenya and Uganda respectively. Other places where data was collected were industrial and semi-industrial processing establishments. A total of 181 respondents were interviewed comprising 50, 87 and 56 respondents from Kenya, Tanzania and Uganda respectively. The survey tools used were structured and semi-structured questionnaires which had been prepared, discussed and coded before the survey. Interviews were conducted in local languages. The data collected were analyzed by use of Microsoft Excel version 2016. Descriptive statistics were used to analyze demographic and socio-economic information and a standardized business model was used to calculate total fishing revenue (TFR), operating fixed cost (FC), variable cost (VC) and gross income (GOI) for the various players involved in Nile perch value chain.

Summary of findings

i. Fifty two percent of actors in the Nile perch fish value chain are new entrants in the business with less than 10 years experience.
ii. Fishing and trading are dominated by men while artisanal processing is dominated by women.
iii. Fishing and fish trade take equal time of up to 12 hours while processing takes up to 9 hours in day. Fishers however spend five days in a week whereas traders up to 14 days in a month on average in fish trade.
iv. Fishing, fish trade and processing is a fulltime activity for a majority of fishers, traders and processors although about 10% combine fishing with agriculture and 5% combine fish trade and agriculture while 21% combine fish processing with other businesses.
v. Selling of Nile perch fish is determined chiefly by the estimated size and quality of the fish. These sizes are; small-sized fish (1.5-5Kg with an estimated length of 48 cm to 76 cm), medium-sized fish (6-10 Kg with a length till about 80 to 84 cm) and large-sized fish (> 11 Kg measuring from 98 cm and above). The bigger the Nile perch, the higher the price. Among the three countries Kenya offers the highest price across all sizes.
vi. In the local and regional market there are several different Nile perch products dealt with namely; fish fats, fish frame, fish heads, fish skins, off-cuts/red meat trimmings, fish maw which are ex-factory by-products and are processed further by artisanal processors. Other products from whole fish include salted, fried and smoked Nile perch also processed by artisanal processors.
vii. Fish processing establishments on the other hand produces fillets, headed and gutted, chest kiblins, steaks and skin on fillets as their core products and fish frames, fish skin, off cuts, fish maws and fat as their by-products.
viii. Ex-factory by-products constitute approximately 56% by weight of all factory processed products and 40% by value, and thus implying their high significance
ix. The value chain of Nile perch in the three riparian countries do not differ much.
x. On average, fishers' catch was 25Kg/trip for gillnets and 49Kg/trip using longlines. It costs more to buy gillnets than longlines while it costs more to operate longlines than gillnets. Gillnets however, generate more profits than longlines although the income difference is insignificant. Longlines have higher variable costs in fuel, bait and food, resulting to slightly lower profit.
xi. Fish traders deal in about 78Kg/trip while factory agents deal in about 1,772 Kg of fish per trip. Nile perch by-products are slightly higher in weight compared to core products, but lower in value. It is twice more expensive to process fish in Uganda than in Tanzania and almost four times more expensive than in Kenya because of the high operational costs especially electricity bills coupled with continued load shading that makes it expensive to run the heavy-duty machinery in the processing plants. By-products

nevertheless generate more profitability to by-product processors and traders than artisanal processors. Volumes of by-products dealt with, are substantial yet not well documented in national statistics and can become a significant economic opportunity especially for women who specialize in processing.

xii. Fish Factory agents in Kenya save 6 to 7 times more money than their counterparts in Tanzania and Uganda, which can be related to higher profitability and ease of banking in Kenya across financial platforms. Fishers in Uganda saves more money than their counterparts in Tanzania and Kenya.

xiii. Majority of fishers, artisanal processors and by-product traders preferred keeping their money in cash at home or saving through mobile money platforms.

xiv. Infrastructure that support value chain activities such as smoking kilns, cold rooms, drying racks, fish stores, electricity supply and accessible all-weather roads are inadequate, leave alone being well developed.

xv. Most Fishers, traders and artisanal processors report that market constraints are the most severe followed by regulatory requirements and security. In Tanzania and Uganda, factory agents ranked regulatory requirements at the same level as markets. Industrial and semi-industrial processors however reported low fish prices and high operational and input costs as the constraints they face.

xvi. The by-products market has not been given due attention at the policy level by the riparian states. There is only limited information on how it operates. Thus, operating conditions and requirements needed to uplift this emerging sector to higher economic importance are not fully understood

The study therefore recommends the following: -

I. Undertake a baseline survey to ascertain the operating conditions and requirements for the fish by-products chain and consumer preferences including policy interventions needed to upscale its economic contribution

II. Improve processing conditions and marketing of by-products for the regional market, given their emerging economic significance.

III. Improve data collection and documentation of fish by-products trade especially at border posts and markets

IV. Institutionalize data collection for post-harvest sector at biennial intervals, similar to frame survey and CAS

V. Embrace the new value chain dynamics and re-orient policy towards resource sustainability with equitable benefits for all, while balancing the needs of each actor group

VI. Develop mechanisms to address cross-border conflicts and insecurity. The high value of the Nile perch fish and products is exacerbating insecurity

VII. Harmonize and enforce slot-size limits across all countries

Table of Contents

List of tables

List of figures

List of abbreviations and acronyms

DiFR	Directorate of Fisheries Resources
EU	European Union
FC	Operating Fixed Cost
FGD	Focus Group Discussion
FMP	Fisheries Management Plan
GIZ	German Technical Cooperation
GOI	Gross Income
IUU	Illegal Unreported and Unregulated
KeFS	Kenya Fisheries Service
KII	Key Informant Interview
LVFO	Lake Victoria Fisheries Organization
MCS	Monitoring Control and Surveillance
NP	Nile Perch
NPFMP	Nile Perch Fisheries Management Plan
OSNP	Operation Save Nile Perch
TFR	Total Fishing Revenue
VC	Operating Variable Cost

1 Introduction

Lake Victoria, Africa's largest tropical lake is estimated to support a population of about 40 million people regionally (World Bank, 2009). The fishery's production is estimated at one million tons (Marshall and Mkumbo, 2011), worth millions in landing value and about US$ 400 million in exports (LVFO, 2015, Mkumbo and Marshall 2014). The lake provides direct employment to about 220,000 people working as boat owners and fishing crews and another 600,000 working indirectly as processors, traders and gear and boat makers. In addition, an estimated 3 million people are dependants on the Lakes' fisheries resources. The fishery's contribution to GDP is between 2-3% annually (Various Fisheries reports 2008-2015). The fishery also generates substantial revenues to the local authorities through boat registration and licensing (Odongkara et al., 2005). These figures indicate that fisheries resources of Lake Victoria make significant contributions to the local and national economies of the Partner States.

The fishery is dominated by three commercially important species which include Nile perch (*Lates niloticus*), *Dagaa (Rastrineobola argentae*) and Tilapia (*Oreochromis niloticus*). However, much of lake's economic contribution comes from the Nile perch, which generates significant foreign exchange estimated at over 60% of the total fisheries contribution in the lake. Nile perch fishery also provides employment and income to millions of people within and outside the region. The regional frame survey report of 2016 indicates that over 50% of fish crafts and people in Lake Victoria target Nile perch (LVFO, 2016d). This makes Nile perch the single most significant driver of Lake Victoria's fisheries. This is also evident from the various efforts and measures taken to address threats posed on the fishery.

Despite the benefits from the Nile perch fishery, there is inadequate understanding on the share of benefits derived from the fishery along the supply chain. There are claims that the wealth from the fishery is unfairly distributed such that fishers on one hand are exploited by fish agents, and traders on the other hand, agents are exploited by factory owners. In addition, the exact amount of fish and by-products traded in local and regional markets is unknown. Moreover, how the fish is processed and how that influences its quality, is unclear. Furthermore, the level of investment in Nile perch enterprise and legislation governing processing and trade needs to be understood. This report therefore presents the findings of a study undertaken to critically determine the distribution of value and share of benefits along the Nile perch chain in regional and local trade from fishers to consumers.

1.1. *Background*

The significant contribution of Nile perch fishery to international market is well recognized within fisheries related literatures. However, this is not the same for local and regional trade, where its contribution is not fully quantified and understood. Such a gap can lead to loss of revenues to the government and lack of

critical information that can inform management of the fishery. Drawing from this realization, GIZ global program is collaborating with Lake Victoria Fisheries Organization (LVFO) towards supporting the implementation of the Nile perch Fisheries Management Plan II (NPFMP II) and the Fisheries Management Plan III (FMP II) of Lake Victoria. The overall objective of the program is to ensure food security and to reduce poverty by increasing fish supply and income. The program concentrates on three main areas of activities; Improvement of the artisanal fisheries leading to better access to fisheries products and employment opportunities, promotion of sustainable fisheries and reduction of illegal, unreported and unregulated (IUU) fishing. Target groups include; vulnerable households and communities, artisanal fishers and small- and medium sized enterprises in the fishery sector. Additional stakeholders are ministries responsible for fisheries management, fishing organizations, associations and training institutions. Results of this study will offer supplementary support to the implementation of this program by exploring, quantifying and qualifying the local and regional Nile perch production, processing and marketing.

The fisheries resources of Lake Victoria contribute enormously to the regional economies of Kenya, Tanzania and Uganda. in 2014, the fishery injected about USD 840 million, with USD 540 million generated at the beach and a further USD 300 million from Nile perch exports (LVFO, 2016a). This value emanates from an annual fisheries production estimate of 1 million tons, where 95 % of the total catch and 90% of biomass is composed of Nile perch, Nile tilapia and *Dagaa*. The Lake's fisheries employ close to 1 million people directly and indirectly and supports livelihoods of another 3 million. Contribution to GDPs of riparian States is about 2% for Kenya, 2.8% for Tanzania and 3% for Uganda (LVFO, 2016a).

The lake's production and value of the three commercial species has varied over the years. Estimated annual production in 2014 for *Dagaa* was 509,598 tons valued at USD 135 million, Nile perch 198,624 tons valued at USD 545 million and Tilapia 291,778 tons (LVFO, 2016a). This makes Nile perch, the most commercially significant contributor in Lake Victoria. However, the threats posed to the fishery such as increasing fishing effort, inadequate enforcement of fishery regulations, growing local and regional market for small immature fish (illegal trade) has led to the riparian states developing measures to guide the management of the fishery (LVFO, 2015). Key management measures of the fishery include LVFO strategic plan (2016-2020), Lake Victoria Fisheries Management Plans; I, II and III (2016-2019), IUU-RPOA (2004) and Nile Perch Fishery Management I and II (2015-2019).

Despite all these challenges, Nile perch is still a principal economic driver of Lake Victoria and still holds potential for further development and earnings in foreign exchange. It is estimated that Nile perch is exported to over 50 countries, where European Union (EU) markets account for 45% by volume and 50% by value. The major importers of Nile Perch products in EU market include Holland, Spain, Italy and Germany (MRAG 2008 unpublished report). The most exported NP products

are fresh skinless, boneless fillets, maws, headed and gutted. While much of information has already been collected or known about the international trade of NP, information is scanty on the regional and local markets for Nile perch products. For example, the quantities and types of products traded; handling and processing of these products; actors dealing with the products; profit margins along the chain; and regulations governing regional and local markets are largely unknown.

This lack of regional and local market information on the Nile perch fishery could hinder the development of adequate management and development options for maximizing socio-economic benefits as well as sustainability of the fishery. For sustainable utilization of the Nile perch fishery for food and nutritional security in the East Africa region, it is therefore important to conduct a value chain analysis for the regional and local Nile perch trade by exploring, quantifying and qualifying the local and regional Nile perch production, processing and marketing. This will provide a solid basis for evaluating the impact of the regional and local NP trade on food and nutritional security as well as assist in improving policy issues for improvement and management of the fishery for increased incomes for both dependent communities and riparian states economies.

1.2. *Purpose of the study*

The overall objective of Nile perch value chain was to prepare a value-chain analysis report for the local and regional Nile perch trade in East Africa and to identify aspects of local and regional processing and trading.

1.3. *Scope of the study*

The study sought to address gaps in information concerning the local and regional Nile perch value chain. Study of local chain addresses fish that is targeted for local level and including country-level fish supply chain, while at the regional level the study addresses the regional trade in Nile perch fish and products. Analysis begun at the landing site level where fishers' social, economic and marketing dynamics were recorded. Data collected included demographic data, fish catch amounts, prices, type of buyers and proportions sold to different buyers, amounts invested and ownership and constraints facing actors. Players buying fish from fishers at this level were also analysed. Similar data was collected from fish traders, agents, artisanal, by-product, semi-industrial and industrial processors. In addition to these, types of processing done was also recorded. The study was conducted at selected landing sites and markets traversing riparian districts/counties in Kenya, Tanzania and Uganda. Two border crossings of Mpondwe (between DRC and Uganda) and Busia (between Kenya and Uganda) were also visited to collect regional-cross border data.

2 Context of the Nile perch fishery

2.1. *Number of fishers targeting Nile perch, fishing crafts, catches and value*

Lake Victoria is a multi-species and multi-gear artisanal fishery dominated by the introduced Nile perch, Nile tilapia and the indigenous *Dagaa* locally known as 'Omena and 'Mukene' in Kenya and Uganda respectively. Of these, Nile perch is mainly destined for regional and international markets while *Dagaa* and tilapia are traded locally and regionally. The most commonly used fishing gears are longline hooks, gillnets and small-seine while the dominant fishing crafts consists of *Sesse* boats propelled by paddles, sails and outboard engines. According to (LVFO, 2016a), over half of the number of fishers in the lake target Nile perch, with 53.68% (23,433) of the number of fishers in Kenya, 50.92% (55,800) in Tanzania and 52.02% (36,282) in Uganda (Table 1). Significant number of gears and crafts also target Nile perch.

Table 1.Number of fishers, crafts and gears targeting Nile perch in Lake Victoria

Indicator	**Kenya**	**Tanzania**	**Uganda**
	NP	NP	NP
No.of fishers	23,433	55,800	36,282
No.of Sesse-flat crafts	1,483	5,137	13,177
No.of sesse- crafts pointed at both ends	5,103	10,496	1,348
No.of longline hooks	2,912	8,072,277	4,376,811
No.of gillnets	3,337	312,245	343,262

Source: (LVFO, 2016a)

2.2. *Current status; trends in Nile perch stock and harvest levels, management, trends in processing and trade*

Estimates on the stock levels of the fish species in Lake Victoria are generated from lake-wide hydro-acoustic surveys. According to the LVFO stock assessment report of 2016, standing stock and biomass estimates of Nile perch greater than 10 cm total length from the last three acoustic surveys from 2014 to 2016 indicate decrease in Nile perch biomass from 1.230 million tonnes recorded in 2014 to 0.851 million tonnes in 2016 (

Table 2) (LVFO, 2016b, LVFO,2016c). The highest decline (33%) was in Tanzania followed Kenya at 31%. However there seems to have been dramatic improvements from the hydro-acoustic survey of September 2017, where the biomass had increased from 851,461 million tonnes in 2016 to 1,120,944 million tonnes or an increase of 31.6% (LVFO, 2017). These improvements are thought to be due to the recent and ongoing intense MCS measures, especially in Tanzania and Uganda. The population structure of Nile perch however, indicates skewed population towards juveniles with only 0.4% of Nile perch being above the lower limit of the slot size (LVFO, 2016b). This is a good sign of productivity, but a bad one for the fish processing industries that target Nile perch between 50-85 cm total lengths. This

may explain why some processing factories are operating below the installed capacity while others have closed completely for lack of raw materials.

Table 2. Standing stock and biomass estimates in tonnes for Nile perch greater than 10 cm total length from three acoustic surveys

	September 2014	**November 2015**	**August 2016**	**September 2017**
Kenya	65,761	58,374	40,172	70,659
Tanzania	651,353	621,254	417,936	593,037
Uganda	513,133	448,146	393,353	457,248
Total	**1,230,247**	**1,127,774**	**851,461**	**1,120,944**

Source (LVFO, 2016b)

Nile perch is mostly caught by *Sesse* boats propelled by either paddles, sail or engine. Paddles are used in near waters while sail or engine are used in distant waters. These crafts mainly use gillnet and longline hooks. Estimates on catch rates from the main craft-gear combinations in Nile perch fishery showed a decreasing trend. For instance, Sesse paddled boats operating gillnets decreased from 12.5 ± 1.5 0 Kg/boat/day in April 2014 to 11.0 ± 1.3 kg/boat/day in November/December 2015, whereas *Sesse* paddled boats using longlines decreased from 31.7 ± 1.7 to 24.1± 1.4 kg/boat/day. At the same time, decline was also reported in *Sesse* boats using sail or outboards engines as represented by 48.8 ± 4.5 to 44.7 ± 4.6 kg/boat/day in motor/sail boats with long lines (LVFO, 2016b). Comparisons between countries however, indicate that Tanzania has higher catch rates compared to Kenya and Uganda. And this could be attributed to the higher biomass recorded in Tanzania than other countries.

2.3. *Nile perch fish marketing system*

2.3.1 Participants and gender roles

The Nile perch value chain is a complex web consisting of fishing crew, boat owners, collectors, factory agents, traders, artisanal processor, semi-industrial and industrial processors. The supply chain is a complex web that involves many individuals in the pre-harvest, harvest and post-harvest. There was a total of 45 Nile perch processing factories in the region in the early years of 2000. Today, only 24 processing factories are active, translating to a decline by 53% (LVFO, 2016b). Due to decline of raw material supply (Nile perch), even the existing fish factories now process at only a percentage of their installed capacity (Table 32, Table 33, Table 34). For example, in Uganda the present installed processing capacity is 64 tonnes against a previously installed capacity of 540 tonnes, indicating a decline by 88% (LVFO, 2016b). The number of Nile perch fishers (boat owners and fishing crews) are estimated to be around 115,515 representing about 50% of the total 219,919 fishers in Lake Victoria. However, the number of those involved in the post-harvest sector is not collected, but it is estimated to be higher than those of fishers if those involved indirectly and auxiliary services are included.

In Tanzania, Nile perch is harvested in about 85% (544 landings sites) of the 641 landing sites. Based on sampling data from sampled landing sites in the present study, it is estimated that there are 4 factory agents per landing site, 38 fish traders and 46 small-scale fish processors. This translates to an average of 87 direct post-harvest actors. Extrapolation of these figures by the total number of predominant Nile perch landing sites gives an estimate of 47,265 actors directly involved in Nile perch post-harvest sector in Tanzania. However, these figures may highly fluctuate since fish traders and processors move from one landing site to the other. These figures also do not include those involved in local and regional markets whose details are very difficult to obtain. In addition to traders and small-scale processors, there are more people involved in Nile perch handling at the landing site level. In Tanzania, it is further estimated that there are an average of 4 to 5 people handling a kilogram of Nile perch. When fish is landed at the landing site, there is one-two persons carrying the fish from the boat to the weighing area. At the truck there are three people, one who weighs the fish, then there is another who loads the fish into the truck and another person is the driver. These excludes the number of people offloading fish at the factory. This scenario of actors is similar to Kenya and Uganda.

In Kenya out of 334 beach landing sites, there are 193 landing sites predominantly landing Nile perch or at least constituting over 50% of the catch. Based on sampling of post-harvest actors in the sampled sites in the present study, provides an average of 3 factory agents per landing site, 51 fish traders and 27 small-scale fish processors. This translates to an average of 81 direct post-harvest actors. Extrapolation of these figures by the total number of predominant Nile perch landing sites gives an estimate of 15,578 actors. Number of persons involved in indirect and auxiliary activities is estimated to be even higher.

In Uganda, there are about 363 approved landing sites on Lake Victoria alone and only 30 of the approved landing sites are gazetted to handle fish destined to fish processing establishments. Nile Perch being the major commercial species, it is approximated that 90% of the 363 approved landing sites handle the species on the Lake. It is estimated that there is an average of about 51 fish traders, 8 factory agents and 16 small scale fish processors per typical landing site. This translates to an average of 75 direct post-harvest actors in the Nile perch fish value chain. Extrapolation of these figures by the 30 gazetted landing sites gives an estimate of 2,250 actors directly involved in the Nile perch post-harvest sector at these landings although there are several other approved but un-gazetted landing sites whose data on traders and small-scale processors might make a significant difference once incorporated.

Men dominate fishing activities, while women dominate processing activities. However, women dominance is only limited to low scale processing such as frying, smoking and sun-drying/*Kayabo* across the three countries due to lack of capital as stated by many women interviewed. Even within the semi-industrial processing

women are mostly involved in salting and cleaning of the fish frames while men do the packaging and loading. This is different from the industrial fish processing establishment where both men and women are involved in all sections within the processing department, except for loading and packing that is dominated by men.

2.3.2 Forms of product traded, prices and destination markets

Nile perch has various products and by-products traded locally and regionally. The major local markets for Nile perch products are districts and counties outside the riparian areas such as Nairobi, Dar-e salaam, Mombasa, Tanga, Kampala, Nakuru etc. The major regional markets for Nile perch include DR Congo, Rwanda, Burundi, and South Sudan. There is also intra-regional trade, with some products being sold between the riparian states. From the survey, the major Nile perch products and by-products traded locally and regionally include; fresh fish, fish chest, fish frames, off-cuts, fish meal, fish maws, fried fish, dried fish/*Kayabo*. Of these, fresh fish is mainly traded at the local level while fish maw sold to fish maw processing establishments. Fresh fish and *Kayabo* are also transported to major towns in Tanzania such as Dare-s salaam, Tanga, Mtwara, Kigoma, Ruvuma and Rukwa regions. The major market destination market for Nile perch products in Tanzania is DRC which imports over 390,000 kilograms of fish frames, 143,090 kilograms of off-cuts and about 64,500 kilograms of *Kayabo* annually. Rwanda, Burundi, and Uganda also import these products, but at a very meagre level. A substantial amount of processed products and by-products also leaves Kirumba market which is the main regional export source from Tanzania to neigbouring countries, especially to DRC through Mpondwe border in Uganda (Table 3). Data for Uganda's Mpondwe market with DRC is presented in (Table 6). Very small amounts of fish maws and chilled Nile perch (from industrial processing) leave Kenya for Uganda and vice-versa, where Uganda exports fresh, smoked and sundried Nile perch into Kenya through the Busia border point (see

Table *4*, Table 5).

Table 3. Nile perch processed products and by-products traded locally from Kirumba market in Tanzania for the first six months of 2018

Product form	**Weight in Kgs**	**Value in USD**	**Destination**
Chips	10,000	18	Masasi
Fish Frame	68,000	13,177	Kigoma, DAR, Kibirizi
Fish Head	81,000	21,650	Kigoma, Songea, Kibirizi
Dry Fish Meal	55,000	8,998	Tarime, Masasi DAR, Sirari
Frozen Nile perch	82,000	61,934	DAR, Arusha, Tarime

Salted whole fish	136,000	69,920	Masasi, Tandahimba, Makambako, Newala
Fresh Nile perch	10,000	6,655	Arusha, DAR
	442,000	182,352	

Source: Kirumba Fish Market 2018

Table 4.Nile perch product imports into Kenya from Uganda through Busia border point annually for the year 2017

Product form	**Weight in Kgs**	**Destination**
Fresh Nile perch	6,865	Kisumu, Nairobi, Mombasa, Kitale, Bumala, Kakamega
Smoked Nile perch	500	Kisumu, Nairobi, Mombasa, Kitale, Bumala, Kakamega
Sundried Nile Perch	70	Kisumu, Nairobi, Mombasa, Kitale, Bumala, Kakamega
Total	7,435	

Source: Kenya Fisheries Service; Busia border 2017

Table 5. Nile perch product exports out of Kenya through Busia border point annually

Product form	**Weight in Kgs**	**Value in USD**	**Source**	**Destination**
Chilled whole Nile perch	22,000	45,670	Sindo, Homabay Mbita, Lake Turkana	Kampala, Uganda
Fresh chilled fish maws	1000	8,750	Gikomba market, Nairobi	Kampala, Uganda
Total	23,000	54,420		

Source: Kenya Fisheries Service; Busia border 2017

Table 6. Supply chain for products handled at the Uganda-DRC Mpondwe regional market

Product	**Factory Price/kg UGX**	**Market Price/kg UGX**	**Preservation form**	**Source**
Fish heads	1,600/=	5,000/=	Smoked, salted and sun dried	Lake Victoria (Uganda and Tanzania), Lake Albert
Fish frames	1,600/=	3,000/=	Salted sun dried, fresh, smoked	Lake Victoria(Uganda and Tanzania), Lake Albert
Whole fish	N/A	Varies with size	Fresh	Tanzania (Stealthily brought in inside fish frames due to the on-going enforcement in Uganda)

Offcuts (red meat and trimmings)	2800/=	6,000/=	Fresh, salted, fried, salted-sun dried	Lake Victoria (Uganda and Tanzania)
Fish skins	1,440/=	500/= per piece	Fresh, salted, smoked, salted-sundried	Lake Victoria (Uganda and Tanzania)

2.4. *Nile perch management measures, processing and trade legislation*

2.4.1 Legislation related to Nile perch in Kenya

Kenya's legal framework consists of the newly promulgated law; the Kenya Fisheries Management and Development Act no.35 of 2016 (FMDA, 2016). This Act succeeds the older Act, Cap 378 of 1989. The new Act (FMDA, 2016) consists of sweeping changes in the management of fisheries in Kenya. It establishes the Kenya Fisheries Service to oversee management of fisheries resources. It also establishes the Kenya Fisheries Marketing Authority charged with marketing of fisheries products. The Fish Trust Fund is also established in the new Act to mobilize resources for fisheries development and management. All these new institutions are in the process of full constitution. The Act also establishes the Monitoring, Control and Surveillance Unit within the Kenya Fisheries Service, which includes a disciplined force. The Cabinet Secretary may also form an Inter-agency MCS-Unit that shall coordinate MCS actions in fisheries.

In terms of specific Nile Perch fishery management, Kenya lacks a specific law. However, the new and older Act have articles that addresses Nile perch as part of the general fishery. The new Act has not yet been complemented with fisheries regulations and thus the older fisheries regulations under Cap 378 are still effective. Some of the areas that may relate to Nile perch in the older regulations include:

1. All fishing is to be conducted under license, where is it also specified the species targeted, gear to be used and also states prohibitions and conditions
2. All fishing vessels are to be licensed including vessel type and propulsion method
3. All fish trading is to be conducted under license
4. All fish processing is to be conducted under license and also states conditions for licensing e.g. provision of monthly data
5. All fish exports are to be accompanied by a health certificate and shall provide data on type of product, amounts, destination and value
6. Transportation of fish must be accompanied by a fish movement permit

Some of the measures that may relate to Nile perch in the new Act include:

1. Management measures in each fisheries management plan shall have the legal force of regulations made pursuant to the FMDA. This by extension means that domestic adoption of NPFMPs would have legal force.

2. Gears prohibited for fishing are specified e.g. beach seine and monofilament net
3. The new Act also gives power to the Kenya Fisheries Service Director General to specify in the regulations the types of gear, including mesh sizes of nets to be used, specify fishing areas, limit amount, size, age and other characteristics and species or composition of species, of fish that may be caught, landed or traded
4. It also states that no landing of fish shall be permitted at any point except at a fish landing station or port
5. Fish quality shall be maintained through monitoring production of fish products and fish feed with a view to assessing risks to humans and also regulate fish handling, landing, transportation, processing and marketing
6. The Act through a technical committee on fish quality and safety, shall specify conditions for the placing on the market of fish, fish products and fish feed
7. The Committee shall also issue health certification of fish, fish products and fish feed subject to the consignment meeting set requirements

2.4.2 Legislation related to Nile perch in Tanzania

Harvesting, handling and processing of Nile perch is regulated by the Fisheries Policy of 2015, Fisheries Act No 22 of 2003 and its principal regulation of 2009. The regulations recommend the use of a single panel (of 26 meshes) gillnets of 6 inches and above. For the hooks, the required size is between number 10 and 12. The law prohibits the use of beach seine, monofilament nets and other fishing gears and methods such as vertical joining of nets to catch Nile perch; and to land fish in non-gazetted landing site. In addition, the law requires that everyone involved in the fishery should be licensed and registered by the district authority. The law also requires that anyone involved in the fishery should be a registered member of the respective BMU. In Fish handling and processing, the law prohibits handling and processing of fish in places that are not clean and safe. Further, the law prohibits trading of fish in non-recognized places/landing sites. The law also requires that those handling and processing, including those carrying fish from the boats to trucks wear special attires and gumboots and should land the fish in recognized fish bandas/shed.

2.4.3 Legislation related to Nile perch in Uganda

Uganda has several legislative measures relating to management of the Nile perch fishery

The National Fisheries and Aquaculture policy 2018 (Vision: A modern, productive, profitable and sustainable fisheries and aquaculture sub-sector)

The policy identifies a number of challenges limiting fish production as;

- Limited regulation and enforcement of laws and guidelines
- Use of illegal destructive gears that catch immature fish
- Excessive fishing effort
- Fishing in nursery and breeding grounds
- Increased demand for fish leading to over capacity
- Inadequate information to guide management decisions
- High post-harvest losses attributed to poor weather, poor handling and expensive cooling facilities
- Inadequate human, technological and infrastructural capacity
- Low research funding leading to limited research

This policy is supported by several Statutory Instruments (Sis) that include rules and regulations as below:

a). Fish (fishing) Rules 2010 have specific clauses that touch on the Nile Perch fishery including;

- Acceptable slot size is stipulated as 50-84 cm
- Acceptable mesh size is seven inches
- Acceptable long line hook size is 9 inches
- It provides for species specific licenses inclusive of the Nile Perch fishing license
- Vessel No. plate must be mounted on vessels
- Fish movement permit must be issued for traceability purposes

b). The Fisheries and Aquaculture (Quality Assurance) Rules 2017

- This highlights the onboard handling, landing, landing site facilities, transportation, documentation, handling in processing plants, exportation and recall of products from markets.
- This is also supported by the draft Standard Operating Procedures of 2011

c). The BMU rules (2016)

- These highlight the role of the different stakeholders in managing the Nile perch fishery

2.4.4 Regional management measures and plans relating to the Nile perch fishery

The huge economic importance of the Nile perch fishery to riparian states in terms of employment, foreign earnings and poverty reduction led to drafting of a species-specific management plan. The first Nile Perch Fishery Management I (2009-2014) was drafted and operationalized in 2009. The plan proposed to reduce fishing effort and capacity; implement closed seasons and closed areas; eradicate illegal trade in undersized, immature fish and the harmful illegal fishing practices such as beach seining and undersized gillnets. Other management measures that were in the NPFMP-I included self-monitoring and control initiative by industry associations and industry's zero-tolerance policy to Nile perch's slot size of not less than 50 cm. There was also the Operation Save Nile Perch (OSNP) initiative that emphasised fighting Illegal, Unreported and Unregulated fishing (IUU fishing) through improved monitoring, control and surveillance (MCS) operations.

Despite having NPFMP-I, some of the intended objectives were never met. This led to development of the Nile Perch Fishery Management II (NPFMP-II), which called for a paradigm shift in management of the fishery. The LVFO Council of Ministers meeting of November 2013 also gave new impetus to the process of development of NPFMP-II by emphasizing on critical areas for change. NPFMP-II outlined a number of measures to help achieve stated objectives including:

i. Establishment of enabling conditions to increase wealth creation and sharing at the local level
ii. Advancing policy-driven mechanisms at central and local levels such infrastructural investments, institutional and fiscal arrangements to support implementation of the management plan
iii. Addressing regulation of access to resources, compliance with existing fishing
regulations and formalization/regulation of all post-harvest activities
iv. Involvement of all actors including fishers, boat-owners, processors and traders in management measures
v. Mobilization of adequate human, financial, and logistical means and ensure accountability of institutions towards implementation of the plan
vi. Promotion of sustainable approaches for financing, including establishing mechanisms for co-financing by all commercial operators involved in fishing and value chain
vii. Conducting of research and improvement knowledge on stock dynamics and status and development of capacities of riparian countries and LVFO Secretariat in economic analysis

Other specific measures outlined in the plan are reducing fishing effort to 2015 levels, considering introduction of closed seasons, exploring introduction of secure fishing rights, control of access and regulation of post-harvest activities with a focus

on the fish maw trade. However, as sound as the plans may be, the riparian states have perennially faced several challenges in implementing these plans. For example, there needs to be uniform crackdown on illegal fishing practices, across all member states. Lagging behind of any member in enforcement, jeopardizes the fight against illegalities as some of the targeted fishers may move to areas where the vice is not considered a threat. In addition, Uganda does not enforce on the upper slot size regulation, while in Kenya undersize and above higher slot size is evident in markets. This too threatens sustainability of Nile perch in the wake of emerging fish maw business. Another challenge envisaged in the plan is lack of reliable local sources of funding to support the implementation. Countries over-rely on donor funding to support fisheries management and research, while some donor objectives and funding may not exactly align to management objectives.

2.5. *Prospects of the NP production, processing and trade in context of current situation*

The Nile perch management measures carried out by the riparian states are geared towards sustaining fish harvest for increased production, income generation and reducing poverty among the population. However, the increased efforts that have resulted in the decline of stocks does not only impact on its sustainability, but economic importance as well. The situation has been complicated by the emerging trade in fish maws, which targets big fish. It should be noted that Nile perch export accounts to over 60% of the total fish exports from the region. Thus, conservation and management of Nile perch is critical to stakeholders in Lake Victoria. This explains why some of the partner states have taken drastic measures to remedy the situation. For example, Tanzania and Uganda are currently carrying out comprehensive operations to eradicate all fishing illegalities in Lake Victoria. This include removing known destructive fishing gears such as beach seine and monofilament nets. Tanzania has also been enforcing against fishing practices such as vertical joining of gillnets among others. These efforts if well implemented and supported by all stakeholders may lead to improved management of the Nile perch fishery. For instance, In Tanzania positive impacts of these efforts have begun to be felt whereby, bigger Nile perch are found in local markets as opposed to previous years, where they were flooded with juveniles. This will boost processing and trading of Nile perch locally and regionally by enabling fishers and traders to get better income.

3 Methodology and approaches

This study was preceded by a regional planning workshop attended by the national team leaders in Arusha, Tanzania from 16th -18th June 2018. The planning meeting discussed in detail the operationalization of the study and development of study tools. This was important so as to harmonize the study methodology and tools.

3.1. *Study area*

The study was conducted simultaneously in the three riparian states of Kenya, Tanzania and Uganda from 19th June to 13th July 2018. Visits were made to 27 fish landing sites (see annex Table 31). Large markets and border points where local and regional Nile perch are processed and handled, were also visited. These included Kirumba market and Nyamhongolo area in Mwanza, Obunga market in Kisumu and Busia border point in Kenya and Ggaba market and Mpondwe border in Uganda. Other sites visited included departments of fisheries offices within the study districts/counties and industrial and semi-industrial processing establishments. Nile perch landing sites were selected based on the geographical coverage, accessibility and proximity given the short time available for the study. This was important in order to obtain the required information and meet the targeted sample size.

3.2. *Sample size*

Purposive sampling was employed to recruit survey participants. The rationale was to interview knowledgeable individuals involved in Nile perch fishery from capture to consumption. Respondents interviewed were boat owners, artisanal fish processors, industrial processors, fish traders/agents, fisheries officers and a representative from LVFO secretariat. Other categories of respondents were semi-industrial processors dealing in Nile perch by products. Participation in the study was voluntary and consent statement was read to the participant prior to their participation. A total of 193 respondents were interviewed in the study as shown below (Table 7)**.**

Table 7.Number and category of respondents interviewed

Stakeholder group	**Kenya**	**Tanzania**	**Uganda**	**Total**
Fishers	24	52	27	103
Nile perch traders and agents	17	14	9	40
Artisanal fish processors	3	12	9	24
Industrial and semi-industrial	2	7	3	12
Policy level ministry officials	1		2	2
LVFO secretariat			1	1
District/County Fisheries Officers	3	2	5	10
Total	**50**	**87**	**56**	**193**

3.3. *Data collection strategy*

Both quantitative and qualitative frameworks were employed to collect data. Quantitative technique employed the use of a semi-structured questionnaires. The questionnaire had been prepared, discussed and coded before the survey. The interview was conducted in local languages or Swahili. Interviews took between 40-60 minutes to complete. Data collected from questionnaires focused on the demographic characteristics of respondents; socio-economic and marketing data; investment and operational costs; and financing and technical support information. Questionnaires were mainly used to interview fishers, artisanal, industrial and semi-industrial fish processors, fish mongers and traders as well as factory agents. Qualitative approach included the use of Key Informant Interviews (KIIs) administered to fisheries officers, policy level ministry officials, official from LVFO and officers in charge of fish markets. The interviews were conducted at their places of work and it took 30-50 minutes to complete. The questions focused on legislation of Nile perch; volumes and type of products traded; investment costs, description of the value chain; constraints and opportunities in the Nile perch fishery. The data collection tools are in Annex 8.3.

3.4. *Data analysis*

Data was entered at the national level by each country Team using standardized data templates in Microsoft Excel 2016. The data-set had been prepared and harmonized for easy entry and analysis. Descriptive statistics were used to analyze demographic and socio-economic information and results presented in form of averages and percentages in tabular and graphical forms. A standardized business model was used to calculate total fishing revenue (TFR), operating fixed cost (FC), variable cost (VC) and gross income (GOI) for the various players involved in Nile perch value chain. This information was also used to generate return on investments, break-even points and income generated along the chain from capture to consumption.

Breakeven points for fish quantities and sales volumes were calculated as follows.

$$Breakeven\ point\ (Quantity) = \frac{\text{TFC}}{\text{SP\_Kg} - \text{VC\_Kg}} \quad \text{.....(1).}$$

$$Breakeven\ point\ (Sales) = \frac{\text{TFC}}{\frac{\text{SP}_{\text{Kg}} - \text{VC}_{\text{Kg}}}{\text{SP}_{\text{Kg}}}} \quad \text{.....(2).}$$

Where; TFC is Total Fixed Cost, SP_Kg is Selling Price/Kg, VC_Kg is Variable Cost/Kg.

4 Study Findings

4.1. *Actors' demographic indicators*

Data from interviews indicates that fishing was male-dominated, with 96% of fishers being male and only 4% were female (only encountered in Tanzania) (

Table 8). Similarly, fish trading was also male-dominated but with a higher percentage of females. By-product trading was also dominated by males constituting 85% and 15% females. However, artisanal fish processing was entirely dominated by females. Literacy levels amongst all actor groups were at least above 50%, with factory agents indicating a higher percentage (36%) of those above secondary school educations. In terms of literacy by gender, those attended Madras were all male, while those not schooled were male 5% and 1% female. Those who attained primary school education were 59% male and 72% female. Those attained secondary school education were 28% male and 16% female. Those attained tertiary education were all male at 5%. Those attained university education were 1% male and 6% female.

The fishery is dominated by youthful persons with average inclusion of 48% being in the age bracket of 31-40 years and 18% in the bracket 18-30 years. The fishery is also dominated by relatively new entrants, where those with below 10 years' experience were 48% among fish traders, 48% among fishers and 75% among artisanal processors and 60% by-products traders. These results signal important demographic indicators in the Nile perch fishery that has majority of actors being new entrants and youthful.

Table 8.Actors' demographics indicators in percentage

Indicator	Variable	Fisher	Fish Trader	Factory agent	Artisanal processor	By-products trader	Average percent inclusion
Gender	Female	4	43	7	100	15	**19**
	Male	96	57	93	0	85	**81**
Education level	Madras	1	0	0	0	0	**1**
	Not schooled	6	0	7	13	8	**6**
	Primary	63	62	43	81	38	**61**
	Secondary	26	33	36	6	23	**26**
	Tertiary	2	5	7	0	23	**4**
	University	2	0	7	0	8	**2**
Age	18-30	14	14	36	13	40	**18**
	31-40	49	38	50	56	40	**48**
	41-50	31	33	7	25	20	**28**
	>50	6	14	7	6	0	**7**
Experience in years	<10	48	48	57	75	60	**52**
	11-20	39	38	21	19	30	**35**
	>20	13	14	21	6	10	**13**

Source: Survey data

4.2 Actor's socio-economic indicators of actors

4.2.1 Fishers

Actors' socio-economic characteristics are presented here by actor group and by country. Fishers on average spent 11.3 hours per day fishing, although Kenyan fishers indicated fishing at least 10 hours (Table 9). Longline fishers fished longest spending up to 16 hours in the Lake with some going for 3-4 days' trips especially amongst Kenyan and Tanzanian fishers. Fishers in Kenya and Uganda claimed that enforcement authorities have banned overnight fishing as a way of curbing overfishing. These claims however could not be verified, as there are no official communications from resource managers to that effect. In terms of days, fishers in all countries indicated fishing for an average of 5 days per week. In Busia County in Kenya, some landing sites have created local regulations barring fishing during weekends.

Majority of fishers (>80%) had fishing as a fulltime occupation with less than 10% being in farming as an alternative or other occupation (Table 9). In terms of investments, gillnets fishing units had invested more in equipment compared to longlines with an average of investment of $ 3,341/boat compared to $ 1,547/boat by longlines. Generally, Kenyan gillnet fishing units had invested half of that of Tanzania and Uganda, owing to most actors being non-motorized. Longline fishers had closely similar level of investments across the three countries. A majority of fishers (>72%), sourced funds from personal savings to invest in equipment. This is further corroborated by the high percentage of fishers who reported to own their own equipment (Table 9). Fishers in Tanzania (24%) and Uganda (15%), however indicated more dependence on factory agents for finance. However, ownership of the equipment reverts to fishers once fully paid for.

Table 9.Fishers socio-economic indicators

Indicator	Variable	Kenya	Tanzania	Uganda	Regional average
Time spent	Average hours/trip	10	12	12	11.3
	Average days/week	5	5	5	5
Primary occupation	Fishing	88%	83%	100%	88%
	Farming	4%	10%	0%	6%
	Other	8%	8%	0%	6%
Average investment costs in equipment	Gillnet fishing units	$ 1,530	$ 3,512	$ 3,618	$ 3,341
	Longline fishing unit	$ 1,441	$ 1,613	$ 1,566	$ 1,547
Equipment ownership	% owning equipment	80%	100%	100%	95%
Source of capital for investment	Bank loan	2%	0%	4%	2%
	Factory agent	2%	24%	15%	17%
	Personal savings	90%	72%	74%	76%
	Relative/Friend	5%	4%	7%	5%

Source: Survey data

4.2.2 Fish traders and factory agents

Trading actors (fish traders and factory agents) on average spent closely similar number of hours as fishers, with an average of 11 hours (Table 10). In terms of days spent in a month, the regional average was 14 days a month, but Kenyan actors spent more days. This is lower to that of fishers and can be explained by the need to take some days off to deliver fish and organize for supplies such as ice.

On average (77%) of trading actors had fish trading as a fulltime occupation but with a range of 67% in Kenya and 86% in Uganda (Table 10). The second most important occupation was farming. In terms of investments in equipment, fish traders had invested an average of $ 361, but with a large variation, where Tanzanian traders had invested only $ 39 on average. The little investment for fish trading in Tanzania can be attributed to the fact that artisanal fish trading and processing is dominated by women who mostly use basin and buckets to carry fish from the landing sites to nearby markets. At the same time, males involved in fish trading use weaved baskets and bicycles to transport fish to local markets. However, this is quite different from Kirumba, the main entry and exit point for most of the Nile perch products to national and regional market. Here, fish traders and processors are organized into groups of between 20-50 people. Traders find it advantageous to be in a group because they use a group trade license, storage and market facilities such as tables given to groups at the fish market. For example, in Kirumba market, the group pay a rent of USD 157 for renting the office and store and USD 110 for using the rack annually. These payments are contributed by the individual members of

the groups. Because of these arrangements, investment, fixed and variable costs are very minimal. Factory agents on average had invested $ 18,610 but with a large variation between countries, particularly for Tanzania where most factory agents do not have their own trucks and fish collector boats. They are provided with trucks fully fuelled and filled with ice. They only pay some amount of money to the driver of the truck.

Table 10. Fish traders and factory agents' socio-economic indicators

Indicator	Variable	Kenya	Tanzania	Uganda	Regional average
Time spent	Average hours/trip	13	10	11	11
	Average days/month	15	13	13	14
Primary occupation	Fishing	67%	75%	86%	77%
	Farming	0%	8%	0%	5%
	Other	33%	17%	14%	18%
Average investment costs in equipment	Fish traders	$ 442	$ 39	$ 601	$ 361
	Factory agents	$ 26,576	$ 4,174	$ 34,206	$ 18,610

Source: Survey data

4.2.3 Artisanal and by-product processors

Artisanal and by-product processors spent an average of nine hours in a day's trip, which was the least time spent in fishery activities amongst all actor groups (Table 11). Occupational characteristics of artisanal and by-product processors are similar to those of fish traders and factory agents. Majority had fish processing and trading as their primary occupation.

In terms of investment, artisanal processors' investments were quite low, with an average of $78, although Kenyan processors had relatively higher investments ($ 269). By-product processors in Uganda had an average investment amount of $ 6,868, while by-products traders and processors in Tanzania had an average investment amount of $ 179. The higher investment by Ugandan by-product traders was due to ownership of transport vehicles owned and hence the high value, while in Tanzania they had no such equipment. By-product processing in Tanzania was dominated by women whose major investments are basins, baskets and drying racks. Processing of by-products in Tanzania too, is carried out in an unconventional way compared to Uganda, where only minimal costs are incurred. For example, processors visited were operating from rented village land where they pay a small amount of money (<USD 26) a month to the village leadership. Their major investments are drying racks, tents for covering products during rainy season and polythene bags. In terms of operations, workers in these processing units own their working tools such as gumboots, wheel-barrows, gloves, knives etc., hence their very low investments. The only by-product trader interviewed in Kenya, had no

investments, and mostly hired trucks to ferry products. The trader in Kenya had contracts with a factory processor to buy by-products in bulk and then re-distribute it to artisanal processors without adding any value, and hence required no investments in equipment.

Table 11.Artisanal fish processors' socio-economic indicators

Indicator	Variable	Kenya	Tanzania	Uganda	Regional average
Time spent	Average hours/trip	8	6	12	9
Primary occupation	Fish processing and trading	67%	67%	89%	75%
	Farming	0%	8%	0%	4%
	Other business	33%	25%	11%	21%
Average investment costs in equipment	Artisanal processor	$ 269	$ 45	$ 56	$ 78
	By-products trader		$179	$ 6,868	$ 3,930

Source: Survey data

4.3. *Fish marketing information*

4.3.1 Fishers' sales prices

Nile perch fish marketing from fishers to other actors in the value chain is chiefly determined by size and quality for processing. There are three notable fish sizes marketed in the fishery. The small-sized fish (1.5-5Kg), medium-sized fish (6-10 Kg) and large-sized fish of more than 11 Kg (Table 12). Discussion with some respondents experienced in weighing and measuring length of Nile perch, revealed that small sized fish of 1.5 kilograms has a length of between 48 and 51 cm long while that of 5 kilograms ranges from 71 to 76 cm. The medium sized fish weighing 6 kilograms is about 80 cm long and that of 10 kilograms has a length ranging from 84 to 97 cm. Large-sized fish ranges from 98 cm to over 100 cm. This is corroborated by the CAS data of 2015 in Tanzania. Because of these variations some of the small-sized fish fall below the regional lower slot size of 50 cm. Based on field data, fishers reported mostly catching the small-sized fish and less of the medium-sized and rarely for the large-sized fish. The regional average beach price per kilo of the small-sized fish from fishers was $ 2.40. However, there were country variations, with Kenya having the lowest price and Tanzania the highest. This partly corroborates claims by fishers and factory agents that prices offered by processing factories were low in Kenya, necessitating the agents to sell fish in Uganda, particularly in Jinja via fish collection boats where it is sold at $3/Kg.

The regional average price per kilo for medium-sized fish was $ 3.07, but similarly with regional variances (Table 12). The regional average price per kilo of the large-sized fish was $ 4.25, highest price in Kenya and the lowest in Uganda. However, in Tanzania, due to current crack-down on illegalities large sized Nile perch are not

landed, thus prices could not be recorded. In Kenya and Uganda no strict enforcement is ongoing in regard to upper slot size.

Table 12.Fishers average prices per kilo by size and country

Indicator	Variable	Kenya	Tanzania	Uganda	Regional average
Average fish prices	Small-sized fish (1.5-5Kg)	$ 2.26	$ 2.47	$ 2.40	$ 2.40
	Medium sized fish (6-10 Kg)	$ 3.47	$ 2.99	$ 2.92	$ 3.07
	Large-sized fish (> 11 Kg)	$ 4.50		$ 3.99	$ 4.25

Source: Survey data

Although general regional and country level average prices have been described above in context of fish sizes, fishers' prices were additionally determined by the type of buyer they sell to, except for Uganda where fishers' prices at a particular landing site were similar. Kenyan buyers offered the highest prices across all sizes, except for factory agents who offered the lowest price for small-sized fish (Figure 1). Generally, fish traders were offering higher prices across the three countries, compared to those from factory agents. Fish maw collectors were only recorded to buy fish directly from fishers in Kenya while it was not the case for Uganda and Tanzania.

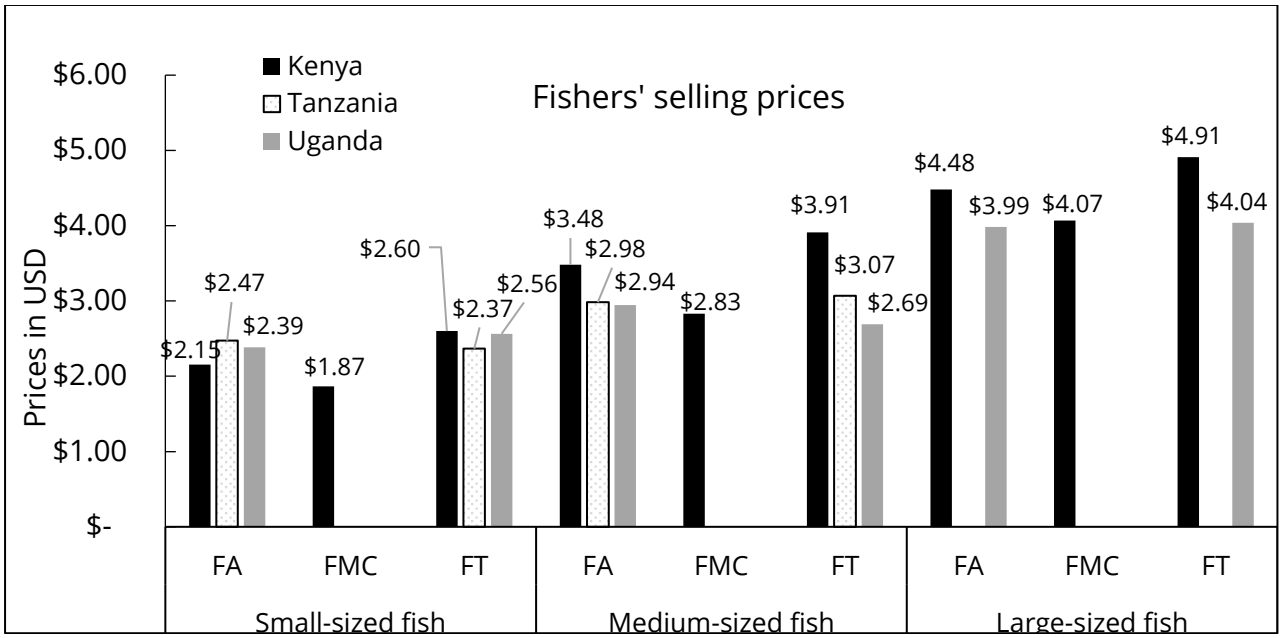

Figure 1. Fisher's Nile perch prices by size, country and type of buyer. Codes: FA (Factory agent), FMC (Fish maw collector) and FT (Fish trader). Source: Survey data

4.3.2 Fish traders and factory agents' sales prices

Fish traders and factory agents' sales prices per kilo for small-sized fish was between $ 2.33 and $ 3.01, with factory agents receiving the highest prices, except in Kenya, where fish traders received slightly higher prices (Figure 2). Average

regional medium-sized fish prices were slightly higher than those of the small-sized fish in each country, but with factory agents receiving higher prices compared to fish traders. It cannot be clearly ascertained by this study why factory agents' sales prices are low in Kenya, but high for medium-sized fish. More studies should be conducted to provide size structure and prices data. Large-sized fish prices which were only recorded in Kenya and Uganda were highest in Kenya. Traders who were mostly selling the large-sized fish directly to fish maw collectors attained higher prices than factory agents in both Kenya and Uganda.

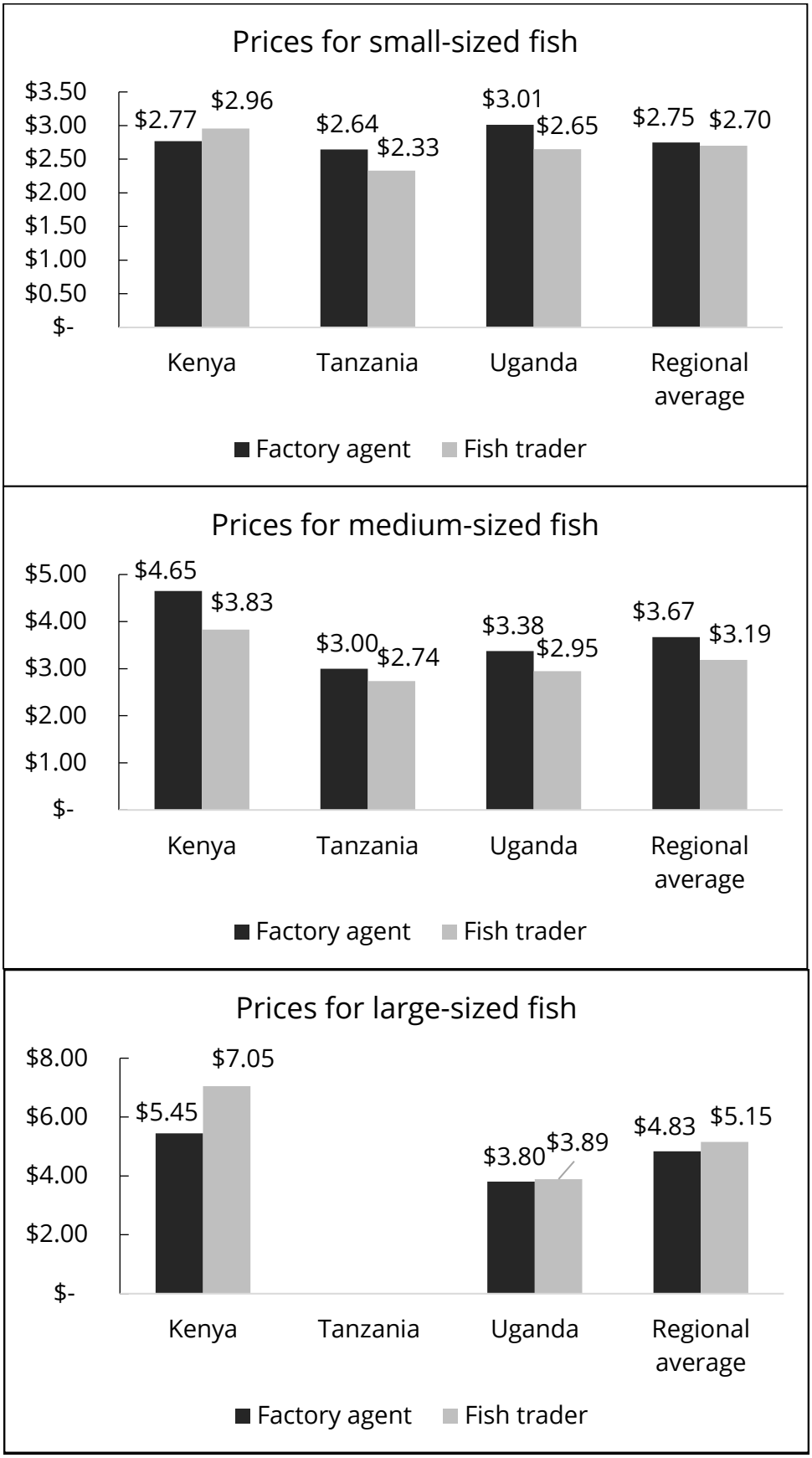

Figure 2. Fish traders and factory agents' sale prices by country and fish size. Source: Survey data

4.3.3 Artisanal and by-product processors' sales prices

This study was only able to document a limited number of processed products and by-products due to challenges of tracking down all the relevant players who are scattered. In addition, there were challenges of tracking data from Tanzania since some of the by-products were transported directly into Mpondwe in Uganda-DRC border and hence this data is not readily available. Data on by-products prices from factories was also challenging to get. Nevertheless, key products and by-products captured are listed below (Table 13). Although by-products data captured both pre-processed stage and post-processed prices, only ex-factory purchase prices for pre-processed products are presented here. Fish fat prices were only documented in Kenya and Uganda and the average sales price by by-products traders was $ 0.62/Kg. Fish frames regional average price was $ 0.61/Kg, while fish heads were $ 1.19/Kg, only recorded in Uganda. In Kenya the fish heads and fish frames were sold together as one piece. Fish skins had an average price of $ 0.26, with Uganda having a higher price. In Kenya the fish skins are first trimmed off meat and then dried and sold separately. The small pieces of meat are then mixed with wheat flour and fried as a meal sold in major towns in Western Kenya. The remaining skin is steamed and dried again and used as an ingredient for fish meal. The skin is said to have a high protein content and hence its choice for fish meal. In Tanzania and Uganda, it has additional uses, where each piece of skin is rolled and sold into DRC where it is used as food.

Value added Nile perch products included, salted, smoked and fried fish. Salted Nile perch was only recorded in Tanzania and sold at $ 2/Kg. Fried fish was selling at an average of $ 2.28. Notably this price is in the same range as that of fresh processable quality fish. However, artisanal fish processors who dealt with the fried, salted and smoked fish mostly purchased the un-processable quality fish, which was at a much lower price. Smoked fish on average was sold at $ 2.22/Kg.

Table 13. Artisanal and by-product processors' purchase and sales prices

	Kenya	**Tanzania**	**Uganda**	**Regional average**
Ex-factory fish by-products purchase prices				
Fish fats	$ 0.80		0.44	$ 0.62
Fish frame	$ 0.39	$ 0.80	$ 0.65	$ 0.61
Fish heads			$ 1.19	
Fish skins	$ 0.16		$ 0.46	$ 0.26
Off cuts/ red meat trimmings			$0.77	
Fish maw			$187	
Value added products sales prices				
Salted		$ 2.00		
Fried	$ 2.00		$ 2.56	$ 2.28
Smoked		$ 2.00	$ 3.33	$ 2.22

Source: Survey data

4.3.4 Processing factories production amounts and sales prices

Data on processing factories was difficult to get and as a result only limited information is presented here. In Kenya only two factories were operating around the Lake and data collected indicates that they on average processed about 300 tonnes of fresh Nile per month per processing factory. It was difficult to get comprehensive data on total amounts of the assorted products produced including by-products due to lack of systematic data collection system by fisheries authorities or sometimes the data is scattered all over and thus making it difficult to piece everything together. However, based on available data from DiFR, Uganda, an attempt to approximate volumes of products and by-products emanating from a tonnes of fresh Nile perch has been done here (Table 14**Error! Reference source not found.**). The largest proportion of fish products by weight is fish frames constituting 40% of the total weight, but with a very low sale value. Fillets form the second largest proportion (31%) and have considerably high value. Fish maws constitute only 2% by weight but have the highest value at USD 55/Kg. In the Kenya the factory F.O.B price was indicated USD 50/Kg. Traditionally, fillets, headed & gutted, Chest/kiblins, steak and skin on fillets (speciality exported to Israel) have been considered as core products from the Nile perch. On the other hand, by-products (fish frames, skin, offcuts and fat) are also gaining significance in value (Table 14**Error! Reference source not found.**). The by-products as calculated below constitute 56% by weight and 40% by value, when including the fish maw.

For Tanzania, data obtained from Annual Fisheries statistics of 2016 indicates that processing factories handles about 26,043.6 metric tons (or 38%) of the total 68,403.6 metric tons of Nile perch produced in the country (Table 15). However, only 3,859 metric tons of the by-products from the processing plants are traded locally and this includes dried fish frames, dried fish off-cuts, frozen fish chest, frozen fish frames, frozen fish heads and frozen fish offcuts. The rest of the products are exported to international markets. This implies that over 42,359 metric tons of Nile perch and it's by products are traded in local and regional market (Table 15). By-products sold nationally and regionally contributed 9% of total production with a value of USD 1,563,720.

In Kenya, data obtained from Annual Fisheries statistics of 2015 indicates that Nile perch catches constituted 28% of Lake Victoria's total production (Table 16). Nile perch also constituted 51% of Kenya's fish exports in that year. In 2016 production dipped slightly to 30,070 Mt but increased in percentage contribution to 31% of total production but dipped again to 46% in export value. However, from the annual statistics it is not possible to desegregate some products which are aggregated together with non-Nile perch products. The report does not also record Nile perch by-products. Extracts related to Nile perch are presented below (Table 16). Data

from Uganda is also presented here from DiFR statistics (Table 17), and similarly does not show breakdown of by-products.

Table 14. Average sales prices and proportional volumes of assorted Nile perch products typically produced by fish processing factories, per tonne of fresh fish

Product type	Product class	Processed quantity of products in Kg/tonne of fresh fish	Approximate % weight/tonne	Approximate value in USD/Kg	Approximate total value in USD/ tonne of processed product
Fish frames	By-product	401	40%	0.4	161
Fillets	Core product	308	31%	5	1,542
Headed & gutted	Core product	107	11%	4	429
Skin	By-product	67	7%	0.2	13
Offcuts/ red meat	By-product	50	5%	0.8	40
Fish maws	By-product	21	2%	55	1,148
Chest/kiblins	Core product	15	2%	1.3	20
Fat	By-product	18	2%	0.4	7
Steaks	Core product	6	1%	3.5	21
Skin on fillets	Core product	6	1%	4.5	27
		1,000	100%		3,360

Source: Calculated from fish processing factory data; DiFR, Uganda

Table 15. Nile perch products annual statistics for Tanzania for 2016

Fishery products	Weight (Kgs)	FOB value USD)
Landed fresh Nile perch	68,403,600	125,541,611
Products destined for international markets		
Dried Fish Maws	1,199,850	48,886,915
Fresh Fish Fillets	7,175,808	40,783,184
Fresh H&G Fish	1,137,151	5,240,729
Frozen Fish Maws	378,009	15,377,916
Frozen H&G Fish	1,560,491	6,490,679
Frozen Fish Fillets	8,580,941	58,994,912
Sub-total	**20,032,250**	**175,774,334**
Products destined for national and regional markets		
Fish Frames	566,000	199,815
Dry Fish Meal	1,587,000	28,485
Frozen fish chest	270,650	328,880
Dried Fish Frames	1,003,500	301,050
Dried Fish Off Cuts	16,000	1,920
Frozen Fish Frames	732,500	61,900
Frozen Fish heads	901,400	146,450
Frozen Fish Offcuts	935,356	495,220
Sub-total	**6,012,406**	**1,563,720**
Total for product and by-products	**26,044,656**	**177,338,054**

Source: extracts from Tanzania's annual fisheries statistics report of 2016

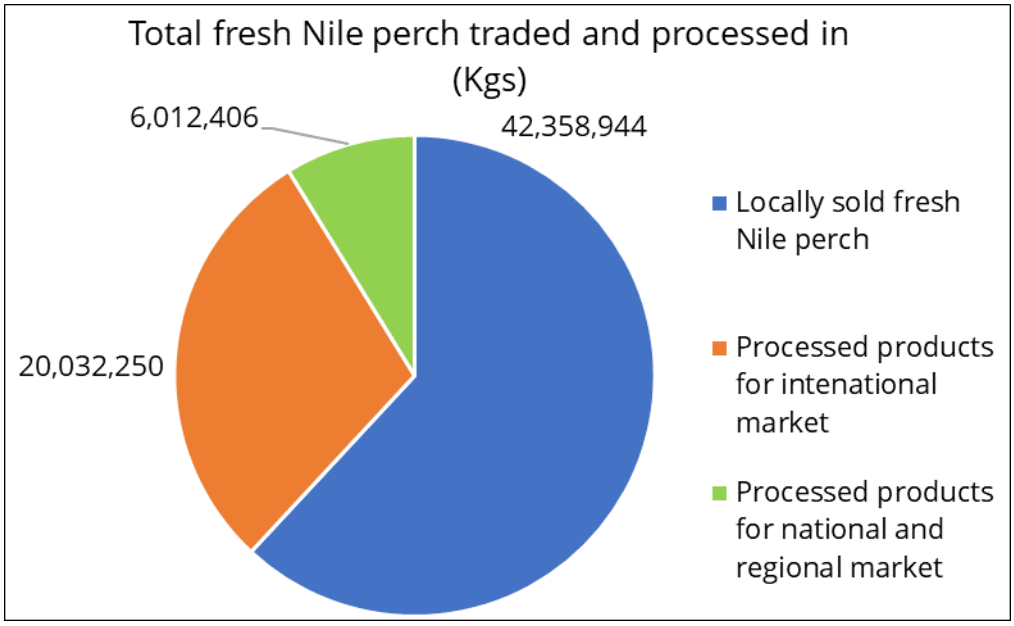

Figure 3. Nile perch production statistics in Tanzania. Source: extracts from Tanzania's annual fisheries statistics report of 2016

Table 16.Nile perch products annual statistics for Kenya for 2015

	2015		2016	
Fishery products	**Weight (Kgs)**	**Value USD)**	**Weight (Kgs)**	**Value USD)**
Landed fresh Nile perch	31,287,000	68,150,000	30,070,000	90,470,000
Frozen Nile Perch Fillets	2,091,000	8,892,610	1,222,000	3,333,100
Chilled Nile Perch Fillets	1,723,000	7,040,540	641,000	3,360,380
Fish maws	143,000	5,333,410	66,000	2,8654,200
Headed and Gutted Fish	761,000	3,032,030	453,000	1,9543,000

Source: Extracts from Kenya's annual fisheries statistics reports of 2015 and 2016

Table 17. Average monthly production of core and by-products from Ugandan industrial processors

Core products (Monthly average) exported out of Uganda/kgs	**By-products (Monthly average)- Nile perch only/ kgs**
859,390.1	290,600

Source: DiFR, Uganda

It is now evident that a significant market for by-products exists and targets regional markets. The Mpondwe border by-products market is probably the largest of such markets in the region (Table 18). Upto 12 tonnes of assorted Nile perch by-products arrive at Mpondwe market weekly. Main sources are processing factories from Tanzania and Uganda. Some of the by-products are usually value added while others are added after wholesaling. Several hundreds of traders and artisanal processors are engaged in trading and processing of the by-products fish frames, fish skins, fish heads, smoked wholefish, sun-dried wholefish and fish trimmings. While a few traders and by-product processors are formal by way of registration by government or associations, majority are informal and fisheries management authorities lack documentation about them. Most of these by-products are shipped across the Uganda-DRC border using motor-cycles. Once across on the DRC-Kasindi trading centre, they are bulked again onto waiting trucks and transported to inland markets such as Beni, Butembo and Kisangani in DRC. One of the challenges in the by-products markets here is the low level of handling and quality standards and lack of either preservation or processing facilities.

Table 18. Nile perch by-product exports arriving at Mpondwe border point in Uganda from Tanzanian and Ugandan fish factories weekly

Product type	Average weekly amounts in Kgs	Sales price USD/Kg
Salted heads	3,490	1.3
Smoked heads	543	
Fresh by-products	1,867	
Salted frames	3,759	0.78
Salted skins	788	0.46
Fresh heads	1,225	
Fresh trimmings	420	1.6
Total	**12,091**	

Source: Cross-border trade data; DiFR, Mpondwe border point, Uganda, 2018

4.4. *Mapping of the local and regional Nile perch value chains*

4.4.1 Value chain map for Kenya

The Kenyan value chain for the Nile perch fish follows two basic value chains, but with complexity growing as players increase in the chain. The path followed by each chain is determined by fish size and processing quality. In the first value chain, fish of processable quality and allowable slot-size (> 50, < 85 cm) is sold directly to factory agents, although other actors also purchase the fish. However, although the preferred buyers are the agents. In the second value chain, fish of un-processable quality and slot size (<50,>85 cm) is expressly targeted by other buyers, other than processing factory agents. All fish (100%) is deemed to have been distributed in different proportions in the two value chains presented below (Figure 4,Figure 5). Estimated volumes ending to each actor group were calculated based on proportions reported in interviews, and thus these figures must be understood to be inherent on the sample. In some cases where it was not possible to ascertain the proportions, a diamond arrow has been used to depict lack of data.

Based on the sample, approximately 69.8% of the fish was destined for the processable quality value chain (Figure 4). Out of this, 52.7% was purchased by factory agents and ultimately going to processing factories. Some processable quality fish may also end up in the local market, if bought by traders (7.9%) targeting local markets within Kenya, or 1.3% going directly to consumers. Another 7.9% was sold to fish collectors, who sold to factory agents or fish maws collectors. Fish collectors had no investments in equipment nor added any value and only acted as middlemen. Once the fish is received by factory agents, it may end up in Kenyan fish factories or in Uganda as earlier suggested due to better prices there. Volumes of by-products from processing factories out of the total volume from fishers were challenging to estimate.

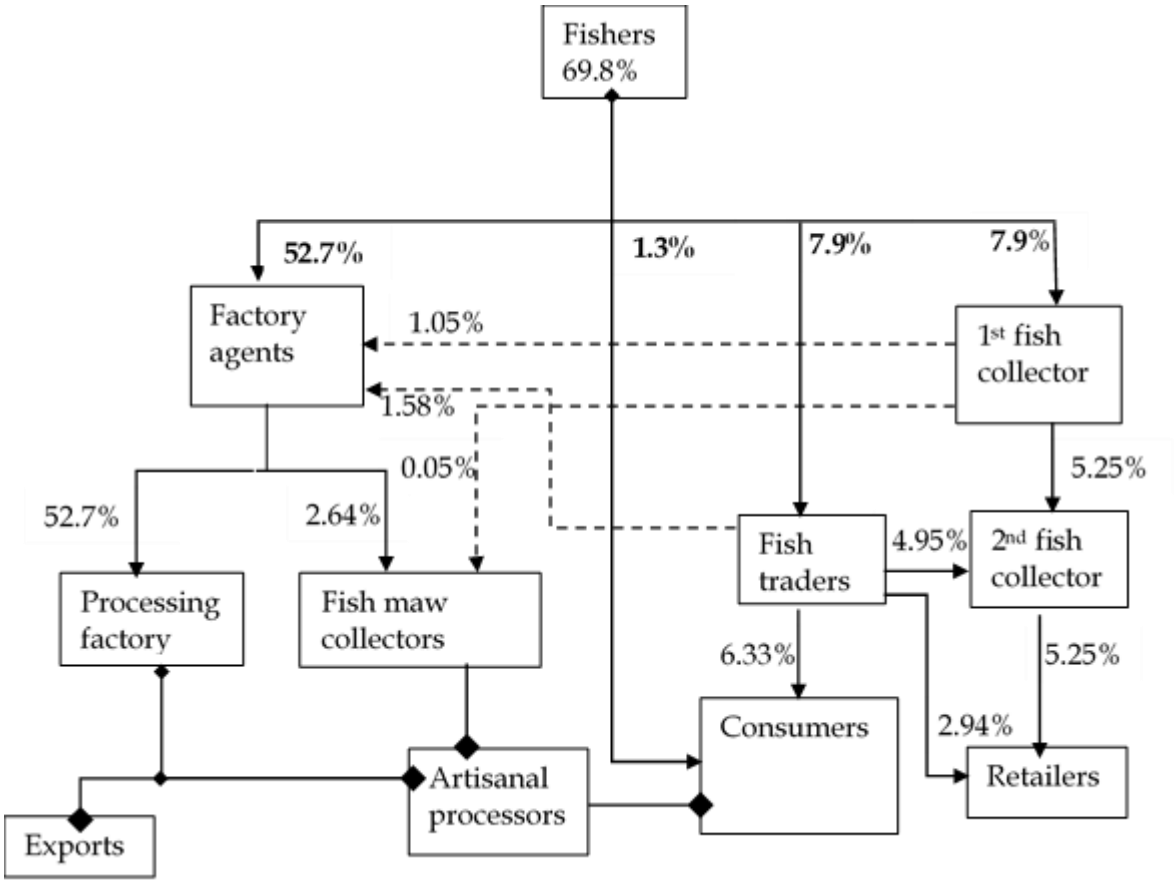

Figure 4. Value chain map for processing quality fish in Kenya

In the second value chain which was estimated to absorb 30.2% of total fishery catches, fish ended up in the local market. One of the reasons for the higher volume of fish in Kenya going through the local value chain compared to Tanzania and Uganda, was cited as lack of a competitive market for fish through the processing chain. This has been as a result of closure or collapse of many fish processing factories, leaving only two operators around the Lake region and one in Nairobi. Fishers and factory agents claimed that this had introduced uncompetitive behavior amongst the remaining factories such as lowering of prices without prior or at short notice and unfavourable business conditions such as collusion of factories with the favoured factory agents so as to run down competition from other agents. Fish through this chain also constitutes large-sized Nile perch, whose fish maw would fetch high prices. Since fish whose maw has been extracted cannot be passed on for factory processing, it ends up at the local markets. Out of the 30.2% amount in this chain, approximately 15.8% of it was purchased by fish traders, 12.6% by fish maw collectors and 1.9% by artisanal processors. Fish rejected by factory agents at the landing sites on account of size or low processing quality, also ends up joining this value chain.

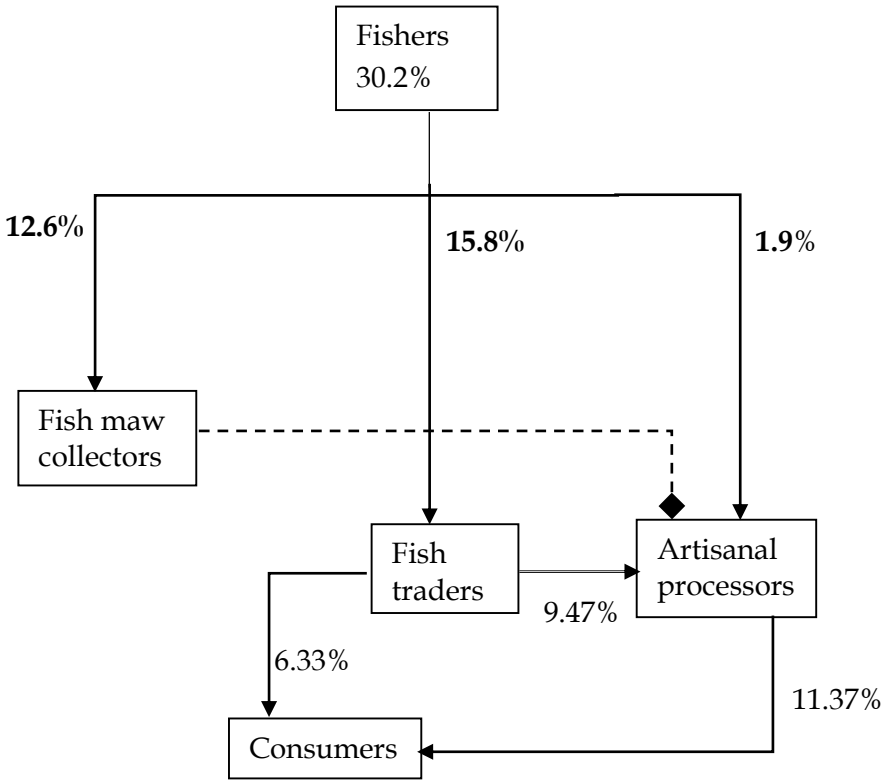

Figure 5.Value chain map for poor processing quality, undersize and oversize fish in Kenya

4.4.2 Value chain map for Tanzania

The Nile perch value chain for local market is a simple chain that starts from a fisher who comprises the boat owner and the fishing crew (Figure 6). From this chain, based on the sample of the present study, very small amounts of fish (~5.59%) were sold here. Once fishers landed the fish, traders took up ~3.46%. Amounts going to artisanal processors could not be ascertained. Most of fish sold in this chain is that rejected by factory agents. Traders then sell the fish at local markets or landing site to consumers around. A few fishers also sell directly to consumers. Fish bought by the artisanal processors is usually transported to their processing structures for processing. The most processed Nile perch products for local market include salted and smoked fish. Fish maw collectors are only interested in removing the maw and then selling the fish to fish processors.

In the second value chain for processable quality and size (50-85 cm), up to 94.41% of the fish was recorded as sold here (Figure 7). This value chain involves a variety of actors such as fishers, traders/factory agents, processors and regional market dealers. Once fish had been landed, it was sold to factory agents who took up 90.95% of the fish at the set price, while sale to local and wholesale traders and processor was conducted through negotiation with boat owner/crew. Prices of Nile perch at landing sites fluctuate with the supply and market conditions. Artisanal processors who buy fish directly from fishers process it and sell to actors in regional markets. Nile perch by-products from processing factories are sold to wholesale

traders and artisanal processors who process the products and sell to regional markets in DRC, South Sudan and Rwanda. The by-products dealers have some form of self-organization through registered associations. For example, at the Kirumba market where there are three such groups namely; Ibanda fish dealers comprised of 45 male and 5 females, Mwakyo cooperative society comprised of 44 males and 12 females, and Uwasa cooperative society consisting of 36 males and 10 females. The former are fish trading groups and the latter a processing group. There are also some 6 individual fish by-product processors and traders located in Mwanza city.

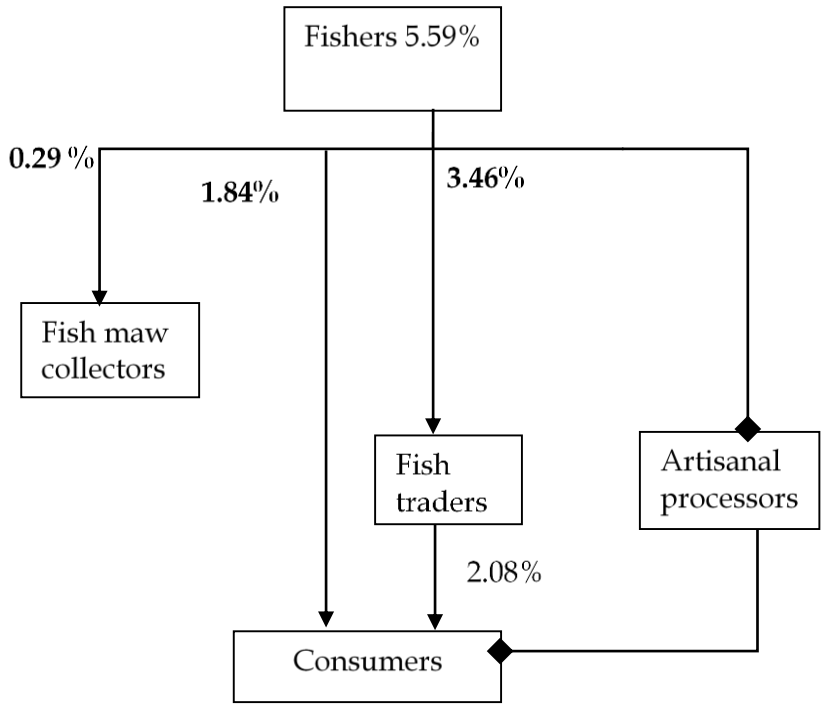

Figure 6.Value chain map of Nile perch destined for local market in Tanzania

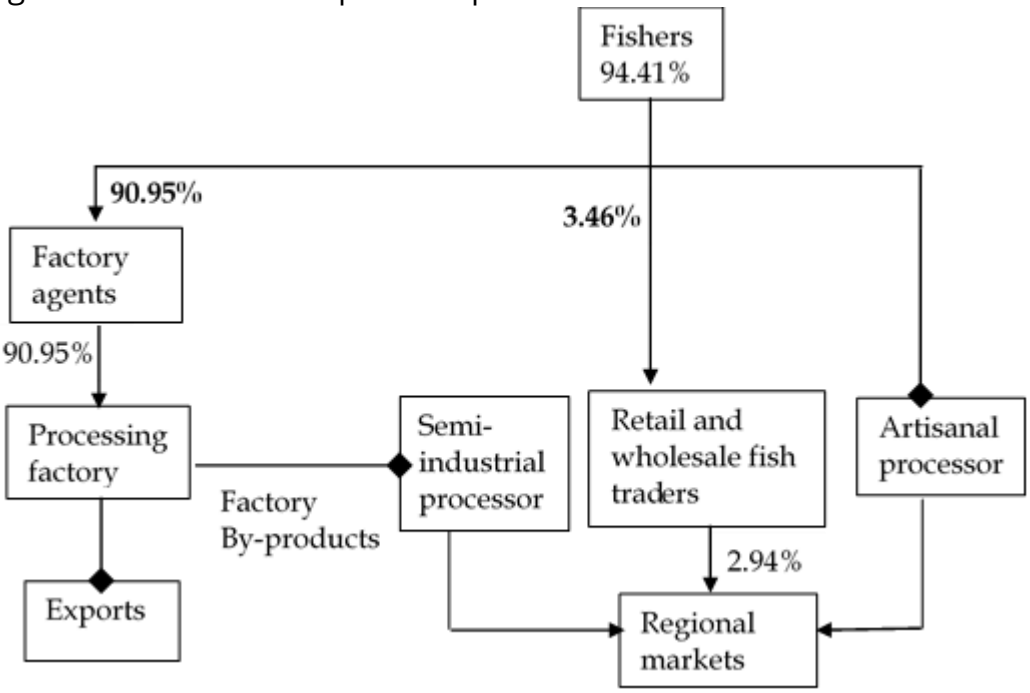

Figure 7.Value chain map of Nile perch destined for regional market in Tanzania

4.4.3 Value chain map for Uganda

Categorization of actors in Uganda's Nile perch fish value chain can be largely described by range of investment and function as explained below (Table 19).

Table 19. Description of actors in Uganda by scale and function

Actor type	Scale and functions of actor type
Large scale industrial fish processing establishments	Fish processing establishments with capital investments worth UGX 12 billion ($3.1 million) and above
Semi-industrial fish processors	Fish processing establishments with capital investments worth UGX 5 billion ($1.3 million) and below
By-products dealers	Traders that specialize in buying and selling fish bi-products only
Fish collectors	Are fish traders that dock containerized fish boats and buy fish from other fishers without actively engaging in fishing themselves.

Based on the field data and sampled respondents, the value chain can further be described based on the channel that fish follow once delivered at the beach by fishers. The channel that ends up in the local market, mainly targets Nile perch of large sizes, usually above 20 Kgs, with the fish maw being the target product. An approximate 4.14% of fish was recorded as traded through this channel. Similar to the Kenyan model, rejected fish at the landing sites on account of size or exportable quality issues, ends up joining the local market. Fishers fishing nearshore using small boats mainly sell their catch to fish mongers through this channel.

Fish maw traders who have increased over time, target buyers of large-sized Nile perch. These traders then remove the fish maw and sell it to the fish maw collectors or processing establishments. The remaining meat is sold to local markets, road side markets and to artisanal processors who either sell in cut portions as fresh or fried fish. Semi-industrial processors also buy small quantities of this fish and sell the non-exportable quality products to local buyers like hotels and restaurants. They also sell to other local and regional market outlets.

About 4.08% of fish was sold by fish mongers on the local market. However, the few traders that sell Nile perch in the local market usually deal with fish of un-processable quality and small un-acceptable sizes, although small sizes are now rare due to the ongoing slot size enforcement in Uganda. Some fish traders also sell their fish to artisanal processors that further process the fish by either deep frying, smoking or salting and sun drying. Since large volumes of Nile perch fish destined for artisanal processing are either of un-processable quality or immature, current

enforcement measures have led to low level of processing through smoking, salting and sun drying. Consultations from the Directorate of Fisheries Resources indicated that it is one of the management measures introduced to reduce processing of immature fish.

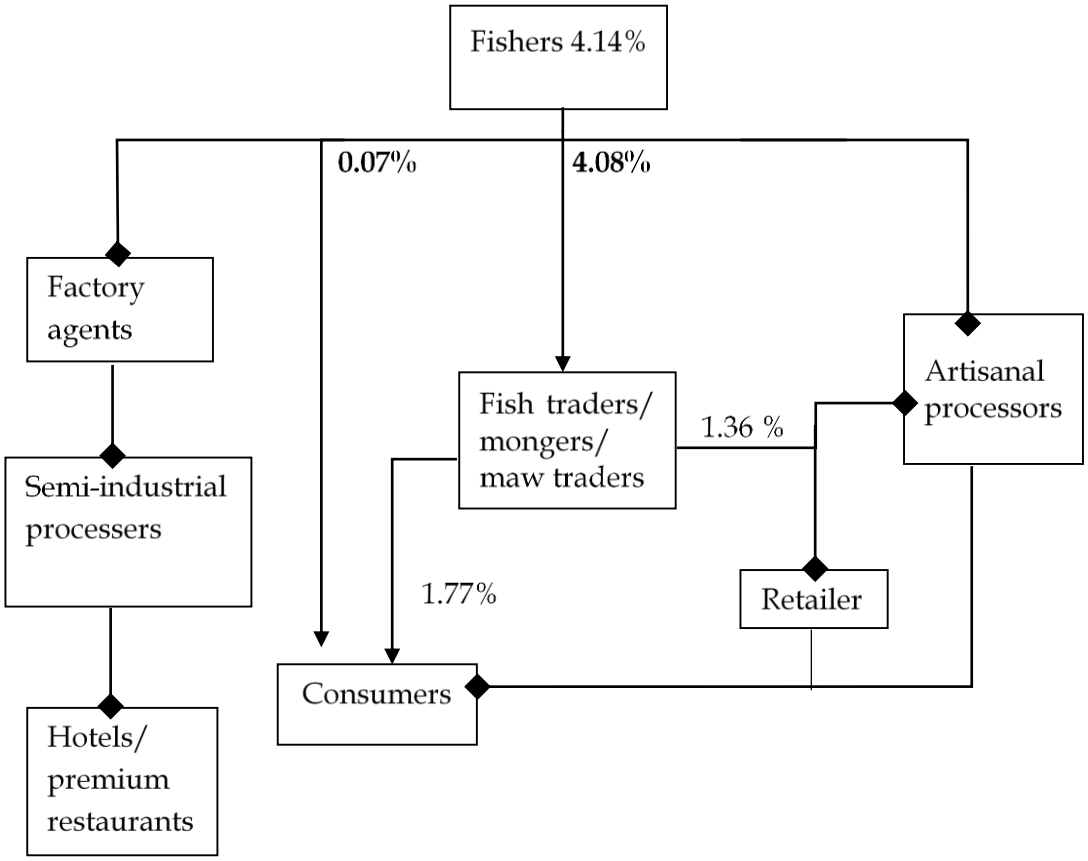

Figure 8.Value chain map of Nile perch destined for local market in Uganda

Majority (~95.86%) of the Nile perch fishers interviewed sold their catch directly to factory agents (Figure 8). This link is strong due to fishers' dependence on factory agents for operational cash or equipment loans advanced to them. Although majority of fishers owned their own equipment (Table 9), some explained that there was always a silent obligation to remain loyal to the factory agents who previously provided a loan to buy equipment and had to sell fish to them. This practice is prevalent especially in Kenya and Uganda. Through this arrangement, majority of the fishers are bound to supply specific factory agents through informal contracts which are also dependent on an individual's trustworthiness. This type of trading normally occurs at gazetted landing sites with gazetted Local Fish Inspectors (LFI) that inspect for quality and safety of the received fish. Unlike other fish species, Nile perch is only landed in gazetted sites that have BMUs, fisheries staff and company inspectors that records the volume as well as the quality of the product. It is upon satisfaction that the consignment is bought off and loaded into containerized trucks with ice at the ratio of 1:1 (fish to ice ratio). When the truck is full and ready to leave for the factory, the Local Fisheries Inspector certifies the consignment as fit for human consumption by issuing a Local Fish health certificate. In addition to health certificate, Tanzania, like the other riparian countries issues a fish movement permit

indicating the volume transported to the processing plant. However, this is not always the case as some of the trucks are impounded with undersized fish and still some fish are rejected at the factory because of quality issues after failing to follow laid procedure. Little compliance to this requirement can be attributed to inadequacy of fisheries staff at every landing sites and corruption. For the Ugandan fishery, another channel is where fishers directly sell their fish to factories who have landing jetties or stationed trucks at gazetted/approved landing sites.

A small number of fishers (~4.08%) of those interviewed sold their fish to collectors who transport it in containerized fish collection boats that also have ice. This mainly happens in the Islands where transportation of fish from a single catch to a gazetted or approved landing would be very costly. Some fish collection boats carry fish belonging to different owners who pay an agreed amount, usually ranging between 400 and 600 UGX per kilogram of fish loaded for transportation. Some fish collection boats belong to factory agents who buy off the entire catch upon landing.

Factory agents sell fish to both industrial and semi-industrial processors. Industrial fish processing factories mainly process for the premium high-end markets i.e. the EU, USA and Middle East, leaving by-products such as un-exportable quality fish fillets, red meat trimmings, fish frames, fish heads, skins, fats etc. for the regional market. Semi-industrial fish processors, process fillets targeting mainly the local and regional markets.

Similar to Tanzania, by-products from both types of industries are sold to dealers who are usually in large groups of organized traders in the chain with registered associations and have approved constitution governing them. The trade in by-products attracts an initial deposit to a processing establishment which acts as a guarantee and it is slowly deducted and topped up for as long as the contract is in force. Some of the processing establishments visited, reported that a single dealer is issued a tender to buy all by-products from the fish processing factories. The dealer then sells to fellow by-product traders, that then follow the chain of selling to the artisanal processor or individually processing them for the regional market.

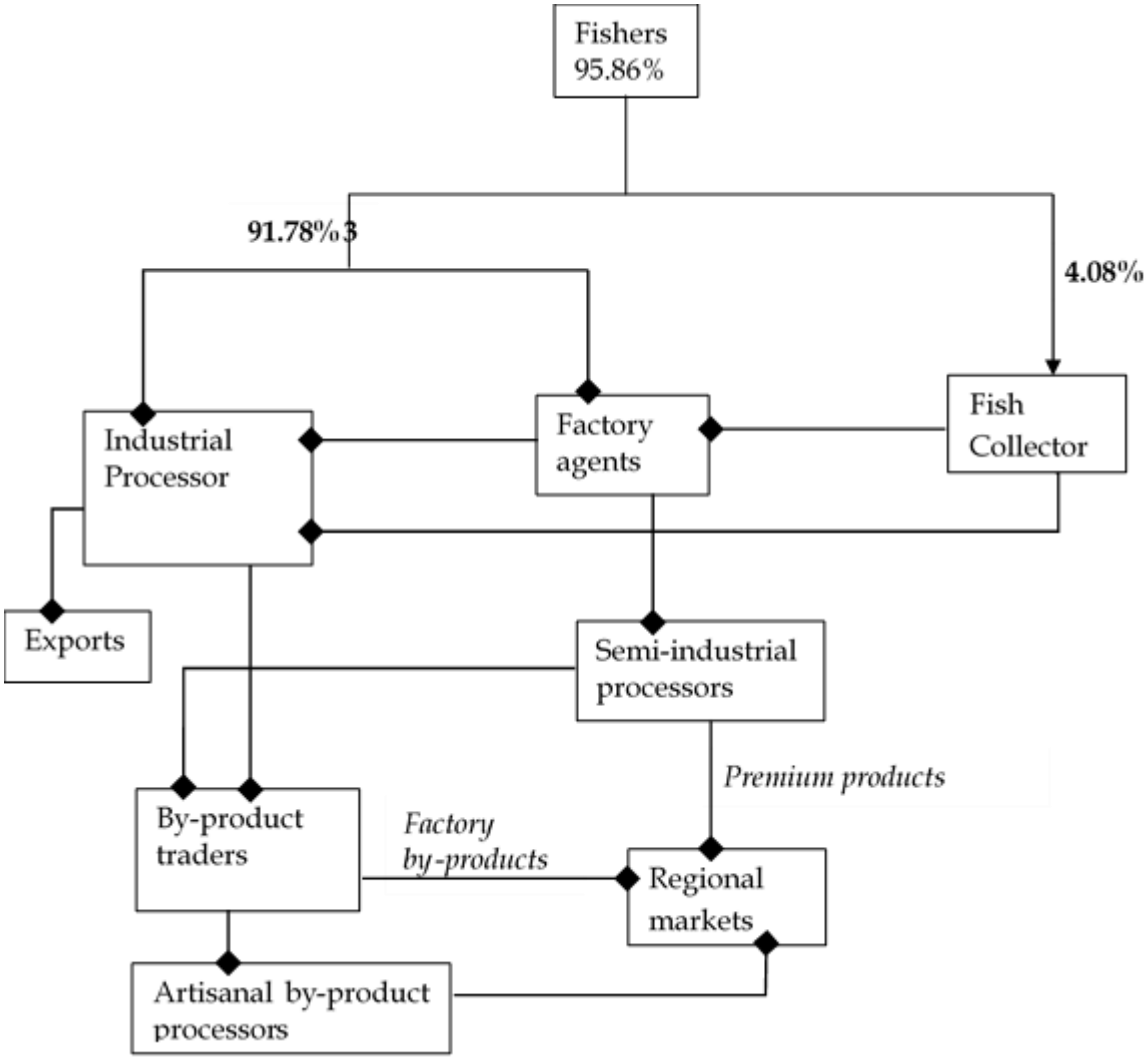

Figure 9.Value chain map of Nile perch destined for international and regional market in Uganda

4.5. *Actors' business models and profitability analysis*

4.5.1 Fishers

In terms of fish catch, gillnets average catch was 25 Kg/day/boat, with the lowest amount in Kenya the highest in Uganda (Table 20). Longline catches were 49 Kg/day/boat with the lowest amount in Tanzania and the highest in Uganda. This contradicts the 2016 stock assessment findings which show catch rates to be highest in Tanzania (LVFO, 2016b). However, the explanation for this outcome was thought to be the intense crackdown on illegal gears and enforcement of slot size in Tanzania and Uganda in the past few months. This means the catches reported might have reduced.

Fishers' costs during fishing can be divided into two categories. Variable costs that occur regularly such as fuel, bait, ice, food, levies, ice and gear accessories and fixed costs such as licenses and maintenance costs. Fixed costs incurred by gillnet fishers were an average of $ 180/month/fishing unit. However, fishers in Kenya incurred the least costs. This can also be related to the low investment amounts in Kenya

where most vessels were non-motorized compared to Tanzania and Uganda. Longlines incurred lower fixed costs compared to gillnets, at an average of $ 110/month/fishing unit.

Variable costs for gillnets in Kenya were also low at $ 49/month/fishing unit, while the regional average was $ 692. Both Tanzania and Uganda had relatively higher variable costs. The low variable costs in Kenya for gillnet vessels can be explained by the low level of motorization and hence lower costs in fuel.

Variable costs for longlines were relatively higher at an average of $ 1,095/month/fishing unit, but with the lowest in Tanzania and highest in Uganda. This is because of the low fuel prices compared to other countries and fishers do not travel to offshore waters all the time. As a result of this, they have low variable costs.

In terms of monthly boat profitability, gillnet fishers in Kenya realized the least amount ($ 318), while the regional average was $ 714. For the longlines average profitability was $ 691/month/fishing unit. Kenyan and Tanzanian profitability were higher, but very low for Uganda at ($ 118). One of the explanations given by fishers was that they were incurring very high variable costs, as also indicated by the data. The profitability figures presented here are only for the boat earnings. When divided amongst an average of three fishers and after paying off the boat owner's share, individual fishers earn considerably lower wages than shown here.

Fishers average breakeven fish quantity for gillnets was 92 Kg/month/fishing unit but lower for longlines at 27 Kg/month/fishing unit. However, there are large variations where longlines in Kenya attained negative breakeven point, suggesting that they had very low fixed costs, but higher variable cost per kg. Average sales breakeven point showed similar patterns as quantity where long lines in Kenya had negative breakeven point. The average breakeven sales was $ 242 for gillnets and $ 53 for long lines.

Table 20. Fishers' fish amounts, costs and profit analysis

Variable (Monthly)	Indicator by fishing unit type	Kenya	Tanzania	Uganda	Regional average
Average fish catch	Kg/trip for gillnet	9	22	33	25
	Kg/trip for longline	80	27	49	49
	Kg/month for gillnet	154	517	843	603
	Kg/month for longline	966	435	951	698
Fixed costs	Gillnet	$ 31	$ 215	$ 174	$ 180
	Long line	$ 150	$ 95	$ 74	$ 110
Variable costs	Gillnet	$ 49	$ 603	$ 990	$ 692
	Long line	$ 1,546	$ 364	$ 2,415	$ 1,095
Profitability	Gillnet	$ 318	$ 557	$ 1,033	$ 714
	Long line	$ 993	$ 671	$ 118	$ 691
Break even quantity in Kgs	Gillnet	16	163	18	92
	Long line	-15	62	7	27
Break even sales in USD	Gillnet	$ 41	$ 444	$ 29	$ 242
	Long line	$ -101	$ 167	$ 25	$ 53

Source: Survey data

4.5.2 Fish traders and factory agents

Fish traders traded an average of 78 Kg and 1,772 Kg for factory agents per trip. Monthly tonnage was an average of 1,391 Kg for fish traders—slightly less than that of factory agents per day. Factory agents' tonnage was 12,448 Kg per month on average, but with a wider range between countries. This translates to 2 trips/month for 7-ton truck. At country level, this translates to two trips in Kenya, one in Tanzania and four trips in Uganda. This indicates Uganda's turnover time was higher. Low trips for Tanzania can be attributed to the fact that the survey was conducted at the peak of crackdown on illegalities. This contributed to significant number of fishers temporarily leaving the fishery, thus lowering the amount of fish caught and transported to processing plants.

Fish traders and factory agents in the three countries incurred relatively low fixed costs (Table 21). This is reflective of the long spread of most costs e.g. licenses and maintenance costs. This is surprising since most traders and agents would be expected to incur higher costs in maintenance of boats. However, in this study this was not the case as is also corroborated by fishers, who owned most of their equipment. Variable costs were however relatively higher than fixed costs. Fish traders incurred an average cost of $ 172/month but lowest in Tanzania and highest in Kenya. Factory agents' costs were significantly higher than traders', with an average of $ 4,195.

In terms of profitability, fish traders had monthly profits of $ 589 on average, with an equal amount ($ 778) in both Kenya and Uganda and a lowest ($ 137) in Tanzania. Factory agents had significantly higher amounts in profits with an average of $ 8,316, with the highest amount in Kenya and lowest in Tanzania. These figures on factory agents were however obtained from a very low sample size and should be interpreted as such.

Fish traders' average breakeven fish quantity was 12.8 Kg/month and even lower for factory agents at 1.4 Kg/month. In terms of breakeven sales, they were also low at an average of $ 37/month for fish traders and only $ 4/month for factory agents. In comparison with fishers, fish traders and factory agents had much lower breakeven points, suggesting that they incurred very low fixed and variable costs. This is also evident from findings on fixed and variable costs.

Table 21. Fish traders and factory agents' fish amounts, costs and profit analysis

Variable (Monthly)	Indicator	Kenya	Tanzania	Uganda	Regional average
Average fresh fish volumes dealt with	Kg/trip for fish traders	70	41	140	78
	Kg/trip for factory agents	1,455	992	3,860	1,772
	Kg/month for fish traders	1,370	726	2,265	1,391
	Kg/month for factory agents	11,780	5,946	26,567	12,448
Fixed costs	Fish traders	$ 1	$ 7	$ 4	$ 3
	Factory agents	$ 17	$ 59	$ 15	$ 35
Variable costs	Fish traders	$ 245	$ 47	$ 184	$ 172
	Factory agents	$ 9,893	$ 656	$ 1,774	$ 4,195
Profitability	Fish traders	$ 778	$ 137	$ 778	$ 589
	Factory agents	$ 18,782	$ 1,015	$ 5,473	$ 8,316
Break even quantity in Kgs	Fish traders	5.4	22.9	4.7	12.8
	Factory agents	0.3	3.1	1.5	1.4
Break even sales in USD	Fish traders	$ 21	$ 62	$ 15	$ 37
	Factory agents	$ 1	$ 8	$ 4	$ 4

Source: Survey data

4.5.3 Artisanal and by-product processors/traders

Artisanal processors mainly dealt with smoked, dried and salted fish. They processed an average of 439 Kg/month (Table 22). However Kenyan and Ugandan processors had higher volumes than Tanzanians. The low volumes in Tanzania can

be attributed to the ongoing enforcement against undersize fish which was previously being processed. By-products processors/traders amounts for fresh products was an average of 9,315 Kg/month, with Ugandan processors dealing with the least amounts and the highest among Kenyans.

Fixed costs amongst both artisanal and by-products processors were relatively low, owing to low maintenance costs due to lack of investments in equipment (Table 11). Variable costs were relatively higher compared to fixed costs (Table 22). The average cost was $ 59, with the lowest cost in Tanzania and highest in Kenya. On average by-products processors incurred $ 195, with the lowest cost in Uganda and highest in Kenya.

In terms of profitability, Tanzanian artisanal processors earned very little, which is associated with the lack of availability of raw materials to process due to ongoing enforcement. In contrast, Kenya and Uganda artisanal processors earned higher profits of $ 307 and $ 745 respectively. By-products traders also earned higher profits of $ 801 on average, with the Kenyan single dealer earning the highest amounts and Tanzanian ones earning the least. It must be noted that these figures are from very low sample sizes for both types of processors and thus should be interpreted in this context.

Table 22. Artisanal and by-product' fish amounts, costs and profit analysis

Variable (Monthly)	**Indicator**	**Kenya**	**Tanzania**	**Uganda**	**Regional average**
Average volumes of assorted fish products and by-products	Kg/month for artisanal processors	1,467	64	1,150	439
	Kg/month for by-products processors/traders	12,900	9,500	5,545	9,315
Fixed costs	Artisanal processor	$ 1	$ 5	$ 18	$ 6
	By-products processors/traders	$ 11	$ 21	$ 4	$ 8
Variable costs	Artisanal processor	$ 284	$ 11	$ 122	$ 59
	By-products processors/traders	$ 505	$ 247	$ 126	$ 195
Profitability	Artisanal processor	$ 307	$ 5	$ 745	$ 136
	By-products processors/traders	$ 2,424	$ 319	$ 941	$ 801

Source: Survey data

4.6. *Savings culture of actors*

On average, factory agents as would be expected of high-income earners, saved the highest amounts of money per month and surprisingly followed by fishers (Table

23). Generally, Kenyan actors had higher savings amount than Tanzanians and Ugandans. The Kenyan factory agents had the highest amounts of savings which can be partly explained by the high profitability they attain.

Table 23. Actors' monthly savings amount in USD

Actor type	Kenya	Tanzania	Uganda	Regional average
Factory agents	1,744	234	103	745
Fishers	384	102	397	246
Fish traders	253	64	146	172
By-products trader	240	-	114	127
Artisanal processor	20	47	-	37

Source: Survey data

Generally, in Kenya there was a higher saving rate in banks with 33%of actors saving in banks, compared to 28% in Tanzania and 30% in Uganda (Table 24). Majority of fishers in Kenya preferred saving through mobile money platforms, while in Tanzania and Uganda they preferred keeping their money in cash at home. Artisanal processors in Kenya preferred saving through merry go-round while those in Tanzania were keeping their money in cash at home or saving through mobile money platforms Those in Uganda were not saving at all. Savings through merry-go rounds, mobile money and at home by some actor groups suggests that they preferred ready cash channels rather than those that required some form of transactions to access the money. On the other hand, factory agents and fish traders preferred banks and mobile money platforms to save. Generally, cooperatives, merry-go-round (table banking), micro-finance institutions were not in much use amongst most actors. The banking and financial technology system is fast getting entrenched where it is easy to just transact using a mobile phone via multiple bank platforms and services, thus making it easier to transact and save. This might explain why the micro-finance and cooperatives are not the preferred option. Mobile phone platforms are also increasingly providing quick loans such as M-Shwari in Kenya through the MPESA mobile money platform operated by Safaricom (Kenya's largest mobile company). This may also partly explain the low levels of savings with cooperatives and micro-finance institutions that would offer the same service, but under more stringent conditions than mobile money loans.

Table 24. Institution used by actors for savings by percentage and by country

Actor type	Artisanal processor	By-products trader	Factory agent	Fish Trader	Fisher	Country Average
	Kenya					
Commercial bank	-	100%	100%	33%	21%	33%
Commodity group	-	-	-	-	-	-
Cooperative	-	-	-	-	8%	5%
Factory agent	-	-	-	8%	8%	7%
House	-	-	-	8%	8%	7%
Merry-go-round	100%	-	-	25%	-	12%
Micro-finance bank	-	-	-	8%	-	2%
Mobile phone savings	-	-	-	17%	54%	35%
None	-	-	-	-	-	-
	Tanzania					
Commercial bank	-	100%	50%	20%	32%	28%
Commodity group	-	-	-	-	-	-
Cooperative	-	-	-	20%	2%	3%
Factory agent	-	-	-	-	-	-
House	50%	-	17%	-	36%	34%
Merry-go-round	-	-	-	-	-	0%
Micro-finance bank	-	-	-	0%	-	0%
Mobile phone savings	50%	-	33%	60%	30%	35%
None	-	-	-	-	-	-
	Uganda					
Commercial bank	-	-	33%	50%	30%	30%
Commodity group	-	-	-	-	4%	3%
Cooperative	-	-	-	-	-	-
Factory agent	-	-	-	-	4%	3%
House	-	33%	-	25%	52%	42%
Merry-go-round	-	-	-	-	-	-
Micro-finance bank	-	-	-	-	4%	3%
Mobile phone savings	-	-	-	-	4%	3%
None	-	67%	67%	25%	-	15%

Source: Survey data

4.7. *Analysis of infrastructure and opportunities for improvement*

Frame survey, biennial fisheries statistics often provide information on the social infrastructure at landing sites. Based on results of the frame survey of 2016, there are a total of 1,535 landing sites across Lake Victoria. The results also indicate a notable increment in the number of some facilities and services at the landing sites.

For instance, the number of landing sites accessible to all weather roads increased from 601 to 653 from 2014 to 2016 respectively, similarly those connected with electricity also increased to 241 from 154 recorded in 2014 survey. However, some facilities decreased as represented by drying racks and smoking kilns (Table 25).

From the study, most of the landing sites and markets visited, reflect the regional picture presented below. Most of the landing sites visited lacked requisite facilities such as functional cold rooms and ice making machines, drying racks, smoking kilns, fish *bandas*, electrical supply, portable water and accessible to all weather roads. This makes fish handling challenging due to lack of these facilities. Artisanal processors and traders also faced severe challenges in terms of lack of sheds for conducting business especially at markets and at landing sites.

Table 25. Facilities and services at landing sites in Lake Victoria

Variable	2014	2016
Number of landing sites	1,530	1,535
Landing sites with bandas (Fish shed)	293	295
Landing site with cold rooms	35	41
Landing sites with working cold rooms	12	13
Landing sites with drying racks	169	146
Landing sites with smoking kilns	428	395
Landing sites with fish stores	79	76
Landing sites with electrical supply	154	241
Landing sites with portable water	208	289
Landing sites accessible to all weather roads	601	653
Landing sites with mobile networks	1450	1479

4.8. *Constraints facing actors*

A number of constraints were recorded from the study and are presented below as a consolidation based on value chain dimension by actor type. A detailed list of specific constraints is listed in annex (Table 35).

4.8.1 Fishers

Fishers' ranked market constraints at the top with 24% of them ranking market issues as the most severe, followed by infrastructure, security and occupational safety and costs in that order (Table 26). There were however country specificities, with Kenyan fishers ranking high security and occupational safety concerns compared to the other two countries. Most fishers at all the places reported being harassed by security forces from Uganda in turn accused them of trespassing and fishing without requisite documents required. Interestingly, contrary to popular sentiments that fishers lack capital and access to credit were not highly ranked. They also did not seem to be overly concerned about resource decline in the same level as managers.

Table 26.Fishers' perception of constraints in percentage

Value chain dimension constraint	Kenya	Tanzania	Uganda	Regional average
Markets	27	25	21	24
Infrastructure	13	16	14	15
Security and occupational safety	28	9	16	15
Costs	7	19	7	14
Regulatory requirements	0	14	13	11
Entry capital	15	3	15	9
Resource decline	3	4	9	5
Financial access and inclusion	3	6	1	4
Stakeholder involvement	3	4	2	3

4.8.2 Factory agents and fish traders

Factory agents and fish traders, similarly to fishers reported market constraints as most severe followed by regulatory requirements and security and occupational safety, infrastructure and costs in that order (Table 27). Country specificities also indicated that Tanzania and Uganda ranked regulatory requirements at the same level as markets. Kenyan factory agents and fish traders indicated security concerns as a priority that needed attention, lamenting that they bore the brunt when their equipment used by fishers was confiscated by Ugandan forces and were forced to pay heavy fines.

Table 27.Factory agents and fish traders' perception of constraints in percentage

Value chain dimension constraint	Kenya	Tanzania	Uganda	Regional average
Markets	21	22	19	21
Regulatory requirements	7	22	19	14
Security and occupational safety	21	3	5	12
Infrastructure	9	14	14	11
Costs	5	11	19	10
Financial access and inclusion	7	17	5	10
Entry capital	7	3	10	6
Resource decline	5	8	5	6
Business risk	11	0	0	5
Post-harvest losses	7	0	5	4

4.8.3 Artisanal fish processors

Market and infrastructure constraints were ranked as most severe by artisanal fish processors just as fishers and traders (Table 28). They were also severely constrained by high costs of operations and low financial access.

Table 28. Artisanal fish processors' perception of constraints in percentage

Value chain dimension constraint	Kenya	Tanzania	Uganda	Regional average
Markets	29	29	29	29
Infrastructure	29	17	15	17
Costs	0	14	18	14
Financial access and inclusion	14	14	12	13
Regulatory requirements	0	17	6	11
Security and occupational safety	0	3	12	7
Resource decline	14	3	3	4
Entry capital	0	0	6	3
Stakeholder involvement	14	3	0	3

4.8.4 Industrial and semi-processors

Industrial and semi-industrial processors had fewer, constraints facing them as listed below (Table 29).

Table 29.Industrial and semi-processors' perception of constraints

1. Low fish prices
2. High operational and input costs
3. Competition for fish from neighbouring countries
4. Harassment by security forces
5. Declining catches/supply
6. Difficult loaning conditions
7. Levies (double taxation)
8. Poor transport
9. Stiff competition from fish maw processors

4.9. *Employment and wages*

Employment, wages and staffing data on Nile perch fishery is not readily available. However, from field surveys, a number of variables were collected. Fish traders and artisanal processors generally had no employees. However, artisanal processors sometimes engaged 1-2 casual labourers, when a lot of processing requiring speed had to be done to avoid spoilage. By-products traders and semi-industrial processors undertaking by product processing were varied in terms of workers engaged, between 5 and 30 and mostly on a casual labour basis.

On the other hand, factory agents had a relatively consistent model of engagement where they engaged 5 workers on average. Monthly wages for labourers engaged were variable with workers paid an average of $ 350 in Kenya, $ 35 in Tanzania and $ 128 in Uganda. The large variation can be attributed to the position and education

of workers. Managerial staff with at least tertiary level of education were paid higher than non-specialised workers with low level of education.

Industrial processing factories had the highest number of employees. On average they employed 71 permanent staff and 58 temporary staff (Table 30). On average 80 0f the employees were males and 49 females. Data from industrial processors from Tanzania was challenging to obtain. Level of wages, training and education for workers was also challenging to obtain in all the three riparian countries. Nevertheless, there were common features on the cadre of employees and organization.

Processing factories generally have the main department being production unit, with several sections such as fish receiving and washing, filleting, trimming, packing, freezing/blast, storage (chillroom/coldroom), by product, loading, quality control, cleaning, and packaging. Staffs in these sections have primary and secondary education and long-term experience between 7 to 10 years. These employees earn between about $ 3-5/day in Kenya, $ 1.3-4.4 in Tanzania and $ 2.3 in Uganda depending on the nature of work. However, the head of each section has either a diploma or degree in food processing and handling, microbiology and marketing. Other departments are transport (truck and boat), engineering (machine and garage), and accounts and procurement. These departments save for transportation section has employees with requisite qualification in accounting, procurement, mechanical and electrical engineering, refrigerator and air conditioning knowledge. Each section has between 25 to 50 staffs, but with a slight dominance of men.

Table 30. Staffing in industrial processing factories

Variable	Kenya	Uganda	Regional average
Average of No. of permanent staff	95	56	71
Average of No. of temporary staff	73	48	58
No. of males	107	62	80
No. of females	61	42	49

5 Discussion

5.1. *Actors in the Nile perch Value Chain*

Actors in the Nile perch fishery are young and most are new entrants. This indicates that the most energetic individuals dominated the fishery, which can be viewed positively in the lens of provision of adequate labour force. However, it may also be an indication of deteriorating income alternatives necessitating inflow of new entrants. While this data is insufficient to come to such a conclusion, it points to where more research can be directed. Although a majority of actors were literate, they were mostly below primary education level. This can portend low levels of knowledge on many factors that may be necessary for management of the fishery, maintenance of fish quality or even personal development such as financial management.

One major observation from this study indicates that the Nile perch fishery remains a lucrative business in the Lake Zone. It has continued to attract new entrants in all the various sectors such as fishing, trading and artisanal processing. Whereas the fishery is dominated by a relatively young population, what is striking is the number who have joined the fishery in the last 10 years (Table 2). It is worth noting that with these new entrants into the fishery, Nile perch remains a significant employment avenue for the local people. Given the observation made that most actors in the artisanal processing are women while at the same time new entrants in this area stands at about 75% in the last 10 years, women have found Nile perch processing a lucrative activity to engage in. These results confirm what has been the trend in Nile perch fishery for a prolonged period of time (see Lwenya et al 2006, Odongkara et al 2005, Odongkara, 2006 and Onyango et al 2006). The results also indicate that traders take more time in their trade of Nile perch than any other activity they undertake.

5.2. *Nile perch value-chain analysis*

Nile perch has three main value chains in the three countries. The first is the chain that targets national market while the second targets regional markets and a third which targets the international (overseas market). Our focus is however, the national and regional markets. The national market absorbs various Nile perch products right from the landing sites to the more interior areas. Our study results based on a small sample size in the landing sites sampled indicate that most Nile perch fished was sold to fish factory agents and about 30% went to the national markets in Kenya while less than 10% went to the national markets in Tanzania and Uganda. However national statistics indicate otherwise for example for Tanzania which indicates that only 38% of fish is processed. This needs further verification to see what would be results with a larger sample size and perhaps over a longer period. The study was also conducted during a crackdown for undersize fish and thus the indication for Tanzania and Uganda that large volumes of fish were ending in factories could have credence.

There are indications also that, exports to the regional market has been on the increase since 2010 especially for the salted *Kayabo* as a result of high demand of swim bladder in the international markets (*per observations*). Most of the Nile perch by-products are sold in local markets to consumers, while the regional market for Nile perch fish and products has remained Rwanda, Burundi and DRC and Southern Sudan (Lwenya, 2006 and Onyango, 2015). Nile perch is traded smoked, salted, sun-dried and deep fried and also has several by-products.

5.3. *Infrastructure and processing methods*

Processing of fish for the local and regional market is undertaken through smoking, sun-drying, deep frying and salting. Other products traded in the region include fish fats, frames, heads and skins. The use of Kilns for smoking, racks for sun-drying and three stone stoves for deep frying dominate the artisanal processing infrastructure. Some of these infrastructures are still traditional i.e. the use of three stone stoves for deep frying. There are efforts to improve both smoking Kilns and sun-drying racks. However artisanal processors have found the cost involved in the improved equipment way far off beyond their means thus they resort to the old traditional mechanisms. This is indeed an area that can be strengthened in terms of more research and development by government and development partners.

Traditionally, Nile perch processing methods have ensured longevity of the fish. For example, the use of salt in preserving fish. Salt has the ability to absorb water from fish, creating an environment in which development of mold and bacteria are impaired. It is argued that bacteria that decay food and causes diseases are killed by a high concentration of salt. Smoking and deep frying also have almost similar effects on fish but not as effective as salting. Sun drying, the oldest traditional way of preserving fish, has similar effects of removing water from fish thus inhibiting microbial growth and chemical reactions. The challenge that these processing methods faces in the region is the infrastructure used. There are no facilities to dry the fish and its products to complete dryness, moreover during rainy season processors face serious problems. Smoking also faces the similar problem. The areas where processing takes place also raises sanitary and hygienic questions. In addition to using traditional smoking methods, the use of wood as a source of energy has a spiral effect as it clears trees that are useful for reducing soil erosion. When trees are cleared, agriculture, which is another activity of these fishers is greatly affected.

5.4. *Market opportunities and challenges*

Pricing of Nile perch does not follow any standards as is the case in other protein foods such as meat and beans among others. Pricing largely depends on several variables, including bargaining power and market factors. The bargaining power

depends on the size of the fish, demanded and the quantity in the market as well as storage ability. This limits Nile perch fishers and traders to realize the full value of the fish. It could be beneficial for fishers and traders to standardize their pricing methods according to weight, as it is currently the practice with trade in beef and other protein foods, rather than sell by estimating fish size using visual determination.

Nile perch prices differ according to size and quality in the region. Prices of Nile perch fish increases with size. The prices for the large-sized fish are more than double the price of small-sized fish in both Kenya and Uganda where such fish are found. This is not good for recruitment and sustainable stock. The large-sized fish are the adults are important for stock recruitment but their high prices are an attraction for their high catch and trade. A fisher will not go for small-sized fish if with less than the quantity of the large-sized fish he can get more than double the income given the higher prices. The large-size fish also gives in addition the swim bladder which fetches more than double the price of the fish it comes from.

The current Nile perch management plan (NPFMP-II) proposes three key immediate strategies to revive the dwindling fishery including access controls by fishers, control of illegal gears and regulation of post-harvest including regional and fish maw trade. Efforts in achieving the first two controls has been attempted where lake-wide licensing under a regional framework of licensing has been undertaken, while intensive MCS has been taking place in Tanzania and Uganda. Controls on fish maw trade has however been challenging and not uniformly and properly regulated across the three countries. Although the LVFO Council of Ministers in its communique of November, 2013 called for re-activation of OSNP, only in 2018 has it been reactivated and even then no funds have flowed to Partner states yet. This hinders progressive tackling of illegalities in the lake.

NPFMP-II also calls for harmonization of procedures and conditions attached to licensing among the three Lake Victoria riparian States. However, this has so far not occurred. It also calls for licensing of all post-harvest actors. This has also not been effectively undertaken and was even challenging to get statistics for this study. For instance, most district officials reported not having any records on these actor groups. NPFMP-II also notes key challenges facing the Nile perch fishery as; lack of infrastructure and equipment, the use of unsuitable practices in fish handling, processing and marketing, poor fish quality control and inadequate market information systems

5.5. *Fish consumption and preferences*

Discussion with fishers revealed that consumption is not a problem within the fishing community since fish is in high demand and even the fishers themselves consume their own catch. This is similar to findings of Onyango et al (2005) which

reported that 60% of the fishers always eat fish. They revealed that they eat Nile perch most followed by Tilapia and Dagaa. However, when asked on the fish they prefer most, majority 49% indicated Tilapia and then Nile perch 33% and dagaa 12%. The remaining percentage have preferences to other fish species. At the same time, information on fish preference and consumption by destination indicate that most people within the fishing communities consume fish in its fresh form, with few people preferring fried fish. People in these communities prefer fresh fish because it is easily available. This is different from hinterland and other areas where smoked and salted fish are preferred and consumed because they are cheap and have a longer shelf life. In addition, there are fears that quality of the fresh fish may be compromised. At the regional level, Kayabo (smoked/salted) Nile perch and fish frame are more preferred in DRC than any other destination. The reason for preference and consumption is because the longer shelf life and low price of buying the fish.

In the present study, when traders and processors were asked about what their customers preferred, they reported to be everything they were sellling and could not pinpoint specific products over others. This suggests that a more detailed consumer preference study for Nile perch fish products and by-products is needed, where consumers can be the target respondent.

6 Conclusions and recommendations

This study has revealed that Nile perch value chain is generally not simple. Nile perch flows through a number of channels from the landing sites to the consumers. In the local market, Nile perch and or its products sold in one market originates through more than one channel. Several actors are noted to be involved in the channel. Women remain significant players in the processing and trade of Nile perch

5.6. *Handling and processing*

Handling and processing of Nile perch for the national and regional market remains underdeveloped. Although the fish handled and processed for these markets have served the populations for a considerable period of time, the handling requires special efforts to improve. There is need to invest in cheap processing technologies which will enable complete dryness and avoid re-drying as is the practice nowadays. Moreover, improvement of packaging materials is inevitable. There is need to move away from the use of simple packaging materials, although they are preferred due to their low cost, convenience of handling and readily available. They are also preferred due to ability for reusing a number of times before they are discarded. There is need to explore the use of materials that are not fragile, can be easily cleaned after use to prevent recontamination of the fish products. Baskets and sacks, currently in use, do not offer any barrier to insect infestation and rodent attack, nor are they impervious to water or other fluids. As a consequence of these, products stored in baskets, mats or sacks are susceptible to rapid deterioration if exposed to rain.

Nile perch has several products that are traded in the national and regional markets and costs for these products are not significantly different in the regional market despite the origin of the fish product.

5.7. *Infrastructure development*

The mobile saving platform has really created an environment for fishers to save their money although a significant number still save money at home. The use of commercial banks is a preference for a high number of factory agents. Efforts need to be directed either at taking the commercial banks to the fishers or commercial banks should enter into agreement with the mobile phone companies on savings schemes.

Infrastructural improvement remains one limiting factor in the Nile perch value chain. Not all landing sites have received electricity which is crucial in establishing ice plants and even pumping of water. Less than a quarter of the landing sites have access to potable water. It is therefore noted that investment in infrastructure is principal in ensuring that Nile perch yields it full potential in ensuring better access to fisheries products and employment opportunities, promotion of sustainable fisheries and reduction of illegal, unreported and unregulated (IUU) fishing.

5.8. *Marketing (current and future)*

The pricing system used in the fishery raises questions as to whether it yields the correct value of fish. The use of estimating size by visual determination is very subjective. Although fish going to processing factories is sold using weights, that going to the national and regional markets is sold through estimation of size and deriving prices. It could be beneficial for buyers and sellers to adopt pricing methods according to weight, as is done with other products other than fish. This will likely address the low profitability that fishers earn.

The difference in profitability to fishers using either long lines or gillnets is not significant (USD 714 and USD 691 respectively). The break-even point for the gears however is significantly different (92Kg/month/fishing unit for gillnets and 27Kg/month/fishing unit for longlines). Operationally, long line is the most expensive gear to operate compared to gillnet, which remain as most expensive in terms of investments. This implies that fishers will prefer to use longlines than gillnets although the two gears can still be used.

5.9. *Legislation*

Managing the Nile perch value chain is crucial to ensure sustainability of the stocks and continued availability of the fish. According to the findings of this report, Nile perch has not only provided incomes to local people but it has been an important source of food too. Its management should take cognizance of this fact. Policies for its management should integrate food and nutrition security, welfare and economic development. Legislation used for its management should place resource wealth at the center. Efforts are also needed to build Nile perch stocks through effort control, especially eliminating illegal fishing gears and practices without jeopardizing employment opportunities (i.e. creating alternative employment opportunities). The management approach should ensure that creation of wealth does not encourage over-exploitation. It is important to establish a sustainable capacity enhancement to deal with the complexities of the fisheries and the ensuing changes. Concerted efforts should also be directed at establishing a permanent and sustainable funding mechanism for the management of the fisheries. Management should give the resource users, in the value chain, the incentive to generate the full range of benefits on a sustainable basis. At a broader regional policy level, a number of measures are needed to promote regional trade in fisheries. These include:

Expand and operationalize Internal and External One Stop Border Post (OSBP)

OSBP is key to aligning National and Regional Fish Trade Policies. Creating of OSBP with Compliance Assessment Framework and Simplified Trade Regimes that allow common recognition of quality and safety standards, customs clearance and

administration procedures will facilitate speedy movement of fish products across common borders. There are several OSBP being established within the SADC, COMESA and EAC REC's regions, these OSBP are strategically selected to become efficient transit and trade corridors. In addition to the already established OSBP, it is advised to expand more internal and external borders at the main sea-ports. These will reduce the costs of cross-border trade by simplifying internal border formalities, avoiding unnecessary duplication of clearance procedures at borders and fully opening up markets in the region, hence enabling participating Member States to take advantage of the economies of scale.

Harmonization of Trade Tariffs (Tariff Barriers, Non-Tariff Barriers and Common External Tariffs)

EA countries are part of several regional trade agreements, the existence of overlapping of regional (EAC, SADC and COMESA) as well as bilateral trade is considered as a challenge. It raises the problem of coordination and commitment for an individual country, which in turn limits the effectiveness and implementation of agreed protocols.

Common External Tariff (CET) is set based on Rules of Origin that exist in different categories of trade regimes on capital goods, raw materials, intermediate goods and final goods, there is need of aligning them to the national regulations. It is also the case now that Tariffs and Non-Tariff Barriers are eliminated for member countries based on agreed Rules of Origin.

Formulate regional certification policies, certification procedures, standards and regulations for promoting inter and intra-regional fish trade

Domesticate and or support the African Eco-labeling certification scheme to facilitate inter and intra fish and fishery products trade flow as well as providing requirements for the sustainable marine and inland capture fisheries harvesting. Additionally, such a scheme is expected to provide information to consumers that a fish product has been produced from or through an improved environmental performance compared with similar products. Studies have indicated that, consumers are now concerned with food quality in terms of taste, safety, cost, health benefit, local business

Specific recommendations and proposed interventions are listed here

Recommendations	Proposed interventions	Actors involved
Undertake a baseline survey to ascertain the operating conditions and requirements for the fish	- Mobilize research funding - Commission a detailed survey capturing key aspects of the by-products chain	- By-product dealers (ex-factory), processors, retailers and

by-products chain and the consumer preferences	- Conduct a consumer preference study targeting the consumer end	consumer end players (individuals, restaurants, hotels, supermarkets)
Improve processing conditions and marketing of by-products for the regional market.	- Educate processors on improved processing methods and fish handling techniques and standards - Mobilize resource for research and investment in appropriate and affordable processing technologies with establishment of pilot sites in each country	- By-product dealers (ex-factory), processors and retailers
Improve data collection and documentation of fish by-products trade especially at border posts and markets	- Establish a sustainable and permanent border monitoring on fish by-products and fish markets - Draft Standard Operating Procedure for data collection	- By-product dealers (ex-factory), processors and retailers - Border Fisheries Inspectors - LVFO
Institutionalize data collection for post-harvest sector at biennial intervals, similar to frame survey and CAS	- Draft Standard Operating Procedure for census data collection targeting post-harvest sector players. This can be done by embedding it to the frame survey or conduct a separate exercise	- Fisheries Officers - LVFO
Embrace the new value chain dynamics and re-orient policy towards resource sustainability with equitable benefits for all, while balancing the needs of each actor group	- Establish a mechanism of increased government, NGO and private-sector support - Formulate organizational models and agreement to improve bargaining power of fishers and traders	- Fisheries management authorities - LVFO

	- Establish a sustainable funding mechanism that will focus on technology research and development - Revise legislation to enable fishers to adopt more consistent pricing methods. - Formulate legislation that considers by-products as significant economic sectors based on their significance that is emerging	
Develop mechanisms to address cross-border conflicts and insecurity	- Harmonize tariffs and non-tariffs that affect trade in Nile perch and its products - Establish quality laboratories at the border points to ensure compliance to food Safety standards - Improve security in the lake in the wake of serious thuggery targeting fish and boat engines - Establish a cross-border mechanism for registration and tracking of boat engines across the three countries to stem theft	- Fisheries management authorities - LVFO - Riparian security agencies
Harmonise and enforce slot-size limits across all countries	- Formulate and establish a periodic decision-making mechanism/process on Nile perch fishery and trade	- Fisheries management authorities - LVFO

7 References

Fennema OR. (1996). Food chemistry. 3rd ed. New York: Marcel Dekker.

GoK. (2015). Kenya fisheries annual statistical bulletin. Nairobi: State Department for Fisheries and the Bue Economy, Governement of Kenya.

Ikwaput-Nyeko, J., Kirema-Mukasa, C., Odende, T., and Mahatane, A. 2009.

LVFO. (2015). Nile Perch Fishery Management Plan for Lake Victoria, 2015-2019. Jinja: Lake Victoria Fisheries Organization. Retrieved from http://www.lvfo.org/content/documents-0

LVFO. (2016) Technical Report: Stock Assessment Regional Working Group. Jinja, Uganda: Lake Victoria Fisheries Organization, 17 pp.

LVFO. (2016a). Fisheries Management Plan III (FMP III) for Lake Victoria Fisheries, 2016-2020. Jinja: Lake Victoria Fisheries Organization. Retrieved from http://www.lvfo.org/content/documents-0

LVFO. (2016b). Report on regional Stock Assessment for Lake Victoria. Jinja.

LVFO. (2016c). Report of the lake-wide hydro-acoustic and environmental survey. Jinja: Lake Victoria Fisheries Organization

LVFO. (2016d). Regional status report on Lake Victoria bi-ennial frame surveys between 2000 and 2012. Jinja: Lake Victoria Fisheries Organization

LVFO. (2017). Report of the lake-wide hydro-acoustic and environmental survey. Jinja: Lake Victoria Fisheries Organization

Lwenya, C., E.O. Yongo, and R.O. Abila, (2006) Assessment of the Cross-border Fish Marketing Channels for the Major Commercial Fish Species of Lake Victoria: Case of Kenya.

Management of Fishing Capacity in the Nile Perch Fishery of Lake Victoria. African Journal of Tropical Hydrobiology and Fisheries. 12: 67-73

Mkumbo, O. C., & Marshall, B. E. (2015). The Nile perch fishery of Lake Victoria: current status and management challenges. Fisheries Management and Ecology, 22(1): 56-63. doi: 10.1111/fme.12084.

MRAG. (2008) Technical Report: Value-chain Analysis of Lake Victoria Nile perch Fishery. Jinja, Uganda: Lake Victoria Fisheries Organization

Odongkara K, M. Kyangwa, J. Akumu, J. Wegoye and I. Kyangwa (2005). Survey of the regional fish trade. LVEMP Socio-economic Research Report 7. NARO-NAFIRRI, Jinja.

Odongkara, K. (2006). Generation, flow and utilization of information on the regional fish trade. IMFP Socio-economic Series 2. Jinja, Uganda.

Ogwang', V.O, Nyeko, J. I and Mbilinyi, R. 2009. Implementing Co-management of Lake Victoria's Fisheries. Africa Journal of Tropical Hydrobiology and Fisheries, 12: 52-58.

Onyango, P. O, M. Salehe, and H. D. J Mrosso, (2006). Assessment of the regional fish marketing channel for the major commercial fish species of Lake Victoria, Tanzania. IFMP Technical document.

Onyango, P.O., M.Salehe., H.D.J . Mrosso (2005) Lake Victoria Socio-economic Baseline Survey, Tanzania. IFMP Technical document

Potter NN, Hotchkiss JH. (1995). Food science. Food science texts series. 5th ed. New York: Chapman & Hall.

World Bank (2009). LVEMP II Project Appraisal Document Report No 45313-AFR, 197 PP).

8 Annexes

8.1. *Study sites*

Table 31.List of landing sites and markets visited in each country

Kenya		Tanzania		Uganda	
County	**Site**	**District**	**Site**	**District**	**Site**
Busia Kenya	Marenga, Osieko, Busia border post	Bukoba	Mubembe	Buikwe	Kiyindi
Homabay	Kiumba, Sori	Busega	Ihale, Nyamikoma,	Buvuma	Lyabana, Mawungwe, Mubaale, Nalubaale,
Kisumu	Asat, Dunga, Obunga artisanal processing site	Ilemela	Kayenze, Ndogo,	Busia	Busia Market, Busia border post
Migori	Nyang'wena, Sori,	Magu	Kigangama	Masaka	Kachanga, Kaziru,
Siaya	Uhanya, Usenge,	Rorya	Nyang'ombe, Sota,	Wakiso	Kasenyi
				Kasese	Mpondwe border post
				Kampala	Gaba market

8.2. *Installed capacity of Nile perch processing plants in East Africa*

Table 32. Installed processing capacity for Kenyan processors

Name of Establishment	**Annual installed capacity in Metric Tons**	**Estimated daily installed capacity in Metric Tons**	**Holding capacities of Cold stores in Metric Tons**	**Comments on operating capacity**
East African Sea Food Ltd	11,520	37	150	Operating below Capacity
Fish Processors (2000) Ltd	9,600	31	135	Operating below Capacity
Kendag Limited	8,640	27	100	New Establishment
Ceer Processing Ltd				

Table 33. Installed processing capacity for Tanzanian processors

	Region	**Name of Establishment**	**Installed Processing Capacity (tons/day)**	**Current Status**	**Current Production (tons/day)**	**% Utilization Capacity**
1	Mwanza	Vic Fish Ltd	140	Working	60	43
2	Mwanza	Nile Perch Fisheries Ltd	100	Working	70	70
3	Mwanza	Tanzania Fish Processors Ltd	120	Working	80	67
4	Mwanza	Victoria Perch Ltd	120	Working	50	42
5	Mwanza	Omega Fish Ltd	70	Working	10	14
6	Mara	Prime Catch (Exporters Ltd)	100	Working	50	50
7	Mara	Musoma Fish Processors	60	Working	35	58
8	Kagera	Kagera Fish Company Ltd	20	Working	10	50
9	Kagera	Vic Fish Ltd/ Supreme perch	60	Working	30	50

Table 34. Installed processing capacity for Ugandan processors

No.	Name of fish processing plant	Location	Production capacity (Tonnes)	Current operational status/capacity (Tonnes/day)
1	Greenfields (U) Limited	Entebbe	40	12
2	Lake Bounty Ltd	Kampala	45	13
3	Gomba Fishing Industries	Jinja	25	Just opened
4	Ngege Limited	Kampala	25	Just opened
5	Marine and Agro Processing	Jinja	40	Just opened
6	Byansi Fisheries Co. Ltd	Kalisizo, Rakai	25	3
7	Karmic (U) Ltd	Entebbe	35	30
8	Iftra (U) Ltd	Kampala	15	10
9	Tampa Fisheries Ltd	Entebbe	40	In process of opening
10	Mpongo Ltd	Kampala	15	5
11	Fresh Perch ltd	Entebbe	20	18

8.3. *Detailed list of constraints*

Table 35.Consolidated value chain constraints for all actor groups

Value chain dimension	Consolidated constraints
Costs	- High operational costs
Entry capital	- Expensive equipment - Lack of capital
Financial access and inclusion	- Difficult loaning conditions - Difficulties of loan repayment by fishers - Lack of financing information - Lack of loan access facilities
Infrastructure	- Lack of cold chain facilities - Poor communication network - Poor transport - Lack of processing sheds
Markets	- Difficulties of payment by buyers - Lack of bargaining power - Lack of market information - Limited fish market alternatives - Low fish prices - Price discrimination - Price fluctuations - Low fish demand - Unfair contractual obligations - Stiff competition - Unfair contractual obligations
Regulatory requirements	- Levies (double taxation) - Licensing costs/requirements - Lack of involvement in planning - Issues about the legal mesh size requirements which are untenable with the current fish sizes
Resource decline	- Declining catches/supply
Security and occupational safety	- Gear destruction and loss - Harassment by security forces - Insecurity - Lack for safety measures - Arrest over undersize gear
Stakeholder involvement	- Ad-hoc and complicated regulations - Lack of involvement in planning

Post-harvest losses	- Factory rejects - Fish spoilage
Business risk	- Difficulties of payment by buyers - Poaching of fish by other traders - Risk of losing money

8.4. *Terms of Reference*

Project leader	Adolf Gerstl
Technical coordinator	Hilde De Beule
Background of the assignment	GIZ is implementing the Global Program on Sustainable Fishery and Aquaculture in four countries (Mauritania, Malawi, Madagascar, Uganda). The overall objective of the program is to ensure food security and to reduce poverty by increasing fish supply and income. The Global Program is part of the special initiative "One World-No Hunger" (SEWOH) of the German Federal Ministry for Economic Cooperation and Development (BMZ). It concentrates on three main areas of activity: Improvement of the artisanal fisheries leading to better access to fisheries products and employment opportunities, promotion of sustainable fisheries and reduction of illegal, unreported and unregulated (IUU) fishing. Target groups are vulnerable households and communities, artisanal fishers and small- and medium sized enterprises in the fishery sector. Additional stakeholders are ministries responsible for fisheries management, fishing organizations, associations and training institutions. The country package Uganda is concentrating on sustainable fisheries management of Nile perch at Lake Victoria. The political partner of the project is the Lake Victoria Fisheries Organization (LVFO and the current project activities should contribute to the implementation of the Nile Perch Fisheries Management Plan-II and the Fisheries Management Plan III of Lake Victoria. The implementing partners of this project are the LVFO and the Uganda Fish Processors and Exporters Association (UFPEA) and the Kenya Fish Processors and Exporters Association (AFIPEK). The project includes implementation and outreach in Kenya and Tanzania, as these are two additional riparian states at Lake Victoria. The BMZ has a strong focus on food and nutritional security for which a more detailed understanding is needed. In recent years more and more Nile perch is consumed locally. Little is known about the exact amount that enters the local and regional market or its processing and marketing. Where does the fish come from: which proportion of the fish on the local market is within the legal size limit? How is it processed and how does this influence the quality of the fish? What is the cost/revenue/margin at each step of the value chain and what is the required personnel investment? Who are the main actors controlling this market? What legislation is currently governing the local and regional processing and trade? This consultancy will offer supplementary support to RFBC implementation, by exploring, quantifying and qualifying the local and regional Nile perch production, processing and marketing.

Issues to be addressed	The specific task is to: Prepare a value-chain analysis report for the local and regional Nile perch trade in East Africa to identify following aspects of local and regional processing and trading: - Processing: Main actors and the role of the women, infrastructure & processing methods, potential improvements, staff requirements, capital requirements, cost/income, quality issues - Trading: Main actors and the role of women, infrastructure & potential improvement, local and regional market opportunities and challenges, cost/profit, consumers and buying behavior.
Activities of the consultant	The expert shall perform following tasks - Carry out a short desk study of recent, relevant literature and legislation. - Convene a meeting with representatives of the fish processors, fish traders and fishermen associations and Ministries responsible for fisheries and trade to identify current challenges within the local and regional Nile perch value chain to fully understand the main constraints/opportunities in local and regional handling, processing and marketing of Nile perch. - Investigate and map the structure of the distribution channels for Nile perch from catch to the regional markets, using 2 examples per distribution channel per country (in case they differ). - Identify the different actors in processing and trading (including identification and quantification) and describe their interaction. - Investigate the role of women within this value chain (processing and trading) and identify gender specific challenges/opportunities. - Document and collect information on the local processing methods of Nile perch: different products, processing cost, price, etc. - Identify the consumers of different Nile perch products and their buying behavior. What are their requirements (quality and other)? What are the prices that they are willing / able to pay, etc.? - Assess possibilities to improve current processing techniques regarding cost, hygiene, etc. - Collect information on domestic / regional markets and compile information on individuals / groups involved in the Nile perch trade (highlight the position of the women) - Assess the existing infrastructure used for processing and trading Nile perch on local and regional markets and assess opportunities and costs for improvement of this infrastructure. - Review staff requirements in processing and trading considering aspects such as numbers, educational level, permanent or temporary employment, average wages, position of women versus men etc. - Outline a simple business model(s) (capital costs/revenue/operating costs/margin) that represent(s) the key processing activities required to sustain and improve local and regional trade. - Investigate prices for Nile perch throughout the distribution channels and review costs and margins associated with the

	process to reach the local and regional market. - Determine the costs and benefits of Nile Perch fishery focused on local and regional trade to estimate the break-even point. This should include estimating the costs and benefits at each stage of production and marketing chain (i.e. value chain) and how it impacts on the different actors (fishermen/boat owners/traders). - Review required investment in processing and trading for market entry, as well as to secure current/future markets national/regionally and assess the requirement of investment in this including access to funds and financing opportunities. - Prepare and present the key findings of the study to the stakeholders at a feedback workshop (1-2 days). The views of the stakeholders should be included in the final report. - Produce a final report from the study activities. - Produce a final report from the workshop upon receiving stakeholders' comments.
Expected outputs	The Expert will present a consolidated report demonstrating the work done, namely; - Technical report for the project. - Workshop outputs/reports. - Layman's report: a one to two page non-technical summary of the report to be used as a briefing paper for key stakeholders as an annex to the assignment report. - Actor's map of the whole value chain according to *Capacity WORKS* standards as annex. - Systematic graphical display of the value chain as optical summary of the report in annex to the assignment report. Graphic must also be submitted as high resolution PDF for further use in GIZ publications. - Provision of picture material of the value chain: at least 20 photographs displaying different stages of the value chain to be used in publications by GIZ and in line with the respective requirements. - A map displaying the regional trade streams of Nile perch and its products
Format of report	The Final report should follow the structure indicated below: - Title page - Table of content to three levels - List of annexes as appropriate - Table of tables, figures and pictures - Abbreviations and acronyms - Executive summary (1 to 2 pages) - Introduction - Main body divided into different sections as appropriate, normally Context, Methodology, Performance in relation to TOR, and discussion (up to 30 pages) - Conclusions and recommendations (each recommendation must be preceded by a conclusion, that refers to a discussion in the main body of the report) - Annexes as required including Terms of Reference, Schedule and People met.

	The report will be produced using MS Word and will be available in hard and electronic form, both in Word copy and all the elements together in a single file pdf format. Pictures must be taken in accordance with GIZ rules and guidelines and copy- as well as user-rights must be assigned to GIZ. Pictures must be submitted as electronic copies and should have a suitable resolution to be printed on A0 format.

Report to be reviewed by	RFBCP		
Duration	Working days UG	Working days TZ	Working days KE
The overall requirement is as follows:			
Preparatory work / desk study	2	2	2
Planning meeting	1	1	1
Field work such as visiting Landing sites, markets, processing sites, stakeholder meetings, etc. for purpose of data collection.	12	12	8
Workshop preparation list of invitees, content preparation, moderation, etc.	1		
Workshop delivery (1 day)	1		
Report writing	2	2	2
Consolidating regional report	4		
Total	23	17	13
Total input day for the team: **53** working days			
Start Date	Approximate starting date: 01.05.2018	Completion: 15.07.2018	

Experience and qualifications	**Qualifications and skills:** 1) Fisheries scientist / Economist 2) Agro – or socio economist 3) Food scientist **Experience**1) Proven experience in the Nile perch fishery in the great lakes region 2) Understanding of the fisheries economics, fish marketing, fish quality and processing for Nile perch fishery at the artisanal level 3) Experience in value chain analysis The consultant is expected (but not obliged) to subcontract local consultants either for work in Kenya, Tanzania or Uganda within the agreed man-days.

8.5. *Data collection tools*

1. Fishers' Questionnaire

Ethics statement

Dear correspondent,

We are doing a survey on Nile perch fish value chains in Lake Victoria in Kenya, Tanzania and Uganda. The data we collect will be only used to generate policy recommendations to improve benefits from fish trade in the region and country. We hope you will be free to provide /us with true and accurate data and information. Please feel free to ask any questions or raise any issues you might have before or at the end of the interview. We will present findings at a stakeholders' workshop at the end of data collection. Thank you for your participation.

Datasheet Code…… Date…… Enumerator Initials: ……

Landing site……District/County……Country……

Section A: Demographic data.

1. Respondent's sex
   [a.] Male [b.] Female
2. Highest level of education
   [a.] No school [b.] Primary [c.] Secondary [d.] Tertiary [e.] University
3. Respondent age
   [a.] 18-25 [b.] 26-30 [c.] 31-35 [d.] 36-40 [e.] 41-45 [f.] 46-50 [g.] >51
4. Years in the fishery
   [a.] <5 [b.] 6-10 [c.] 11-15 [d.] 16-20 [e.] 21-25 [f.] >25
5. Type of vessel/s used
   [a.] Sesse flat [b.] Sesse pointed [c.] Parachute [d.] Raft [e.] Other
6. Type of gear/s used
   [a.] Long-line [b.] Gillnet [c.] Other

Section B: Socio-economic and marketing data

7. List your occupations? rank them in importance of income generation (from most important)

	List of occupations	Rank in order
1.		
2.		
3.		

8. On average how much time do you spend fishing?

   (*This refers to the total time between when a person leaves their home and completes fishing).*

Trips/day	Hours/trip	Days/week

9. Give information on the quantity of fish sold in high and low seasons

High season		Low season	
Quantity sold/	Sales	Quantity sold/ trip	Sales

Quantity of fish [a] Kilograms [b] Bag [c] Buckets [d]Boxes [e] Whole fish [f] Other specify

10. To whom do you sell your fish?

Type of buyer	Proportion of sales in %
Fish monger/trader	
Factory agent	
Fish maw collector	
Consumer	

11. Do you have contractual obligations with your buyer?

[a] Yes [b] No

Section C: Inputs and costs

a) Investment costs

12. List equipment you use, its ownership and costs in Shs?

Equipment type	Qty	Total Purchase Cost	Ownership		Source of capital *1. Personal savings (PS)* *2. Bank loan (BL)* *3. Micro-finance loan (MF),* *4. Relative/Friend/'s loan (RL)* *5. Factory agent loan (FAL)* *6. Government support (GS)*	If not owned; rent/ day
			Yes	No		
Boat *i. Sesse flat* ☐ *ii. Sesse pointed* ☐ *iii. Parachute* ☐ iv. *Raft* ☐ v. *Other*						
Propulsion type *i. Engine in HP……* ☐ *ii. Sail* ☐ iii. *Paddle* ☐ iv. *Other*						
Fishing Gear *i. Longline* ☐ ii. *Gillnet* ☐ *iii. Other.* ☐						
Ice box…… ☐						

Other……						

b) Operational costs (Fixed and variable)

13. What are your fixed costs

Type of cost	Frequency of cost	Cost each time	Annual cost
Boat repair			
Propulsion			
Fishing Gear repair			
Fishers license (for all			
Boat registration fee			
BMU registration fee			
Anchorage			
Other……			

14. What are your variable costs per trip?

Type of cost	Cost/trip
Fuel and lubes	
Bait	
Communication	
Food	
Ice	
Hire of fishing equipment	

Section F: Financing, information and technical support

15. How much do you save per/week? and where?

16. Have you received institutional support on the following? If yes name institutions

	Tick				
	Yes	No	Type	No.	Institution/s**
Training (state area of training)*					
Assistance to access credit***					
Assistance to access					
Others:					

* Training code: [a] Quality control [b] Business management [c] Others- specify

**Institutions code: [a] Government [b] Academic [c] Private arrangement [d] Other (specify)

*** Type credit code: [a] Money [b] Equipment [c] Other-specify

**** Type markets code: [a] Market information [b] Price information [c] Product information [d] Others-specify

17. What are the main problems you encounter in your fishing operations. Choose the most severe problem in each category

Dimension	Type of problem (*Tick one*)
Capital	i. Expensive equipment ii. High operational costs iii. Lack of financing information iv. Difficult loaning conditions v. Other specify……
Marketing	i. Low prices ii. Lack of bargaining power iii. Unfair contractual obligations iv. Lack of market information v. Stiff competition vi. Declining stocks vii. Other specify……
Infrastructure	i. Lack of cold chain facilities ii. Poor transport iii. Other specify……
Regulations	i. Licensing costs/requirements ii. Levies (double taxing) iii. Lack of involvement in planning iv. Lack of security measures v. Lack for safety measures vi. Other specify……

2. Traders/agents' Questionnaire

Ethics statement

Dear correspondent,

We are doing a survey on Nile perch fish value chains in Lake Victoria in Kenya, Tanzania and Uganda. The data we collect will be only used to generate policy recommendations to improve benefits from fish trade in the region and country. We hope that you will be free to provide /us with true and accurate data and information. Please feel free to ask any questions or raise any issues you might have before or at the end of the interview. We will present our findings at a stakeholders' workshop at the end of data collection. Thank you for your participation.

Enumerator Initials: …… Date…… Datasheet Code……

Landing site……District/County……Country……

Section A: Demographic data.

1. Respondent's sex
   [a.] Male [b.] Female

2. Highest level of education

   [a.] No school [b.] Primary [c.] Secondary [d.] Tertiary
   [e.] University

3. Respondent age

[a.] 18-25 [b.] 26-30 [c.] 31-35 [d.] 36-40 [e.] 41-45 [f.] 46-50 [g.] >51

4. Years in the fishery
   [a.] <5 [b.] 6-10 [c.] 11-15 [d.] 16-20 [e.] 21-25 [f.] >25
5. What category of fish trading are you involved in
   [a.] Fish agent [b.] Fish monger/trader

Section B: Socio-economic and marketing data.

6. List your other occupations apart from fishing activities? rank the occupations in importance of income generation (from most important)

	List of occupations	Rank in order
1.		
2.		
3.		

7. On average how much time do you spend in fish trading in a day?

8. Give information on the quantity of fish sold in high and low seasons

High season					Low season				
No. of trips per month	Source of fish and proportion	Quantity bought/ trip	Purchase price	Sales price	No. of trips per month	Source of fish and proportion	Quantity sold/ trip	Purchase price	Sales price

Source of fish code [a] Fishers [b] Other traders [c] Other specify
Quantity of fish [a] Kilograms [b] Bag/buckets [c] Whole fish [d] Other specify

9. To whom do you sell your fish?

Type of buyer	Proportion of sales in %	Location
Fish monger/trader		
Factory agent		
Fish maw collector		
Factory		
Consumer		

Location code: [a.] Local market [b.] National market [c.] Regional [d.] International [e.] Other

10. What is the most preferred product by consumers?

11. Do consumers buy the product at set price?
    [a.] Yes [b.] No [c.] Negotiated

12. Do you have contractual obligations with your buyer/s? (specify)

13. How do you transport your fish to the market/buyer

[a.] On foot [b.] Bicycle [c.] Motor cycle [d.] Public transport [e.] Truck [f.] Boat [g.] Other

Section C: Inputs and costs

c) Investment costs

14. List equipment you use, its ownership and costs in Shs?

Equipment type	Qty	Total purchase price	Ownership		Source of capital *1. (Personal savings (PS)* *2. Bank loan (BL)* *3. Micro-finance loan (MF),* *4. Relative/Friend/'s loan (RL)* *5. Factory agent loan (FAL)* *6. Factory (FY)* *7. Government support (GS)*	If not owned; rent/ month
			Yes	No		
Transport *vi.* Bicycle ☐ *vii. Motorcylce* ☐ *viii. Carrier boat* ☐ ix. *Vehicle* ☐ x. *Other*						
Cold chain *v. Freezer* ☐ *vi. Ice box* ☐ vii. *Cold room* ☐ *viii. Ice plant* ☐ ix. *Other*						
☐ *Other……*						

d) Operational costs (Fixed and variable)

15. What are your fixed costs

Type of cost	Frequency of cost	Cost each time
Transport equipment repair		
Licenses *1.* *2.*		
Taxes and levies *1.* *2.*		
Insurance		
BMU registration fee		
Other……		

16. What are your variable costs per trip?

Type of cost	Cost/trip	Cost/month
Fuel and lubes		
Staff/Labour		
Communication		
Packaging material		
Food		
Ice		
Electricity		
Water		
Truck parking fees		
Others		

Section D: Financing, information and technical support

17. How much do you save per/week? and where?

18. Have you received institutional support on the following? If yes name institutions

	Tick				
	Yes	No	Type	No.	Institution/s
Training (state area of training)					
Assistance to access credit					
Assistance to access markets					
Others:					

*Institutions code: (1) Government (2) Academic (3) Private arrangement (4) Other (specify)

** Type credit code: (1) Money (2) Equipment (3) Other-specify

** Type markets code: (1) Market information (2) Price information (3) Product information (4) Others-specify

** Type markets code: (1) Quality control (2) Business management (3) Others- specify

19. What are the main problems you encounter your business operations. Choose at least two most severe problems

Dimension	Type of problem (*Tick one*)
Capital	i. Expensive equipment ii. High operational costs iii. Lack of financing information iv. Difficult loaning conditions v. Other (specify).....
Marketing	i. Low prices ii. Lack of bargaining power iii. Unfair contractual obligations iv. Lack of market information v. Stiff competition vi. Unreliable supply vii. Other (specify).....
Infrastructure	i. Lack of cold chain facilities ii. Poor transport

	iii. Unreliable power supply iv. Other (specify).....
Regulations	i. Licensing costs/requirements ii. Levies (double taxing) iii. Lack of involvement in planning iv. Lack of security measures v. Other (specify).....

For agents only

20. What are your staff requirements

Requirement	**Description for permanent staff**	**Description for temporary staff**
Educational level		
Type of training		
Wage level		
Gender (how many women/		

Codes

Education: [a.] No school [b.] Primary [c.] Secondary [d.] Tertiary [e.] University

Type of training [a.] Processing and handling [b.] Management[c.] Marketing and sales [d.] Others (specify)

3. Processors' Questionnaire

Ethics statement

Dear correspondent,

We are doing a survey on Nile perch fish value chains in Lake Victoria in Kenya, Tanzania and Uganda. The data we collect will be only used to generate policy recommendations to improve benefits from fish trade in the region and country. We hope that you will be free to provide /us with true and accurate data and information. Please feel free to ask any questions or raise any issues you might have before or at the end of the interview. We will present our findings at a stakeholders' workshop at the end of data collection. Thank you for your participation.

Enumerator Initials: ..... Date..... Datasheet Code.....

Landing site.....District/County.....Country.....

Section A: Demographic data.

1. Respondent's sex
   [a.] Male [b.] Female
2. Highest level of education
   [a.] No school [b.] Primary [c.] Secondary [d.] Tertiary [e.] University
3. Respondent age

[a.] 18-25 [b.] 26-30 [c.] 31-35 [d.] 36-40 [e.] 41-45 [f.] 46-50 [g.] >51

4. Years in the fishery
[a.] <5 [b.] 6-10 [c.] 11-15 [d.] 16-20 [e.] 21-25 [f.] >25
5. What category of fish processing are you involved in
[a.] Industrial [b.] Semi-industrial [c.] Artisanal

Section B: Socio-economic and marketing data.

6. List your other occupations apart from fishing activities? rank the occupations in importance of income generation (from most important)

	List of occupations	Rank in order
1.		
2.		
3.		

7. On average how much time do you spend in fish processing in a day?

8. Give information on the quantity of fish processed in high and low seasons

Type/form of product processed	Quantity processed/ month	* Purchase price of raw material/ fresh fish	Sales price of finished product	**Type of buyer	***Location
Smoked					
Sun-dried					
Salted					
Fried					
Fish frame					
Fish chest					
Fish off-cuts/					
Others (specify)					

**** Note**: The purchase price refers to fresh fish bought from fishers and traders or by-product from factory*

******* *Buyer code: [a.] Consumer [b.] Wholesaler [c.] Retailer [d.] Other*

****Location code: [a.] Local market [b.] National market [c.] Regional [d.] Other*

9. What is the most preferred product by consumers?
10. Do consumers buy the product at set price?
[a.] Yes [b.] No [c.] Negotiated
11. Do you have contractual obligations with your buyer/s? (specify)
12. How do you transport your fish to the market/buyer

[a.] On foot [b.] Bicycle [c.] Motor cycle [d.] Public transport [e.] Truck [f.] Boat [g.] Other

Section C: Inputs and costs

e) Investment costs

13. List equipment you use, its ownership and costs in Shs?

Equipment type	Qty	Total purchase price	Ownership		Source of capital *8. (Personal savings (PS)* *9. Bank loan (BL)* *10. Micro-finance loan (MF),* *11. Relative/Friend/'s loan (RL)* *12. Factory agent loan (FAL)* *13. Factory (FY)* *14. Government support (GS)*	If not owned; rent / month
			Yes	No		
Transport *i.* Bicycle ☐ *ii. Motorcylce* ☐ *iii. Carrier boat* ☐ iv. *Vehicle* ☐ v. *Other*						
Cold chain *i. Freezer* ☐ *ii. Ice box* ☐ iii. *Cold room* ☐ *iv. Ice plant* ☐ v. *Other*						
Smoking, drying, frying and storage ☐ *i. Stove/jiko* *ii. Smoking kiln* ☐ iii. *drying racks* ☐ *iv. store* ☐ *Other*						
☐ *Other……*						

f) Operational costs (Fixed and variable)

14. What are your fixed costs

Type of cost	Frequency of cost	Cost each time	Annual cost
Transport equipment repair			
Processing equipment/facilities			

Licenses *1.* *2.*			
Taxes and levies *1.* *2.*			
Insurance			
BMU registration fee			
Other……			

15. What are your variable costs per trip?

Type of cost	Cost/month
Fuel and lubes	
Staff/Labour	
Communication	
Salt	
Cooking oil	
Energy (firewood, charcoal)	
Packaging material	
Food	
Ice	
Electricity	
Water	
Others	

Section D: Financing, information and technical support

16. How much do you save per/month? and where?
17. Have you received institutional support on the following? If yes name institutions

	Tick				
	Yes	No	**Type	No.	*Institution/s
Training (state area of training)					
Access to credit					
Access to markets					
Others:					

*Institutions code: (1) Government (2) Academic (3) Private arrangement (4) Other (specify)

** Type credit code: (1) Money (2) Equipment (3) Other-specify

** Type markets code: (1) Market information (2) Price information (3) Product information (4) Others-specify

** Type markets code: (1) Quality control (2) Business management (3) Others- specify

18. What are the main problems you encounter your business operations. Choose at least two most severe problems

Dimension	Type of problem (*Tick one*)
Capital	i. Expensive equipment ii. High operational costs iii. Lack of financing information iv. Difficult loaning conditions v. Other (specify).....
Marketing	i. Low prices ii. Lack of bargaining power iii. Unfair contractual obligations iv. Lack of market information v. Stiff competition vi. Unreliable fish supply vii. Other (specify).....
Infrastructure	i. Lack of cold chain facilities ii. Poor transport infrastructure iii. Unreliable power supply iv. Other (specify).....
Regulations	i. Licensing costs/requirements ii. Levies (double taxing) iii. Lack of involvement in planning iv. Lack of security measures v. Multiplicity of requirements vi. Other (specify).....

For semi-industrial only

19. What are your staff requirements

Requirement	**Description for permanent staff**	**Description for temporary staff**
Educational level		
Type of training		
Wage level		
Gender (how many women/men)		

Codes

Education: [a.] No school [b.] Primary [c.] Secondary [d.] Tertiary [e.] University

Type of training [a.] Processing and handling [b.] Management[c.] Marketing and sales [d.] Others (specify)

4. Industrial Processors' Questionnaire

Ethics statement

Dear correspondent,

We are doing a survey on Nile perch fish value chains in Lake Victoria in Kenya, Tanzania and Uganda. The data we collect will be only used to generate policy recommendations to improve benefits from fish trade in the region and country. We hope that you will be free

to provide /us with true and accurate data and information. Please feel free to ask any questions or raise any issues you might have before or at the end of the interview. We will present our findings at a stakeholders' workshop at the end of data collection. Thank you for your participation.

Enumerator Initials: …… Date…… Datasheet Code……

District/County……Country……

Section A: Processing information

1. Years in the fishery

[a.] <5 [b.] 6-10 [c.] 11-15 [d.] 16-20 [e.] 21-25 [f.] >25

2. Give information on the quantity of fish processed

Type/form of product processed	Quantity processed / month	* Purchase price of raw material/ fresh fish	Sales price of finished product	**Type of buyer	***Location
Fillets					
Headed-gutted					
Fish frame					
Fish chest					
Fish off-cuts/					
Others (specify)					

**** Note**: The purchase price refers to fresh fish bought from fishers and traders or by-product from factory*

******* *Buyer code: [a.] Consumer [b.] Wholesaler [c.] Retailer [d.] Other*

****Location code: [a.] Local market [b.] National market [c.] Regional [d.] International [e.] Other*

3. What is the most preferred product by consumers?
4. Do consumers buy the product at set price?

[a.] Yes [b.] No [c.] Negotiated

5. Do you have contractual obligations with your buyer/s? (specify)

Section B: Inputs and costs

g) Investment costs

6. List equipment you use, its ownership and costs in Shs?

Equipment type	Qty	Total investment	Source of capital *1. (Personal savings (PS)* *2. Bank loan (BL)* *3. Relative/Friend/'s loan (RL)*	If not owned; rent/ month
Transport				
Cold chain				
Processing and packaging				

h) Operational costs (Fixed and variable)

7. What are your fixed costs

Type of cost	Cost per month/year
Transport equipment repair	
Processing equipment/facilities	
Licenses *1.*	
Taxes and levies *1.*	
Insurance	
Other……	

8. What are your variable costs?

Type of cost	Cost/ month/year
Fuel and lubes	
Staff/Labour	
Communication	
Packaging material	
Ice	
Electricity	
Water	
Others (specify)	

Section D: Financing, information and technical support

9. Mention any kind of support you receive from government and its agencies
10. Mention the kind CSR activities you are involved in
11. What are the main problems you encounter in your business operations
12. What are staff requirements in your establishment

Requirement/Item	**Permanent**	**Temporary/casual**
No. of employees		
*Gender of employees [no.]		
**Education qualification		
***Training/skills		
Wage level		

Codes

* Gender: [a] Male [b] Female

**Qualification: [a.] No school [b.] Primary [c.] Secondary [d.] Tertiary [e.] University

***Training/skills [a.] Processing and handling [b.] Management[c.] Marketing and sales [d.] Others (specify)