The sub Saharan Journal of Social Sciences and Humanities (SJSSH)
ISSN: 2619-8894 (Online), 2619- 8851 (Print)

# Do Market Opportunities for the Nile Perch Matter in Contributing to Household Income? Evidence from Lake Victoria Fisheries in Tanzania

***Fausta M. Mapunda[1,*], Modesta N. Medard[2], Lugano L. Kusiluka[3], Anders Dalsgaard, A[4,5] and Robinson H. Mdegela[6].***

*[1] Department of Policy, Planning, and Management, College of Social Sciences and Humanities, Sokoine University of Agriculture, P.O. Box 3035 Morogoro, Tanzania. Email: fmapunda@sua.ac.tz*
*[2]P.O. Box 10831 Mwanza, Tanzania, E-mail: modesta_medard@yahoo.co.uk*
*[3]Mzumbe University P.O. Box 1 Tanzania. E-mail: ljmkusiluka@mzumbe.ac.tz*
*[4]Section of Food Safety and Zoonosis Department of Veterinary and Animal Sciences, Faculty of Health and Medical Sciences, University of Copenhagen, Stigböjlen 4, 1870 Frederiksberg C. E-mail: adal@sund.ku.dk*
*[5] School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore.*
*[6] Department of Veterinary Medicine and Public health, College of Veterinary Medicine and Medical Biosciences, Sokoine University of Agriculture, P.O. Box 3021 Morogoro Tanzania. E-mail: mdegela@sua.ac.tz*

**Received:** February 13, 2020; **Accepted:** December 12, 2020; **Published:** June 15, 2021

**Abstract:** *Increasingly fish marketing in Tanzania has become demand-driven. Recently, domestic and regional markets for fish are emerging as lucrative business ventures. To what extent Lake Victoria Nile Perch marketing contributes to fishers, processors, and traders' income in the region remains unclear. This study specifically: (i) examined the marketing opportunities of the Nile perch (Lates niloticus) in the Lake Victoria basin and its contribution to household income and (ii) analyzed opportunities and challenges facing the Nile perch value chain actors. Random sampling was employed to select 100 fishers, processors, and traders. A structured questionnaire was the primary tool for data collection. A multiple regression model was used to estimate the causal effect relationship between fish market opportunities and the income earned. Results indicate that the size of the business capital, knowledge of fish quality control, and bookkeeping were statistically positive and significantly contributed to increased household income at $P<0.01$. The quantity of fish sold per month shows a significant contribution to household income at $p<0.05$. The freshness of fish was an important attribute affecting customers' attraction, thereby increasing the income of the fisheries. Weak institutional support forms another potential constraint for Nile perch stakeholders from realizing the benefits of integration in the regional market. The fish chain actors need to develop appropriate marketing strategies such as segmenting the market according to consumers' preferences to exploit new market opportunities. There is a need to promote policies that support strengthening domestic and regional fish markets for increasing employment opportunities, household income, and economic growth. A comprehensive policy analysis governing fish marketing arrangement and credit markets remains a potential area for further research.*

**Keywords:** Nile perch, Lake Victoria, Value chain, Market opportunities, Fish attributes
.

## 1.0 Introduction

Fisheries sector plays a vital role as a source of cash income and food security, supporting diets and nutrition in the Global South. (Moreau and Garaway, 2021). The demand for fish in Sub-Saharan Africa is rising due to demographic growth, increasing wealth, and a diet shift to fish (Chu et al., 2019). Increasingly fish marketing in Tanzania has become demand-driven. The population growth rate of 2.7 per annum and an increase in income are among the factors attributing to the demand for fish. Wenaty et al., (2018) show that the annual per capita fish consumption between 2012 and 2015 has ranged between 7.4 to 7.7 kg. High demand by domestic, regional and international markets expands the market of the Nile Perch (Thorpe and Bennett (2004; Mkuna and Baiyegunhi, 2020). Empirical studies indicate that the demand for fish and fish products in the diet attributes to increased awareness of health benefits such as lower levels of dietary fat (Akhter et al., 2013) and availability of essential fatty acids (omega-3) (Wang, et al., 2009; Chaula et al., 2019). To artisanal and small-scale inshore fisheries, fish

and fish products are rich sources of protein, macro-and micro-nutrients, and an essential complement to starchy staple diets of the poor people (Subasinghe and Chief, 2015). Evidence shows that Lake Victoria fishing contributes about 30 percent of the total animal protein intake in the country and supply raw materials (fish meal) for the formulation of animal feeds (Mkuna and Baiyegunhi, (2019).

The fisheries sector plays a crucial role in the socio-economic development of Tanzania, providing income, export revenues, and employment with an estimated 4 million jobs (about 35 percent of rural employment) (Eggert *et al.,* 2015; Nazir *et al.,* 2018; Mkuna and Baiyegunhi, 2019). On average, the sector contributed about 10 percent of the foreign earnings and about 2 percent of the Gross Domestic Product (GDP) in 2015 (URT, 2016). Lake Victoria is the second biggest freshwater lake globally, covering 68,000 sq. km, and the largest Lake in Africa (Crul, 1995). It is the most productive freshwater fishery in Africa (URT, 2016). Kenya is sharing the lake (6 percent of shoreline), Uganda (43 percent), and Tanzania (51 percent) of the total area (Mugimba et al., 2018). The lake supports the fishery of three major commercial fish species: the Nile perch (*Lates niloticus*), Nile tilapia (*Oreochromis niloticus*), and sardines (*Rastreneobola argentea*). The Nile perch dominates in terms of landed value, export, and foreign earnings. Evidence shows that Tanzania is the leading exporter of Nile perch fillets to the European Market (EU), exporting 12 400 tones (47.5 percent market share), followed by Uganda with 10 800 tones (41 percent) and Kenya with 2900 tones (11 percent) (Muthoni, 2019). In 2014, Nile perch contributed 27 percent to total annual fish production which contributed about 65 percent to the total value of the Lake Victoria fisheries. Sardines' production significantly increased and contributed 55 percent (433,845 tones in volume) of the total annual fish production. In terms of value, sardines contributed an average of 152.6 million in 2015, contributing about 78.0 percent to the entire value of production (NBS, 2010).

In the Lake Victoria basin, fishing and fish marketing are among the standard ways of increasing household income among smallholder fisheries, employment opportunities, and ensuring household food security. Estimates reveal that about 90 percent of fish catch is for sale in domestic and regional markets. The sector employs over 100,000 full-time fishers engaging in fishing (Onyango, 2017). Employment in the industry does have multiplier effects in other economic activities such as boat manufacturing and operations, fish processing, and trading (Odongkara *et al.,* 2009). Indirectly fish industry has employed more than four million people, including boat builders, fish processors, net and engine repairers (USAID, 2015). The leading employers in this area are the fisheries, processing industries for Nile perch, small-scale fish processors (for dried fish), and fish traders, the main actors in the value chain. Thorpe and Bennett (2004) define a fish supply chain as a set of interdependent agents (fishermen, processors, and distributors) that work together, consciously or unconsciously, to convey fish-derived products to the ultimate consumers. For example, the traditional small-scale processors engaged in smoking and salting fish are the dominant actors. Since markets are imperfect in developing countries, the fish value chain actors incur high transaction costs since fish and fish products are highly perishable, an attribute that may influence them to sell fish at lower prices. Weak coordination of the artisanal fishers, asymmetric market information, and small volumes of products supplied raise more costs. Although the international market dynamics have primarily driven the Nile Perch supply chain, the supply of quality Nile Perch and other fish products depends on the chain actors and the institutional environment.

Apart from the Nile Perch being for export, the traditional marketing system of fish and fish products focuses on domestic consumers. Recently, the regional markets for fish are emerging as lucrative business ventures. According to URT (2016), the Democratic Republic of Congo, Rwanda, and Burundi are potential markets. DR Congo accounts for 18 percent of the export of fish products, Malawi 5 percent, Kenya 2 percent, and Rwanda 1 percent. However, the quantities of fish and fish products exported to these neighboring countries are under-estimated because most of this trade is informal. The traders buy raw fish and process the fish to increase their shelf life by smoking, frying, and sun drying. To what extent Lake Victoria Nile Perch marketing contributes to income in the region remains unclear. This study examined the existing marketing opportunities of the Nile perch in the Lake Victoria basin and its contribution to household income. It also analyzed opportunities and challenges facing the Nile perch value chain actors. The hypotheses tested were that product attributes and individual or household characteristics affect the income of actors in the fishery sector. The paper contributes to the existing literature in twofold; to the society, the findings provide a better understanding of the economic viability of fish attributes (freshness, fried or smoked) and household characteristics in contributing to household income. To policymakers, information obtained from the study will guide informed decisions regarding interventions on the Lake Victoria fishing and marketing and institutional innovations in enhancing the livelihood of fishers.

## 2.0 Theoretical and Conceptual Framework

The transaction cost theories guided this study. As defined by North (1990), transaction costs are involved when products and services are exchanged between actors. These costs include accessing market information such as consumer preference, fish product attributes negotiation, and contracts enforcement costs. The theory of change is that participation in Nile perch business allows the value chain actors to take advantage of domestic and regional market opportunities while increasing household income. Having attended training may improve fish handling and marketing, leading to better prices and ultimately enhancing their income. Institutional factors such as access to financial markets is critical to the development of the fish business. This study investigated whether formal or informal financing sources were potential sources in acquiring start-up capital and facilitating the propensity of fishers to engage in fish business. Fish attributes drive the demand for fish: the study considered whether marketing of fresh, smoked, or fried fish improved the income of the fish value chain actors.

The sub Saharan Journal of Social Sciences and Humanities (SJSSH)
ISSN: 2619-8894 (Online), 2619- 8851 (Print)

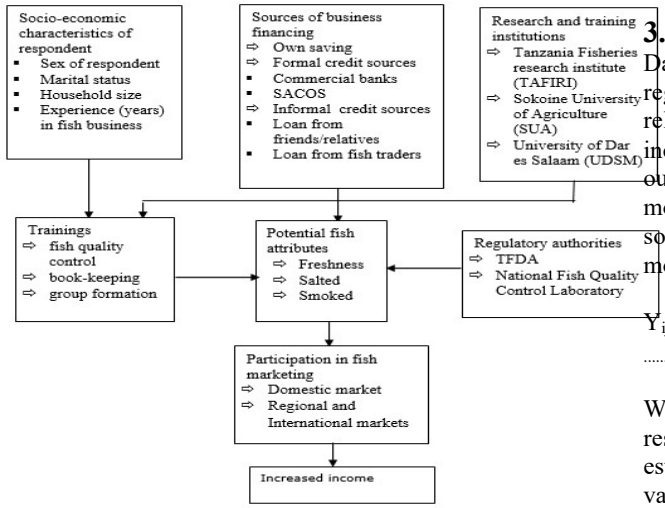


Fig.1: A conceptual framework of the study

## 3.0 Methodology

### 3.1 Study Area and Sampling procedures

The study is based on a household survey conducted in 2014 in Mwanza region, Tanzania, located on the shores of Lake Victoria. Lake Victoria is located in East Africa; within 0°20′N to 3°00′S and 31°39′E to 34°53′E at an altitude of 1134 m. The sampling strategy involved a combination of methods: first, purposive sampling was employed to select Mwanza. As the second stage, Ilemela District was chosen amongst the district in Mwanza where Lake Victoria is located. The selection of Ilemela was based on two reasons: first, most fishers, processors, and traders work in the area. Second, the Kirumba market is located in the area where fish marketing activities are taking place. Random sampling was used to select 100 fishers, processors, and traders.

### 3.2 Data collection

A structured questionnaire was the primary tool used to interview respondents. Specifically, information collected included the socio-economic and demographic variables, the types of fish most preferred by consumers, product form, and employment opportunities along the fish value chain. Additionally, information on the sources of capital to finance start-up business were also collected.

The second type of data came from an innovation platform where various primary stakeholders: fishers, processors including owners of cold chain stores, participated in the workshop. Secondary stakeholders: stakeholders such as government officials in the fisheries sector, regulatory authorities such as Tanzania Food and Drugs Authority (TFDA), the National Fish Quality Control Laboratory (NFQCL), researchers from Sokoine University of Agriculture (SUA), University of Dar es Salaam (UDSM) and the Tanzania Fisheries Research Institute (TAFIRI) were part of the innovation platform. A forum of important stakeholders comprising fisheries, processors, and consumers aimed to discuss opportunities and challenges facing the traders and processors in the fish marketing value chain and identify potential unexploited employment opportunities in the sector.

### 3.3 Data analysis

Data were analyzed using Stata 13 software. A multiple regression model was used to estimate the causal effect relationship between fish market opportunities and the income earned. Income generated per month was our outcome variable measured in Tanzanian Shilling (TAS) as monthly income from fish sales. The analysis included the socio-economic and institutional variables. The analytical model was as follows:

$$Y_{ij} = \alpha + \beta^1 X_{ij} + \varepsilon_{ij} \quad \text{.....(1)}$$

Where Y represents the outcome variable (the income of the respondent i), α is a constant term, $\beta^1$ are parameters to be estimated, X are vectors of socio-economic and demographic variables including sex of the respondent, marital status, experience i.e. years in the fish business, household size estimated as adult equivalent, sources of start-up capital to engage in fisheries activities, whether the respondent ever attended any training, training on quality control, training on bookkeeping, the size of the business capital and whether the fish buyers financed the operational cost in fish business. Other independent variables include the quantity of fish per month. Attributes in fish marketing including freshness and whether smoked fish were marketed, the average quantity of fish (kg) sold, whether engagement in fish business was a full-time job were considered, and ε was the error term.

**Variables analyzed**

**Sex of the respondents**

In the regression model, the variable was recorded as a dummy variable equal to 1 if the respondent was a male and 0 if the respondent was a female. Sex is an important demographic factor that influences income-generating activities. A positive sign is expected when male household heads are involved in fishing because of the nature of the occupation.

**Marital status**

This was a dummy variable equal to one for a married head and 0 otherwise. Married heads are likely to engage in fish marketing since they have family responsibilities. A positive coefficient is expected, leading to increasing household income.

**Experience in the fish business**

This was a continuous variable, measured as a number of years, the fish value chain actors participated in fishing and marketing. A positive sign was expected to imply that the more years the actors have engaged in business, the higher the income is anticipated since the respondent could have more market information and access to the market thus increasing more income.

**Total income earned**

This was a continuous outcome variable measured as a total amount of money earned (TZS) per month.

The sub Saharan Journal of Social Sciences and Humanities (SJSSH)
ISSN: 2619-8894 (Online), 2619- 8851 (Print)

**Household size**
The variable was a continuous variable representing the number of members within the household. Both positive and negative signs are expected: on the one hand, more household members mean more labour to engage in fish marketing, thus increasing the likelihood of improving household income. On the other hand, a negative sign is expected because having more members in the household means more mouths to feed, thereby reducing household income.

**Size of capital**
The variable was measured as a continuous variable. The more the fishers had considerable money to run the business the higher the income was expected due to having the capacity to cover operational costs in the Nile perch business.

## 4.0 Findings and Discussion

### 4.1 Socio-economic and Demographic Characteristics of the respondents

Table 1 shows that 53 percent of the fishers and traders were male. Most of these fishers and traders were married (83 percent), while widowed, divorced, or separated respondents comprised 17 percent. On average, a household consisted of six members. Economically, more members of the household imply more labour and, therefore, more production. The fish value actors had an average working experience of 5.9 years.

**Table 1: Socio-Demographic Characteristics of the Respondents (n=100)**

| Variable | Obs. | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Sex- male respondent | 100 | 0.53 | | 0 | 1 |
| Marital status of the respondent | | | | | |
| Married respondents | 100 | 0.83 | | 0 | 1 |
| Widowed , divorced or separated | 100 | 0.14 | | 0 | 1 |
| Single respondents | 100 | 0.03 | | 0 | 1 |
| Household size (number ) | 100 | 5.31 | | 2.600 | 13 |
| Experience in fish business (years) | 100 | 5.865 | 2.389 | 1 | 7.5 |

From the surveyed area different sources of start-up capital in fish business were identified. Almost half of the respondents (51 percent) reported starting the business from their savings and 21 of respondent received financial support from family members. Only 12 percent of the fishers obtained loans from financial institutions such as commercial banks and Savings and Credit Cooperative Societies (SACOS). Evidence suggests that about 10 percent accessed loans from their relatives and friends, implying that social networks could be another potential source of start-up capital in fish business. These findings are like the study's findings by Ruddle (2011) in Vietnam that start-up capital in fish business was based on various sources: from the banks, individual moneylenders, family members, or friends. The survey results indicate that only 13 percent of the respondents had attended formal training related to fish marketing activities. We find that training on bookkeeping comprised 7 percent while 6 percent had participated in training on quality control. Only one percent of respondents attended training on group organization and formation. Over 86 percent of the chain actors reported not having attended any formal training regarding fish marketing activities.

On average, the size of the business capital was 519,889 TZS (236.3 USD). In terms of operational costs, about 43 percent of the respondents reported being financed by fish buyers. On average, the monthly income earned from the fish business was 295,990.5 TZS (134.5 USD).

**Table 2: Sources of business financing and monthly average income earned (n=100)**

| Variable | Obs. | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| **Main sources of initial business capital** | | | | | |
| Own saving | 100 | 0.51 | | 0 | 1 |
| Loan from formal financial institutions | 100 | 0.12 | | 0 | 1 |
| Assistance from family members | 100 | 0.21 | | 0 | 0 |
| Loan from friends and relatives | 100 | 0.10 | | 0 | 0 |
| Crop faming and trading | 100 | 0.05 | | 0 | 1 |
| Loan from fish buyers | 100 | 0.01 | | 0 | 1 |
| The size of business capital (TZS) | 99 | 519,889.2 | 395,785.5 | 0 | 1,250,000 |
| Fish traders or financiers of operational costs in fish business | 100 | 0.43 | | 0 | 1 |
| Average income earned per month (TZS) | 100 | 295,990.5 | 337,501.5 | 74,500.5 | 1,250,000 |

The survey results (Table 3) indicate that only 13 percent of the respondents had attended formal training related to fish marketing activities. We find that training on bookkeeping comprised 7 percent while 6 percent had participated in training on quality control. Fishers, processors, and fish traders who had attended training on group formation were only one percent. Over 86 percent of the fish value chain actors reported not having heard any formal training regarding fish marketing activities.

**Table 3: Training attended by the fish value chain actors (n=100)**

| Variable | Obs. | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| **Training attended** | | | | | |
| Whether the respondent ever attended training | 100 | 0.13 | | 0 | 1 |
| Respondent attended training on book-keeping | 100 | 0.07 | | 0 | 1 |
| Training on fish quality control | 100 | 0.06 | | 0 | 1 |
| Training on group organization and formation | 100 | 0.01 | | 0 | 1 |
| No training attended | 100 | 0.86 | | 0 | 1 |

The findings of the study show that respondents used different ways of saving their cash (Table 4). About 36 percent used to keep their money in commercial banks and saving and Cooperative Societies (SACCOS). Almost 24percent of respondents saved cash in their homes, and 5 percent were involved in rotating savings and credit cooperatives (ROSCA).

**Table 4: Ways in which fishers and traders save their cash (n=100)**

| Variable | Obs. | Mean | Standard deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| **Means by which money is saved** | | | | | |
| Saved in formal financial institution | 100 | 0.36 | | 0 | 1 |
| Saved at home | 100 | 0.24 | | 0 | 1 |
| Saved in ROSCA[1] | 100 | 0.05 | | 0 | 1 |
| No savings | 100 | 0.33 | | 0 | 1 |
| savings at home and mobile phone | 100 | 0.02 | | 0 | 1 |

## 4.2 Association between fish market opportunities and income earned

Table 5 presents regression coefficients suggesting the effect of fisheries market opportunities and income earned per month. The R-square suggests that the predicting power of the model on the correlation between socioeconomic factors affecting fish marketing and household income was 0.6. Results indicated that the size of the business capital, knowledge of fish quality control, and bookkeeping were statistically positive and significantly contributed to increased household income at $P<0.01$. The quantity of fish sold per month concerning household income remains robust and statistically significant at $p<0.05$. A coefficient of whether the traders attended any training results suggested that the variable was negative and statistically significant. The result implies that attending training did not matter since traders were likely to earn less income from the fish business. These findings are contrary to Ayubu (2017), who argues that training is crucial for fishers to realize the benefits of fish marketing.

Interestingly, coming to specific training, traders that attended training on bookkeeping and fish quality control increased their likelihood of earning higher monthly incomes. This training enabled fisheries to ensure the quality of fish that could fetch premium prices, thereby increase their income. The size of business capital is positively and significantly associated with income earned per month. A unit increase in the capital invested in the fish business leads to a rise in monthly earnings by 0.63. The result supports our hypothesis that socioeconomic variables may be more crucial in predicting participation in fisheries business while affecting their income (Fiorella *et al*., 2014). Business buyers and financiers as an informal source of capital are more likely to reduce the income of fishers. It could be that the buyers, i.e., the financiers buy fish at lower prices. Although social capital is a dominant form in fish governance, the system is less likely to fulfill the fishers' objectives since it requires long time relationships, strong ties, and donor dependency to support business expansion (Jaabi and Esemu, 2017). There are good reasons to believe that linking smallholder fisher to formal financial institutions may be a potential mechanism to facilitate credit access in solving the problem of business financing and therefore increase the likelihood of improving the income of fishers. Experience from the fishing communities in developing countries shows that poor access to credit is a primary constraint in the fisheries sector (Kleih *et al*., 2013). Nazir *et al.* (2018) suggest that fishers have limited access to a formal credit system due to a lack of assets that may act as collateral and a lack of good credit history. The average quantity of fish sold per month suggests a positive and statistically significant association with the increased income of fishers. The result implies that the volume of fish sold matters; as the market share of fisheries increases, the income also increases. A unit increase in a kilogram of fish sold leads to a rise in income by 42.7 TZS. Onyango (2017) shows that the income of fishers has increased over time. On average, the fishers earn between USD 100 and 400 annually.

The findings show that being a full-time fishery reduces the household income, implying that diversification of income sources is crucial to fishing communities. The freshness of fish sold suggested an important attribute affecting fishers' income. These results indicate that the freshness of fish is likely to influence the buying decision of consumers and hence higher chances of increasing fishers' income.

**Table 5: Regression coefficients on the association between socioeconomic variables and average income earned per month from fish business (Standard errors in parentheses)**

| Variables | (1) Income earned (TZS) per month |
|---|---|
| sex | 54,879.884 |
| | (60,304.583) |
| Married respondent | -67,035.540 |
| | (73,920.465) |
| Experience (years) in fish business | -16,933.601 |
| | (42,261.153) |
| Adult equivalent | -34,311.840* |
| | (18,846.808) |
| Whether respondent attended training | -668,510.771*** |
| | (190,563.982) |
| Dummy= 1 if respondent attended training on bookkeeping | 769,919.003*** |
| | (211,779.101) |
| Dummy= 1, if respondent attended training on quality control | 609,855.151*** |
| | (195,377.703) |
| Size of business capital (TZS) | 0.635*** |
| | (0.076) |
| Dummy =1, if fish buyer finance business operational capital | -118,466.712** |
| | (56,790.159) |
| Average quantity of fish (kg) sold per month | 42.681** |
| | (18.409) |
| Dummy=1, if fish business is full time job | -212,684.223* |
| | (117,851.982) |
| Dummy= 1, if dealt with marketing of fresh fish sold an important attribute | 141,845.926* |
| | (78,450.023) |
| Dummy=1, if dealt with smoked fish | 104,087.251 |
| | (91,170.660) |
| Constant | 200,744.598 |
| | (173,804.492) |
| Observations | 99 |
| R-squared | 0.605 |

*** p<0.01, ** p<0.05, * p<0.1

## 4.3 Potential market opportunities

Based on the innovation platform, stakeholders indicated that the demand for fish maws to manufacture surgical sutures had created new business ventures. Women and other fish traders have specialized in marketing fish maws, which have lucrative markets and thus create employment opportunities. On average, fish maws have a premium price ranging from 220,000 TZS (100$) per kg (for a large fish maw), 160,000 TZS (72.72$) (medium-to-large), TZS 95,000 (43.18$) (medium), and TZS 54,000 (24.54$) for small size maws against TZS 5000 (2.2$) per kg of Nile perch. Worldwide evidence shows that women substantially contribute to the fisher's economies (Harper *et al.,* 2013). Evidence shows that Tanzania earned more than $42 Million from maw export in 2017 (Bagumire *et al.,* 2018). Our findings support the findings by Medard et al. (2019) that women play a central role in fish processing and marketing while Men dominate in

fishing and export processing factories. However, gender roles, cultural, socio-economic, and political factors affect women's participation in the higher nodes of the value chain (Kamau and Ngigi, 2013). Evidence suggests that over 75 percent of women are involved in the artisanal fish trade. Due to family responsibilities, the demand for cash income has become strong incentivized for women to engage in fish processing and marketing to cover consumption expenditures for food, clothing, and children's educational expenses affecting the livelihood of the entire household (Fröcklin *et al.,* 2013). Allendorf (2007) indicates that women who participate in income-generating activities are more likely to invest in children's education and health. The high demand for cold storage facilities, ice plants, and increased cold chain transportation facilities has created more opportunities for fish and fish products markets, increasing employment opportunities in the area. The demand for these facilities translates into improved fish handling practices leading to reduced post-harvest losses along the fish value chain.

### 4.4 Challenges facing fishers, fish processors, and traders in the Lake Victoria Basin

Experience from stakeholders' innovation platforms shows that fish traders face stiff competition in the world market for fish with an increasing supply of *Pangasius* (catfish) fish from Thailand, India, China, and Japan. The supply of *Pangasius* from China, Taiwan, and Vietnam threatens the Nile perch market because the two fish species look similar. Competition in fish marketing has led to changing employment in the fish sector in Tanzania. As a result, most processors have turned to part-time or casual labourers in the study area. Another challenge is that the stakeholders face market competition from neighbouring East African countries, i.e., Kenya and Uganda. Fish processors in Bukoba in Tanzania, for example, compete with processors in Uganda who buy fish at premium prices.

Moreover, the handling and processing costs are relatively cheaper in Uganda. Information asymmetry among Nile perch chain actors on the preferences of European Union consumers and dependency on social capital in sharing market information are among the challenges facing the Nile perch chain actors. Due to imperfect market information, transaction costs in the fish business increases, thereby affecting the income of the actors in the fish value chain. As a result, fish traders need significant investment capital to break even.

Weak institutional support forms another potential constraint to the Nile perch stakeholders from realizing the benefits of integration with the export market. The findings of the study have shown that only 12 percent accessed credit from financial institutions. The study's findings support Kaleshu and Temu (2012) that rural households face challenges accessing financial services. Additionally, Mwaijande and Lugendo (2013) show that 49 percent of fish actors in Tanzania have limited access to credit. More evidence shows that in developing countries, credit markets from formal financial institutions are not well established, and therefore, credit rationing to smallholder farmers is commonly reported (Asfaw et al., 2012; Weber and Musshoff, 2012). As a result, poor access to the market and weak institutions raise transaction costs and limit smallholder farmers' decisions to participate in markets (Mmbando et al., 2015). Institutional innovations may a potential mechanism to enable smallholder farmers to respond to new challenges in marketing and overcome market failures (Hazell *et al.,* 2006).

Despite the relevance of findings, this study has some limitations: supermarkets and fast-food restaurants were not part of this study as among the essential market outlets for fish and fish products. The volume of fish traded domestically was difficult to quantify since there is a limited database to track the quantity of Nile Perch sold domestically and regionally. Another limitation is the use of cross-section data; we suggest further research to consider randomization and the use of panel data. Nevertheless, there are good reasons to believe that government initiatives that cut across fishers heterogeneous actors at each node of the value chain should be seen as a catalyst to address fishers' needs. The initiative should consider awareness creation regarding credit education, consumer preference, marketing strategies, and sustainability in fishing.

## 5.0 Conclusions and Recommendations

This study concludes that the size of the business capital, knowledge on fish quality control and bookkeeping, the quantity of fish sold, and the freshness of fish play a significant role in increasing the income of fisheries. The study findings imply that increasing the income of fishers through fish business matters since it may improve the food and nutritional security of fishing households and other actors in the fish value chain. Based on the findings from the innovation platform, we have seen that women and other fish traders have specialized in emerging markets of fish maws, which fetches a premium price, thus creating more employment opportunities and ultimately increasing household income. The study findings have indicated that training on quality fish quality control and bookkeeping is likely to increase the income of fishers. The study recommends specific training such as fish handling along the value chain, enhancing fish quality for more income. The study's findings have revealed that the size of the business capital significantly contributes to fishers' gain. However, only twelve (12) percent of fishers had accessed credit from a formal financial institution. Training on group formation may enhance knowledge on collective marketing to fishers. The groups may act as collateral to access loans from the financial institution to expand their business for more income. The groups are potentially a mechanism to improve the bargaining power in the fish business, reduce transaction costs and improve household income. Evidence Table 2 has shown that being financed by fish buyers is likely to reduce the income of fishers. Possibly, this is not a sustainable source of financing since these financiers may buy fish at a lower price. The study recommends that institutional support such as access to credit and market information may be proper for fishers' participation in the fish business for better income. Fish attributes such as freshness have positively affected fishers' income. The fish actors need to develop appropriate marketing strategies such a segmenting the market according to consumers' preferences to exploit new market opportunities. Relevant authorities should regularly organize the training of actors to product quality, credit

education, and marketing strategies for fish and fish products for more income.

Furthermore, there is a need to reconsider players' relationship in the Nile Perch industry on market integration from resource-based and marketing perspectives. There is a need to promote policies that support strengthening domestic and regional fish markets to increase employment opportunities, household income, and economic growth. A comprehensive policy analysis governing fish marketing arrangement and credit markets remains a potential area for further research.

## Acknowledgments

The authors are grateful to The Danish International Development Agency *(*DANIDA*)* for funding the project through Building Stronger Universities for growth and employment. The authors recognize the contribution of the Tanzanian fishers who gave their time and interest to be interviewed. We express our sincere thanks to the fisheries officers, marketing officers at Kirumba in Mwanza, processors and all the enumerators for their hard work.

## References

Asfaw, S., Shiferaw, B., Simtowe, F., and Lipper, L. (2012). Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food policy* **37**, 283-295.

Ayubu, S. (2017). Value chain analysis of farmed Nile tilapia in selected areas, Tanzania, Sokoine University of Agriculture:Doctoral dissertation, Sokoine University of Agriculture 186 pp

Bagumire, A., Muyanja, C. K., and Kiboneka, F. (2018). The value chain analysis of Nile perch maw trade in East Africa. *The Responsible Fisheries Business Chains Project of Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) under Contract*, 1-52

Chaula, D., Laswai, H., Chove, B., Dalsgaard, A., Mdegela, R., & Hyldig, G. (2019). Fatty acid profiles and lipid oxidation status of sun dried, deep fried, and smoked sardine (Rastrineobola argentea) from Lake Victoria, Tanzania. Journal of Aquatic Food Product Technology, 28(2), 165-176.

Crul, R. C. (1995). "Limnology and hydrology of Lake Victoria."*CABI Direct.* 79 pp.

Eggert, H., Greaker, M., and Kidane, A. (2015). Trade and resources: Welfare effects of the Lake Victoria fisheries boom. *Fisheries Research,* 167, 156-163.

Fiorella, K. J., Hickey, M. D., Salmen, C. R., Nagata, J. M., Mattah, B., Magerenge, R., Cohen, C. R., Bukusi, E. A., Brashares, J. S., and Fernald, L. H. (2014). Fishing for food? Analyzing links between fishing livelihoods and food security around Lake Victoria, Kenya. *Food Securit,y* 6, 851-860.

Fröcklin, S., de la Torre-Castro, M., Lindström, L., and Jiddawi, N. S. (2013). Fish traders as key actors in fisheries: Gender and adaptive management. *Ambio* 42, 951-962.

Harper, S., Zeller, D., Hauzer, M., Pauly, D., and Sumaila, U. R. (2013). Women and fisheries: Contribution to food security and local economies. *Marine Policy,* 39, 56-63.

Hazell, P., Poulton, C., Wiggins, S., and Dorward, A. (2006). 'The future of small farms: synthesis paper'. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/9218.

Jaabi, S. A., and Esemu, T. (2017). Fish Enterprise Financing and its Impact on Exports and Research and Development: The Case of Uganda's Fish Industry. *Institutions and Economies*, 35-59.

Kaleshu, J., and Temu, S. (2012). Expansion of rural financial services through linkage banking in Tanzania: Is joint action between savings and credit cooperative societies (SACCOS) a promising approach? *Enterprise Development and Microfinance* , 23, 146-160.

Kamau, P., and Ngigi, S. (2013). Potential for women fish traders to upgrade within the fish trade value chain: evidence from Kenya. *DBA Africa Management Review,* 3, 93-107.

Kleih, U., Linton, J., Marr, A., Mactaggart, M., Naziri, D., and Orchard, J. E. (2013). Financial services for small and medium-scale aquaculture and fisheries producers. *Marine Policy,* 37, 106-114.

Mary Muthoni, N. (2019). Fisheries Policy Reform Decisions and their Influence on Harmonization and Coordination: A Case of African Union and East African Community. CUE, 136pp http://localhost/xmlui/handle/1/6812 ,

Medard, M., Van Dijk, H., & Hebinck, P. (2019). Competing for kayabo: gendered struggles for fish and livelihood on the shore of Lake Victoria. Maritime Studies, 18(3), 321-333..

Moreau, M. A., & Garaway, C. J. (2021). Trading Fast and Slow: Fish Marketing Networks Provide Flexible Livelihood Opportunities on an East African Floodplain. Frontiers in Sustainable Food Systems, 316

Mkuna, E., & Baiyegunhi, L. J. (2019). Determinants of Nile perch (Lates niloticus) overfishing and its intensity in Lake Victoria, Tanzania: a double-hurdle model approach. Hydrobiologia, 835(1), 101-115

Mkuna, E., & Baiyegunhi, L. J. (2020). Impact of Nile perch (Lates niloticus) overfishing on fishers' income: Evidence from Lake Victoria, Tanzania. African Journal of Agricultural and Resource Economics, 15(311-2020-1790), 213-229..

Mmbando, F. E., Wale, E. Z., and Baiyegunhi, L. J. (2015). Determinants of smallholder farmers' participation in maize and pigeonpea markets in Tanzania. *Agrekon* **54**, 96-119.

Mugimba, K., Chengula, A., Wamala, S., Mwega, E., Kasanga, C., Byarugaba, D., Mdegela, R., Tal, S., Bornstein, B., and Dishon, A. (2018). Detection of tilapia lake virus (Ti LV) infection by PCR in farmed and wild Nile tilapia (Oreochromis niloticus) from Lake Victoria. *Journal of fish diseases,* 41 (8), 1181-1189

Nazir, I., Chauhan, R., Khati, A., and Arya, P. (2018). Role of credit for the upliftment of the fisheries sector. *International Journal of Fisheries and Aquatic Studies,* 6(2):01-04

North, D. C. (1990). Transaction costs, institutions, and economic performance. San Francisco, CA: ICS Press. pp. 13-15

Odongkara, K., Abila, R. O., & Luomba, J. (2009). The contribution of Lake Victoria fisheries to national economies. African journal of tropical hydrobiology and fisheries, 12(1), 47-51

Onyango, P. (2017). Socio-economic Characteristics of the Lake Victoria Fisheries. *In* "Lake Victoria Fisheries Resources", Springer pp. 161-184.

Ruddle, K. (2011). " Informal" Credit Systems in Fishing Communities: Issues and Examples from Vietnam. *Human Organization*, 224-232

Subasinghe, R. P. and Chief, A. B. (2015). Nutrition-sensitive aquaculture: a timely initiative. *FAO Aquac Newsl*, *53*(2)

Tran, N., Chu, L., Chan, C. Y., Genschick, S., Phillips, M. J., & Kefi, A. S. (2019). Fish supply and demand for food security in Sub-Saharan Africa: An analysis of the Zambian fish sector. Marine Policy, 99, 343-350.

Thorpe, A., and Bennett, E. (2004). Market-driven international fish supply chains: the case of Nile perch from Africa's Lake Victoria. *International Food and Agribusiness Management Review* **7**, 40-57

USAID, (2015).The Importance of Wild Fisheries For Local Food Security Tanzania: http://www.usaid.gov/what-we-do/global-health/nutrition/countries/tanzania-nutrition-profile.

Weber, R., and Musshoff, O. (2012). Is agricultural microcredit really more risky? Evidence from Tanzania. *Agricultural Finance Review* **72**, 416-435.

Wenaty, A., Mabiki, F., Chove, B., & Mdegela, R. (2018). Fish consumers preferences, quantities of fish consumed and factors affecting fish eating habits: A case of Lake Victoria in Tanzania. International Journal of Fisheries and Aquatic Studies, 6(6), 247-252.