Public Health Threats Around the Kivukoni Fish Market At Dar es Salaam, Tanzania

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Abstract
Both communicable and non-communicable diseases have erupted as a result of fish-related activities. The health effects of fishing activities are regrettably ignored and taken for granted by the general public who frequent fish markets. Additionally, this phenomenon has received little attention from researchers. The study's primary objective was to investigate activities at the Kivukoni fish market that could harm people's health. The study aimed to investigate incidents at the Kivukoni fish market that jeopardise public health and investigate perceived gender implications of public health mismanagement. For both quantitative and qualitative data, the study used a cross-sectional research methodology. Random and purposeful sampling was employed to select respondents and key informants at the market, and descriptive statistics (frequencies, percentages) were used to analyse qualitative data. On the other hand, qualitative data were coded in themes and sub-themes to support the study's goal. The study findings show that the market's public health is threatened by stalls, poor packing, spacing, and flooring, fish waste deposits, insufficient drainage that draws flies, and loud noises. It was further revealed that foul smell, noise, emissions, improper drainage, and poor sanitation caused the market to become wet and slimy; resulting in flu, skin irritation, difficulty breathing, and cancer. The study recommends that the government should prioritise improving health-seeking behaviour among market users through education, awareness-raising, and skill development.

1. Background information

More than 41,408,000 people work in the fishing industry worldwide, with 11,289,000 in aquaculture (Watterson et al., 2008). Most work in fisheries, food security, and nutrition in developing countries. Fishing contributes to population growth, rising incomes, and urbanisation (Alam, 2014). Over 500m people rely on fishing for their livelihoods. For people experiencing poverty, fish provides essential sources of the cheapest form of animal protein and nutrients, such as protein, retinol (vitamin A), vitamin D, vitamin E, iodine, and selenium (FAO, 2008, Béné et al., 2016). Fish consumption assists children's brain development and learning, protects their vision and eye health, and protects them from cardiovascular diseases and certain cancers (Watterson et al., 2008). Despite the importance of fish, the scope of public health risks associated with fishing activities is mostly unexplored (Woodhead et al., 2017).

It is worth noting that all fish-related activities take place at fish markets, where people gather to buy or sell fish, fruits, vegetables, or any other food material (URT, 2009). In this way, a fish market is a place for selling and buying goods and services related to fish products—including wholesale trade, agent, and retailer—between fishermen and fish merchants, or the sale of seafoods to individual consumers (Shang, 1998). According to FAO (2008), a fish market may include commercial fishing, harvesting, processing, and marketing. Other authors, such as Yuong and Muir (2002) add that activities at a fish market include selling fish and preserving, storing, transporting, and storing equipment to meet the needs of fish sellers and buyers. In this way, a crowded fish market attracts different fishing activities conducted in one area. It has been reported that fish processing activities have attracted more attention in public health in Africa, like in other parts of the world, because food hygiene and storage practices may create a significant risk to consumers from food poisoning (Watterson et al., 2008). However, because policymakers frequently lack sufficient data on health issues related to fishing activities, public health in fisheries has been neglected in national policy and donor priorities (Finegold et al., 2017).

Africa's fishery output was valued at US$24bn, accounting for a total of US$235bn in global fishery output (FAO, 2014; Phillips & Subasinghe, 2010). Tanzania is one of the African countries with over 4m people employed in fishery activities, directly or indirectly; and fish accounts for approximately 30% of the source of animal protein consumption; and 2.5% of the country's GDP (FAO, 2009; URT, 2010; BOT, 2016). Following the significant contribution of the fishery industry to the economy, the Tanzanian government was influenced to construct marketing facilities (Sambuo et al., 2021). The country has a considerable number of fish markets along Lake Victoria (Mwaloni), Lake Tanganyika, Lake Nyasa, Lake Rukwa, Lake Eyasi, the Indian Ocean, and other small bodies of water (URT, 2010). Despite the economic importance of fish markets, they often operate in highly vulnerable conditions that call for urgent attention to safeguard the health of the communities involved in fishery activities (Watterson et al., 2008). Unfortunately, even though it is known that activities involving public gatherings entail risks to people's health, the government seems not to be aware of it (URT, 2010).

Public health is the science and art of preventing pandemics and diseases (URT, 2009). The main focus of public health is to prolong life and promote human health through organised efforts, informed choices of society, and the promotion of healthy behaviours, communities and environments. It is concerned with public health to protect national, community, and individual health; primarily aiming at increasing the population's well-being by providing essential public health services to all citizens (ibid.). Despite government efforts to reduce public health risks, the work environment around fish markets is still ignored and marginalised within the broader field of public health dimension (Watterson et al., 2000; URT, 2010).

Most public health concerns are preventable by treating or controlling communicable and non-communicable diseases. Haque et al. (2014) inform that several health problems have been found with fish retailers in fish markets, including fish retailers that are commonly infected by several diseases such as common cold (cough, chorizo), diarrhoea, lesion (on hands, between fingers, between toes) and skin diseases. Most fish markets are overcrowded and have premises surrounded by offensive smell arising from drains, privy, water closets, earth closets or urinals that are not ventilated to destroy or render harmless and inoffensive gases, vaporous, dust or other impurities and noise generated: all of which are dangerous to the health of those working in, customers and/or neighbours.

According to Woodhead (2018), regardless of the importance of fish markets, there is a lack of understanding of the dimension of health issues affecting people associated with fishing activities. Thus, this area has limited research synthesis (Watterson et al., 2008). The Tanzanian government has made notable attempts to prevent any factors that may jeopardise public health, including initiating community awareness programs and enacting the Public Health Act (TNHP, 2017). The policy contain drafted regulations on the management of waste disposal, as well as established policies and strategies to ensure an efficient fisheries sector that does not only safeguard the health of the of the people; but also contributes to food security and nutrition, growth of the national economy, and improvement of the well-being of fisheries stakeholders while conserving the environment. However, despite these pronouncements, the causes threatening public health around fish markets, including the Kivukoni Fish Market, have not been well-established in Tanzania.

The Kivukoni Fish Market (KFM) is among famous fish markets in the Indian Ocean at Magogoni, Dar es Salaam, Tanzania. Public health activities around the Kivukoni Fish Market are guided by the National Fisheries Policies of 2015 and the Public Health Act of 2009. National fisheries policies aimed to address challenges that hinder the development of the fisheries sector, like illegal fishing, and explore the potential opportunities and benefits in the fishing industry. Unfortunately, the challenge of public health is not adequately addressed in these policies. It is the Public Health Act that aims to address the public health challenges that hinder the satisfaction of fish market premises. Thus, it functions to control epidemic, endemic, and pandemic diseases.

The law recognised that overcrowded premises like the Kivukoni Fish Market are presumed dangerous to sellers' and customers' health. Hence, the law calls for sufficient toilets for males and females. This regulation prohibits smell or sewage effluents that are injurious and hazardous to health; and seawater pollution through oil, grease, ballast, waste, and sewage. Consequently, ministry-related fishing introduced various programmes to reduce risks to public health, including avoiding particular harvest areas, sizes of fish, or even particular

species of fish; as well as controlling the method of capture, improving fish handling, hygienic and storage of catch that may directly affect the quality of seafood. Various measures are taken to identify activities that endanger people's health during harvesting, processing, or post-processing of fishery products to mitigate risks of infection. However, relatively little has been done on public health, which jeopardised the safety of fish markets. This study aimed to examine factors threatening public health at the KFM.

The KFM is crowded and attracts different public health concerns. A number of broader surveys on fishing have been carried out but none have addressed the public health issue at the KFM. These include a study by Adams (1997), who researched fish parasites and risks to public health. Also, Onyango et al. (2009) surveyed potential strategies to address fishers' problems; while Shah et al. (2012) investigated the prevalence of antibiotic resistance in Pakistani and Tanzania's fish-farming environments. On their part, Mgode et al. (2014) examined public health concerning Leptospira infections in freshwater fish. However, none of these studies have addressed activities threatening public health at the KFM; hence the existence of an information gap that this inquiry seeks to fill. This study is envisaged to benefit policymakers and the government by re-evaluating weaknesses in public health control to improve conditions around fish markets and enable people engaged in them live in a healthy environment. The study advocates Sustainable Development Goal No. 3, which focuses on good health and improving the well-being for people of all ages. It also aligns with the National Development Vision 2025, which strives to achieve good health in the face of air pollution, unsafe waste disposal, smog, and leaded gasoline: all of which have dexterous effects on human health. From the foregoing, the following objectives that guided this study include identifying activities that jeopardise public health at the KFM; examining perceived gender effects of mishandling of public health; and exploring efforts to control activities that endanger public health.

2. Methodology

2.1 Study area description

The KFM is located along the Indian Ocean, at Kivukoni in Ilala Municipal, Dar es Salaam region, in Tanzania. It formally started in the 1970s as a small market with such activities as fish sales and food vending. The KFM was selected for this study because it saved more than 1600 people from different areas in Dar es Salaam and nearby regions, and was the largest fish market along with the coastal region. Due to this, the fish market is overcrowded, and hence calls for public health attention. In 2002, the government collaborated with GICA to build a modern Kivukoni fish market. The market contains different partitions, known as zone, dealing with processing, retail, wholesale, trade, and other fishing activities.

The study employed a cross-sectional research design because it allows data to be collected, also responds positively to time and financial constraints (Bailey, 1998). It involved 30 male and female respondents randomly selected at the KFM early

in the morning. Literature argued that a population size of 30 can be the minimum sub-sample size sufficient for statistical research analysis (Bailey, 1998; Alam et al., 2014). Male participants were selected based on whether one was a fisherman, middleman, or a fish processor; while female's selection was based on whether one was a fish seller, food seller, labourer, and/or a consumer. Also, purposive sampling was used to select ten (10) key informants, including doctors, fish inspectors, health inspectors, environmental health officers, and the head of environmental conservation.

This study employed more qualitative methods, supported by quantitative methods of data collection, to gather both primary and secondary data. An open-ended questionnaire was administered to 30 respondents to allow them share life experiences on the issue of public health. At the same time, other questions were close-ended, as respondents were required to simply answer "YES or "NO." Qualitative data from key informants, group discussions, and case studies were analysed to support the study's objectives. A total of three (3) focus group discussion (FGD) sessions were conducted in the fish market, where each group discussion consisted of 4 to 6 fish fryers, sellers, and retailers. Quantitative data were analysed descriptively and presented in frequency percentages in tables, employing the Statistical Package for Social Sciences (SPSS). The descriptive statistics used frequencies and percentages to analyse health threats and practices addressing public health threats.

3. Results and discussions

3.1. Respondents' social and demographic profiles

3.1.1 Sex of respondents

As per the survey, more than half (59%) of the respondents were men, and less than half (41%) were women (Table 1). The results revealed that the nature of the activities performed at the fish market attracts more men than women. This finding is similar to Bene's (2003) finding that while women do not participate in actual fishing activities, their contribution to fishing activities cannot be underestimated. The finding demonstrates that the nature of women's function at the KFM makes it more likely for women to experience public health problems than men.

3.1.2 Age of respondents

In this study, over one-third (35%) of the respondents were aged between 40 and 49 years, indicating that one had to have the energy to conduct fishery activities effectively and generate income to support one's family (Table 1). This finding aligns with Jeyarajah (2015), who found that age usually influences an individual's working ability. However, productivity increases with age and decreases with the late life cycle. Findings also revealed that about 10% of the respondents were aged between 20 and 29 years (Table 1). The number of youth participating in fishing activities is small compared to middle-aged youth, further indicating that youth do not engage in fish-related activities for income reasons.

Table 1: Socio-demographic characteristics of the sample (*n -30*)

Variables	Category	%	Variables	Categories	%
Sex	Male	56	Education	Primary	69
	Female	43		Secondary	31
Age	20-29	10	Occupation	Fishermen	13
	30-39	23		Wholesale	13
	40-49	36		Retail	23
	50-59	16		Consumer	28
	60-69	13		Processor	23
Marital Status	Married	60	Years spent in fishing Activity	1-5	30
	Unmarried	40		6-10	20
				11-15	7
				16-20	30
				21-25	10
				26 above	3

Furthermore, the finding shows that a small proportion (14%) of respondents were elders aged between 60 and 69 years (Table 1). This small proportion means that although adult people have more experience in fish-related issues, however, they are at high risk of diseases like diarrhoea because aging weakens them.

3.1.3 Marital status

Table 1 shows that a significant proportion (60%) of women and men were married, and (40%) were single. This result agrees with the findings of Nwabeze et al. (2013), who attributed that the dominance of married women and men is due to an act of protectivity on the part of women in ensuring food security, generating income, and reducing the vulnerability of feminine within the family, as well as ensuring the health safety of the family.

3.1.4 Education of respondents

Table 1 shows that most respondents (69%) have primary school education, and 31% had attained secondary school education. The findings imply that a low education level might directly influence the mismanagement of public health and how to manage public health at the KFM. This finding is similar to that of Yuerlita et al. (2005), who reported that the percentage of primary school education among fishers was higher than other levels of education because fish activities have their traditional ways of learning, and sometimes can be handed from one generation to another; hence making one to not necessarily needing high education and specialised skills to engage in the trade.

3.1.5 Respondents' years spent in fishing and related activities

The findings show that one-third (39%) of the respondents had an experience of 1–5 and 16–20 in fishing-related activities. Remarkably, a small percentage (3%) had 26 years of fishing-related activities. A small percentage implies that the vast experience of the respondent through education will raise awareness and knowledge.

3.1.6 Respondents' activity at the KFM

Table 2 shows that less than one-third (28%) of the respondents were consumers of fish products, and were women.

The findings further indicates that less than one-third (23%) of the respondents were fish processors and retailers. In contrast, a small proportion (13%) of respondents were fish men, which implies that a large population of people found at fish markets buy fish products. Thus, in any case of disease breakdown, there is the likelihood of disease spreading to the community. One key informant said:

> *"KFM market had a total of 1600 workers registered, including fishers. The market could serve almost 10,000 people daily, most of whom are fish product consumers."*

The large number of people attending the fish market further implies that public health risks at the KFM face both men and women.

4. Areas threatening public health around the KFM

4.1 Smelling and noise at Kivukoni Fish Market

Table 2 indicates that the majority (86%) of the respondents agreed that offensive smells, noise, and pollution contaminate the atmosphere of the fish market. At the same time, just a tiny proportion (14%) of the respondents agreed that the smell and noise are no problems due to the nature of the environment. Observations show that the foul smell at the KFM is caused by improper handling of fish waste disposals like fish bones, shortage of packaging materials, and a frying section at KFM. This finding aligns with Alam et al. (2014), who found that fish markets are often characterised by wet and slimy flooring, foul smell, deposits of fish waste, improper drainage, and the presence of flies. One discussant revealed that firewood was the reliable source of fuel in the market. Wood smoke produces various gases, including carbon monoxide, which impair the body's ability to transport oxygen; causing dizziness and fatigue. Nitrogen dioxide, which causes difficulties in breathing, and polycyclic aromatic hydrocarbons, also cause irritation and inflation of the lungs, which may result in lung cancer.

Table 2: Areas threatening public health at Kivukoni Fish Market

Variables	Condition Responses	Frequency	Per cent
Packaging and storage system	Very bad	16	55
	Not bad	14	45
Spacing	Not enough	17	55
	Enough	13	45
Sanitation facilities(toilet)	Not enough	25	86
	Enough	5	14
Drainage system	Not proper	18	59
	Proper/clean	12	41
pollution and noisy	Too high	25	86
	Too low	5	14
Clean water	Yes	11	34
	No	19	66

One key informant from the Medical Department said:

> *"Offensive smells threaten public health by affecting people's respiratory system; coughing causes chest pain and flue, and difficulties in breathing."*

On the other hand, observation shows that noise was caused by fishers hauling in their catch, thrumming sounds and voices from different auction tables; as well as the presence of bus and ferry terminals nearby. One correspondent informed that this condition can affect people's psychological conditions and make them uncomfortable.

4.2 Sanitation facilities

Most respondents (86%) said the KFM's ranking sanitation facilities were not adequately cleaned, and were also insufficient to support a considerable population like that at the KFM. Only a small proportion (14%) of the responses shows that toilets were well-cleaned (Table 2). This finding agrees with Mwangi (2017): that toilets are essential to achieving good sanitation; and that one needs access to and consistent use of a safe and hygienic toilet to promote good personal hygiene and public health.

Regarding this, one discussant commented thus:

> *"Toilets in the market are not adequate compared to the daily population coming to the market, which influences some people to use unofficial places for their needs, like urination around the market and/or in the sea. There is no free access to toilet services around this market; and sometimes, it is harder for some people to access toilets, an aspect that influences people to pollute the environment and urinate without washing hands."*

Washing hands with soap is essential after toilet use because soap is the most effective and inexpensive way to prevent diarrheal diseases. This finding is similar to Curtis and Cairncross (2003): that hands often act as vectors of disease-causing pathogens from person to person, either through direct contact or indirectly via surfaces.

4.3 Access clean water to the KFM

Findings show that a significant proportion (66%) of the respondents indicated insufficient clean water to support fishing and related activities (Table 3). Observation shows that some people suffer from diarrhoea due to the lack of enough clean water at all times. Some people use salt water for toilet water, drinking, and other activities that cause the eruption of diseases like diarrhoea. These findings are similar to Waswa et al. (2007), who found that adequate clean water is critical in a fish market to support running activities and drinking for people's health and prevent the outbreak of pandemics.

4.4 Drainage system at the KFM

The finding shows that most (59%) respondents indicated that the drainage system at the KFM was not in good condition to allow smooth flow of sewage water (Table 2).

One of the discussants said:

> *"Drainage systems are not always cleaned because fish processing and waste block sewage systems, which caused lesions on legs and skin diseases."*

This finding is similar to Mwangi (2017), who found that the drainage system in the fish market is covered by fish scales, fish frames and packing materials, which interfere and block the drainage system, resulting in additional labour costs to scoop off these wastes mechanically. These findings contradict the Public Health Act (Cap 1008, Section 118(n)), which insists that all business premises should be clean.

4.3 Perceived effects of public health by gender at the KFM

4.3.1 Perceived effects on public health by gender

According to the survey, a significant proportion (76%) of the respondents perceived that men were more exposed to the effects of mishandling of public health threats than women (Figure 1).

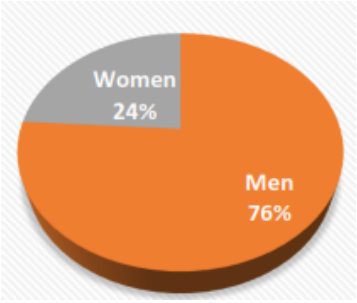

Figure 1: Perceived impact of public health by gender at KFM

Compared to women, men stay longer at the marketplace performing different activities, including hauling, conducting auctions, frying fish, finishing processing, and doing retail business. One group discussion with fish fryers elucidated that there were 48 kitchens in the market for flying fish; all of which are owned and controlled by 20 business people who are also responsible for their maintenance in the case of damages. The owners of kitchens employ men to fry fish; and these work from early morning up to nine o'clock in the evening, depending on the availability of fish and customers. This implies that men are more likely to be affected by harmful effects than women.

The informants pointed out that most fryers use fuelwood in frying fish, with the smoke being produced causing coughing, chest pain, flue, and breathing difficulty, which also causes dizziness and fatigue. These findings are aligned with Alam et al. (2014), who found that fish fryers were commonly infected by several diseases such as common cold (cough, coryza), diarrhoea, lesions on hands and between fingers/toes. Also, one key informant from Mnazi Mmoja Hospital pointed out that wood smoke produces different chemicals, including polycyclic aromatic hydrocarbons that may also cause cancer in people exposed to it for long periods.

From the foregoing, it is clear that men were more exposed to hot and full-smoke environments compared to women. Such environments allow more heat to penetrate internal parts of the body, which may cause skin eruption, heat fatigue,

heat cramps, heat syncope, heat exhaustion, strokes, and heart failure. Additionally, stem from boiling pots causes respiratory infections as it combines crude oil and other gasses from smoke, causing eye/ear problems and regular flow of mucus. One discussant pointed out:

> "*When it is too hot, I soak my clothes in the water, and I wear them while wet to reduce the heat in my body.*"

The FGDs further revealed that the kitchens also covered with tiny soot, which is poisonous to human health. This tinny soot melts and drips into fish during the hot season. Moreover, tinny soot causes dry cough and chest pain.

Therefore, activities carried out by men exposed them to health hazards, more than women. During one FGD, one discussant (fisherman) lamented that men complained about lesions on their legs, skin diseases, and diarrhoea due to the unclean environment at the KFM; further pointing out that women suffered less because their activities concentrated on buying fish and other products for retail businesses, hence spending only few hours in the market. Hence, it was just a small proportion (24%) of the respondents who suggest that women are affected by the hazardous health activities at the KFM.

5. Conclusions and recommendations

The study findings have shown that the significant factors that threaten public health at the KFM include smell and noise, insufficient sanitation facilities, the lack of adequate access to clean water, and improper drainage systems. It is recommended that the ministry responsible for health and the Ilala Municipal authorities address these health risks to prevent an outbreak of diseases. Emphasis should be on providing water and sanitary services, proper disposal and/or re-use of fish wastes, and modifying the existing drainage systems to allow a smooth flow of waste- or unclean water. Equally, the government and fish market management should establish programs to educate fish traders on the best public health practices of carrying out their activities in the market to avoid health ill-effects.

References

Alam, M. M., Haque, M. M. & Shikha, F. H. (2014). Studies on Public Health and Hygiene Condition of Retailers at Fish Markets in South-central Bangladesh. *Journal of the Bangladesh Agricultural University*, 12(2): 411–418.

Alam, M. M., Haque, M. M. & Shikha, F. H. (2014). Studies on Public Health and Hygiene Condition of Retailers at Fish Markets in South-Central Bangladesh. *J. Bangladesh Agril. Univ*. 12(2): 411–408.

Andrew Watterson, David Little, James A. Young, Kathleen Boyd, Ekram Azim and Francis Murray. (2008). Towards Integration of Environmental and Health Impact Assessments for Wild Capture Fishing and Farmed Fish with Particular Reference to

Public Health and Occupational Health Dimensions. *International Journal of Environmental Research and Public Health*. 5(4): 258 – 277.

Bandura, A. (1986). *Social, Foundations of Thought and Action; a Social Cognitive Theory,* Prentice-Hall.

Béné, C. (2003). When Fishery Rhymes with Poverty: A First Step Beyond the Old Paradigm on Poverty in Small-Scale Fisheries. *World Development,* 31(6): 949–975.

Béné, C., Arthur, R., Norbury, H., Allison, E. H., Beveridge, M., Bush, S. & Williams, M. (2016). Contribution of Fisheries and Aquaculture to Food Security and Poverty Reduction: Assessing the Current Evidence. *World Development*, *79:* 177–196.

Njaya, F., Donda, S., & Béné, C. (2012). Analysis of power in fisheries co-management: Experiences from Malawi. *Society & Natural Resources*, *25*(7), 652-666.

Garrett, L. (2007). The challenge of Global Health. *Foreign Affairs,* 86(1); 14–38.

Haque, M. M., Little, D. C, Barman, B. K., Wahab, M. A. & Teffer T.C. (2014). Impacts of Decentralised Fish Fingerling Production in Irrigated Rice Fields in Northwest Bangladesh. *Aquaculture Research,* 45(4): 655–674.

Jensen, G. L. & Greenless, K. J. (1997). *Public Health Issues in Aquaculture*. *Revue scientifique et technique (International office of Epizootics) 16(2): 641–651.*

Kothari, C. R. (2004). *Research Methodology Methods and Techniques.* (2nd Ed.). New Delhi: New Age International (P) Limited, Publishers.

Malhotra, A., Schuler, S. R. & Boender, C. (2002). *Measuring Women's Empowerment as a Variable in International Development. The* World Bank, Washington, DC. 12pp.

Marendi. P. (2015*). Public Procurement Legal Framework Implementation and Performance of State Corporations in Kenya*. PhD dissertation in Supply Chain Management, Jomo Kenyata Agriculture and Technology University. 259 pp.

Mgode, G. F., Mhamphi, G. G., Katakweba, A. & Thomas, M. (2014). Leptospira Infections in Freshwater Fish in Morogoro Tanzania: a Hidden Public Health Threat. *Tanzania Journal of Health Research*, *16*(2).

Moghadasian, M. H. (2008). Advances in Dietary Enrichment with n-3 Fatty Acids. *Critical Reviews in Food Science and Nutrition*, *48*(5): 402-410.

Mugenda, O. & Mugenda, A. (1999). *Research Methods Quantitative and Qualitative Approaches*.

Mwangi, A. (2016). Influence of Fish Trade Activities on the Environment in Gikomba Fish Market, Nairobi County, Kenya. Doctoral dissertation, Kenyatta University.

Onyango, P. O., Haule, T. D., & Mwanahamisi, S. (2005). Potential Strategies to Address Fishers' Problems in Lake Victoria, Tanzania.

Panneerselvam, R. (2008). *Research Methodology*: New Delhi: Prentice Hill of India.

Phillips, M. & Subasinghe, R. (2010). Small-scale Shrimp Farmers and Global Market-Trends, Prospects and Adaptation. In V. Alday-Sanzy (Ed.): The *Shrimp Book.* Nottingham: Nottingham University Press community. Available at http://hdl.handle.net/11671/789.

Sambuo, D. B., Kirama, S. & Malamsha, K. (2021). Fish Price Determination Around Lake Victoria, Tanzania: Analysis of Factors Affecting Fish Landing Price. *Global Business Review*, 22(2): 348–363.

Shah, S. Q., Colquhoun, D. J., Nikuli, H. L. & Sørum, H. (2012). Prevalence of Antibiotic Resistance Genes in the Bacterial Flora of Integrated Fish Farming Environments of Pakistan and Tanzania. *Environmental Science and Technology*, 46(16): 8672–8679.

Taylor S. Marandi. A. (2008). Social Determinants of Health and the Design of Health Programmes for People Experiencing Poverty. *BMJ.*, 337.

United Republic of Tanzania (URT). (2013). *Population and Housing Census of 2012.*

Venugopal, V. (2002). Biosensors in Fish Production and Quality Control. *Biosensors and Bioelectronics*, 17(3) 147–157.

Waswa, F., Otor, S., Olukoye, G., Mugendi, D. (2007). *Environment and Sustainable Development; a Guide for Higher Education in Kenya*. Volume 2. Kenyatta University.

WHO. (2006*). Constitution of World Health Organization, Basic Documents.* 45th ed.

Winslow, Charles-Edward Amory. (1920). The Untitled Field of Public Health. *Modern Medicine, 2: 183–191*.

Woodhead, A. J., Abernethy, K. E., Szaboova, L., & Turner, R. A. (2018). Health in Fishing Communities: A Global Perspective. *Fish and Fisheries*, *19*(5): 839-852.

Young, A. J., & Muir. F. J. (2002). Fish Biology and Fisheries. *Marine Resources Economics* 17(2): 163–173.

Yuerlita, K. & Sylvain, R. P. (2010). Livelihood Features of Small-scale Fishing.