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Chapter

Enhancing Food Security through Fisheries for Rural Communities around Lake Mutirikwi in Zimbabwe

Shadreck Tanyanyiwa and Garikaimose Tongowona

Abstract

This article investigates the impact of artisanal fisheries as pathway to food security for communities around Lake Mutirikwi in Masvingo province. The study area receives inadequate rainfall for food production. The study based on qualitative research methods and triangulation of data collection, which provides comprehensive understanding of the impact of fisheries to food security in the study area. A sample of 20 respondents was purposively selected for this investigation. The study revealed that the fish industry is an invaluable source of food security for rural communities around Lake Mutirikwi; and has also improved the standard of living of the locals. It also revealed challenges facing the industry and they include lack of infrastructure development and poor social services inhibit the viability of the industry. Another challenge is the disintegrated and inconsistent legislation in the fishing which hinder the viability of the sector. The chapter concludes that the fishing industry, especially aquaculture has the potential of contributing overwhelmingly to food security, however, there is need for infrastructure development such as roads within the fishing communities; and, alignment of fishing policies.

Keywords: artisanal fisheries, aquaculture, fish farming, food security, climate change

1. Introduction

Food security has become a widespread global phenomenon especially at the turn of the twenty-first century [1]. According to the 1996 World Food Summit, 'food security is when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life' [2]. Food security affects more than human health and welfare; it also contributes to economic and political stability [1]. Most countries that experience political instability are always associated with food insecure territories. Food insecurity in such countries might have been as a result of political instability or vice versa. Conversely, food insecurity exists when people lack sustainable

physical or economic access to enough, safe, nutritious, and socially acceptable food for a healthy and productive life [3]. Food insecurity may be chronic, seasonal, or temporary. Chronic food insecurity occurs over a sustained period as people fail to meet their food requirements, because poverty inhibits their access to productive or financial resources. Seasonal or temporary food insecurity, also known as transitory food insecurity is caused by a sudden inability to produce or access adequate amounts of food [2]. Transitory food insecurity is usually unpredictable. Most countries experience transitory food insecurity largely because of climate change induced droughts, poor policies and pricing of food.

To sum up, there are three human-induced threats that create food insecure communities: poor policies, climate change, and armed conflicts [3]. The three threats are closely intertwined. For instance without water there would be no food; if there is water and agricultural inputs in a politically unstable country, there would still be no food. Therefore, food security requires agricultural inputs, water and stability, even innovative ways of crop production can only be effective in stable environments with enabling policies [3] such as pricing regimes that make food unaffordable for the poor.

Climate change is the biggest threat to food security. Climate change affects rainfall patterns, with dire consequences in less developed countries that rely on rain-fed agriculture. At the international level a number of poverty eradication initiatives have been put in place to deal with the pressing issue of food security, with minimal success. These include the Sustainable Development Goals (SDGs) that are expected to be achieved by 2030. While the first two SDGs pertaining to no poverty and zero hunger, specifically addresses food security, the other 15 goals are also linked to food security directly and indirectly. While the SDGs timeline remains elusive for many countries, a food-secure world, where all people have unrestricted access to safe, nutritious and affordable healthy food suitable for sustainable lives is still an anticipated one [4].

Africa as a continent has been critically impacted by food insecurity and has not shown tangible improvements in dealing with the crisis. Instead, the failures have been incessantly affecting the population. According to the International Monetary Fund (IMF), in 2022 about 123 million people about 12% of sub-Saharan Africa population experienced food insecurity [5]. Climate change and conflict are the main drivers of food insecurity in Africa, where many countries rely on humanitarian food aid. Low crop production has resulted in increased imports of grain. In 2018, 73 million tons of grain worth about \$15 billion was imported by some African countries [6]. Estimates are that if adequate response measures are not put in place by 2030, there would be about 118 million extremely poor people exposed to drought, floods and extreme heat in Africa [7]. Therefore, without increased efforts, food security challenges will continue to befall many nations and, in the process, risk missing the SDG target of eradicating hunger by 2030 [6].

In Zimbabwe, about 70% of the population lives in rural areas, where many through poverty are susceptible to food insecurity. At times a promising agricultural season could be weakened mid-season by dry spells or invasion of locusts. One of the worst drought periods was in 1991/1992, when the country had only 13,000 tonnes of maize left, about 2 days of food [3]. And, the 2002/2003 drought did not only affect Zimbabwe, but was felt across five other southern African countries, where 13 million people required urgent food aid between April and June 2002. The figure jumped to 15.25 million by December, 2002, with Zimbabwe accounting for almost half total number of people in need of food [7]. These figures alone reveal the severity

of drought problems in the country that went on to experience more drought periods that were coupled with price shocks of 2008.

These trends of food insecurity have forced a number of countries in SSA to transform and diversify from over-reliance on crop production to fishery production. In recently years, the contributions of the fishery sector both artisanal capture fisheries and aquaculture has become essential in promoting food and nutrition security especially in low-income countries. For example, in 2014, Zambia was the sixth largest producer of farmed fish mainly breams, a local name for tilapia, in Africa and the largest in the Southern African Development Community (SADC) [8]. The increasing demand for fish in Africa has also created opportunities for re-inventing African aquaculture development. There is evidence that aquaculture growth in Africa has increased, contributing to livelihoods through food security and incomes [9]. Fisheries and aquaculture contribute to the envisioned blue economy, which is generally sustainable harnessing of water resources for economic growth and food security [9].

Capture fisheries is a typical fishery activity which entails harvesting of fish from the natural water systems whilst fish farming or aquaculture is the growing or rearing of fish for food or ornamental purposes on farms or private properties such as ponds, tanks, and raceways [8, 9]. However, with capture fisheries the fish stocks are common property until harvested as this entails capturing fish from their wild habitat such as the lakes or dams. Capture fisheries activities together with fish farming are both regarded as food production and hence are categorised as vital sources of food production and food security [8].

Therefore, in the face of low crop production, in most SSA countries, we believe that the fishery sector could become another promising avenue or a panacea to food insecurity not only in Zimbabwe, but across Africa and other low-income countries around the world. Based on the four pillars of food security—utilisation and nutritional value, availability, access, and stability fish has the potential to provide an important albeit under-recognised role in global food security. Therefore, this study, using triangulation data collection method, investigated the contribution of artisanal fisheries to food security for rural communities around Lake Mutirikwi in Zimbabwe.

2. Role of artisanal fisheries in food security

The contribution of fisheries to global food security has often been underestimated. More than 158 million people each year benefit from the nutritional value of fish [9]. The fishing industry is particularly important in reducing hunger and malnutrition among many of the world's poorest and most vulnerable populations [10]. Fisheries and aquaculture ventures have often been subjectively disconnected from other parts of the food and agricultural systems in food security studies, debates and policy-making [11]. According to [12], limited attention has been given to fish as a key element in food security and nutrition strategies at national level and in wider development debates and platforms. Professional fisheries discussions have focused mainly on questions of biotic sustainability and on the economic efficacy of fisheries, abandoning concerns linked to their contribution to alleviate hunger and malnutrition; and in supporting livelihoods [11]. In most countries, increased consumption of fish and its contribution to the diets of low-income populations that include pregnant and breast feeding women, and young children has become a vital strategy for improving food security and nutrition [8, 9, 11, 12].

The multibillion dollar blue economy uses different strategies for fish production. However, despite minimal coverage in the trajectory of fish and food security, available sources indicate that, in 2014 capture fisheries and aquaculture provided an estimated 3 billion people with about 20 percent of their average per capita intake of animal protein, and a further 1.3 billion people with about 15 percent of their per capita intake [13]. This share can exceed 50 percent in some countries. For example, in West African coastal countries, where fisheries have historically been a central element in local economies, the quantity of total dietary protein from fish is high; estimated to be above 60% in Gambia, Sierra Leone and Ghana [13]. Similarly, in Asia, where fisheries are tremendously imperative and fish farming has developed rapidly over the last decades, the overall dietary protein from fish is estimated to be between 50 and 60 percent in Cambodia, Bangladesh, Indonesia and Sri Lanka [14]. Fish provides a correspondingly momentous proportion of protein in the human diets in most small island states such as the Maldives, where fishing is one of the primary sources of income [15]. The fishing industry in the Maldives employs half of the country's work force and provides a livelihood for much of the population. Fishing is also one of the main attractions Maldives' bustling tourism industry [15].

The impact of small-scale and large-scale fisheries differs in the way they contribute to the development of the local communities and the world in general. Scholars such as [14–16] noted that, small scale fishery make a substantial contribution to food security and nutrition; and provide food to rural and urban poor in developing countries, often in the form of canned fish. Whereas on the contrary the large-scale fishery industry also contributes to food security though less compared to the small-scale, which has a direct inclination on societal development [16]. The consumption of small oil-rich pelagic fish mackerel, herring, pilchard, sardine, and anchovy is predominantly significant in developing regions such as sub-Saharan Africa [10]. Although previously viewed as food for the poor, the sale and consumption of pelagic fishes has gained popularity across social classes due to the nutritional benefits and rapid processing time. Unlike larger fish that require more labour-intensive post-processing to remove guts, small pelagic fish can be easily dried on large racks in the sun in just a few days [9, 10]. One major nutritional advantage of this practice is that sun-dried pelagic fish can be consumed whole, thus preserving micronutrients in the head, bones, and intestines of the fish. Sun-dried fish can be stored without refrigeration for months, providing long-term food security for low-income families [10].

Fish has an equal share in the proportion of tradable foods. International trade represented 37% of the total fish production, with a total export value of \$129 billion, of which \$70 billion were exports from developing countries [17]. Scholars believe that international fish trade has mixed impact on the well-being, food security and nutrition of local fishing populations [8–10]. On one hand, some experts point to the contribution that export revenues from fisheries make to local economies and extra government revenues, with opportunities to redistribute those for pro-poor interventions, including support for food security and nutrition [9, 13, 14]. Moreover, the growth and employment generated through fisheries adds to the livelihoods of the poor. Some scholars, on the other hand, have revealed that in many cases remunerative international fish trade generating billions of dollars in revenues co-exist with miserable living conditions of the local communities who have been excluded from the trade by harsh commercial regulations and legislations, losing access to employment and to a rich source of food [18–20]. The problem stems from the inability of

governments in developing countries to negotiate acceptable agreements with foreign fishing operators who exploit the blue economy to their advantage and in the process depleting fish stocks.

In Asia, aquaculture development has been prompted by increasing demand from the growing urbanising populations, deteriorating capture fisheries supplies, investment in education and technology research, a dynamic private sector and high levels of public investment in infrastructure to support agricultural development [21]. From about 2003 there has been a vibrant small and medium enterprise (SME) fishing sector, predominantly in China, Vietnam, Thailand, Indonesia and the Philippines, which targeted both domestic and international markets [22]. Asia is known as home to the world's majority of small-scale fishers and aquaculturists. Small-scale aquaculture in Asia is divided partially into overlapping, categories: traditional, and more specialised. The traditional aquaculture is dominated by ponds scattered across villages. The ponds are usually small, ranging from less than 0.2 hectares to multiple water bodies often constructed for harvesting drinking water and/or used for washing, bathing, watering livestock, irrigation and fishing [22]. This integration of aquaculture and crop-animal systems is now popular in most of Asian rural communities. If managed efficiently, the integration of fishing and crop-animal benefits from synergisms among enterprises, diversity in produce and environmental soundness. Both enterprises benefit from nutrient recycling of otherwise unused waste materials [22]. However, according to the [11], aquaculture for poverty reduction and food security is developing fast, but not always in ways supported by numerous development agencies. Rather than being a means to secure nutritional gains and income directly for the poorest smallholder farmers, aquaculture is progressively a means to intensify domestic fish supply to low-income consumers, develop employment opportunities, support local economic multipliers, and generate revenue from trade [11].

Studies in Malawi, Bangladesh and the Philippines exhibited positive income, employment and consumption effects for poor households adopting small-pond or cage aquaculture systems [21–23]. Therefore, aquaculture has proved to be central in enhancing food security and incomes. In 2012, about 30 villagers in Magochi district, eastern Malawi, harvested over 200kgs of fish from two cages developed with the help of the United Nations Development Programme (UNDP) [23]. However, in most parts of the world aquaculture has not been taken seriously which has led to the problem of poverty and over dependent on donor relief.

In Africa, as demonstrated in Malawi, Uganda and Zambia small-scale fisheries generate employment, especially in the post-harvest activities such as fish processing and marketing. Fish are therefore not only a source for food security but also generate incomes for the fishing communities.

3. An overview of artisanal fisheries and aquaculture enterprises in Zimbabwe

Zimbabwe is endowed with abundant freshwater resources in both commercial and communal farming areas, comprising a total land area of 386,847 square kilometres and a water area of 3910 square kilometres; making the country the largest freshwater fish farm in farm. However, despite the presence of immense growth opportunities for both capture fisheries and fish farming activities amid a general rise in global aquaculture activities and production, less than 5% of Zimbabwe's fish

farm is utilised for fish production. Freshwater aquaculture in Zimbabwe has gained momentous growth over the years and such growth can be attributed to a number of factors ranging from the government efforts, the private sector and non-governmental interventions [24].

The small but relatively developed fish industry places Zimbabwe among the top 10 fish farming countries in Sub-Saharan Africa. Wild capture fisheries and fish farming are both practiced in Zimbabwe. According to [25] the fishery sector exploits about 114 indigenous fish species and an additional 30 exotic species, which were introduced for aquaculture production. Commercial aquaculture in the country is largely based on two species Nile tilapia and rainbow trout. The warm water temperatures of above 24°C in northern Zimbabwe are conducive for tilapia farming, with the cooler temperatures in the eastern highlands been conducive for trout production [24]. Both species are farmed on a commercial scale. The African catfish and Indian carps are also nurtured, though to a lesser extent. The most important commercial fish stocks exploited by fishers in Zimbabwe are within five reservoirs namely Kariba, Chivero, Manyame, Mutirikwi and Mazvikadei [25].

Artisanal fishing made up of various small-scale farmers with archaic technology and low capital dominates the fishing industry in Zimbabwe. Produce from these small-scale fish farmers is not processed rather it is mainly for local consumption [26]. There are no statistics on the number of artisanal fishers in the whole country except on Lake Kariba, where it was estimated that 1154 artisanal fishers reside in 41 fishing villages along the lake [27]. The artisanal fishery also generates considerable additional employment such as fish traders, boat building and net making. Nevertheless, information relating to the contribution of artisanal fishing in the fishery sector is minimal and scarce which undermined the role of small-scale fishing in rural development in Zimbabwe.

Capture fisheries from Lake Kariba is the backbone of the fishery sector in the country, accounting for almost 90% of the country's fish production. Capture is mainly through an open water semi-industrial fishery that exploits pelagic fish commonly as Kapenta and an artisanal inshore fishery circumscribed to the shallow inshore water where exploitation is through gillnets [28, 29]. Artisanal fishery is also common practice along Lake Kariba as local communities around the lakeshore vie for the available natural resource for their livelihood.

The fishery sector contributes to the economy of Zimbabwe in a variety of ways. According to [11] fisheries have diversified agricultural outlook, creating employment, increased government revenues, foreign exchange generation, regional trade and integration, and enhanced food security [30]. About 4000 people are employed in aquaculture with nearly 44,000 employed in inland fisheries [30]. Between 2001 and 2011, the national production of fish and aquatic products in Zimbabwe increased with more than double in weight and value, [30]. The production of fish and other aquatic animals has contributed immensely to nutrition and food security in most rural parts of Zimbabwe [29–31].

The contribution of the aquatic livestock to the national agriculture sector is generally underestimated as compared to the crop sector contribution. Statistics provided by FAO in 2018 pointed out that capture fisheries production is estimated to be about 18,500 tonnes per year [30], against a potential national demand of 60,000 tonnes. Much of the production is Nile tilapia raised in floating cages in Lake Kariba operated by the Lake Harvest company, one of the leading private aquaculture firms in Africa, which also operates in Uganda and Zambia [31]. To cover for the fish deficit, in 2021

Zimbabwe imported meats, fish and seafood ingredients valued at US\$2.62 million. However, with abundant freshwater for fish farming, the country has potential to produce 1.5 million tonnes per year, supporting 1.2 million people at the primary production level.

Produce from capture fishery and aquaculture are largely sold whole and frozen. They are similarly obtainable in whole, fresh state. Tilapia/bream are a popular and well-favoured species in Zimbabwe. Relatively, there is a robust preference for farmed tilapia over the wild-caught, as the latter are alleged to have quality problems of off-flavours and decomposition [30]. Tilapia, most farmed in Zimbabwe, is often processed into frozen fillets sold in butcheries and supermarkets across the country. Fillet processing by-products, such as heads and belly flaps are easily affordable to low-end consumers. Trout, on the other hand, being a non-endemic species farmed only in the Eastern Highlands, is both less popular and more expensive than tilapia, and is mainly available in fashionable supermarkets and restaurants. The range of trout products includes frozen whole trout, trout fillets, smoked trout and trout pates [27, 28]. For rural communities around fishing villages, fish has replaced beef and chicken during meal times.

3.1 Legislation and policies for the fisheries sector in Zimbabwe

There are a number of legislative frameworks that govern the fishery sector in Zimbabwe. However, there is no legislation that directly deals with aquaculture. Some of the laws on the management of fisheries are drawn from the Parks and Wildlife Act; the Environmental Management Act; the Constitution of Zimbabwe; the Water Act; and Zimbabwe National Water Authority Act.

The Parks and wildlife Act amended in 1996 guides control and manage the fisheries sector in the country. Though, its major purpose is the management of the Parks which may include the water bodies crucial for fisheries. The Act ensures the control of fishing activities which include, regulating the use of the nets, explosives and the introduction of the new species. Furthermore, the Environmental Management Act (EMA) chapter 20: 27 plays a crucial role in the management of natural resources. The EMA ensures prevention against pollution and environmental degradation which also protects the aquatics species. Along with the EMA, the Water Act of 1998 also ensures that all kinds of pollution are criminalised and deemed offences so as to protect the water resources.

The absence of an integrated, consistent and all-inclusive legislative framework meant for the governance of the fishery sector both artisanal and aquaculture highlights the negation of the sector's contribution to the economy and the livelihoods of the local communities in general. The essence of the sector in economic growth and food security has been often disregarded, which has led many illegal activities taking place around the key water bodies. The application of many fragmented pieces of legislation like the ones existing in Zimbabwe is burdensome and often creates loopholes that result in the mismanagement of the natural resources, hence downplaying the contribution of such to the economy and food security clusters. Cumbersome compliance measures of these clauses prohibit locals from enjoying the natural resources in their areas, creating conflict between the government and the communities. In response, communities have in most cases opted for illegal ways of exploiting the fish resources, which defeats the principle of sustainable development as illegal fisheries disturb biodiversity.

4. Study area in perspective

Masvingo Rural District (MRD) lies in natural regions 4 and 5 that receive low rainfall that does not support adequate food production under rain-fed conditions. Zimbabwe is divided into five agro-ecological regions known as natural regions based on three core characteristics rainfall regime, soil quality and vegetation. These attributes decline from natural region 1 through to natural region 5. Erratic annual rainfall especially during the month of January to March has been the main contributor to low crop yields in the district resulting in food insecure households. The livelihoods of the households in MRD are highly susceptible to rainfall variability and extreme events due to their heavy reliance on rain-fed agriculture. During the last decade, there has been recurrence of weather hazards that included droughts and floods worsening the vulnerability of most households living in rural Masvingo. Reduced forest cover, deteriorating grazing lands, soil erosion, pests and diseases are some of the effects of the hazards that have had negative impacts on agricultural production. Most food security assessments reports place MRD among the districts with prevalent food insecurity challenges and rely on food assistance [32]. According to assessment reports 24% and 35% of the households in Masvingo were food insecure during the peak hunger season of 2016 and 2017 respectively [32]. Limited water harvesting and storage structures increased the vulnerability of households to food insecurity and malnutrition, while conversely reducing their ability to adapt, mitigate and recover from these shocks. In a 10-year period 2006–2016 the district experienced about 12 climate-change related hazards and shocks with a frequency of about 5–6 times on average. The district experienced droughts in 2008, 2009, 2013, 2014 and 2016 and cyclone induced floods in 2007 and 2017 [32]. There were also other shocks that affected the livelihoods of the communities such as hyperinflation, cash crisis and armyworm. This frequent occurrence of shocks left households with no time to adequately recovery. Consequently, households become more vulnerable as their assets were depleted at a faster rate than they could recoup them.

However, intermittent high rainfall experienced in some parts of the region boost the few water bodies such as Lake Mutirikwi where the practice of fish farming is ideal. Therefore, the study was narrowed down to the smallholder fisheries and aquaculture practices in Masvingo Rural District's Lake Mutirikwi area, which is the country's second largest inland water body after Tugwi Mukosi Dam. The picture of Lake Mutirikwi in Masvingo is illustrated in **Figure 1**.

The economic downturn that affected Zimbabwe post 2000 resulted in a general increase in the capture fisheries activities around Lake Mutirikwi both conventional and unorthodox as families sought alternative food sources and incomes around the water body. Aquaculture Zimbabwe (AQZ), a local non-governmental organisation that works towards the promotion of fisheries and aquaculture-based livelihoods started work in MRD in 2011 and subsequently there was an increased interest and participation in this water-based livelihood option [33]. With donor support from Department of International Development (DFID), European Commission and World Food Programme, AQZ brought in the much-needed capital support and set up fish farming production ponds for communities in wards 12, 13, 14, 15 and 16 that are around the lake. AQZ also started supporting existing fishery cooperatives on the lake including training of the illegal fish poachers towards sustainable fisheries resource utilisation [33]. It is against this background

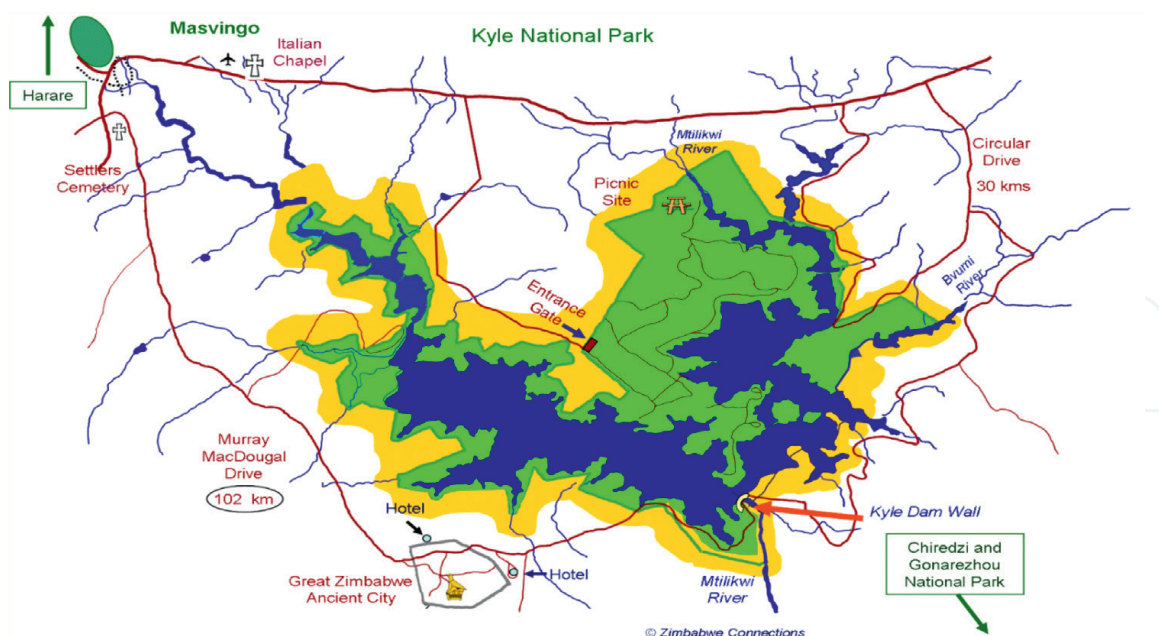


Figure 1.
Lake Mutirikwi in Masvingo. Source: Zimbabwe Connections.

that the study sought to investigate the contribution of the smallholder capture fisheries and aquaculture activities to food security for the rural communities- within and around Lake Mutirikwi.

5. Objective

The main objective of the study was to investigate the impact of artisanal fisheries and aquaculture enterprise as pathways to food security for rural communities around Lake Mutirikwi in Masvingo Rural District, Zimbabwe.

6. Methodology

The study used mixed methods and triangulation of data collection. Triangulation involved the use of multiple data sources in qualitative research for a comprehensive understanding of a phenomenon [34]. Data was collected using secondary and primary methods. Through secondary data collection methods the researchers screened articles in books, journals, and newspapers that focused on food security, fishing farming, and aquaculture. One-on-one interviews and questionnaires were the main features of primary data collection. Questionnaires were mainly for demographic information about the respondents.

Primary data was collected from a sample size of 15 respondents from MRD wards 12–16, and five officials from government ministries and departments involved in the fish value chain and food security in Zimbabwe, and particularly in the district. The sample was purposively selected. The main questions were:

- What gave rise to the fisheries industry in rural communities around Lake Mutirikwi, in Masvingo?

- What contribution is the fishery industry making to food security for the rural communities around Lake Mutirikwi?
- How can the rural communities maximise the benefits of the fisheries industry?

7. Findings

The research discovered that both male and female members in the study area actively participate in both artisanal fishing and aquaculture activities. Eleven men and four women from the fishing community took part in the study.

Males as depicted in **Figure 2** constituted a larger number of respondents within the fishing community because they are mostly bread winners of families. Three of the female participants are also heads of families.

The ages of the participants (**Table 1**) ranged from 25 to 60 years old.

Sixty percent (**Table 2**) of the respondents from the fishing community have some secondary education, while all the five officials from supporting agencies have university education.

Their main source of income is fishing. The research findings revealed that most of the productive modes in society are controlled and owned by masculine men.

The participants in the study were unanimous in the positive benefits that the fisheries had brought to the community. The fisheries sector has been a key pillar for food security and a valuable source for reducing poverty in the rural communities around Lake Mutirikwi, especially following the failure of the agriculture sector as a result of climate change induced droughts.

7.1 Food security

Fish has made an inimitable contribution to food and nutrition security for the rural communities around Lake Mutirikwi where many were previously poor and under-nourished. Fish which has a rich source of high quality protein, a range of micronutrients, and fatty acids essential for human brain development, has replaced

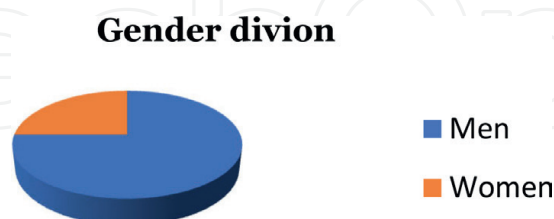


Figure 2.
Gender distribution.

Age	Men	Women
50–60	2	0
40–49	4	3
25–39	5	1

Table 1.
Age distribution.

Level of education	No. of people	(%)
Primary level	3	15
Secondary level	12	60
Tertiary	5	25

Table 2.
Educational distribution.

beef and other meats. This alternative source of food came as other livelihood activities such as agricultural and non-agricultural casual labour, informality that include petty trading, livestock selling, and remittances were dwindling. Previous incomes that poor households typically earned were eroded by the increasing food prices. However, through fishing, over 5000 families have been cushioned from effects of successive droughts after various international non-governmental organisations assisted them to venture into commercial fish farming. Respondents in ward 16 for instance pointed out that the failure of the agriculture sector during the 2018–2019 drought resulted in food insecurity, deepening their dependence on artisanal fisheries for food and income. Because of the drought period, other avenues of livelihoods that often come with the post-harvesting period were affected, leaving the local poor submerged in poverty.

A 50-year-old male small scale farm in ward 16 said *“I thought of trying my hand on fishing after my whole crop was a write-off. And, I am more than happy with the results from fishing.”* A 45-year-old male respondent residing in ward 14 explained, *“I noticed fishing as a paying practice hence it has been a critical source of food security and income for my family. Through fish I am assured of daily financial income.”* This explains the centrality of the fishery sector that has become more than a source for food security, but an income earner for the local communities around Lake Mutirikwi.

A 40-year-old female respondent said *“Since I started fishing, the health of my family has improved. Because we do not only eat fish, but fish helps us to buy other basics such as maize meal.”*

7.2 Income

The investigation found out that artisanal fisheries and aquaculture enterprises in Masvingo Rural District have served as major avenues for income for households. A male government official in the district said, *“Artisanal fisheries and small-scale fishing enterprises have become more than safety nets, because of their capacity to provide labour opportunities and incomes to the resource poor households who had few options of reducing their vulnerability and food insecurity associated with both transitory and structural poverty.”*

A female agriculturalist noted *“With the failure of the agriculture sector and associated employment opportunities, incomes from the fishing ventures brought relief. Incomes generated from artisanal fisheries have been used in a variety of ways to improve the livelihoods means and in other circumstances has been used as capital for other small businesses such as poultry and gardens.”*

A 40-year-old male respondent from the fishing community said, *“Through income from fishing, I managed to build a good house, buy a small car and I am paying school fees for my children and young brothers”.* This illustrates that artisanal fisheries and aquaculture enterprises have substantially contributed to the livelihoods of many poor households in Masvingo. Fishing has become a source of capital for many who have not only built houses, but purchased cattle, thus attaining a sense of wealthy

accumulation. *“I was able to build a house and buy cattle using money earned from fisheries”* said a 35-year-old female respondent.

Weekly, earnings for artisanal fisheries and aquaculture enterprises range from US\$250-US\$750, which one respondent said *“surpasses salaries or wages of most formal employees.”* Therefore, one can conclude that fishing has become a viable sector that has positively impacted the livelihoods of the communities around Lake Mutirikwi in Masvingo.

7.3 Employment

Artisanal fisheries both the offshore Kapenta and the largely gill-net artisanal, generate regular direct employment for the fishers, fishing vessel crews and various divisions of fishing enterprise employees. A considerable workforce has also been directly engaged in aquaculture activities. In addition, many other people in Masvingo are gainfully employed indirectly in the downstream trades of gear and craft marketing and repairs, fish processing and distribution. One respondent said, *“Artisanal fisheries and aquaculture enterprises have created jobs for me and my children who just completed ‘O’ level”*.

A secondary school-leaver, said *“Since I finished school, I had nothing to do until I was introduced to artisanal fishing as a fisher-folk and I am now able to help my mother with the few basic commodities and contribute to our household income.”*

Some of the respondents who reside at Nemamwa Growth Point, which is one of the fish marketing places, revealed that aquaculture activities have also increased the supplies of fish resources to the market. Aquaculture has augmented the struggling capture fishery sector which has been over exploited by many people including illegal fisher folks.

7.4 Education

One sector in which artisanal fisheries and aquaculture enterprises have made a significant contribution towards is the education sector. Education is an important element in the fight against poverty, because it provides one with alternatives or choices in life. Because of poverty levels in most of rural areas in Zimbabwe, including MRD, many children drop out of school due to the failure by parents to pay school fees and/or because of hunger. This has resulted in high incidences of child-marriages of the girl-child due to the inability of parents to send their children to school. However, the fishing industry is bridging the incomes gap providing opportunities for previously poor households to send children to school.

A 35-year-old single mother of four stated, *“I am able to pay school fees for my four children who were not going to school after their father died”*. Respondents in all the wards appreciate the role of the fishing industry in financing the education of their children or siblings. Some children were unable to go to school because of hunger, however with the incomes increment from fishing activities households are able to buy adequate food stuffs for their children and send them to school. *“My children are now well fed before going to school”* said a 30-year-old mother.

7.5 Health

In addition to the challenge of paying school fees, many respondents noted that another reason why children were not able to go to school was the issue of health.

Women respondents said *“Schools usually chase away children who infected with diseases such as ring worms, or flu to curb the spread of the disease. In the past we could not afford to buy the medicines, since the clinic has shortages. But today through fishing, we can afford.”*

Through artisanal fisheries and the spread of aquaculture activities many households in the local communities in MRD are now able to afford paying medical bills for their children. A male respondent said, *“I can pay for household needs like medication through income obtained from the fisheries. Clinics have been experiencing shortage of drugs, so we are now able to buy prescribed medication for our families.”*

7.6 Agriculture

The investigation noted that artisanal fisheries and aquaculture activities have also contributed essentially to the agricultural sector in both crop production and animal husbandry. A 55 year old male respondent said *“Through the income generated from the fisheries sector, I have been able to buy agricultural inputs such as seeds, pesticides and fertilizers.”* Another 45 year old male respondent said *“Fishing provided me and my family with start-up capital for a small-scale irrigation scheme.”*

The small irrigation schemes have boosted crop production in once arid areas of the district. Owners of the schemes practice horticulture growing various vegetables, thus diversifying their nutritional diets. Others through fishing proceeds have ventured into livestock farming buying cattle and goats. Respondents in wards 14 and 15 explained, *“We have been facing challenges of maintaining the welfare of our cattle as a result of inadequate financial resources but since the time we joined fishing we are now able to meet the costs even to purchase more cattle”.*

7.7 Community response to the fisheries and aquaculture industry

There were varied perceptions from the general community in the various wards around Lake Mutirikwi, regarding the contribution of artisanal fisheries and aquaculture enterprise to food security and as a source of income. The study discovered that artisanal fisheries activities are the most commonly practiced way of fishing than aquaculture activities, which seems to be a new idea and way of fishing to the local communities. A number of respondents who were interviewed about aquaculture practices expressed their interest, but lack of start-up capital and technical know-how of such an initiative.

Even those who practice capture fisheries acknowledged that aquaculture is more viable compared to capture fisheries. There is no competition of the resource when one sets up a fishing pond.

Respondents in ward 16 also stated that in capture fisheries there are regulations that have to be complied with such as adhering to the fishing calendars whereby during the stipulated days on the calendar for no fishing, no one must exploit the natural resource; which is different when doing your own fishing business at home. Any time any day you can harvest fish and sell.

Some of the interviewees in ward 13, who rely on funding from international non-governmental organisations for their aquaculture enterprises, pointed to the uncertain political climate that might force the NGOs to withdraw funding because of government policies that might constraint their work. The NGOs involved in aquaculture activities within the communities around Lake Mutirikwi included World Vision, AQZ and the European Union.

The respondents also felt that their new found wealth does not correspond with existing infrastructure in the area. *“Our access roads are in a terrible state, and they get worse when there are rains. Because we are using these roads, we are prepared to contribute something so that the roads are repaired.”*

The researchers noted that fishing activities in the realms of hydroponics and aquaponics are still shrouded practices within the rural areas of MRD. Aquaponics is a sustainable farming method that combines hydroponics (growing plants in water) with aquaculture (raising fish) [14]. The waste produced by the fish provides nutrients for the plants, and the plants, in turn, clean the water for the fish. Therefore, there is need to fund and educate the local communities in sustainable ways of fishing. Absolute concentration on capture fisheries as a common practice may lead to the extinction of some fish species due to over exploitation as the demand for fish increases. In addition, because of the profitability of the blue economy, fishing activities are also increasing above the carrying capacity of Lake Mutirikwi.

7.8 Challenges faced by the artisanal fisher folk

While the artisanal fisher folk and fishermen and women bask in the wealth of the fishing venture, they expressed concern over a number of challenges that might limit their benefits from the industry. These include seasonal variations, fishing licence, storage facilities, transportation, capital, water sources, and legislative bottlenecks.

7.8.1 Seasonal variations

The seasonal shift in fishery activities is a cause of concern within the fishing communities. They explained that the seasonal variations from summer to winter substantially influence the production of fish. The effects of the seasonal variations are in the quantities of fish during winter, which are lower than the summer catch. This, therefore impacts on the food security and livelihoods of the local communities as incomes decline. The researchers therefore noted the need for support that may cushion the local communities from the shocks of income decline during winter when fish quantities are low.

An elderly respondent aged 60, with more than 20 years of fishing experience said, *“Since I started fishing as an artisanal fisher folk, I have never accumulated income more than US\$400 during the winter season as compared with my monthly income of not less than US\$1000 under normal circumstances”*. Therefore, seasonal variation presents great challenges for the respondents as they lack other alternative sources of income to safeguard them during winter. One mechanism of dealing with the dilemma of seasonal variations could be through aquaculture projects.

7.8.2 Fishing licences

Fishing licences is a major challenge faced by both the fishing communities and officials from the relevant authorities such as the National Parks and Wild Life. The law stipulates that for one to carryout fishing activities, one must be in possession of a fishing licence that has to be paid for. The Department of National Parks and Wild Life is responsible for ensuring that all fisheries comply with the fishing regulations; and that the fish species are sustainably exploited to avoid the dilemma of over exploitation. Among the central issues specified the by-laws are the net sizes and fishing periods and fishing places. This area of fishing licences has been a point of conflict

between the fishing community and the responsible authorities as the fisher folks tend to ignore the law and carry on with illegal fishing practices without conforming to access fees and regulated water bodies such as breeding areas. Officials from the Wildlife and Parks department are worried, *“Acts of illegal fishing are very rife in MRD. Many fishermen who are carrying out fishing activities are using big sized nets not permitted under the law. They are fishing in prohibited areas such as breeding areas; and also exploiting small sized tilapia which is not in tandem with the fishing guidelines”*.

To address this challenge there is need to educate and raise awareness on the part of the fisher folks to ensure that they understand and comply with the fishing laws. Conversely, those who possess fishing licences complained about illegal fisher-folks. *“Illegal fishermen usually steal fish from our nets and in some circumstances leave the nets dilapidated.”* This therefore demonstrated the prevalence of conflict among the communities themselves and against the law enforcers.

The respondents in wards 13 and 14 argued that they are disgruntled with the licence fees, which they claim are exorbitant, compared to the income earned from the fishing initiatives. Some even went further to argue along the rights issue, pointing out that they should not be made to pay for resources that are within their community, because they are shared common property.

The researchers noted the differences that exist between the relevant authorities, their policies and mechanisms of enforcing them are to the detriment of the fishing industry. The failure to have a single board or government department responsible for managing the fishery sector in Zimbabwe could be a contributing factor to the challenges of illegal fishery around Lake Mutirikwi. The researchers are of the opinion that there is need to establish an all-inclusive organ that would handle all the issues concerned with the design, implementation and monitoring of the fishery legislature.

7.8.3 Storage facilities

Fish is a highly perishable commodity that requires suitable storage facilities. The investigation found out that most of the fishermen involved in the fish value chain have inadequate storage facilities, which results in great losses. The respondents said *“The problem is worse in summer when temperatures are high. Lack of storage facilities forces us to market our catch directly from the lake which is burdensome.”*

A male respondent said, *“My business is not growing fast because of the unavailability of storage facilities as I may have to sell my supply at lower prices instead of keeping at home for long”*. This becomes unsustainable and unreliable especially when demand in the market is low.

In an effort to preserve excess catch, many of the respondents resort to sun-drying, and then sell the commodity as dried fish. A woman respondent said *“Because of storage problems, I often have to sun-dry the fish, which is not a favourite of many, who prefer fresh fish.”* However, drying affects the nutrient base of the fish, which is low compared to the nutrients in fresh fish.

7.8.4 Transportation

Transportation of fish from the Lake to the market is a challenge on the part of the fisher-folk and small-scale fisheries who could not afford refrigerated transportation vehicles. One of the respondents said, *“The hiring fees are quite expensive, sometimes we have to resort to own transport such as personal vehicles or commuter Omni buses to take the fish supply to the market places in the city or to hotels outside the city”*.

The respondents in ward 16 have problems transporting fish supplies to places such as Great Zimbabwe Hotel or other food outlets outside Masvingo town. Fishermen and women reported that sometimes they are forced to pay high fares to ferry their products to the market which hinders the profitability of the fish product as operational costs become extortionate. *“Because of the smell of fish, we are forced to pay more when hiring vehicles to transport our produce,”* said a women respondent.

7.8.5 Capital

Whilst fish farming has more benefits as compared to capture fishery, the idea of aquaculture as a practice has not been fully grasped in Masvingo. A female aged 38 pointed out, *“We as women also want to start our fisheries projects but the main challenge is that we do not have money to buy the inputs needed such as the seeds and feed”*.

Some small-scale initiatives have been noticed during the research but the challenge was that these are not fully functional and operational, because of lack of adequate funding to either purchase the relevant equipment needed or to buy the feed and seeds required to start the fish farming projects. In addition, the respondents from the various wards of MRD argued that the costs associated with feeding the fish are excessive such that some have resorted to buy the feed in Harare and transport them to Masvingo which is costly. However, as an alternative the researchers noted the need for subsidies from the government and the donor community towards supporting aquaculture enterprises which might be viable income generating initiatives.

7.8.6 Water sources

The investigation carried out with most of the local community members revealed that the water sources are also a major constrain to fishing practices in Masvingo. Water levels tend to decrease especially when there has been low annual rainfall. For instance, the respondents pointed out to the 2018–2019 season when there was low rainfall which affected both artisanal fisheries and aquaculture activities. A 46-year-old male respondent noted, *“The partial exercising of fish farming is caused by inadequate, unreliable and sporadic sources of water that could not last throughout the entire year”*.

Fish farming in ponds requires regulated renewal of water, and the failure to do so often result in increased mortality of young fish. However, the problem of low water levels could be resolved through water harvesting.

7.8.7 Legislative bottlenecks

While the fishing industry has potential as source of food security and poverty alleviation, disintegrated and inconsistent legislation throttles the viability of the industry. The multiplicity of uncoordinated legislation in the management of the fisheries sector creates problems that often results in unsustainable exploitation of the aquatic resource. For instance, the responsibility for the conservation and management of capture and recreational fisheries lies with the National Parks and Wildlife Authority of the Ministry of Environment, while the responsibility for aquaculture rests with the Ministry of Agriculture, Irrigation and Mechanisation. This fragmentation in regulating the fishing industry creates problems in the management and documentation of activities, which is the reason why information pertaining to the sector in the socio-economic life has been scarce in Masvingo and other parts of the country.

8. Conclusion

While artisanal fisheries and aquaculture enterprises have provided sources of food security and improved livelihoods, not much has been done in terms of the development of infrastructure in the fishing villages. For the fishing communities around Lake Mutirikwi, there is lack of development of infrastructure such as roads and bridges to make the shoreline accessible. In addition, social service provisions are poor and inadequate. Though much has not been done in terms of infrastructural development there is still green light for development in the future, if the relevant stakeholders in the fish value chain are engaged in corporate social responsibility.

However, there are a number of services that have emerged in Masvingo Rural District as a result of the viability of the fisheries industry. Many traders from the nearby areas visit Lake Mutirikwi area for fish trading, some are even venturing into barter trade with the local communities, hence making goods available to the locals who could not have had access to such services.

The multiplicity of legislation and policies in the fishing industry seem to throttle the viability of the sector. This also makes policing of the industry difficult.

9. Recommendations

While the fishing industry has contributed to food security and livelihoods of some communities in Masvingo, the industry could still achieve more with regard to poverty alleviation and rural development. There are many initiatives and strategies that can be implemented to improve the fishing industry especially aquaculture which has the potential of contributing overwhelmingly to food security. Not only would the fishing industry lead to livelihoods enhancement, but ensure sustainable fishing and conservation of the different fish and other aquatic species. There is need to establish a single department responsible for streamline and strength the legal policies and institutional frameworks. The department would develop and implement responsive policies that speak to the growing need for an enabling environment to expand the fisheries and aquaculture value chain and enterprise and in turn positively contribute the country's GDP.

Through the existing government legislation on devolution of power, rural district councils and traditional leaders must be accorded appropriate authority to manage and develop fisheries in their jurisdiction. With local authorities empowered to collect revenue from fisheries within their areas, and channel the proceeds into rural development initiatives.

Once the above are in place, then educating the fishing communities on sustainable practices would follow. This would include adherence to policies and regulations governing the fishing industry. The government in partnership with international organisation should aggressively promote aquaculture. Provide incentives for women participation in the fishing industry, especially in aquaculture.

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