PJ PALGO JOURNAL OF AGRICULTURE
ISSN 2476-8359
Volume 8 Issue 1, August 2021.Page 1 - 10
http://www.palgojournals.org/PJA/Index.htm
Corresponding Authors Email:cgmusuka1962@gmail.com

AN OVERVIEW OF SMALL-SCALE FISH FARMERS IN KAFUE DISTRICT OF LUSAKA PROVINCE, ZAMBIA.

Brighton Simfukwe[1], Confred G. Musuka[1] and Simbotwe Mwiya[2]

Kapasa Makasa University, Department of Agriculture and Aquatic Sciences, P.O. Box 480195, Chinsali, Zambia[1].
Project Coordinator, United Nations Development Programme GEF Orange- Senqu Sap Implementation Project. Centurion, Pretoria, South Africa[2]

Accepted 24 August, 20201

The current study was based on an Overview of Small-Scale Fish Farmers in Kafue District, Zambia. Used questionnaires to collect respondents' data, and then used Microsoft Excel 2016 for analysis. The results of the study showed that small-scale fish farming had become an important source of livelihood, and played a role in fighting food insecurity, malnutrition and alleviating poverty in the study area. That was demonstrated by the number of people involved in aquaculture and the number of new aquaculture companies established to expand the aquaculture industry. The contribution of small farmers was essential to ensure the supply of fish on the Zambian market. One way the government was involved in aquaculture was through providing loans to people to expand their activities. The main challenge faced by small fish farmers in the study area was the lack of access to and/or the distance from areas where they obtained a commercial feed. Additionally, the results showed that commercial aqua feeds were very expensive, so, most people were unwilling to feed their fish with a balanced diet, as they were mostly more than 60% of the total production cost. Therefore, that resulted in a loss of harvest. Thirty-one (31.0%) per cent of fish farmers produced 200 to 300 kg of fish, 24.1% produced 300 to 400 kg of fish, only 20.7% produced 500 kg and 13.8% produced less than 100 kg of fish and 10.3% fish production was between 100 and 200 kg. Other major challenges encountered included; lack of high-quality fish fingerlings, low population density, and lack of funding. Although there were many challenges in sourcing commercial feed, the study shows that fish farmers were partially or completely dependent on commercial feed in some way. The results of the study also showed that the age of the farmers, the breeding experience, the size of the pond, the use of aqua feed on the farm and the distance from the market significantly affected the production of small-scale fish farming in the area. The implications of the findings were that fish production in the study area could be increased through the expansion of aquaculture hold in facilities, increased use of commercial feeds in existing ponds and integrated fish farming. It is suggested that government and its cooperating partners should consider providing support (i.e., credit facilities, production inputs, supply of high-quality fingerlings and fish feed, strengthen the provision of extension services, train farmers to improve fish farming and management practices, etc.) to small-scale farmers, to enable them upscale their activities. At the same time, farmers should be encouraged to establish cooperatives.

Keywords: Overview, Small-scale, Fish Farmers, Kafue district, Lusaka, Zambia

1.0 INTRODUCTION

Small-scale fish producers play a vital part in Zambia's total aquaculture production. In 2014 production from small-scale farmers was estimated to be 10, 000 tonnes (Genschick *et al*., 2017). However, the full potential among smallholder aquaculture in the country has not been fully seized owing to several challenges associated with the sub-sector most of which include: drought which leads to drying of ponds in summer, lack of quality fingerlings, flooding, siltation of ponds, pond maintenance, poor security, high cost of feed and / or low quality of feeds (Shitote *et al*., 2017).

It is imperative that small-scale fish farmers have access to good quality feeds at reasonable prices in order to ensure their yields are optimized (Nsonga and Simbotwe, 2014). The diet offered to fish must be well balanced in order to meet the different nutritional requirements of the cultured species. However, most small-scale farmers were reluctant to use commercial diets, considering the high cost which was mostly above 70% of the total production costs (Albert *et al*., 2015). In a study by Mainza and Musuka (2015), it was alleged that commercial or complete feed was very expensive, such that most small-scale fish farmers only feed their fish once a day, resulting in low fish productivity. On-farm feeds have been an alternative but the major challenge associated with them is that yields are compromised if they are not well balanced.

Increased uptake of aquaculture by small-scale farmers could as well help increase per capita fish consumption as much as it will enhance livelihoods and combat poverty (Kassam, 2013). This is because as the human population continues to grow, it tends to put more pressure on natural resources, i.e., more individuals and societies become food insecure, lacking access to sufficient amounts of safe and nutritious food for normal growth, development and an active healthy life (Rana *et al*., 2009; Grafton *et al*, 2015). As a result of this, there is a need to ensure that fish farmers adopt Best Management Practices in fish farming in order to improve their household food security and livelihoods through increased income (Shitote *et al*, 2017).

The aim of the study was based on an Overview of Small-Scale Fish Farmers in Kafue District, Zambia.

2.0 MATERIALS AND METHODS

2.1 Study Area

Kafue District lies in the southern tip of Lusaka province. It is only 45 km from Lusaka district, the capital city of Zambia. It has a total population of 219,000, of which 108,939 were males and 110,061 were females. Kafue district is one of the largest districts in the province after Lusaka and it is critical to the residents of Lusaka and located on the northern bank of the Kafue River, whose water is diverted northward by channel to Chilanga and Lusaka (Britannica, 2013; Hampwaye *et al*., 2016).

The district shares borders with Chongwe in the North-East, Chilanga in the North, Chirundu and Chikankanta in the South, Mazabuka in the South-West. It also shares an international boundary with Zimbabwe. The district has a landmass area of approximately 23,250 km representing 3% of Zambia's area. A considerably large proportion of the district (North-Eastern) comprises hills and escarpments. The South-Eastern part is the Zambezi Valley (Chiawa area). In the South-West (Chanyanya area), is a very flat land often referred to as Kafue flood plain or Kafue flats. The rest of the district is either flat or small pockets of hilly land. Kafue District features a mixture of land use. This includes human settlements, industrial activities, agriculture, forest reserve, wildlife conservation, fisheries, and hydropower generation and water extraction. Human settlements are a major part of land use in the urban area. It is believed that at least 51% of the district's population lives in the urban area, mostly in the informal settlements. In terms of size, the total land area covered by urban centres of the district is less than 1% and more than 99% of land area is rural. The predominant land use in the rural areas is agriculture (Hampwaye *et al.,* 2016).

The Kafue River is the main river running through the district and the name of the district is drawn from this river. The district hosts the confluence of the Kafue River and Zambezi River in Chiawa at Mafungautsi (Hampwaye *et al*., 2016).

The district has only one main industrial urban centre which is Kafue Town. This urban area is a centre for manufacturing, commerce and services industry. The town's industrial area, which gets its power supply from the Kafue hydroelectric scheme, houses an ammonium nitrate fertilizer plant, a textile mill, an iron and steel complex, a firm producing fibre glass fishing boats, a leather tannery, a pulp and paper mill, a copper-processing unit, a bag and sacking plant, and an assembly and equipment-repair plant. A greenbelt separates Kafue's industrial zone from its residential area, where use is made of higher-density housing, a phenomenon that is comparatively rare in Zambian urban settlements. The Great North Road and a railway route pass through Kafue, linking it to Mazabuka and Lusaka (Britannica, 2013; Hampwaye *et al*., 2016).

The district has some minerals being mined such as semi-precious stones like green formering and emeralds which are extracted in the Nakanga area. The district has also potential deposits of gold which are being exploited. Limestone is also mined in the district, mainly in Shimabala Area (Hampwaye *et al*., 2016).

2.2 Sampling Method and Sample Size

The study involved simple sampling also referred to as Probability sampling, which is predicated on the notion of random selection where every item of the population has an equal probability of inclusion within the sample. Information was rigorously obtained from the Ministry of Fisheries and livestock (Department of Fisheries) in Kafue district and small-scale fish farmers within the area through structured questionnaires.

The locations of the registered fish farmers were obtained from the Department of Fisheries. The sample size of the study was supported by a static theory of Claves (1987); which states that any sample of 30% of the units or more gives a real representation of the population. A sample size of 100% was selected which represented the whole population of seventy (70) farmers.

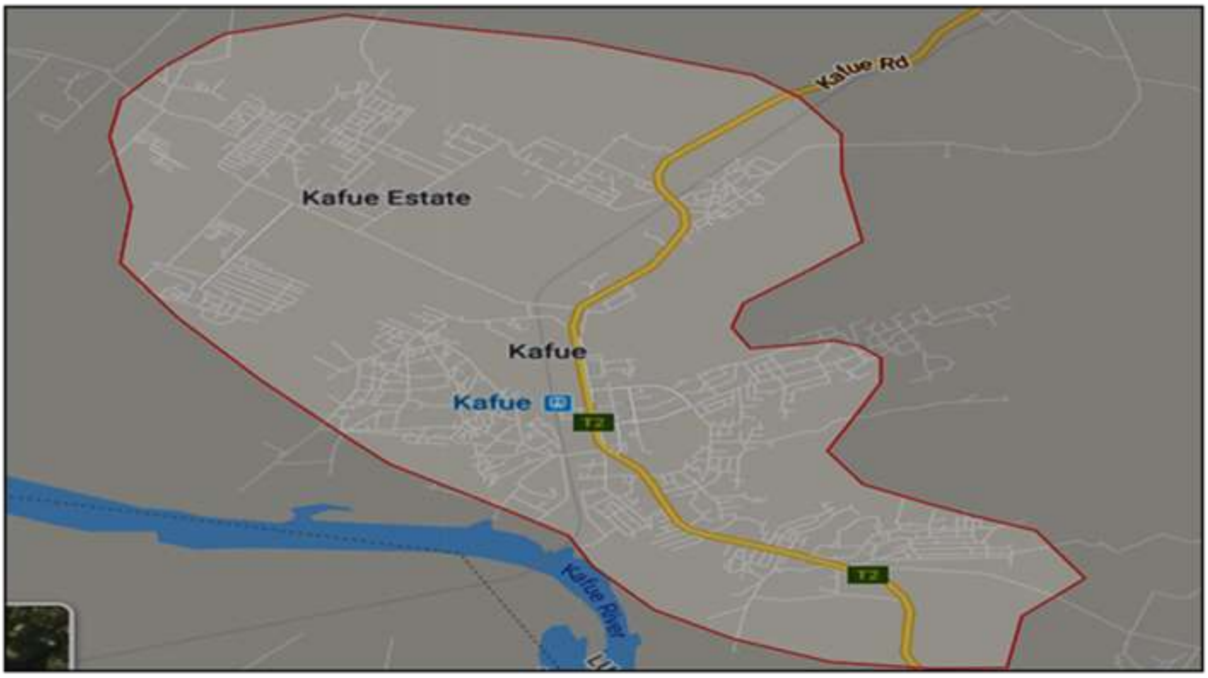


Figure 1: Map of Kafue showing the study Location

$$\frac{n}{N} \times 100 = C$$

To generate the sample size, Boyd's formula was used to calculate the sample size (n) i.e.

$$Sample\ size\ (n) = \frac{CN}{100}$$

Expressing "n" in terms of "N" and "C" gives us the formula for sample size

Where,

$C = Sample\ percentage$

$N = Population\ size$ and

$n = sample\ size$

2.3 Data Collection

Both primary and secondary data were collected within the study.

2.3.1 Primary Data

The collection of Primary data was done using questionnaires, face-to-face interviews and personal observation.

2.3.2 Secondary Data

Secondary data from books, reports, fisheries/aquaculture journals and newspapers. Additional information was collected from the web.

2.4 Data Analysis

After data collection, the variables were converted into numerical data and using an appropriate format, the information was then entered into a computer for processing. It was then analyzed using Microsoft Excel 2016 version to generate pie charts, frequency tables and graphical representation of information. The results were appropriately coded (assigning numbers and/or symbols to responses within the field).

3.0 RESULTS AND DISCUSSION

Table 1 shows that the majority of respondents were males, making up a total of 69% with the remaining 31% being females. This is an indication that there is a gender imbalance in the participation of men and women in Aquaculture related activities. These results agreed with the findings of Brummett *et al.*, (2010) that fisheries and aquaculture related activities are predominantly dominated by men.

Table 1: Gender of Respondents

Gender	Per cent (%)
Males	**69**
Females	**31**
Total	**100**

A challenge that limits women's participation in Aquaculture related activities as indicated by Bosma et al., (2018) was that women were often denied the opportunity to aquaculture training activities as aquaculture was often perceived to be an activity for men. That eventually limited Women's access to training opportunities on new aquaculture technologies.

Similarly, Musaba and Namanwe, (2020) stated that the majority of most fish farmers in Zambia were male i.e., 90%. As such, females were less likely to adopt fish farming due to the high workload and a lot of physical labour, which was required in the construction and management of ponds. According to Maina *et al*., (2014) pond construction was considered to be labour intensive and was mostly done by men. As a result, the authors indicated that female-headed households were discouraged to venture into fish farming.

Correspondingly, the study of Sonjiwe *et al*., (2015) indicated that it was a known fact that the majority of women were usually involved in fish trading and marketing because they felt comfortable doing so and, in most cases, they usually avoided the masculine type of jobs even in their quest for power and access to resources. This could be as a result of how they were raised alongside their cultural beliefs.

Table 2 shows that 82.7% of the fish farmers were married with children, whereas, 17.3% of them were widowed/single. Meanwhile, the same table shows that 83.3% of the respondents had children and 16.7% did not have.

Table 1: Marital status of respondents

Marital Status	Per cent (%)
Married	**82.7**
Single	**17.2**
Total	**100**

The study by Ekong, (2003) indicated that marriage in most societies was highly cherished. Similarly, Fakoya (2000) and Oladoja *et al*., (2008) reported that marriage conferred some level of responsibility and commitment on individuals who were married. The findings of Mangeni and Mhlanga, (2019) also revealed that Aquaculture was significant to those that were married and the benefits of adopting fish farming cascaded to all family members.

According to figure 2, the age distribution showed that 3.4% of respondents were between 20 to 30 years, 20.7% were between 31 to 40 years, 24.1% were in the age category of 41 to 50 and 51.7% were above 50 years. The findings of the study agree with those of Mangeni and Mhlanga *et al*, (2019) who reported that Fish farming activities were undertaken by adults.

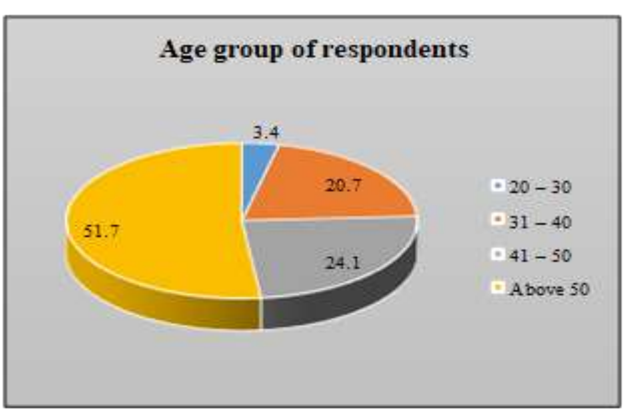


Figure 2: Age of respondents

Olaoye *et al*., (2013) reported that most of the fish farmers fall within the age bracket of 41 to 50 which is considered to be productive, assumed to be a better future for Aquaculture production and economically active (Olowosegun *et al*., 2004). In addition, the study by Obwanga and Lewo, (2017) indicated that the low uptake of aquaculture among women and especially the youth are a threat to the social sustainability of aquaculture.

This also clearly shows that fish farming is undertaken mostly by people in the old age group mostly those above 50 years who were mainly retirees. This implies that aquaculture has not attracted the interest of the younger generation. This can be anticipated that fish farming has been one of the most promising business and source of livelihood by the small-scale fish farmers, which often provides them income to sort out most of the basic needs.

Even though this is the case, the above findings do not agree with the findings of Nabafu, (2010) who reported that the indication of very few young people and women's involvement in Aquaculture highlights insufficient funds (less/no access to credit, capital and loans), inadequate knowledge on fish farming, lack of understanding whether fish farming is a profitable business and lack of youth empowerment in the study area (Obiero *et al*., 2019).

Figure 3 shows that 31% of the respondents had attained tertiary education, 55% had gone as far as secondary education and craft certificates in various fields and 13.8% had only attained primary education.

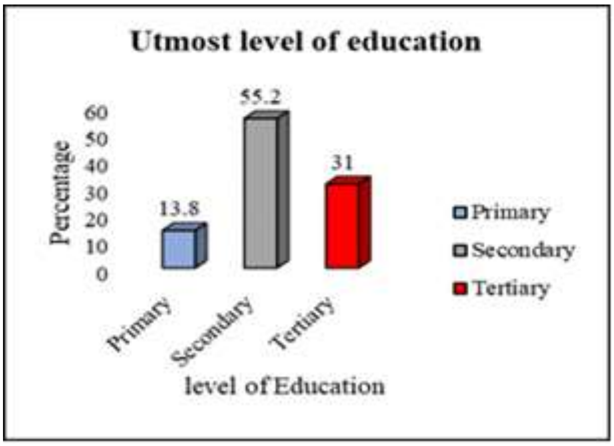


Figure 3: Utmost level of education

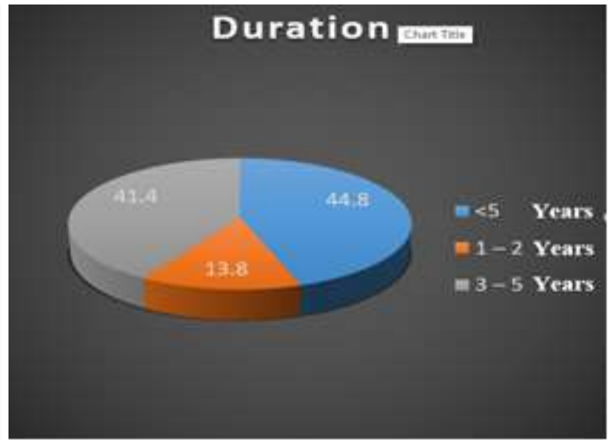


Figure 4: How long fish farmers had been involved in fish farming

This lack of education on the part of some farmers had brought a number of challenges such as improper management of the aquaculture farms (Nsonga and Simbotwe, 2014). The study by Towers, (2016) indicated that the imperatives of Education in Aquaculture cannot be underestimated. Education is an imperative socioeconomic factor while considering the productivity of any farming as it enhances the acquisition and utilization of information on improved technology by farmers and tends to positively influence productivity (Osondu and Ijioma, 2014).

Figure 4 shows that 44.8% of the respondents had over 5 years of fish farming experience, 41.4% had 3 to 5 years, and 13.2% had 1 to 2 years. The findings of the study indicated that most of the farmers in the study area had farming experience regardless of the challenges and the technical know-how of managing their farms.

Meanwhile, figure 5 shows the number of culture facilities owned by fish farmers, while figure 6 indicates their sizes in the study area. Majority had the least number of ponds.

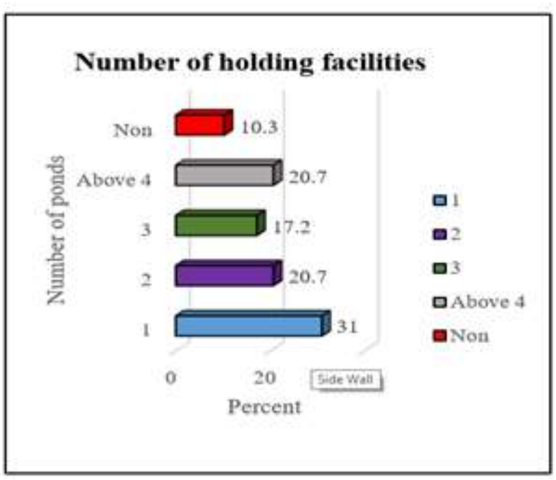


Figure 5: The number of ponds of the respondents

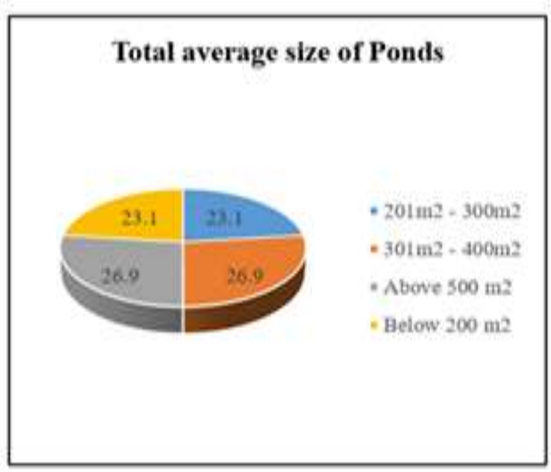
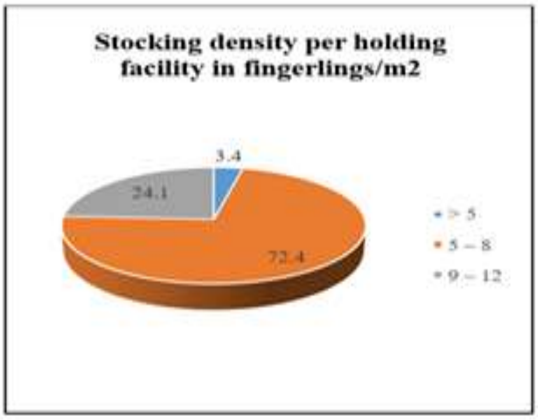


Figure 6: Total average size of Ponds

About 23.1% of the respondents had ponds with sizes in the range from below 200m2 up to 300m2, 26.9% were in the range 301m^2 – 400m^2 and above 500m^2.

Figure 7 on the other hand, shows that the stocking density that had been adopted by most fish farmers was 5 to 8 fingerlings/m2 and the findings show that increasing the stocking density of the cultured species beyond 8 fingerlings/m2 significantly affected the survival and growth of the species. This agrees with Ntanzi *et al*., (2014), who reported that stocking density was also another significant factor that was supposed to affect the growth rate and the survival of fish species stocked. The findings of the study, however, do not agree with the findings of Makori *et al*., (2017) who indicated that to ensure optimized yields of *O. niloticus*, the expected stocking rate in fish ponds was 3 fish/m^2 for the mono-sexed species.



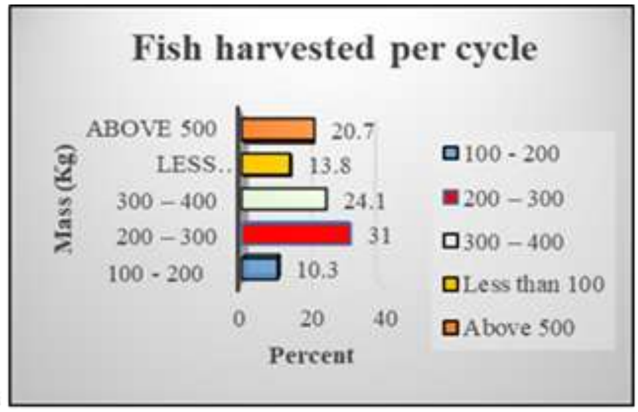


Figure 7: Stocking density per holding facility in fingerlings/m2 **Figure 8: Number of fish (in Kgs) harvested on average per pond from one cycle**

To find out how the stocking density affected the final harvest, data on the number of fish (in Kgs) harvested on average per pond from one cycle was collected which is clearly shown in figure 8. It was noted that the yields were higher by those fish farmers that heavily depended on commercial feeds with harvests per cycle usually in the range of 200 to 300 Kgs, 300 to 400 Kgs and above 500 Kgs as highlighted in (Figure 8).

Table 3 below shows feed types used by the farmers. The study has revealed that the majority of farmers used commercial feed and the least number used commercial and maize bran (Table 3).

Table 2: Feed type used

Feed type	Percent (%)
Commercial	79.3
Own-farm made	10.3
Commercial & maize bran	3.4
Commercial & formulated	6.9
Total	**100**

The researchers found that 79.3% of the fish farmers in the study area entirely depended on commercial feeds for their production, whereas only 10.3% of them used own-farm-made feeds and other leftover foods such as Nshima, kitchen feed or restaurant waste, 3.4% of the farmers partly used commercial feed and maize bran whereas 6.9% of them used commercial feeds and formulated feed. Despite the challenges associated with fish pricing, high feed cost and volume of fish harvested. Hyuha *et al*., (2020) indicated that small-scale fish farmers viewed fish farming to be a profitable venture. In order to overcome the high cost of these commercial feeds, there was an urgent need to investigate ways and means to further improve on-farm aqua-feeds through appropriate research and development programmes in collaboration with farmers and small-scale processors to come up with suitable policies to encourage growth in this sector (Hasan *et al*., 2007).

Figure 9 shows different recommendations obtained from farmers on the quality of commercial feed over on-farm feed.

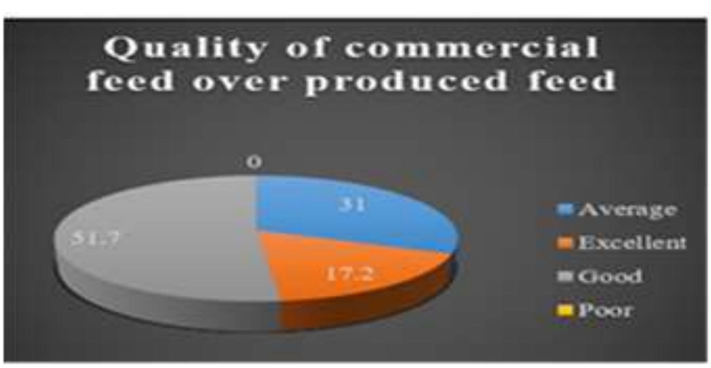


Figure 9: The quality of commercial feed or over produced feed

The study by Brummett *et al*., (2008) indicated that feed was another important challenge facing the development and growth of aquaculture in Africa, where it accounted for over 60% of the total costs of fish production, Jamu and Ayinla (2003). In some countries, the commercial feed was simply beyond the reach of most marginal and small-scale fish farmers, limiting their ability to intensify aquaculture production (World Fish Center, 2009).

The above findings were also reported by Howell, (2020). The author has indicated that obtaining not only quantity but also quality fish feed was another challenge for small-scale producers with almost all farmers reporting that feed was their largest production expenditure per annum (Howell, 2020). A study by WFC, (2009) further stated that feed was the major operational cost for most fish farms, accounting for 50 to 70% of the variable cost depending on farming intensity, thus, the rising cost of commercial feed is therefore inducing some farmers to opt for alternative feeds. Some rotate the commercial feed with kitchen and restaurant waste or chicken by-products while others replace feed with cheaper chicken or duck feed. Even though this was the case, more than half of the fish farmers indicated that commercial feed offers better results compared to the feeds manufactured by them and other alternatives such as feeding fish with restaurant/ kitchen wastes (Figure 9).

Table 4: How long it takes for fish to (in months) grow prior to harvesting

Months	Percent
> 6	44.8%
6 - 7	34.5%
7 – 8	13.8%
8 – 9	6.9%

Higher growth rates were expected in ponds fed with commercial feed compared to those where they used kitchen waste and exclusively maize bran. This could be attributed to the fact that they had considered aquaculture as a business to derive good returns at the end of the growing cycle. The growing cycle was between 6 and 8 months (Table 4). The period of raising tilapia is shortened when it is fed commercial feed compared to that grown extensively.

Table 5 reveals that most of the farmers in the study area sold their fish to local fish markets.

Table 3: Showing to whom the fish was sold

Area	Percent
Neighbours	62.0%
Butcheries	27.6%
Family	20.7%
Outside Kafue	17.2%
Local fish market	100%
Local fish gatherers	17.2%
Outside Kafue	13.8%

This was partly in agreement with the findings of Sonjiwe *et al*., (2015) in a study that was conducted in the same district though it focused on artisanal fisheries. The authors reported that instead of taking their fish to markets, fishers took their fish in the harbour, which was near the river, compared to the local market because it was perceived to be very fresh and did not require covering a long distance.

Table 5 further reveals that most of the fish farmers had ventured into fish farming in order to obtain a livelihood by selling some/if not all of the fish (Olaoye *et al*., 2013). The findings of the study are also supported by the findings of Nsonga, (2015) who reported that the majority of fish farmers (i.e., 80%), revealed that fish farming as an activity was capable of providing them with fish both for food and business, whereas a minority 20% perceived it, to be an activity which only could provide fish to eat for the members of the household and less than 10% considered it as mainly an opportunity to trade.

Table 6, shows the areas or places where small-scale fish farmers wished to sell their harvested fish.

Table 4: Places farmers would want to sell their fish to.

Areas	Percent
My neighbours	3.4%
Butcheries	13.8%
Outside Kafue	3.4%
Supermarkets	3.4%
Local fish gatherers	13.8%
Fish gatherers outside Kafue	31.0%
outside Kafue	13.8%
Exporting to other countries	10.3%

Most of the fish farmers had ventured into fish farming in order to obtain a livelihood by selling some/if not all of the fish (Olaoye *et al*., 2013). The findings of the study are also supported by the findings of Nsonga, (2015) who reported that the majority of fish farmers (i.e., 80%), revealed that fish farming as an activity was capable of providing them with fish both for food and business, whereas a minority 20% perceived it, to be an activity which only could provide fish to eat for the members of the household and less than 10% considered it as mainly an opportunity to trade.

Table 7, highlights the supply of feed to the farms. Despite its high cost and unavailability to most of the farmers, the table shows that only 24.1% of the respondents were able to buy feed without any difficulty. Approximately, 20.3% had access to it within a Km range and so on.

Table 7: How readily available the supply of commercial feed is at their farm

Range	**Percent**
Readily available	24.1%
>1Km radius	10.3%
2 – 4 Km radius	13.8%
5 – 6 Km radius	20.7%
7 – 8 Km radius	6.9%
Readily unavailable	24.1%

Table 8, shows activities implemented by fish farmers to optimize yields.

Table 5: Activities implemented by fish farmers to optimize yields

Activity	**Percent**
Using commercial feed	75.9%
Producing my own feed	44.8%
Producing my own seed	3.4%
Producing different fish species	31.0%
Constructing more ponds	3.4%
Fertilization of ponds	3.4%
Through integrated fish farming	10.3%

To optimize yields, farmers in the study area had come up with alternatives that enhanced their yields i.e. 75.9% indicated that using commercial feed optimized their yields (Jebet, 2017), 44.8% of them pointed out that producing their own feed was one effective way by which they optimize their yields, 3.4% indicated that their yields were optimized by producing their own fingerlings, 31.0% also stated that they optimize their yields by rearing different kinds of species, 3.4% by constructing more ponds, 3.4% by fertilizing their ponds and 10.3% indicated that they optimize their yields through integrated fish farming (Tables 8 and 9).

According to Mainza and Musuka, (2015), in a study that focussed on the extent of small-scale fish farming in three Districts of Lusaka Province, the authors indicated that most farmers practiced polyculture systems because they lacked sufficient financial resources to purchase inputs like the feed but believed that fish could utilize both the pelagic and littoral zone to feed. Often causes that led to low productivity included low stocking densities, and poor pond fertilization, often without fertilization and inadequate crib design and maintenance (Mudenda, 2009). For that reason, there was the need to include physical access to financial services and collateral, which was a major challenge for small businesses (Mainza and Musuka, 2015).

Table 9: Characteristics and activities vital for small-scale fish farmers to optimize fish yields

Characteristic	Percentage
Intelligence	100%
Hard work	89.7%
Aquaculture skills	89.7%
Self-discipline	85.2%
Experience	89.7%
Enough Capital	68.97%
Availability of complete feeds	72.4%
Analytical skills	85.2%
Cooperatives	62.1%
Extension services	93.1%
Government/ NGO Interventions	65.5%
Adequate Human labour/equipment	75.9%
Production of on farm feeds	62.1%
Growing different kinds of species	68.97%

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

An overview of the various small-scale fish farming activities being conducted in Kafue district of Lusaka province, Zambia was established in this study. What emerged was that, the sector was an important source of livelihood, that played a key role in the fight against food insecurity, malnutrition and poverty in the study area. At the same time, small holder farmers' contribution was essential to ensuring the availability of fish in Kafue district. However, the age of the farmers, farming experience, pond size, the use of on-farm aqua-feeds and distance to the market significantly affected fish production of small holder fish farmers. Additionally, it was noted that farmers encountered, several challenges, such as high cost of feed, lack/unavailability of quality fingerlings, low stocking densities, lack of capital (finances) and long distances to places where the commercial feed was accessed. In some cases, it was noted that commercial feed was beyond the reach of most small-scale fish farmers, which in return limited their ability to intensify aquaculture production.

5.2 Recommendation

It is suggested that government and its cooperating partners should consider providing support (i.e., credit facilities, production inputs, supply of high-quality fingerlings and fish feed, strengthen the provision of extension services, train farmers to improve fish farming and management practices, etc.) to small-scale farmers, to enable them upscale their activities. At the same time, farmers should be encouraged to establish cooperatives.

6.0 REFERENCES

Albert, G. J. Tacon., and Metian, M., (2015). Feed Matters: Satisfying the Feed Demand of Aquaculture. Reviews in Fisheries Science & Aquaculture.

Bosma, H. R., Nguyen, D. T., Lorna M. C., and Carandang, A. S., (2018). Gender action plans in the aquaculture value chain: what's missing. Wiley Online Library.

Britannica, The Editors of Encyclopaedia. "Kafue". Encyclopedia Britannica, 19 Jul. 2013, https://www.britannica.com/place/Kafue. Accessed 22 August 2021.

Brummett, R. E., Lazard, J., and Moehl J., (2008). African aquaculture; realizing the potential. Food Policy.

Brummett, R. E., Youaleu, J. L. N., and Tiani, A. M. K., (2010). Women’s traditional fishery and alternative aquatic resource

livelihood strategies in the southers Cameroonian Rainforest. Fisheries Management and Ecology 17:221 – 230.
Ekong, E. E., (2003). An introduction to rural sociology (2nd edition). Uyo. Nigeria dove educational Publishers.
Fakoya, E. O., (2000). Farmers Use of Sustainable Land Management Practices in Ondo State, Nigeria. Unpublished PhD. Thesis, Department of Agricultural Extension and Rural Development, University of Ibadan. Pp 160.
Genschick, S., Kaminski, A. M., Kefi, A. S., and Cole, S. M., (2017). Aquaculture in Zambia: An overview and evaluation of the sector's responsiveness to the needs of the poor. CGIAR Research Program on Fish Agri-Food Systems and Lusaka, Zambia Working Paper: FISH-2017.
Grafton, R., Daugberg, C., and Qureshi, M. E., (2015). Towards food security by 2050, Food security.
Hampwaye, G., Mataa, M., Siame, G., and Lungu, O., (2016). City Region Food System Situational Analysis Lusaka, Zambia. FAO - Food for the Cities Programme. FAO, 2016 - Working Document.
Hasan, R. M., Hecht, T., De Silva, S. S., and De Silva J. G. A., (2007). Study and analysis of feeds and fertilizers for sustainable aquaculture development. Food and Agriculture Organization of The United Nations.
Howell, M., (2020). Feed and seed: addressing challenges in Zambian aquaculture. The Fish Site.
Hyuha, T., Bukenya, J., Twinamasiko, J., and Molnar, J. J., (2020). Profitability analysis of small-scale aquaculture enterprises in Central Uganda.
Jamu, D. M., and Ayinla, O. A., (2003). Potential for the development of aquaculture in Africa. Naga, Worldfish Center.
Jebet, C. L., (2017). Assessment of Factors Determining Yield and Income of Smallholder Fish Farmers in Nyamira County, Kenya. A Thesis Submitted to the School of Post-Graduate Studies in Partial Fulfilment of the Requirements of the Degree of Master of Science in Agricultural Extension of the Faculty of Agriculture and Natural Resource Management Department of Agriculture.
Kassam, L., (2013). Assessing the contribution of aquaculture to poverty reduction in Ghana. PhD thesis.
Maina, J. G., Mbuthia, P. G., Ngugi, J., Omolo, B., Orina, P., Wangia, S. M., Karuri, E. G., Maitho, T., and Owiti, G. O., (2014). Influence of social-economic factors, gender and the Fish Farming Enterprise and Productivity Project on fish farming practices in Kenya. Livestock Research for Rural Development 26 (2) 2014.
Mainza, R. M., and Musuka, C. G., (2015). Extent of Small-Scale Fish Farming in Three Districts of Lusaka Province. International Journal of Aquaculture, 5(42): 1-12 (doi: 10.5376/ija.2015.05.0042).
Makori, J. A., Abuom, O., Kapiyo, P., Anyona, N. D., and Dida, O. G., (2017). Effects of water physico-chemical parameters on tilapia (Oreochromis niloticus) growth in earthen ponds in Teso North Sub-County, Busia County. Journal of Fisheries and Aquatic Sciences.
Mangeni, H., and Mhlanga, W., (2019). The role of smallholder pond aquaculture in livelihoods diversification, income, and food security. A Case of Kushinga fish-farmers, Masvingo, Zimbabwe. International Journal of Aquaculture.
Mhuru, M., (2019, August 5). CSO-SUN Advises government to declare hunger situation a national emergency. News. Lusaka, Lusaka, Zambia: Kwantum Innovations. Retrieved from News.
Musaba, C. M., and Namanwe, E., (2020). Econometric Analysis of Socio-Economic Factors Affecting Smallholder Fish Production in Kabwe District, Zambia. International Journal of Research Studies in Agricultural Sciences.
Nabafu, E., (2010). How to fully engage youth in enhancing Fisheries and Aquaculture in Sub Saharan Africa. National Fisheries Recourses Research Institute (NaFIRRI), Uganda Member of the Youth for Fish Program (YFFP), Malawi.
Nsonga, A., (2015). Status quo of Fish farming in the Northern Province of Zambia a case for Mbala and Luwingu districts. International Journal of Fisheries and Aquatic Studies 2015; 2(6): 255-258.
Nsonga, A., and Simbotwe, M., (2014). Challenges and emerging opportunities associated with aquaculture development in Zambia. International Journal of Aquatic Studies 2(2):232-237.
Nsonga, A., and Simbotwe, M., (2014). Challenges and Emerging Opportunities associated with Aquaculture development in Zambia. International Journal of Fisheries and Aquatic Studies.
Ntanzi, R., Bwanika, G., and Eriku, G., (2014). The Effects of Stocking Density on the Growth and Survival of Nile Tilapia (Oreochromis niloticus) Fry at Son Fish Farm, Uganda. Journal of Aquaculture Research & Development.
Obiero, O. K., Waidbacher, H., Nyawanda, O. T., Munguti, M. J., Manyala, O. J., and Kaunda, B., (2019). Predicting uptake of aquaculture technologies among smallholder fish farmers in Kenya. Aquaculture International.
Obwanga, B., and Lewo, M. R., (2017). From aid to responsible trade: driving competitive aquaculture sector development in Kenya; Quick scan of robustness, reliability and resilience of the aquaculture sector. Wageningen University and Research, Report 2017-092 3R Report 2017-092 3R Kenya.
Oladoja, M. A., Adedoyin, S. E., and Adeokun, O. A., (2008). Training needs of fisher folks on fishing technologies. Journal of Food Agriculture and Environment Science and Technology.
Olaoye, O. J., Ashley-Dejo, S. S., Fakoya, E. O., Ikeweinwe, N. B., Alegbeleye, W. O., Ashaolu, F.O., and Adelaja, O. A., (2013). Assessment of Socio-Economic Analysis of Fish Farming in Oyo State, Nigeria. Global Journal of Science Frontier Research.
Olowosegun, T., Sanni, A. O., Sule, A. M., and Bwala, R. L., (2004). Contribution of Women to Fisheries development in Kainji Lake Basin, in 2004. FISON Conference proceedings.
Osondu, C. K., and Ijioma J. C., (2014). Analysis of profitability and production determinants of fish farming in Umuahia Capital Territory of Abia State, Nigeria. World Journal of Agricultural Sciences 2(7):165-176.
Rana, K., Siriwardena. S., and Hassan. M. R., (2009). Impact of Rising Feed Ingredient Prices on Aquafeeds and Aquaculture Production. Research Gate.
Shitote, Z., Wakhungu, J., and China, S., (2017). Challenges Facing Fish Farming Development in Western Kenya. Greener Journal of Agricultural Sciences.
Sonjiwe, A., Musuka, C. G., and Haambiya, L., (2015). The Contribution of Artisanal Fisheries towards Livelihoods and Food Security among Communities of Chanyanya Fishing Camp in Kafue District of Lusaka Province. International Journal of Forestry and Horticulture (IJFH).
Towers, L., (2016). Importance of Education to be Covered at Aquaculture UK. The Fish Site.
World Fish Centre (WFC)., (2009). Producing tilapia feed locally: A lowcost option for small-scale farmers. FLYER 1956.