Roles and functions of households along the inland fisheries value chain in the Vhembe District Municipality, Limpopo Province

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Abstract: This paper investigated the roles and functions performed by rural households along the inland fishery value chain in the Vhembe District Municipality in Limpopo Province. Primary data was collected from 151 fishing and non-fishing households. Descriptive statistics was employed to profile the socio-economic characteristics of households. Pearson Chi-square and Pearson Product Moment Correlation were used to examine the relationship between socio-economic characteristics (gender and age) of households and their function along the inland fisheries value chain. The study found a positive relationship between gender and function of consumer at 1% probability level. In addition, the correlation between age and function of input supplier and consumer were 0.293 and 0.080 respectively. Consequently, the results show that households play the role of input supplier, fishers, processor, trader and consumer. Therefore, the study calls on the government to create an enabling environment that will encourage households to partake in the value chain of inland fisheries to promote rural livelihoods and to encourage women to participate in inland fisheries.

Subjects: Agriculture & Environmental Sciences; Agriculture and Food; Economics

Keywords: inland fisheries; value chain; correlation coefficient

1. Introduction
Inland fisheries have continued to grow over the past years. For instance, in 2011, about 11.1 million tons of inland fish were produced in the world (Food and Agriculture Organisations

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[FAO], 2016]. It then increased to 11.6 million tons in 2016 and 20 million tons in 2018 (Food and Agriculture Organisations [FAO], 2018, 2020). This evidently indicates that inland fisheries are an important sector that can contribute to food security and income generation, particularly in developing countries.

It was estimated that 90% of people who directly depend on capture fisheries work in small-scale fisheries sector (World Bank, 2012). Therefore, these individuals are undoubtedly employed across the inland fishery value chain.

The current global fishery scale estimated that in 2016, about 59.6 million people were engaged in both capture fisheries and aquaculture either on a full-time, part-time or occasional basis. In addition, 8.3 million of these workers were women (Food and Agriculture Organisations [FAO], 2018). Furthermore, it is reported that in Africa, about 11% of women were employed in both fisheries and aquaculture sectors as compared to 79% and 70% of males employed in fisheries and aquaculture respectively (Food and Agriculture Organisations [FAO], 2018). A survey conducted in South Africa found that only 16.4% of recreational fishers are females while males add up to 76.6% (the remainder being children), particularly within inland fisheries. The primary purpose of recreational fisheries is fishing for leisure, but participants might sell their catch (Ellender et al., 2009). To this end, women play different roles in inland fisheries, marine, aquaculture and recreational fisheries.

The challenge of meeting the expected increase in global population by 2050 stems from feeding and also achieving Sustainable Development Goals (Goals 2, 3, 6, 7 and 15; Funge-Smith & Bennett, 2019). There is, therefore, a need to channel inland fishery value chain benefits for household food security, employment, and income generation, particularly for poor households.

With these being said, the benefits of the fisheries value chain often entail increments of producer share, the minimum cost of processing, increase in efficiency and effectiveness of the actors, boost in business and employment, elimination of unwanted processes such as non-valuable addition, quality assurance in product development to ensure customer satisfaction (Burch & Maes, 2017; Jeyanthi et al., 2017). Overall, the importance of the fisheries value chain is that it highlights enterprise development, enhances the quality of a product and qualitative measures of value addition, promotes coordinated linkages among producers and improves the competitive position of individual enterprises in the marketplace (Awel et al. 2018). Therefore, the improvement of livelihoods is attached to a broader spectrum of value chain activities.

According to Food and Agriculture Organisations [FAO], 2018, Sustainable Development Goal 1 is dedicated to fisheries and fisheries value chain to support the livelihoods of the poor and vulnerable with inclusive access to fisheries and related economic resources. Despite this information, in developing countries such as South Africa, it is reported that the inland fishery value chain is short and the roles of the actors are not clearly defined (Britz et al., 2015; Sara et al., 2017). This includes the roles played by rural households along this value chain. It is against this background that the study seeks to:

(i) Profile the socio-economic characteristics of households in Vhembe District Municipality (VDM).
(ii) Examine the relationship between socio-economic characteristics of households and their function along the inland fisheries value chain.

2. Literature review
First proposed by Porter (1985) as a vital tool to better understand all the elements that involve a firm’s competitive advantage, value chain analysis helps to better comprehend the activities encompassed in a product or service until it reaches the final consumer. This concept involves a full range of activities that are required to bring a product or service from its conception, through the
different phases of production, transformation and delivery to final consumers and eventually to its disposal use (Noji, 2013). That being the case, De Silva (2011) defines a fishery value chain as an interlinkage of value-adding activities that convert inputs into outputs which, in turn, adds to the bottom line and helps to create a competitive advantage. The value chain approach is flexible and comprises all activities that directly or indirectly contribute to the capture, post-harvest processing and marketing of fish (Basurto et al., 2017; Rosales et al., 2017).

Congruently, the fishery value chain differs according to fish, country and region (De Silva, 2011). For instance, fish has many different species that can be prepared in different ways due to the rapid spoil, post-harvest handling, processing, preservation, packaging, storage and transportation. Value chain, in this case, focuses on all the necessary steps that fishery business goes through from raw materials until it reaches the end-user and includes all economic activities and sub-sectors (De Silva, 2011; World Bank, 2012). Thus, the value chain includes producers, input suppliers, operations, processors, retailers and buyers, and also plays an important role in determining the quality, quantities, prices and timing for the success of the products or services (Kumar & Rajeev, 2016).

In South Africa, fish from the inland water is mostly sold raw or processed. For example, Hara et al. (2021) confirm that in parts of the Jozini Town, women traders sell raw fish to the communities. However, these women purchase fish from fishers who fish at the Pongola Dam. Previously, fishing gear such as fence of reeds with fish trap, bow and arrow, thick bundle of vegetation used as a seine net and a stick with a sharp thorn used as a kind of fishing hook are some of the fishing gears that were used. Currently, households use homemade gear such as fishing rafts, fishing rods, and modern fishing rods and nets to catch fish.

South Africa is known as one of the major countries that thrive in marine fisheries. The country is the largest importer and exporter of fish and fish products in the Southern African Development Community (Hara et al., 2017). It is recorded that the country exports 70% of its catch and by far, hake is the most valuable fish produced contributing 40% in value (South African Deep-Sea Trawling Industry Association, 2018; Southern African Development Community—European Union Economic Partnership Agreement, 2017). Additionally, the country exports canned sardines, Anchovies, Horse mackerel, Lobsters and Tuna to various countries such as China, Japan and other Asian countries (Food and Agriculture Organisations [FAO], 2010). Nevertheless, there is no inland fisheries trade in South Africa. This is because the commercial inland fisheries that are similar to marine fisheries do not exist in the country (McCaffety et al., 2012).

Figure 1 shows some of the inputs used by fishing households in the Limpopo Province both modern (A and B) and homemade (C and D) inputs used by fishers in the study area are shown in the figure.

Several authors have highlighted that fishing households play multiple roles and functions along the fishery value chain. For example, Alemu and Azadi (2018) established that fishing households in Northern Ethiopia play numerous roles as fishers, processors, sellers, and consumers. In a study by Nasr-Allah et al. (2019), three main actors in the fisheries value chain were identified. These included fishers, traders (intermediaries, wholesalers, and retailers) and fish processors. Saqulo et al. (2017) examined factors that influence people’s decision to participate in fishery-related activities along the Volta Lake in Yeyi, Ghana. The study found that fishers function as fish harvesters, processors, marketing, fishnet weaving/mending/repairing and fish consumers. In South Africa, Britz et al. (2015) outline that fish production especially aquaculture is predominantly performed by women while fish harvesting in the dams and rivers is mostly a male-dominated activity. On the other hand, Hara et al. (2021) identified fishers, processors, fish retailers, wholesalers and fish warehouses as actors in the value chain of inland fisheries in South Africa. Value chain influencers include the Department of Water and Sanitation, South African Police services and South African Maritime Safety Authorities.
Figure 1. Home-made and modern fishing inputs used by fishers.

Saagulo et al. (2017) identified factors that influence people's decision to go fishing. Four main fishery-related activities were identified, that is, fish harvesting, fish trading, fish processing and making/mending nets. As one of the post-harvesting activities, fish processing adds value to the fish and creates employment, especially for women across the globe (Welcomme et al., 2010). In Malawi, it was found that women are fairly integrated into all the nodes and activities of the fisheries value chain (Manyungwa-Pasani et al., 2017). On that account, the value chain of inland fisheries is, therefore, important in identifying opportunities that households can engage in to promote food security, employment and income generation. Moreover, the inland fishery value chain indicates the relationship between fishery management and the users of the inland fishery resources to promote sustainability for current and future beneficiaries.

However, the lack of value addition facilities, storage facilities, market information, skills and knowledge in post-harvest management, poor and inefficient fish preservation techniques, gender discrepancies, and lack of knowledge of benefits and opportunities, constitute some of the challenges that households face in the value chain of inland fisheries (Beran, 2018; Edwards et al., 2014; Manyungwa-Pasani et al., 2017). These challenges tend to shorten the value chain of inland fisheries. Pedroza-Gutiérrez and López-Rocha (2016) proffer that the flow of fish from fishers to final consumers is determined by fish species, where the fish was caught, factors that define the production and distribution forces and mostly, the actors that are involved in this value chain.

2.1. Role of women in fisheries
Fisheries is a sector that involves both men and women yet, these roles may be distinct based on various factors. For instance, in Bangladesh, particularly in the Padma River, females are restricted to participate in fishing activities (Sunny et al., 2019). This is because fishing is often seen as a male-dominated activity (World-Wide Fund for Nature United Kingdom [WWF-UK], 2012). Despite these restrictions, according to Food and Agriculture and Organisation [FAO], 2014), women are responsible for most of the time-consuming tasks performed offshore. These include making and mending nets, making buckets, baiting hooks and pots, processing and marketing the fish. Mostly, these activities are rendered as non-paid tasks hence the work of women in fisheries is rarely recognised (Ogden, 2017). Likewise, various studies have reported that the role of women in fisheries is at times undervalued, uncredited and underappreciated by society, policymakers and
the fishery sector (Harper et al., 2013). Hence, there is a lack of clearly defined gender roles and responsibilities within fisheries thus, the contribution of fisheries to livelihoods is underestimated.

According to Harper et al. (2020), it is estimated that women roughly account for 2.9 million tonnes of fish and invertebrates, particularly within the production of small-scale inland fisheries. Raemaekers and Sunde (2015) confirm that women in Africa are engaged in both pre-and post-harvesting activities. Another study accentuates that women also hire men to fish on their behalf while their role is mostly linked with post-harvesting activities (Limuwa, 2019). Despite these vast contributions of women in fisheries, they are still unrecognised by the community, and policies are gender-biased (Funge-Smith & Bennett, 2019).

Previous studies have reported that not only are women involved in pre-and post-harvesting activities, but they also serve as a source of information, bookkeepers for household fish enterprises, management of fisheries and, practical backup in fisheries (such as picking up fishing equipment and fishing labourers particularly when the spouse is off fishing; Kusokabe, 2002; World-Wide Fund for Nature United Kingdom [WWF-UK], 2012). For example, unlike men, women will fish for almost all seasons since they are responsible for maintaining the household protein food supply. As a result, both men and women play complementary roles in the fishing sector. For instance, it is also reported that women are likely to be involved in fisheries due to the involvement of their spouses in fishing activities hence they play a role in post-harvest activities such as marketing (Suntornratana, 2002). This suggests that women perform a meaningful role in the value chain of fisheries.

3. Methodology
The study was conducted in the Vhembe District Municipality which is situated on the northern side of the Limpopo Province and is characterised by perennial and non-perennial rivers, flowing into the Luvhuvhu catchment before joining the Limpopo River. Dams such as Nandoni, Nzhelele, Damani, Tshakuma, Mutshedzi, Nwanedi, Lupepe, and Albasini provide water for households in the district for domestic and agricultural purposes (Vhembe District Municipality Integrated Development Plan, 2019/2020). Access to fisheries in most of the dams is not controlled and there are no regulations to control fishing activities (Tapela et al., 2015). Not only do households get water from these dams, but studies such as those conducted by Tapela et al. (2015) indicate that there are fishing activities taking place in most of the dams. However, the fisheries in the study area are mostly small-scale with fishers utilising homemade fishing lines, feed, rods, hooks, baits and buckets (Tapela et al., 2015). Moreover, most of the households are poor and rely on agriculture and social grants for their livelihoods (Cooperative Governance and Traditional Affairs, 2020). The district is mostly characterised by rural communities with Tshivenda as the most spoken language. Additionally, the climatic conditions in the district are suitable for the production of different fish species such as Schilbe intermedia, Labeobarbus marequensis and Oreochromis mossambicus (Water Research Commission, 2013).

Ethical clearance to conduct the study was obtained at the University of Limpopo in 2020 (TREC/38/2020:PG). Primary data was then collected from 151 households in the Vhembe District Municipality (VDM) in Limpopo Province, South Africa. These samples included households participating in inland fisheries and those not participating however it was discovered that about 5 households do not consume fish. These households were then excluded from the analysis since they do not play any role in the inland fisheries value chain. Thus, analysis was carried out of a sample of 146 households formed part of the inland fisheries value chain. Purposive and snowball sampling techniques were used to identify the role players of inland fisheries. These sampling techniques were employed due to the unknown number of fishers, input suppliers, fish traders, fish processors and consumers in the study area. The study area is characterised by fishers who produce fish for selling to communities and retailers (Phosa & Lethoko, 2018).
Yamane’s (1967) formula was used to calculate the minimum sample size:

\[ n = \frac{N}{1 + Ne^2} \]

Where: \( n = \) sample size, \( N = \) total population, \( e^2 = \) margin of error (0.05). These give a total of 151 households in Vhembe District Municipality.

The study employed descriptive statistics to profile the socio-economic characteristics of households in the study area. In addition, Pearson Chi-square and the Pearson Product Moment Correlation (\( r \)) were employed to check the relationship between the socio-economic characteristics of households and their roles along the inland fisheries value chain. The Pearson Chi-square was employed to determine the relationship between gender and function of households along the inland fisheries value chain while the Pearson Product Moment Correlation (\( r \)) was used to examine the relationship between age of households and their function along the inland fisheries value chain.

Pearson Chi-square of independence is used to test the relationship between two categorical variables while \( r \) is a test used to measure the strength or the degree of a linear association between variables and their direction. Following Obilor and Amadi (2018), the correlation coefficient thresholds of 0 represent no correlation. On the other hand, \( r \) value for the corresponding \( df \) (= \( n-2 \)) should be compared with the tabulated value. If the observed value is greater than the tabulated value at a given probability level, the correlation is significant.

4. Results and discussion

Table 1 presents the descriptive results of the study. Of the interviewed households, only 62 participate in inland fisheries. The remainder (89) are non-participants. However, non-participating households are viewed as consumers of the inland fishes. As it can be seen from the results, the average age of the interviewed households in VDM is 46. The maximum household size is 14 with an average of 4 household members. These results imply that majority of the

| Variable                              | N   | Min. | Max. | Mean | Std. Dev. |
|---------------------------------------|-----|------|------|------|-----------|
| Age of household head (years)         | 151 | 22   | 89   | 46   | 14.23     |
| Household size (actual number)        | 151 | 1    | 14   | 4    | 2.36      |
| Total household income (per month in USD) | 151 | 53.09| 2498.34 | 483.58 | 407.77   |
| Distance to market (km)               | 151 | 1    | 28   | 12   | 6.35      |
| Fishing experience (years)            | 62  | 2    | 31   | 8    | 5.94      |
| Distance to fishing area (km)         | 62  | 0.1  | 27   | 5    | 4.42      |
| Average selling price of fish per kg (USD) | 62  | 0    | 1.56 | 0.53 | 0.32      |
| Average quantity of fish sold per year (actual number) | 62  | .00  | 3320.00 | 131 | 422.03    |
households have available household labour. To this end, most households are likely to get 483.58 USD as a total household income per month.

The furthest distance travelled by households to the market is 28 km while on average, households are likely to travel 12 km. Despite the long-distance travelled to the market, households involved in inland fisheries are likely to travel a distance of 5 km to the fishing location. With these being the case, households have at least 2 years of fishing experience with an average of 8 years of fishing experience. Households are likely to buy fish at 0.53 USD per kg, which also depends on the type of fish. The minimum quantity of fish sold per year is 0 suggesting that the reason for participating in inland fisheries is primarily for consumption. Additionally, fishing households are likely to sell an average of 131 fish per year. These results suggest that fishing households do not rely on a single location to catch fish but might travel to other municipalities as well thus increasing the amount of fish sold.

4.1. Role players in inland fisheries and related functions
Table 2 presents the pre- and post-harvesting activities that rural households are involved in. Moreover, it shows the roles and functions of rural households along the inland fishery value chain. It was found that households play multiple roles along the inland fisheries value chain. The roles played by rural households along the value chain include input supplier, fishers, trader,

| Table 2. Role players of inland fisheries and related functions in Vhembe District Municipality |
|---|---|---|
| Role players | Function | %Role players |
| Pre-harvesting | Input suppliers | Sell inputs to fishers | 0 |
| | | Loan inputs | 100 |
| | | Repair inputs | 11 |
| | | Provide guidelines on how to use the inputs | 0 |
| | | Deliver inputs to the fishers | 0 |
| Post harvesting | Fishers | Catch fish (NPHAF) | 100 |
| | | Sell raw fish to traders/ consumers | 60 |
| | | Process the fish for selling | 5 |
| | | Price maker | 21 |
| | | Price taker | 0 |
| | | Consume fish | 82 |
| | | Warehouse | 97 |
| | | Packaging and transportation | 13 |
| | | Marketing and distribution | 8 |
| | Traders | Purchase fish from fishers | 67 |
| | | Sell fish to consumers and process fish | 100 |
| | Processors | Gut the fish, dry/fry fish, and sell fish to consumers | 100 |
| | Consumers | Purchase fish from fishers | 19 |
| | | Purchase fish from traders | 14 |
| | | Price takers | 1 |

Note: NPHAF means Not a Post-Harvesting Activity but actual Fishing
processor and consumer. Input supplying is a pre-harvesting activity identified by the study. In this case, an input supplier sells bait, gear, rods, hooks and nets to fishers. Similarly, an input supplier might loan fridges, boats, and offer transportation to fishers. In addition, the role of an input supplier includes fixing/repairing some of the gears at a cost.

From the post-harvesting activity, the study found that many fishing households play several roles in the value chain. For instance, not only do fishers catch fish, but they also sell raw and processed fish. Moreover, the function of fishers also includes being a price taker and maker, fish consumer and warehouser.

The results in Table 2 also postulate the functions of traders along the inland fisheries value chain in the VDM. The role of traders includes buying fish from fishers, selling to consumers and fish processing. However, some of these traders purchase fish from fishers. About 3 (representing the number of solely fish trades thus 100%) of the identified traders sell processed fish to consumers. Therefore, the main aim of traders is basically to generate income (Kamaylo et al., 2021). Additionally, the role of traders includes selling raw and processed fish and, purchasing fish from fishers. Regarding the function of processors, the study identified 3 processors (represented by the 100%) who solely buy fish from fishers, gut and dry fish and cook the fish to sell to consumers in the local community. This suggests that these fish processors are involved in post-harvest activities. These processors also perform the function of traders. Seemingly, there are similar functions played by traders and processors. Fish trading and processing are largely viewed as female activities while males are responsible for the initial catching of fish (Manyungwa-Pasani et al., 2017; Welcomme et al., 2010). Both fishing and non-fishing households play the role of consumers of fish within the value chain. This is because some fishing households primarily catch fish for consumption purposes and also non-fishing households purchase fish either cooked or raw from fishers, traders and processors.

4.2. Description of role players characterised by gender

The results presented in Table 3 shows the description of the role players of inland fisheries based on gender. As can be seen, majority of the participants of inland fisheries in VDM are males. Additionally, majority of the males are input suppliers, fishers, traders, processors and consumers. Nevertheless, the study recorded 33% of the females as traders and processors. Although fish is consumed by both males and females, many of the households headed by males consume most of the fish. Relatively, 32% of the females consume fish. These results confirm that the value chain of inland fisheries in VDM is dominated by males. These results also affirm the findings of World-Wide Fund for Nature United Kingdom (WWF-UK), 2012).

4.3. Value chain map of inland fisheries in Vhembe District Municipality (VDM)

This section discusses the inland fishery value chain map in the VDM, Limpopo Province. Figure 2 shows the value chain map of inland fisheries in the study area. In this study, inland fisheries activities were identified at both dams and rivers. Mostly, inland fisheries in rural areas are characterised by small-scale, subsistence and recreational fishers. Thus, the value chain of

| Role players | % | % |
|--------------|---|---|
|              | Male | Female |
| Input suppliers | 100 | 0 |
| Fishers       | 92  | 8  |
| Traders       | 67  | 33 |
| Processors    | 67  | 33 |
| Consumers     | 68  | 32 |
fisheries differs by fish species and location (De Silva, 2011). Therefore, this study provides a general inland fisheries’ value chain of the VDM, Limpopo Province. In this study, the main focus of the value chain was the role played by both fishing and non-fishing households.

As shown in Figure 3, the inland fishery value chain in VDM comprises input suppliers, fishers, traders, processors, and consumers. Although fishers are crucial in providing fish, they, however, play multiple roles along the value chain. In essence, these fishers act as households who perform
all functions of the inland fisheries value chain. Moreover, the fishers in the study area mostly
catch Tilapia, Carp, Bass and Catfish which are also preferred for consumption. Similarly, Kamaylo
et al. (2021) attest that, fishers are the primary actors of the fisheries value chain who catch fish
and sell it to other value chain actors. However, these fishers not only perform this task, but also
supply inputs, are traders, processors, and consumers. Equally, fishers can purchase inputs such as
modern rods and nets at the nearest towns or from local input suppliers.

In turn, there are also those households who are purely traders of fish (represented by the
100%). These traders also play the dual role of being processors. Fröcklin et al. (2013) concur with
this, stating that traders sell fresh, processed fish to local customers and other markets. These
consumers might be those who are involved in inland fisheries (particularly, if they rely on fisheries
for food and income) and those who do not participate. Despite this value addition, market access
has been identified as one of the challenges that face inland fisheries in rural areas thus value
chain analysis assists producers to identify possible markets along the fishery value chain (Hara
et al., 2021). To this end, the fisheries value chain in VDM is simple with trade taking place between
the role players.

4.4. Pearson Chi-square and the Pearson Correlation Coefficient results between
socio-economic characteristics of role players and their functions along the inland fisheries
value chain

Table 4 presents the Pearson Chi-square and Pearson Correlation Coefficient results for Vhembe
District Municipality. The socio-economic variables used are gender and age. The Pearson Chi-
square shows that there is a relationship between gender and the function of a consumer. On the
other hand, there is a positive correlation between the age and function of input suppliers and
consumers.

4.4.1. Relationship between gender and function of consumer

The relationship between gender and the function of consumers was estimated. The results show
a statistical significance of 1%. The results imply that both male and female fish consumers have
similar functions along the value chain. For instance, both might purchase fish from fishers or fish
traders. Moreover, the intake of fish is associated with a healthy diet for both males and females
(Wennberg et al., 2012).

4.4.2. Correlation between age and input supplier function

The correlation between age and input supplier function was estimated and the results show that
there is a statistical significance between age and input supplier function. The results presented
a correlation coefficient of \( r = .293 \) and \( p = .021 \). The low correlation might be due to the few input
suppliers identified in the study area. The direction of the relationship is positive, which means that
these variables tend to increase together. The results imply that as the age of the role player
increases, the role player is likely to be responsible enough to take on more functions as an input
supplier. For example, age is associated with experience, which suggests that the input supplier

| District | Input supplier | Fishers | Trader | Processor | Consumer |
|----------|----------------|---------|--------|-----------|----------|
|          | Pearson Chi-square (Gender vs functions of role players) |        |        |           |          |
| VDM      | .274           | .994    | .871   | .678      | .004***  |
| Pearson Correlation coefficient (Age vs functions of role players) |        |        |        |           |          |
| VDM      | .021**(.293)   | .150 (−.185) | .183 (.171) | .170 (.176) | .080*. (336) |

Note: ***, **, * represent significance level at 1%, 5% and 10%. Values in parentheses are the correlation coefficients|
might have enough skills to take on more responsibilities in the value chain. However, the lack of skills will result in poor and inadequate input supply for fisheries (Kassam et al., 2017).

### 4.4.3. Correlation between age and consumer function

The correlation between the age and function of a consumer along the inland fisheries value chain resulted in a positive association. The results show that there is a statistically significant relationship between the age and the function of consumers (r = .336, p > 0.05). The results suggest that as the age of the consumer increases, the likelihood of performing functions such as knowing where to buy fish (different fish markets) also increases. Quagrainie et al. (2009) found a significant relationship between the age of the consumer and the consumption of fish. For instance, the results revealed that consumers prefer inland fish to farmed Tilapia and Catfish. To this end, Quagrainie et al. (2009) established that consumption of fish is significantly dependent on age among other variables.

### 5. Conclusion and recommendation

In light of the results of the study, it is concluded that the majority of the households are still in their active stages of life. This means that these households are still able to participate in various inland fisheries activities. Although the distance travelled to the market is short, the distance travelled to the fishing location is longer. This might be attributed to the different locations that fishing households are likely to travel to catch fish. The study also found that the inland fisheries value chain is simple and short although households perform numerous roles along the inland fisheries value chain in the study area. These roles include input supplier, fishers, processor, trader and consumer. The study not only confirmed that inland fisheries is male-dominated but, males also influence the value chain. Similarly, various functions are attached to these roles. For instance, a fisher is not only able to catch fish but can also function as a processor and a trader. To this end, socio-economic characteristics such as gender have shown a significant relationship with the function of consumers. Likewise, age has a significant relationship with the function of input suppliers and consumers. These results suggest that the older the household head, the more likely they are to take on more functions as input suppliers thus improving their livelihoods through income generation. Moreover, both men and women serve important roles in the inland fisheries value chain and are likely to play similar functions. With this being the case, the study recommends awareness campaigns that will allow households to benefit from the inland fisheries value chain in the form of income generation and food security. Moreover, the study advocates that, policies which recognise women’s involvement in inland fisheries should be developed to encourage improvements of livelihoods, entrepreneurial skills and food security particularly for the female-headed households.

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### References

Alene, A. E., & Azadi, H. (2018). Fish value chain and its impact on rural households’ income: Lessons learned from Northern Ethiopia. Sustainability, 10(379), 1–16. https://doi.org/10.3390/su10103759

Awel, M., Shumeta, Z., & Mitiku, F. (2013). Analysis of fish value chain: The case of Gilgel Gibe Dam I Reservoir, Southwest of Ethiopia. *Journal of Economic and Sustainable Development*, 9(19), 2222–2855. https://iiste.org/Journals/index.php/JEDS/article/viewFile/44715/46133

Basurto, X., Virdin, J., Smith, H., & Jusksus, R. (2017). Strengthening the governance of small-scale fisheries: An initial assessment of the theory and practice. OAK Foundation Publishers. Retrieved June 19, 2021, from https://www.issuelab.org/resources/28270/28270.pdf

Beran, K. (2013). Value chain improvements in small-scale fisheries: Case studies from West Africa [Doctoral Thesis]. University of Rhode Island, Rhodes Island.
Britz, P., Hara, M., Weyl, O. L. F., Tapelo, B., & Rouhani, Q. (2015). Scoping study on the development and sustainable utilisation of inland fisheries in South Africa. Water Research Commission Report, No. TT 615/11/4, Pretoria, Water Research Commission.

Burch, V., & Moes, S. (2017). Boosting business along the fisheries value chain. European Union.

Cooperative Governance and Traditional Affairs. (2020). Vhembe District Municipality LP. Retrieved June 24, 2022, from https://www.cogta.gov.za/dmdm/wp-content/uploads/2020/11/Vhembe-October-2020.pdf

De Silva, D. A. M. (2011). Value chain of fish and fishery products: Origin, functions and application in developed and developing countries market. FAO. Retrieved October 15, 2020, from http://webcache.googleusercontent.com/search?q=cache:Gvzn5m0A60.wwww.fao.org/fileadmin/user_upload/fisheries/docs/De_Silva_report_with_summary.doc+&cd=1&hl=en&ct=clnk&gl=za

Edwards, P., Egna, H., Ichian, S., & Borberg, J. (2014). Value chain analysis helps overcome gender barriers in agriculture. Global Aquaculture Alliance. Retrieved February 1, 2020, from https://aquafishnrcp.oregonstate.edu/sites/aquafishspringandmanagementscience.edu/files/edwards2014valuechain_gaa.pdf

Ellender, B. R., Weyl, O. L. F., & Winker, H. (2009). Who uses the fishery resources in South Africa’s largest impoundment? Characterising subsistence and recreational fishing sectors on Lake Gariep. Water SA, 35(5), 677–682. https://doi.org/10.4314/wsa.v35i5.49194

Food and Agriculture Organisation (FAO). (2014). The role of women in fisheries. Retrieved May 24, 2020, from http://www.fao.org/family-farming/detail/en/c/340571/

Food and Agriculture Organisations (FAO). (2019). National fishery sector overview. https://www.fao.org/fishery/docs/DOCUMENTS/cp/en/FL_CP_ZA.pdf

Food and Agriculture Organisations (FAO). (2016). The state of the world fisheries and aquaculture Contributing to Food Security and Nutrition for all. Food and Agriculture Organisations (FAO). (2016). The state of world fisheries and aquaculture 2018 - Meeting the sustainable development goals. Food and Agriculture Organisations (FAO). (2020). World fisheries and aquaculture. Retrieved February 20, 2021, from http://www.fao.org/3/ca9229en_c/49229en.pdf

Fröcklin, S., de la Torre-Castro, M., Lindström, L., & Jiddawi, N. S. (2013). Fish traders as actors in fisheries: Gender and adaptive management. AMBIO, 42(8), 951–962. https://doi.org/10.1007/s13280-013-0451-1

Funge-Smith, S., & Bennett, A. (2019). A fresh look at inland fisheries and their role in food security and livelihoods. Fish and Fisheries, 20(6), 1176–1195. https://doi.org/10.1111/faf.12403

Hara, M., Greenberg, S., Thow, A., Chimotra, S., & du Toit, A. (2017). Trade and investment in fish and fish product between South Africa and the rest of SADC: Implications for food and nutrition security. Working Paper 47, PLAAS.

Hara, M., Muchapondwa, E., Sara, J. R., Weyl, O. L., Britz, P., & Tapelo, B. N. (2021). Inland fisheries contributions to rural livelihoods: An assessment of fisheries potential, market value chains and governance arrangements. WRC Report No. 2497/12/0. Water Research Commission. 978-0-6392-0240-2.

Harper, S., Ash Shade, M., Lam, V. W. Y., Pauly, D., Sumaila, U. R., & Tsikiras, A. C. (2020). Valuing invisible catches: Estimating the global contribution by women to small-scale marine capture fisheries production. PLOS ONE, 15(3), 1–16. https://doi.org/10.1371/journal.pone.0228912

Harper, S., Zeller, D., Hauser, M., Pauly, D., & Sumaila, U. R. (2013). Women and fisheries: Contribution to food security and local economies. Marine Policy, 39(1), 56–63. https://doi.org/10.1016/j.marpol.2012.10.018

Jeyanthi, P., Chandrasekar, V., & Gopa, N. (2017). Fishers’ perception on co-operative services and willingness-to-pay (WTP) for improved fish marketing services at Njarakkali, Ernakulam District, Kerala. Indian Journal of Fisheries, 64, 278–282. https://doi.org/10.21077/ijf.2017.64.specialissue.76303-45

Kamaylo, K., Gaitso, D., Tsala, T., Tarekgen, K., Oyka, E., Dukamo, M., & González-Redondo, P. (2021). Women value chain analysis of fish in Gamo zone, Southern Ethiopia.Cogent Food and Agriculture, 7(1), 1–18. https://doi.org/10.1080/23311932.2021.1916183

Kassam, L., Lokoh, K., Longley, C., Phillips, M., and Siriwadana, S. N. (2017). Sierra Leone fish value chain with special emphasis on Tonkolili District, Working Papers No. 40706, The WorldFish Centre.

Kumar, D., & Rojev, P. V. (2016). Value chain: A conceptual framework. International Journal of Engineering, Science and Research Technology, 7(1), 74–77.

Kusakabe, K. (2002). Gender issues in small scale inland fisheries in Asia: Women as an important source of information. New Approaches for the Mekong Basin. FAO, Mekong River Commission. Retrieved April 20, 2020, from https://www.fao.org/3/ad070e/ad070e08.htm

Limbuwa, M. M. (2019). Small-scale fishing communities’ perceptions of climate change and its impact on livelihoods, gender roles and the adaptive capacity: A case of Lake Malawi. Norwegian University of Life Sciences.

Manyungwa-Pasoni, C. L., Hara, M., & Chimotra, S. K. (2017). Women’s participation in fish value chains and value chain governance in Malawi: A case of Msaka (Lake Malawi and Chakulu (Lake Chilwa). Institute for poverty, land and agrarian studies (PLAAS), Working Paper 25, 1–31.

McCaffety, J. R., & Ellender, B. R., Weyl, O. L. F., & Britz, P. J. (2012). The use of water resources for inland fisheries in South Africa. Water South Africa, 38(2), 327–344. https://doi.org/10.4314/wsa.v38i2.18

Noji, M. (2013). Enhancing small-scale fisheries value chains in the Mediterranean and Blacksea. Retrieved April 4, 2020, from http://cfcmldestorage.blob.core.windows.net/contents/357/2013/Documents/FullVersion/8P1V_Part1.pdf

Nasr-Alall, A., Habib, O. A., Dickson, M. W., & Charchisa, H. (2019). Value chain analysis of small-scale fisheries in the High Dam Lake in Egypt. International Journal of Fisheries and Management, 11(2), 43–56. https://doi.org/10.5897/IJMFM.2018.0663

Obilor, E. I., & Amadi, E. C. (2018). Test for significance of Pearson’s correlation coefficient (r). International Journal of Innovative Mathematics, Statistics and Energy Policies, 6(1), 11–23. https://seehipoj.org/journals-cl/mar-2018/IJMSEP/full/IJMSEP-M-2-2018.pdf

Ogden, L. E. (2017). Fishermen-The uncounted dimension in fisheries management. Bioscience, 67(2), 111–117. https://doi.org/10.1193/biosci/biw165

Pedraza-Gutiérrez, C., & López-Rocha, J. A. (2016). Key constraints and problems affecting the inland fishery value chain in central Mexico. Lake and Reservoir Management, 32(1), 27–40. https://doi.org/10.1080/10402381.2015.1107666

Phosa, M. J., & Lethoko, M. X. (2018). Contribution of the small-scale fish farming sector to rural income generation in Thulamela Local Municipality, Limpopo.
South Africa. The 3rd Annual International Conference on Public Administration and Development Alternatives, 04-06 July 2018, Stellenbosch University, Saldanha Bay, South Africa.

Porter, M. E. (1985). Competitive advantage: Creating and sustaining superior advantage. Free Press.

Quagrainie, K., Dennis, J., Ndango, L., Darko, F., Ngugi, C. C., Manyala, J., & Amadivo, J. (2009). Value chain development for tilapia and catfish products: Opportunities for women participation. Retrieved November 29, 2021, from https://aquafishcrsp.oregonstate.edu/files/09mer02du_value_chain_development_pdf

Raemanekers, S., & Sunde, J. (2015). Women in fisheries in Africa. Aquadocs. Retrieved May 25, 2020, from https://core.ac.uk/download/pdf/337722466.pdf

Rosaless, R. M., Pomeroy, R., Calabio, I. J., Batong, M., Cedro, K., Escora, N., Facunla, V., Guilayan, A., Narvadez, M., Sarahadil, M., & Sobrevega, M. A. (2017). Value chain analysis and small-scale fisheries management. Marine Policy, 83, 11–21. https://doi.org/10.1016/j.marpol.2017.05.023

Saagula, M. N., Alhassan, E. H., & Amikuzuno, J. (2017). Determinants of fisher’s choice of fishing activity along the Volta Lake in Yei, Ghana. Ghana Journal of Developmental Studies, 14(2), 105–120. https://doi.org/10.4314/gdsj.v14i2.6

Sara, J. R., Weyl, D. L. F., Marr, S. M., Smit, W. J., Foucê, P. S. O., & Luus-Powell, W. J. (2017). Gill net catch composition and catch per unit effort in Flag-Boshiela Dam, Limpopo Province, South Africa. Water SA, 43(3), 464–469. https://doi.org/10.4314/wsa.v43i3.11

South African Deep-Sea Trawling Industry Association. (2018). Markets for South African Hake. Retrieved June 24, 2022, from https://www.sadsfia.co.za/assets/uploads/Factsheet-7-Markets-for-South-African-hake.pdf

Southern African Development Community – European Union Economic Partnership Agreement. (2017). South African fisheries and the SACDEU economic partnership agreement. Retrieved June 27, 2022, from https://sadc-eapo-outreach.com/images/files/sadc-euo-fisheries-july-2017.pdf

Sunny, A. R., Mithun, M. H., Ahamed, G. S., Islam, M. A., Das, B., Rahman, A., Islam, M. A., Rahman, T., Hassan, N., & Chowdhury, M. A. (2019). Livelihood status of The Hilsa (Tenualosa ilisha) Fishermen/ women: The case of the coastal fishing community of the Padma River, Bangladesh. Journal of Coastal Zone Management, 22(2), 1–9.

Suntornratana, U. (2002). Women as a source of information on inland fisheries. New Approaches for the Mekong Basin. FAO, Mekong River Commission. Retrieved April 20, 2020, from https://www.fao.org/3/ad070e/ad070e07.htm#bm07

Tapelo, B., Britz, P. J., & Rouhani, Q. A. (2015). Scoping study on the development and sustainable utilization of inland fisheries in South Africa, Studies on small-scale inland fisheries. Water Research Commission, 2. https://repository.uwc.ac.za/xmlui/bitstream/handle/10566/4533/wrc_rr_2_scoping_study-development_sustainable_utilisation_inland_fisheries_south_africa_2015.pdf?sequence=1&isAllowed=y

Vhembe District Municipality Integrated Development Plan. (2019/2020). Vhembe District Municipality Integrated Development Plan 2019/2020 IDP Review. Retrieved February 25, 2020, from http://www.vhembe.gov.za/media/content/documents/2019/6/0_1d9f54a9f86e33u14ig1bvt1e1u1u1.pdf?filename=VHEMBE%20DISTRICT%20MUNICIPALITY%20IDP%202019/20%20IDP%20REVIEW.pdf

Water Research Commission. (2013). A WRC-funded study investigated the potential of Nandoni Dam, in Limpopo Province, to support the surrounding rural communities through fishery and aquaculture. Retrieved April 25, 2020, from http://www.wrc.org.za/wp-content/uploads/mdocs/TB_1925_fishery%20potential%20of%20Lake%20Nandoni.pdf

Welcombe, R. L., Cox, I. G., Coates, D., Be ne’ C., Funge-Smith, S., Halls, A., & Lorenzen, K. (2010). Inland capture fisheries. Philosophical Translation of the Royal Society, 365(1554), 2881–2896. https://doi.org/10.1098/rstb.2010.0168

Wennberg, M., Tornevi, A., Johansson, I., Hörnell, A., Norberg, M., & Bergdahl, I. A. (2012). Diet and lifestyle factors associated with fish consumption in men and women: A study of whether gender differences can result in gender-specific confounding. Nutritional Journal, 11(101), 1–6 doi:10.1186/1475-2891-11-101

World Bank. (2012). Hidden harvest, the global contribution of capture fisheries. Report no. 66469-GLB.

World-Wide Fund for Nature United Kingdom (WWF-UK). (2012). Fisheries management and gender. Retrieved April 19, 2020, from https://d2ouvy59p0dg6k.cloudfront.net/downloads/women_conservation_fisheries_2012.pdf

Yamane, T. (1967). Statistics: An introductory analysis (2nd ed.). Harper and Row Publishers.
