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Food Security Status and Its Determinants among Inland Fishing and Non-Fishing Rural Households in Sekhukhune District Municipality, Limpopo Province

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ABSTRACT

Background: Inland fisheries are considered to have the potential to reduce food insecurity and malnutrition globally. However, its contribution has been unrecognized. The study aimed to analyze the determinants of food security status among households involved and uninvolved in inland fisheries in Sekhukhune District Municipality (SDM), Limpopo Province. **Methods**: A total of 115 households were interviewed following snowball, purposive, and simple random sampling techniques. Descriptive statistics, Household Food Insecurity Access Scale (HFIAS), and Multinomial Logistic Regression (MLR) were used as data analysis tools. These tools were used to obtain the socio-economic characteristics of households and the determinants of food security status. **Results**: A total of 72 households were identified as fishers, while 43 households were not fishers. Moreover, the results confirm that there was no significant difference in the food security status of households involved in inland fisheries and those who were not involved; however, most of them were mildly food insecure. Additionally, total household income, marital status, level of education and type of agricultural activity determine the food security status of households involved in inland fisheries and those who were not involved. **Conclusion:** The integration of inland fisheries and other sectors is necessary to address household food insecurity related issues.

Keywords: *Food security; Inland fisheries; Multinomial logistic regression*

Introduction

The world human population is expected to grow by 9.7 billion by the year 2050 and inland fisheries is currently regarded as one of the important sectors in meeting the challenges of food security (Food and Agriculture Organization, 2016). Furthermore, fish has high nutrients such as protein, vitamin D and B2, calcium, phosphorus, and minerals which are important for the development of good health (Belton and Thilsted, 2014). Over the years, much attention has been drawn to marine and aquaculture due to its important role in food security, employment, income, and livelihoods (Pradeepkiran, 2019). On the other hand, less attention has been given to inland fisheries as a contributor to livelihoods through the provision of food and employment across the globe (Britz *et al.*, 2015, Lynch *et al.*, 2016). However, current studies have signified the importance of this sector as a source of food security and animal protein, especially among the

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rural poor (Funge-Smith and Bennett, 2019). Thus, Simmance defines inland fisheries as the harvesting of fish from the wild compared to aquaculture (Simmance, 2017). Therefore, aquaculture is simply the production or farming of aquatic organisms such as fish (Martínez Cruz *et al.*, 2012). According to food and agriculture organization (FAO), inland fisheries are mainly practised by rural and small-scale individuals with fewer activities for commercial larger-scale fisheries (Food and Agriculture Organization, 2018).

In South Africa, the fisheries sector is dualistic and comprises marine fisheries and inland fisheries. These sectors are dominated by recreational, small-scale, and commercial sub-sectors and contribute to income, food security, employment, poverty reduction and tourism (Food and Agriculture Organization, 2018). However, commercial inland fisheries that is equal to marine fisheries does not exist in the country (McCafferty *et al.*, 2012). In fact, the sector has been underappreciated, undervalued, and unrecognized as a contributor to household food security (Britz *et al.*, 2015, Tapela *et al.*, 2015). This undervaluation could lead to most fishing households being vulnerable to food insecurity shocks, further compounding the difficulties encountered in maintaining their livelihoods. Concurrently, South Africa is a middle-income emerging market country with a highly productive agricultural sector (Bhorat *et al.*, 2018). Despite its ability to produce food, the country is food insecure at the household level (Stats, 2019). Hence, inland fisheries have the potential to reduce food insecurity challenges, particularly among rural households of South Africa.

The general household survey in South Africa shows that about 6.8 million people experience hunger (Stats, 2019). Earlier research reports a high prevalence of malnutrition and micronutrient deficiency, particularly among the rural poor within the country (Govender *et al.*, 2016, Wenhold and Faber, 2008). Children often face the consequences of poor diets, which results in the loss of lives or poor development (Food Research & Action Center, 2017). Welcomme *et al.*, Karatas and Pradeepkiran argue that fisheries contribute to the nutritional diets of humans across the world and can assist poor households by generating food (Karataş and Karataş, 2017, Pradeepkiran, 2019, Welcomme *et al.*, 2010). This is because the consumption of fish is associated with good brain development, good growth, good immunity and is crucial for strengthening the nervous system (Funge-Smith and Bennett, 2019). Moreover, the general consumption of fish is predominantly important for women and children due to their high demand of micronutrients and protein (Bennett *et al.*, 2018). To this end, Bennett *et al.* and Funge-Smith proffer that inland fish is healthier, since it is natural diet, contains few antibiotics, and is fresher compared to farmed fish (aquaculture) (Bennett *et al.*, 2018, Funge-Smith and Bennett, 2019).

Various factors have been identified to affect the food security status of households. For example, age, level of education, source of income, participation in agriculture, household size, and household income are among these factors, However, the determinants of food insecurity status among inland fishing and non-fishing households are unknown. This paper, therefore, seeks to close this gap.

Materials and Methods

Data were collected via face-to-face interviews in the Sekhukhune District Municipality (SDM) from 115 households involved in inland fisheries and those who were not involved using a structured questionnaire in 2021. The questionnaire was structured in such a way that it captured information regarding the socio-economic characteristics of the respondents (for example, age, gender, and marital status of the household head) and fishing information (such as the distance of the fishing area and the price of fish).

The SDM is situated in the southern-eastern part of the Limpopo Province and covers an area of 13 264 square kilometres. The SDM is known for its majestic mountains and lush valleys, and it is the smallest district in the province. It comprises four local municipalities, namely Elias Motsoaledi,

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Ephraim Mogale, Fetakgomo Tubatse, and Makhudumathamaga Local Municipalities. This district has large dams, such as Da Hoop and Flag-Boshielo dams. Moreover, SDM has warm moist summers and cool dry winters, which are preferable for fish production.

Snowball and purposive sampling techniques were used to identify households that are involved in inland fisheries. On the other hand, households that are not involved in inland fisheries were randomly selected. Descriptive statistics, in the form of means, frequencies, and percentages, were used to identify and describe the combined data on the socio-economic characteristics of the households. The study measured household food security status using Household Food Insecurity Access Scale (HFIAS). The HFIAS measures the prevalence of food insecurity at the household level (Yousaf, 2018). Furthermore, the HFIAS comprises nine occurrence questions combined with a set of nine frequency questions. The measured results are then assigned categorical descriptions or given a numerical value of 0-27 with higher numbers representing a greater level of food insecurity.

A Multinomial Logistic Regression (MLR) was adopted to determine factors affecting the food security status of households involved and those not involved in inland fisheries. A combined analysis was done for both these households.

The categories from the HFIAS were treated as dependent variables, where a score of 0-1 categorized households as food secure (took the form of 0), a score of 2-7, 8-11 and greater than 11 categorized as mildly, moderately, and severely food insecure households, respectively (Chakona and Shackleton, 2017). Within the MLR, these categories considered the value of 0 for food secure (base/reference category), 1 for mildly food insecure, 2 for moderately food insecure, while 3 represented severe food insecurity. According to Greene (Greene, 2002) , the MLR can be expressed as:

$$P_{ij}\frac{exp^{(\beta_j x_i)}}{\sum_{j=0}^{4} exp(\beta)}\ for\ j = 0,1,2,3$$

Where, $Pr(Y_i = j)$ is probability of households' food security status (0 is food secure; 1 is mildly food insecure; 2 is moderately food insecure, and 3 is severely food insecure), j indicates number of household's choice categories in the choice set, X_i represents vector of explanatory variables, and β_i reveals parameters to be estimated.

The probability that household i^{th} choose the reference category is given by:

$$P_i = 1|X_i = \frac{1}{1 + \sum_j^4 = 0 \exp(\beta_j x_i)}$$

However, the probability that the household chooses the alternative categories is estimated by:

$$P_i = (j = m|x_i) = \frac{\exp(\beta_j X_i)}{1 + \sum_j^4 = 1 \exp(\beta_j x_i)}$$

The coefficients of Multinomial Regression are difficult to interpret, since they do not indicate the effect of changing the predictor, the log-odds ratio was adopted to reflect this change.

Ethical considerations: Ethical Clearance (TREC/38/2020: PG) was obtained from the University of Limpopo, South Africa.

Results

Descriptive statistics results: The descriptive results presented in **Table 1** show that the mean age of the household heads was 48, suggesting that most of the households were headed by individuals who were still in their economically active stages. Moreover, the average household size was 5. Households in SDM were likely to receive an income of R8018.52 per month. Regarding distance to the market, households in the study area were likely to travel 1.39 km. However, the closest market reported was 0.50 km and the furthest was 3.50 km. Similarly, fishermen/women were likely to travel about 2.43 km to the fishing area but the furthest was 11 km.

The descriptive results presented in **Table 2** are for categorical and dummy variables used in the study. Most of the households in the study area were headed by males (65%). Regarding the level of education of the household head, the descriptive statistics show that most of them had secondary education and only 10% were illiterate.

Although 37% of the households were not involved in inland fisheries, those who were involved usually do so for consumption purposes,

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as evident in the results. About 75% of the households mentioned that they practice neither crop production nor livestock production. However, these households might be involved in income generating activities. Out of a total of 115 respondents, 30% receive income from both fishing and non-fishing activities. Thus, it can be said that these households have diversified their sources of income.

Food security status of households involved and not involved in inland fisheries: **Figure 1** shows the food security results of households involved in inland fisheries and those not involved. This Figure indicates that 28% of the households involved in inland fisheries are food secure. However, most of these households were under the mildly food insecurity category (39%). About 22% and 11% of these households were moderately and severely food insecure, respectively.

Regarding the food security status of households not involved in inland fisheries, the study found that the majority were mildly food insecure (30%). In addition, about 25%, 26%, and 19% of these households were food secure, moderately food insecure, and severely food insecure, respectively.

MLR results: In the interest of analysing the determinants of food security status among households involved and not involved in inland fisheries, the MLR was employed (**Table 3**). The dependent variable (food security status) had four outcomes. The first outcome was food insecurity, followed by mildly food insecurity. Outcomes three and four depicted moderate food insecurity and severe food insecurity, respectively. Food secure was used as the base (reference/category) outcome. Thus, the study found that variables such as total household income, marital status, level of education and type of agricultural activity are the determinants of food security status among households in the study area.

The Multinomial Logistic results shown in **Table 3** also present the model fit results. For instance, the results presented a -2Log Likelihood of 124.185. The -2Log Likelihood was used to test whether all coefficients of the predictors in the model are simultaneously zero. The probability Chi-square result of SDM was 0.002 with a Chi-square of 61.282. The probability Chi-square in this case indicated that at least one of the regression coefficients in the model was not equal to zero. The Cox and Snell was 57.3%, while the Nagelkerke was 61.9%. The Nagelkerke was the adjusted Cox and Snell and implied that 61.9% of the variance was explained by the model.

Discussion

The results of the food security status of households in the study area showed that was no significant difference between the food security status of households involved in inland fisheries and those who were not involved. These results imply that majority of the households might fall in the same income groups (such as receiving government social grants). Additionally, the average HFIAS implies that the majority of households were mildly food insecure. Agboola also found that majority of households in Sekhukhune were mildly food insecure (Agboola *et al.*, 2016).

When comparing food secure and severely food secure categories, the variable total household income is positive and significant. These results imply that a unit increase in the total household income is likely to increase the chance of the household being severely food insecure. These results were unexpected, since studies have shown that income ensures continuous supply of food (Cirera and Masset, 2010, Hasegawa *et al.*, 2018, Mazenda *et al.*, 2022, Mutea *et al.*, 2019). Ngema *et al.* also found that an increase in household income is less likely to render the household food secure. Himi *et al*. (2020) stated that households with a low monthly income tend to be food insecure (Himi *et al.*, 2020, Ngema *et al.*, 2018).

The MLR result for the variable marital status was negative, but it was significant for mildly food insecurity and severe food insecurity. These results imply that when the household head is married, the probability of the household being food secure increases when holding other factors constant.

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Similarly, the variable is negatively significant under severe food insecurity. The negative coefficient suggests that the more the marital status of the household head changes from unmarried to married, the more the food security status of the household is likely to change from severely food insecure to food secure. Megbowon and Mushunje reported that being married increases the dietary diversity of households, which ultimately improves their food security status (Megbowon and Mushunje, 2016).

These results further explain that a household head who is married and engages in inland fisheries is likely to be food secure compared to an unmarried household head who does not engage in inland fisheries. This is because a married household head has the responsibility of feeding the family although a spouse can assist in this regard. Locke *et al* found that fishing is mostly a family affair in which both husband and wife engage in fishing activities to generate income and food (Locke *et al.*, 2017).

The level of education was positive and significant which implies that as the level of education of the household head increased, the probability of the household being mildly food insecure increased. On the other hand, Akukwe and Kara *et al.* and found a positive relation between the attainment of education by the household head and food security status (Akukwe, 2020, Kara and Kithu, 2020). Maskoameng *et al.* argue that having a low level of education presents a risk associated with food access due to income constraints (Masekoameng and Maliwichi, 2014). Megbowon *et al.* stated that education is important in improving knowledge of nutrition and health and assists in the attainment of employment (Megbowon and Mushunje, 2016). Therefore, when the household head is educated, the likelihood of engaging in inland fisheries might increase, since it will be easier to acquire information about the benefits of inland fisheries for food security.

The type of agricultural activity that households engage suggests that the probability of the household being food secure increased as the households participated in agricultural activities. This is because, agriculture is viewed as a sector that contributes to nutrition, employment, and food security (Pawlak and Kołodziejczak, 2020). Additionally, agriculture serves as one of the risk management strategies for inland fisheries when the household has caught less fish. Thus, like agriculture, fishing is a risky business (Kasperski and Holland, 2013, Mokhaukhau, 2020). To this end, a household involved in both agriculture and inland fisheries is likely to be food secure compared to a household who was not involved.

One of the limitations of the study is that the SDM is the smallest district in the Limpopo Province. Moreover, the sample size does not cover all the local municipalities within this district. Therefore, a need arises to conduct a related study covering the rest of the province to capture the food security differences among inland fishing and non-fishing households.

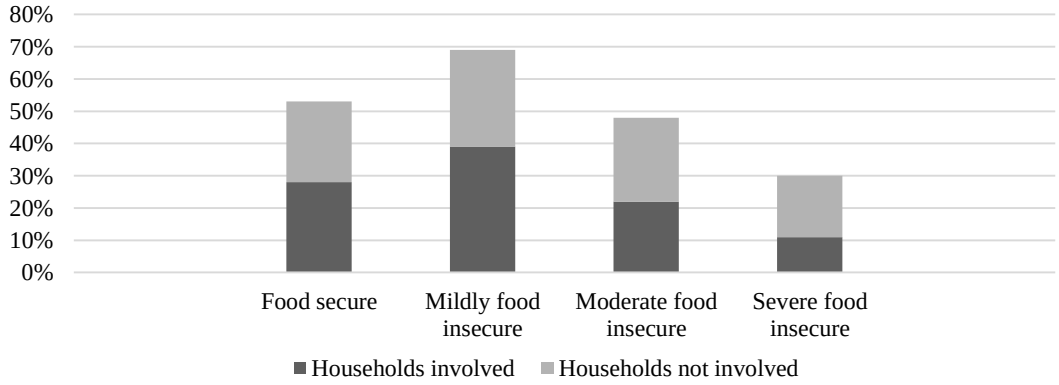

Figure 1. Food security status of households involved and not involved in inland fisheries.

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Table 1. Sample statistical summary of households in the area.

Variables	N	Minimum	Maximum	Mean ± SD
Age of household head (years)	115	26	94	48.00 ± 14.53
Household size (actual number)	115	1	13	5.00 ± 2.52
Total household income per month (Rands)	115	1350.00	30400.00	8018.52 ± 6679.11
Distance to the market (km)	115	0.50	3.50	1.39 ± 0.64
Distance to fishing area (km)	72	0.30	11.00	2.48 ± 3.31

Table 2. Descriptive statistics results for dummy and categorical variables.

Variables	Percentage	Variables	Percentage
Gender		**Reasons for fishing**	
Male	65	Consumption	35
Female	35	Business	17
Marital status		Business and consumption	11
Single	32	Not participating	37
Married	50	**Type of agricultural activity**	
Separated	7	Crop production	11
Divorced	3	Livestock production	13
Widow/widower	8	Both	1
Level of education		None	75
Primary	23	**Source of income**	
Secondary	52	Income from fishing activities	1
Tertiary	11	Income from no-fishing activities	69
Diploma/Certificate	4	Both	30
Illiterate	10		

Table 3. Multinomial results for the determinants of food security among fishing and non-fishing households.

Variables	B	Standard Error	Wald	P-value	Odds ratios	95% Confidence interval	
						Lower	Upper
Mildly food insecurity relative to food insecurity							
Intercept	2.68	3.04	0.78	0.37			
Age of household head	0.04	0.03	1.30	.025	1.04	0.97	1.12
Gender of household head	-1.80	1.11	2.64	0.10	0.16	0.01	1.45
Household size	-0.18	0.19	0.89	0.34	0.83	0.56	1.22
Total household income	0.00	0.00	0.01	0.91	1.00	1.00	1.00
Marital status	-1.57	0.62	6.37	0.01	0.20	0.06	0.70
Level of education	1.05	0.50	4.36	0.03	2.85	1.06	7.65
Distance to market	0.19	0.65	0.09	0.76	1.21	0.34	4.34
Reason for fishing	0.11	0.24	0.22	0.63	1.12	0.69	1.81
Type of agricultural activity	0.01	0.52	0.00	0.98	1.01	0.36	2.83
Source of income	-0.06	0.07	0.93	0.33	0.93	0.81	1.07
Distance to fishing area	-0.19	0.13	1.98	0.15	0.82	0.63	1.07
Moderately food insecurity relative to food insecurity							
Intercept	1.81	3.14	0.33	0.56			
Age of household head	0.02	0.03	0.34	0.55	1.02	0.94	1.10
Gender of household head	-0.55	0.94	0.34	0.55	0.57	0.09	3.67
Household size	0.09	0.19	0.23	0.62	1.09	0.75	1.59
Total household income	0.00	0.00	2.15	0.14	1.00	1.00	1.00
Marital status	-0.82	0.45	3.21	0.07	.044	0.17	1.07

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Table 3. Multinomial results for the determinants of food security among fishing and non-fishing households.

Variables	B	Standard Error	Wald	P-value	Odds ratios	95% Confidence interval	
						Lower	Upper
Level of education	-0.45	0.63	0.50	0.47	0.63	0.18	2.22
Distance to market	-0.14	0.67	0.04	0.82	0.86	0.23	3.22
Reason for fishing	0.10	0.25	0.15	0.69	1.10	0.67	1.80
Type of agricultural activity	0.30	0.57	0.28	0.59	1.35	0.44	4.16
Source of income	-0.01	0.06	0.03	0.85	0.98	0.86	1.12
Distance to fishing area	0.02	0.14	0.03	0.85	1.02	0.78	1.34
Severely food insecurity relative to food insecurity							
Intercept	9.98	6.33	2.48	0.11			
Age of household head	0.06	0.06	1.02	0.31	1.06	0.94	1.20
Gender of household head	0.15	1.31	0.01	0.90	1.16	0.08	15.38
Number of household members	0.40	0.30	1.77	0.18	1.50	0.82	2.73
Total household income	0.00	0.00	4.75	0.02	1.00	0.99	1.00
Marital status	-0.09	0.43	0.04	0.82	0.91	0.39	2.11
Level of education	0.61	0.91	0.45	0.50	1.85	0.30	11.13
Distance to market	-6.51	4.34	2.24	0.13	0.00	0.00	7.42
Reason for fishing	-0.34	0.41	0.71	0.39	0.70	0.31	1.57
Type of agricultural activity	-1.98	1.17	2.87	0.09	0.13	0.01	1.36
Source of income	-0.10	0.09	1.33	0.24	0.89	0.74	1.07
Distance to fishing area	-1.05	1.68	0.39	0.53	0.34	0.01	9.41

Conclusion

It is concluded that there is no significant difference between the food security status of households involved in inland fisheries and those who were not involved. However, the average HFIAS shows that most of the households from the two groups were mildly food insecure. Additionally, total household income, marital status, level of education, and type of agricultural activity determine the food security status of households in SDM. For instance, the level of education of the household head might affect which type of fish to buy based on nutritional composition. Likewise, education might assist these households to make an informed decision on how to benefit from inland fisheries to deal with the prevalence of household food insecurity. Moreover, integrating inland fisheries with agriculture is a good strategy to cope with food insecurity shocks. Therefore, the study recommends awareness campaigns for the diversification of inland fisheries to agriculture to combat household food insecurity.

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Conflict of interest

The authors declare no conflict of interest.

Author's contribution

Potsiso Mokhaukhau J conducted the research; analyzed the data and wrote the manuscript. Belete A and Johannes Hlongwane J had primary responsibility of final manuscript. All authors approved the manuscript for publishing.

Reference

Agboola PT, Oyekale AS & Samuel O 2016. Assessment of Welfare Shocks and Food Insecurity in Ephraim Mogale and Greater Tubatse Municipality of Sekhukhune District, Limpopo Province, South Africa. University of South Africa.

Akukwe TI 2020. Household food security and its determinants in agrarian communities of Southeastern Nigeria. *Journal of tropical agriculture, food, environment and extension.* **19 (1)**: 54 - 60.

[Downloaded from jnfs.ssu.ac.ir on 2024-05-07]

[DOR: 20.1001.1.24767417.2023.8.2.13.1]

[DOI: 10.18502/jnfs.v8i2.12599]

Belton B & Thilsted SH 2014. Fisheries in transition: Food and nutrition security implications for the global South. *Global food security.* **3 (1)**: 59-66.

Bennett A, et al. 2018. Contribution of Fisheries to Food and Nutrition Security: Current Knowledge, Policy, and Research. In *NI Report 18-02. Durham, NC: Duke University*, pp. 2-46.

Bhorat H, Steenkamp F, Rooney C, Kachingwe N & Lees A 2018. Understanding and characterizing the services sector in South Africa: An overview.

Britz PJ, Hara M, Weyl OLF, Tapela BN & Rouhani QA 2015. Scoping Study on the Development and Sustainable Utilisation of Inland Fisheries in South Africa, University of the Western Cape.

Chakona G & Shackleton CM 2017. Household Food Insecurity along an Agro-Ecological Gradient Influences Children's Nutritional Status in South Africa. *Frontiers in nutrition.* **4**: 72.

Cirera X & Masset E 2010. Income distribution trends and future food demand. *Philosophical transactions of the royal society B: Biological sciences.* **365 (1554)**: 2821-2834.

Food and Agriculture Organization 2016. The State of World Fisheries and Aquaculture 2016. Contributing to food security and nutrition for all. Rome.

Food and Agriculture Organization 2018. The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. . Rome.

Food Research & Action Center 2017. The Impact of Poverty, Food Insecurity, and Poor Nutrition on Health and Well-Being.

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.

Govender L, Pillay K, Siwela M, Modi A & Mabhaudhi T 2016. Food and Nutrition Insecurity in Selected Rural Communities of KwaZulu-Natal, South Africa-Linking Human Nutrition and Agriculture. *International journal of environmental research and public health.* **14 (1)**: 17.

Greene WH 2002. Econometric Analysis.

Hasegawa T, et al. 2018. Risk of increased food insecurity under stringent global climate change mitigation policy. *Nature climate change.* **8 (8)**: 699-703.

Himi SN, Islam MA & Majumder S 2020. Determinants Of Food Insecurity Status Of Fisheries Community In Coastal Regions Of Bangladesh. *Bangladesh journal of agricultural economics.* **41 (2)**: 17-28.

Kara A & Kithu L 2020. Education Attainment of Head of Household and Household Food Security: A Case for Yatta Sub - County, Kenya. *American journal of educational research.* **8 (8)**: 558-566.

Karataş E & Karataş A 2017. The importance of fishery production as an income source in Turkey. *Journal of survey in fisheries sciences* **4(1)**: 38-53.

Kasperski S & Holland D 2013. Income diversification and risk for fishermen. *Proceedings of the national academy of sciences.* **110 (6)**: 2076-2081.

Locke C, Muljono P, McDougall C & Morgan M 2017. Innovation and gendered negotiations: Insights from six small- scale fishing communities. *Fish and fisheries.* **18**: 943–957.

Lynch AJ, et al. 2016. The social, economic, and environmental importance of inland fish and fisheries. *Environmental reviews.* **24 (2)**: 115-121.

Martínez Cruz P, Ibáñez AL, Monroy Hermosillo OA & Ramírez Saad HC 2012. Use of probiotics in aquaculture. *International scholarly research notices.* **2012**.

Masekoameng M & Maliwichi L 2014. Determinants of food accessibility of the rural households in Sekhukhune District Limpopo Province, South Africa. *Journal of human ecology.* **47 (3)**: 275-283.

Mazenda A, Molepo N, Mushayanyama T & Ngarava S 2022. The invisible crisis: the determinants of local food insecurity in Gauteng

[Downloaded from jnfs.ssu.ac.ir on 2024-05-07]

[DOR: 20.1001.1.24767417.2023.8.2.13.1]

[DOI: 10.18502/jnfs.v8i2.12599]

municipalities, South Africa. *British food journal*. **124 (13)**: 274-289.

McCafferty JR, Ellender BR, Weyl OLF & Britz PJ 2012. The use of water resources for inland fisheries in South Africa. *Water SA.* **38 (2)**: 327-344.

Megbowon E & Mushunje A 2016. Income Diversification and its Determinants among Households in Eastern Cape Province. *Journal of economics and behavioral studies* **8(6)**: 19-27.

Mokhaukhau J 2020. Risk Management Strategies Adopted by Small-Scale Vegetable Farmers in Thaba Chweu Local Municipality, Mpumalanga Province, South Africa. *Journal of agribusiness and rural development.* **55 (1)**: 45-51.

Mutea E, et al. 2019. Livelihoods and food security among rural households in the north-western Mount Kenya region. *Frontiers in sustainable food systems.* **3**: 98.

Ngema PZ, Sibanda M & Musemwa L 2018. Household food security status and its determinants in Maphumulo local municipality, South Africa. *Sustainability.* **10 (9)**: 3307.

Pawlak K & Kołodziejczak M 2020. The Role of Agriculture in Ensuring Food Security in Developing Countries: Considerations in the Context of the Problem of Sustainable Food Production. *Sustainability*. **12 (13)**: 5488.

Pradeepkiran J 2019. Aquaculture role in global food security with nutritional value: a review. *Translational animal science.* **3 (2)**: 903-910.

Simmance F 2017. The role of small-scale inland capture fisheries for food security in Lake Chilwa. University of Southampton.

Stats S 2019. Towards measuring food security in South Africa: An examination of hunger and food inadequacy.

Tapela B, Britz P & Rouhani Q 2015. Scoping Study on the Development and Sustainable Utilisation of Inland Fisheries in South Africa.

Welcomme R, et al. 2010. Inland capture fisheries. *Biological sciences.* **365 (1554)**: 2881-2896.

Wenhold F & Faber M 2008. Nutritional value and water use of indigenous crops for improved livelihoods.

Yousaf H 2018. Food Security Status and Its Determinants: A Case of Farmer and Non-Farmer Rural Households of the Punjab, Pakistan. *Pakistan journal of agricultural sciences*. **55 (01)**: 217-225.

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