SVU-International Journal of Agricultural Sciences
Volume 6 Issue (1) pp.: 1-14, 2024
Print ISSN 2636-3801 | Online ISSN 2636-381X
Doi: 10.21608/svuijas.2024.252631.1324
RESEARCH ARTICLE

The contribution of the livelihood assets of artisanal fisheries to household livelihoods in Zanzibar islands, Tanzania

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Abstract

This paper reports on the contribution of the artisanal fisheries livelihood assets on household livelihoods in the five fishing villages from Zanzibar Islands namely; Kizimkazi Dimbani, Chwaka, Unguja Ukuu Kaepwani, Tumbe Mashariki and Michenzani. Cross-sectional research design was employed to generate quantitative data through a household survey and qualitative data were drawn through Focus Group Discussions (FGDs) and key informant interviews. Data were drawn from a sample of 333 artisanal fishers who were obtained from the 1991 population through the Yamane formula. The Statistical Package for Social Sciences (SPSS) version 25 was used to perform a chi-square test and binary logistic analysis to assess the association between the livelihood assets of artisanal fisheries and household livelihoods. Results of this study found that the livelihood assets of artisanal fisheries had a statistical association with household livelihoods and the majority of artisanal fishers (79.28%) fall under low household livelihoods outcomes. It has been found that high household livelihood was significantly associated with artisanal fishers who use fibber boats (p=0.0066), motorized fishing vessels (p=0.0409), acquired formal fishing knowledge and skills (p=0.0277), and those fishers who were members of fisher's cooperatives (p=0.0059). It is therefore recommended that the respective government in collaboration with other fisheries stakeholders should address these factors when designing the intervention for improving the artisanal fisheries that will improve the household livelihoods of the artisanal fishers.

Keywords: Artisanal fisheries; fishing villages; household livelihood; livelihood assets of artisanal fisheries and Zanzibar Islands.

1. Introduction

Artisanal fisheries significantly contribute to the livelihoods of millions of households (FAO, 2020b). About half of the global annual marine catch stems from artisanal fisheries. Further to this, more than 120 million people worldwide depend directly on artisanal fisheries and fisheries-related activities (FAO, 2020c). About 47 million of these people reside in developing countries. Artisanal fishers and local coastal communities depend on the ocean and coastal ecosystem for their livelihoods (Cohen *et al*., 2019; Winfield, 2019). Artisanal fishers, who account for more than half of the total global fishery output, continue to be among the most marginalized groups (Spencer, 2021).

Furthermore, households of artisanal fishers in developing countries are characterized by persistent poverty and food insecurity (FAO, 2020c). Yet, they are underestimated, uncounted, and lack the required recognition in policies and plans. In some places, they are hidden in national fishery statistics (Zelasney *et al*., 2020; Teh *et al*., 2020). As such, in many developing countries, there is inadequate empirical information concerning the position of artisanal fisheries in

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Received: December 2, 2023; Accepted: February 1, 2024; Published online: February 3, 2024.

household livelihoods (Béné & Friend, 2011; Teh *et al.,* 2020). Thus, it is crucial to guarantee artisanal fisheries an equal economic, political, and physical involvement in the blue economy. The blue economy will only contribute towards sustainable development goals when the social dimensions and specific characteristics of artisanal fisheries are addressed and considered closely (Ayilu *et al.,* 2022). An obvious expectation is that artisanal fisheries would contribute to fishers' household livelihoods through increased income, social services, housing conditions, savings, and access to valuable assets. In Zanzibar, artisanal fishery plays an important role in the national economy. It provides employment, income, and is a major source of protein (Ochiewo, 2016). Zanzibar, which is a part of the United Republic of Tanzania, has two major islands, Unguja and Pemba, with other small islets (Said and Tanova, 2021). The territorial waters which are the main fishing area is about 4,450 km^2 and 12 miles from the shore (Myers *et al.*, 2021). However, artisanal fishing activities commonly occur within 5 miles from the shore while the fishing vessels used by the artisanal fishers are small (Horsley *et al.*, 2015). The dominant fish species found include large, medium and small pelagic and coral reef fish like emperors, parrotfish, snapper, octopus, lobsters, groupers and squid (Sekadende *et al.*, 2020). Most artisanal fishers in Zanzibar are poor. They use traditional fishing vessels and gears like outriggers canoes and sailing boats with few planked outboard engines (Morales & Horton, 2014). Many coastal populations have been engaged in artisanal fisheries as their primary occupation for earning their livelihoods (Department of Fisheries Development, 2020). It is documented that artisanal fishers lack alternative employment and sources of income for their household livelihoods mainly due to the low level of education (FAO, 2020b). Fishery resources have declined in Zanzibar due to overfishing of marine fisheries resources over the past decades (Rocliffe and Harris, 2016). The annual catch has been declining by 4% each year since 2010 (Hampus *et al.*, 2010). Several studies show that the main factors for declining fisheries and deteriorating conditions of coral reefs are overexploitation of fisheries, destructive fishing gear used, growing population, intensive seaweed farming, indiscriminate mangrove cutting for tourism development, lack of enforcement of fisheries regulation and environmental degradation (Benansio and Jiddawi, 2016). However, there has been a dearth of empirical literature to ascertain the contribution of artisanal fisheries to the household livelihoods of artisanal fishers in Zanzibar. This article addresses the shortage by informing the contribution of the livelihood assets of artisanal fisheries to household livelihood outcomes in the five selected fishing villages in the Zanzibar Islands. The five fishing villages were purposively selected for the study because artisanal fishing a primary livelihood activity and the villages hold the official fish landing sites among 235 landing sites found in Zanzibar and (Stanek, 2015; Department of Fisheries Development, 2020).

2. Materials and Methods

2.1. Study Location

The study was conducted in Zanzibar Islands. Zanzibar Islands is a part of the United Republic of Tanzania (URT). Zanzibar is a combination of two Islands; Unguja and Pemba. Five fishing villages from Zanzibar Islands were studied including Kizimkazi Dimbani, Chwaka, and Unguja Ukuu Kaepwani from Unguja Island, Tumbe Mashariki and Michenzani from Pemba Island. The total area of the Zanzibar Islands is 2,643 km^2 whereby Unguja has 1,658 km^2 and Pemba has 985 km^2 (OCGS, 2020). The five fishing villages were purposively selected for the study because they hold the official fish landing sites among 235 landing sites found in Zanzibar and artisanal fishing is the supreme livelihood activity (Stanek, 2015; Department of Fisheries

Development, 2020)**.** Fig. 1 presents a map of the Zanzibar Islands showing the study locations.

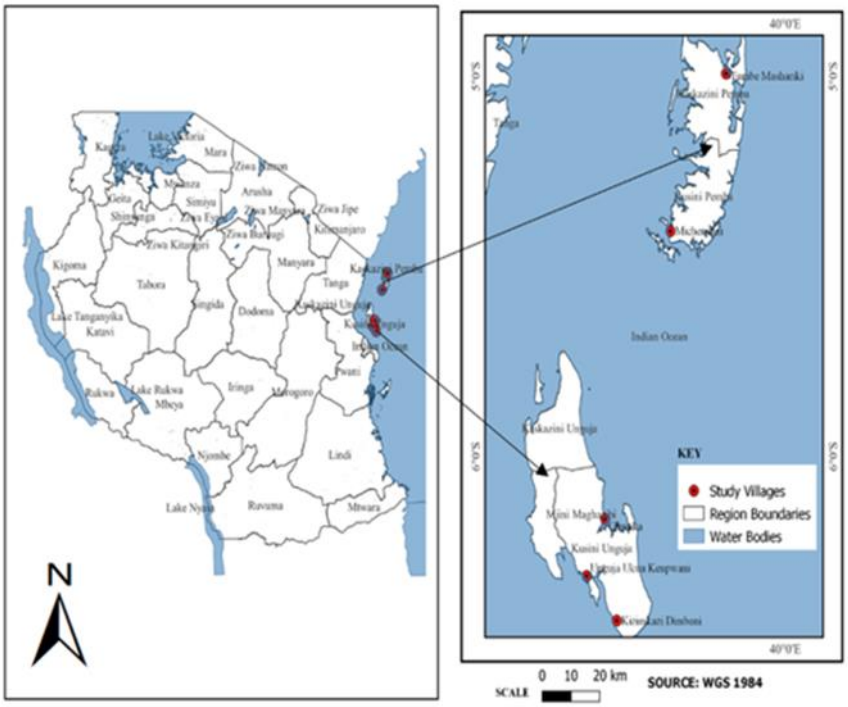

Figure 1: A Map of Zanzibar Islands Showing the Study Locations

2.2. Study Design

This study used a cross-sectional research design and applied both qualitative and quantitative data which were generated at a single point in time (Sekaran and Bougie, 2016). The design provided a comprehensive analysis of the research problem by investigating how the contribution of the artisanal fisheries livelihood assets is related to household livelihoods in the study area (Kumar, 2011). The design also allowed a simultaneous investigation of multiple variables in this study (Baryman, 2008).

2.3. Population and Sample Size

With a discussion on the study population, a sample of 333 from 1991 artisanal fishers (household heads) of five fishing villages was determined through Yamane's formula of 1967 (as cited in Sarmah*et al.*, 2013) as seen below;

$$n = \frac{N}{1 + N(e^2)} = \frac{(1991)}{1 + (1991)(0.05^2)} = \frac{(1991)}{1 + 1991(0.0025)} = \frac{(1991)}{1 + 4.775} = 333$$

(Where by n is the sample size required, N is the study population of the five studied villages (Kizimkazi Dimbani 180 + Chwaka 478 + Unguja Ukuu Kaepwani 430 + Tumbe Mashariki 587 + Michenzani 316 = 1991 (RoGZ, 2020)), *e* is 5 acceptable sampling error or percentage points of the level of precision and 1 is constant). Thereafter, the stratified proportional allocation method was applied to obtain an equal representation of the 333 artisanal fishers from each of the five selected fishing villages (stratum) under study. The formula applied is as seen below;

$$ni = n\frac{Ni}{N}$$

(Whereby, n represents sample size (333), Ni represents the population size of the i stratum (village) and N represents the population size 1991).

Therefore, the obtained proportionate samples were: 30 Kizimkazi Dimbani, 80 Chwaka, 72 Unguja Ukuu Kaepwani, 98 Tumbe Mashariki, and 53 Michenzani. This method is widely used to determine a sample with a higher degree of precision (Fayose and Adebara, 2018). Finally, simple random sampling was applied to select 333 artisanal fishers from each of the five villages by using a lottery method. The artisanal fishers of each village were given numbers drawn from their registration list provided by the beach management unit officers and the pieces with numbers were put in a box and shuffled to mix. Thereafter, the researcher randomly picked numbers from the box to select the required representative proportionated samples of each village under study. This technique was used because it is simple and avoids bias (Cohen *et al.*, 2007). Table 1 presents the summary of the study population and sample size.

Table 1. Summary of the Study Population and Sample Size Distributions.

Locations	Category of the Study Locations					
	Kizimkazi Dimbani	Chwaka	Unguja Ukuu Kaepwani	Tumbe Mashariki	Michenzani	Total
Population	180	478	430	587	316	1991
Sample	30	80	72	98	53	333
Percentage	9.1	24.0	21.6	29.4	15.9	100.0

2.4. Data Collection

Data were generated through questionnaire surveys, focus group discussions, and key informant interviews. The triangulation method created accurate, comprehensive, and enriched data. It helped to balance information and distinctly differentiated data regarding the contribution of artisanal fisheries livelihood assets to household livelihoods. It also offered an opportunity to integrate data analysis and interpretation (Almalki, 2016).

2.5. Study Variables

2.5.1. Dependent variable: Household livelihoods

The outcome variable of this study was computed from 17 questions of four domains which are social services, savings, housing conditions, and valuable assets, and one question of income. All variables had two responses which codes 1=Yes and 0=No, except the variable of income. The variable income had four categories of Tanzania Shillings (TZS); 1=less than 100,000 per month, 2=100,000-199,999,3=200,000-300,000, and 4=>300,0000. Respondents who had an income of 200,000+ were coded 1 while those who had an income of less than 200,000 were coded 0. The composite score of 17 questions and one additional question on income which was dichotomized was computed. The composite score had a possible minimum score of 0 and a possible maximum score of 18. Respondents who scored less than 9 which is 50% were coded 0 and regarded to have low likelihood while those who scored 9 and above were coded 1 and regarded as having high likelihood.

The study measured the outcome variable (Household livelihood) by analysing responses to a set of 17 questions from four domains: social services, saving, housing conditions, and valuable assets, along with one question about income. Each variable was assigned two response options, with the code 1 representing “Yes” and 0 representing “No” except for the income variable.

The income variable consisted of four Tanzania Shillings (TZS) categories: 1) less than 100,000 per month, 2) 100,000 -199,999, 3) 200,000 -

300,000, and 4) greater than 300,000. For respondents with an income of 200,000 or more, the code 1 was assigned, while those with an income below 200,000 were assigned the code 0. A composite score was then calculated by combining the scores from the 17 questions and the dichotomized income question. The composite score ranged from a minimum of 0 to a maximum of 18. Then household with a score of 9 and above was defined as high household livelihood and recorded as 1, otherwise 0 (low household livelihood).

2.5.2. Independent Variables

The livelihood assets of artisanal fisheries were the independent variables of this study including *financial*; access to loans, *physical;* fishing vessels, gears, and technologies, *natural;* fishing grounds, fish species and time in fishing, *human;* fishing knowledge and skills and *social*; markets and cooperatives.

2.6. Data Analysis

The qualitative data were subjected to thematic analysis to generate findings. This involved processing the data collected through key informant interviews and FGDs. In assessing the quantitative data regarding the study subject, basic descriptive statistics such as frequency and percent were used to describe the sample and the characteristics of the respondents. Since the outcome variable had two responses (0=Low household livelihood 1=High household livelihood), the Chi square test of association was first employed to test the association of categorical predictors and household livelihoods. A binary logistic regression model was then used to determine factors associated with high household livelihood among artisanal fisheries. The general logistic regression model is given as:

$$\log it[\pi(x)] = \log\left(\frac{\pi(x)}{1-\pi(x)}\right) = \beta_0 + \beta_1 x_1 + ... + \beta_p x_p$$

Where, $\pi(x)$ is the likelihood of the household to have high livelihood: $x_i's$ are set of independent variables and $\beta_i's$ are their respective parameters. The results of the model are presented in the form of regression parameter estimates and estimated odds ratios (OR). Model Results of both unadjusted and adjusted odds ratios were presented to help unpack how the adjustment affects the impact of the outcome variable. The estimated OR, determined by taking the exponent of the regression parameter estimates, shows the increase, or decrease in the likelihood of the household to have high livelihood at a given level of the independent variable compared to those in the reference category. An estimate of OR > 1 indicates that the likelihood of the household to have a high livelihood at a given level of the independent variable is greater than that for the reference category. Similarly, an estimate of OR<1 specified that the chance of having high livelihoods for households at a given level of the independent variable is less than that for the reference category.

2.7. Conceptual Frame-Work

A conceptual framework for this study (Fig. 2) has been developed to provide an understanding of how livelihood assets of artisanal fisheries contribute to household livelihoods. The framework shows the linkage between the three variables (demographic, independent, and dependent variables) and how they are interconnected. Demographic variables include age, marital status, levels of education, and household size.

The independent variables of this study refer to livelihood assets of artisanal fisheries which are postulated as the five livelihood assets adopted from the Sustainable Livelihood Approach (SLA). In this study, the indicators of artisanal fisheries' livelihood assets include; *financial*;

access to loans, *physical;* fishing vessels, gears and technologies, *natural;* fishing grounds, fish species and time in fishing, *human;* fishing knowledge and skills and *social*; markets and cooperatives. Dependent variables refer to household livelihood; high household livelihoods refer to improved household livelihood outcomes that were achieved through artisanal fishery strategies. In this study, indicators for low and high household livelihood outcomes include household; fishing income, social services, savings, housing condition, and ownership of valuable assets.

Therefore, the conceptual framework of this study is based on the assumption that, when the independent variable indicators are available and applied effectively, high household livelihoods of artisanal fishers can be successfully observed. Indeed, the indicators for household livelihoods in artisanal fisheries include; income, social services, housing conditions, savings, and valuable assets.

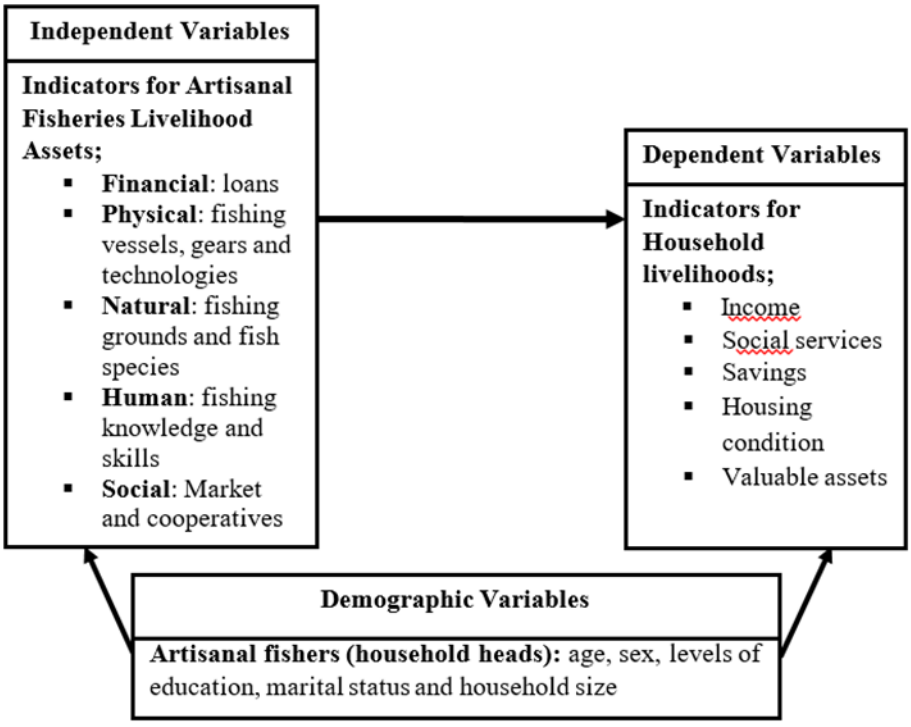

Figure 2: Conceptual Framework for the Study
Source: Authors' conceptualisation

3. Results and discussions

3.1. Demographic Characteristics

Demographic characteristics are vital variables because they describe the basis for the interpretation of the study findings. The fishers' demographic characteristics considered for this study include age, sex, levels of education, marital status, and household size.

3.1.1. Age

Concerning the study finding regarding the age of fishers, Table 2 reveals that out of 333 fishers, 138 respondents equivalent to 41.44% aged between 18 and 35 years, 185(55.56%) were aged between 36 and 60 years; and 10(3.00%) were aged above 60 years. This indicates that the age group of fishers that actively participated in artisanal fisheries ranged between 36 and 60; and from 18 to 35 years, which is equivalent to 55.56% and 41.44% respectively.

3.1.2. Sex

This study reveals that a majority of the respondents, i.e., 331 equivalents to 99.40% were male, and only 2(0.60%) were female (Table 2). The highly noted dominated male artisanal

fisheries in all five villages of study have been because the work needs energy similarly observed in Tema fishing Accra, Ghana (Sandra, 2021) and Lake Tanganyika fisheries Kigoma, Tanzania (Bilame, 2013).

3.1.3. Levels of Education

The present study findings found that out of 333 sampled respondents, 195(58.56) had acquired secondary education, 110(33.03%) had primary education and 28(8.41%) were completely illiterate with formal education (Table 2). This indicates that there is a significant number of respondents who abandon schools and drop out from secondary school to engage in artisanal fisheries. Supporting this, Sundaram *et al*. (2018) reported that fishing is an open-access livelihood activity in coastal areas. It does not need high levels of education and specialized skills; therefore, fishers' have their traditional ways of learning, and is handled from generation to generation.

3.1.4. Marital Status

The marital status of respondents is very important in understanding respondents' household livelihoods. This is because a household is a basic unit and institution that determines the livelihood activities that individuals pursue to be self-sufficient. Table 2 reveals that, out of 333 respondents 313 equivalent to 93.99% were married. Very few respondents 16(4.80%) were single and these were some young males aged between 18 and 20 years. There were also very few proportions 3(0.90%) of respondents were divorced and 1(0.30%).

3.1.5. Household Size

Purposively, the household size of the artisanal fishers was included in demographic characteristics in this study due to its direct association with the aspects of household livelihoods. The study found that 115(34.53%) were households with less than 5 family members, followed by 193(57.96%) who had 6-10 members.

Table 2. Demographic Characteristics of the Respondents (n = 333)

Variable Description	Frequency (n)	Percent (%)
Age		
18- 35	138	41.44
36- 60	185	55.56
Above 60	10	3.00
Total	333	100.00
Sex		
Male	331	99.40
Female	2	0.60
Total	333	100.00
Level of Education		
No formal education	28	8.41
Primary Education	110	33.03
Secondary Education	195	58.56
Total	333	100.00
Marital Status		
Single	16	4.80
Married	313	93.99
Divorced	3	0.90
Widowed	1	0.30
Total	333	100.00
Household Size		
Less than 5	115	34.53
5-10	193	57.96
Above 10	25	7.51
Total	333	100.00

Source: *Field Data, 2022*

Only 25(7.51%) of artisanal fishers had family members sized above 10. Thus, the study findings demonstrate that most of the studied artisanal fishers had extended family or large family and a large family is associated with a high dependency ratio to household heads (Bongaarts, 2001). Table 2 presents the demographic characteristics of the respondents involved in this study.

3.2. Contribution of Financial and Physical Artisanal Fisheries Livelihood Assets on Household Livelihoods

3.2.1. Results of Pearson Chi-Square Test

The results of the Chi-Square test presented in Table 3, which examines the association between financial and physical livelihood assets of artisanal fisheries, and household livelihoods revealed that there was a statistically significant association between the type of fishing vessels and household livelihoods (p=0.0029*). Artisanal fishers who use dhow had a highest (41.67%) representation among households with high household livelihoods followed by those who use fibber boats (30.93%). Besides, the number of fishers per fishing vessel showed a statistically significant association with household livelihoods (p = 0.0320*). Fishing vessels with less than 6 fishers were more prevalent among households with high livelihoods.

Table 3. Association between Financial, Physical Livelihood Assets of Artisanal Fisheries and Household Livelihoods (Results of Chi-Square Test), n=333

Variable	Low N(%)	High N(%)	This	p-Value
Total	264(79.28)	66(20.72)		
Access to loans				0.2817
Not accessed	254(79.13)	67(20.87)		
Accessed	10(83.33)	2(16.67)		
Fishing vessels, gears, and technologies				
Type of fishing vessels				0.0029*
Canoe	156(85.71)	26(14.29)		
Outrigger canoe	34(80.95)	8(19.05)		
Fibber Boat	67(69.07)	30(30.93)		
Dhow	7(58.33)	5(41.67)		
Type of fishing gears				0.2950
Nets	74(77.89)	21(22.11)		
Traps	85(84.16)	16(15.84)		
Lines	71(79.78)	18(20.22)		
Spears	34(70.83)	14(29.17)		
Ownership of fishing vessels			0.3338	0.5634
Not own	170(78.34)	47(21.66)		
Own	94(81.03)	22(18.97)		
Ownership of fishing gears			0.0255	0.8730
Not own	52(80.00)	13(20.00)		
Own	212(79.10)	56(20.90)		
No. of fishers per fishing vessel			4.6010	0.0320*
Less than 6	218(81.65)	49(18.35)		
Above 6	46(69.70)	20(30.30)		
Application of ICT			1.1196	0.2900
Not Applying	193(80.75)	46(19.25)		
Applying	71(75.53)	23(24.47)		
Motorization of fishing vessels			1.8688	0.1716
Motorized	106(75.71)	34(24.29)		
Non- motorized	158(81.87)	35(18.13)		

Source: *Field Data, 2022*

Moreover, a Chi-square test was performed to assess the association between the natural, human, and social livelihood assets of artisanal fisheries, and household livelihoods. As presented in Table 4, it was observed that household livelihood is statistically significant with the acquisition of fishing knowledge and skills (p=0.0062) and memberships in fishers' cooperatives (p=0.0005). High household livelihoods were observed with the artisanal fishers who have acquired fishing knowledge and skills from formal institutions (32.84%). Again, high household livelihood was observed among artisanal fishers who were members of the fishers' cooperative (35.14%).

Table 4. Association between Natural, Human, and Social Livelihood Assets of Artisanal Fisheries and Household Livelihoods (Results of the Chi-square Test), n=333

Variable	Low N(%)	High N(%)	This	p-Value
Total	264(79.28)	66(20.72)		
Fishing grounds, fish size, and time consumed in fishing				
Fishing grounds of respondents			1.5294	0.2162
Inshore waters	217(78.06)	61(21.94)		
Offshore waters	47(85.45)	8(14.55)		
Time spent per fishing trip			4.1022	0.1286
Less than 6 hours	75(72.82)	28(27.18)		
7-10 hours	154(81.48)	35(18.52)		
10 hours and above	35(85.37)	6(14.63)		
Fishing knowledge and skills				
Fishing knowledge and skills acquisition			7.4942	0.0062*
Inherited	219(82.33)	47(17.67)		
Formal institutions	45(67.16)	22(32.84)		
Capacity building programs			0.5382	0.4632
Not Attended	241(79.80)	61(20.20)		
Attended	23(74.19)	8(25.81)		
Markets and cooperatives				
Market area of fish catch			2.7778	0.4272
Village market	156(79.59)	40(20.41)		
Town market	47(83.93)	9(16.07)		
Both village and town market	9(64.29)	5(35.71)		
At the landing site	52(77.61)	15(22.39)		
Customers of fish catch				0.7458
Home consumers	7(70.00)	3(30.00)		
Fishmongers	183(79.22)	48(20.78)		
Fishmongers and home consumers	71(80.68)	17(19.32)		
Hotels	3(75.00)	1(25.00)		
Terms of selling the fish catch				0.1101
Cash basis	263(79.70)	67(20.30)		
Both cash and credits	1(33.33)	2(66.67)		
Members of any fishers' cooperative			12.0339	0.0005*
Non-members	216(83.40)	43(16.60)		
Members	48(64.86)	26(35.14)		

Source: *Field Data, 2022*

3.2.2. The Results of Binary Logistic Regression Model

In this analysis, only independent variables with (p<0.2) in chi-square test results were included. Based on the results of the Binary Logistic Analysis presented in Table 5, which examines the contribution of the artisanal fisheries livelihood assets on household livelihoods, the

following were observed: The type of fishing vessels, specifically the use of fibber boats demonstrated a statistically significant association with household livelihood in both unadjusted (OR = 2.7, p = 0.0012*) and adjusted analyses (AOR = 4.4, p = 0.0066*). fishers who utilized fibber boats had significantly higher odds of having high household livelihood compared to artisanal fishers who used canoe.

The number of fishers per fishing vessel showed a statistically significant association with household livelihood in the unadjusted analysis (OR = 1.9, p = 0.0339*). However, in the adjusted analysis, the association became non-significant (AOR = 1.9, p = 0.0800). Besides, the motorization status of fishing vessels did not show a statistically significant association with household livelihood in the unadjusted analysis. However, in the adjusted analysis, households with motorized fishing vessels had significantly higher odds of high livelihood outcomes (AOR = 3.0, p = 0.0409*). Acquiring fishing knowledge and skills through formal institutions and from fellow fishers showed a significant positive association with household livelihood in both the unadjusted analysis (OR = 2.3, p = 0.0071*) and the adjusted analysis (AOR = 2.1, p = 0.0277*). This implies that households with formal training and knowledge transfer from experienced fishers are more likely to have high household livelihoods. Moreover, membership in fishers' cooperatives exhibited a significant positive association with household livelihood in both the unadjusted analysis (OR = 2.72, p = 0.0007*) and the adjusted analysis (AOR = 2.44, p = 0.0059*). This indicates that households belonging to artisanal fishers' cooperatives have a higher likelihood of high household livelihoods.

Table 5. Results of the Binary Logistic Analysis of the Contribution of Artisanal Fisheries Livelihood Assets on Household Livelihoods

Variable	Unadjusted analysis		Adjusted analysis	
	OR [95% CI]	P-value	AOR [95% CI]	p-value
Type of fishing vessels				
Canoe	Ref		Ref	
Outrigger canoe	1.4[0.59,3.39]	0.4398	1.2[0.47,3.14]	0.6863
Fiber boat	2.7[1.48,4.88]	0.0012*	4.4[1.51,12.57]	0.0066*
Dhow	4.3[1.26,14.52]	0.0194	2.9[0.65,12.79]	0.1640
Fishers per vessel				
Less than 6	Ref		Ref	
Above 6	1.9[1.05,3.56]	0.0339*	1.9[0.93,3.79]	0.0800
Motorization of fishing vessels				
Non-motorized	Ref		Ref	
Motorized	1.4[0.85,2.44]	0.1728	3.0[1.05,8.48]	0.0409*
Time spent per fishing trip				
Less than 6 hours	Ref		Ref	
7-10 hours	0.6[0.35,1.07]	0.0870	0.6[0.31,1.10]	0.0901
10 hours and above	0.5[0.17,1.21]	0.1153	0.6[0.20,1.64]	0.3030
Fishing knowledge and skills Acquisition				
Inherited	Ref		Ref	
Formal institution and from fellow fishers	2.3[1.25,4.15]	0.0071*	2.1[1.09,4.12]	0.0277*
Terms of selling the fish catch				
Cash basis	Ref		Ref	
Both cash and credits	7.85[0.70,87.88]	0.0945	2.51[0.18,34.66]	0.4930
Membership in fishers' cooperatives				
Non-members	Ref		Ref	
Members	2.72[1.53,4.86]	0.0007*	2.44[1.29,4.60]	0.0059*

Source: *Field Data, 2022*

4. Conclusion and Recommendations

This study has successfully established that a majority of artisanal fishers 264(79.28%) had low household livelihoods derived from artisanal fisheries livelihood assets compared to only 66(20.72%) of fishers who had high household livelihoods obtained through their artisanal fisheries. Furthermore, the study has revealed that livelihood assets of artisanal fisheries and household livelihoods were statistically significantly associated ($p<0.05$). With this respect, high household livelihood is associated with fishers who use fibber boats as compared to those who used canoes (AOR=4.4, p=0.0066), Regarding the motorization of fishing vessels, high household livelihood is associated with artisanal fishers who used motorized fishing vessels as compared to fishers who used non-motorized fishing vessels (AOR=3.0, p=0.0409). On fishing knowledge and skills, high household livelihood is associated with those fishers who acquired fishing knowledge and skills from formal institutions as compared with those who acquired inherited fishing knowledge and skills (AOR=2.1, p=0.0277). Regarding membership in fishers' cooperatives, high household livelihood is associated with artisanal fishers who were members in fishers' cooperatives as compared to their counterparts (AOR=2.44, p=0.0059).

It is therefore recommended that fisheries management and other fisheries stakeholders decisions should basically focus on the four factors in action for sustainable artisanal fisheries that will positively contribute to household livelihoods. Those include facilitating the use of modern and motorized fishing vessels, conducting effective and formal fishers' capacity building programs, motivation on the formal formation and membership of fishers' cooperatives. Thus, productive and sustainable artisanal fisheries for household livelihoods are inevitable, hence most of the artisanal fishers operate in inshore waters while the greatest marine resources exist in offshore, deep territorial and internal waters that remain unexploited.

Authors' Contributions

All authors are contributed in this research

Funding

There is no funding for this research.

Institutional Review Board Statement

All Institutional Review Board Statements are confirmed and approved.

Data Availability Statement

Data presented in this study are available on fair request from the respective author.

Ethics Approval and Consent to Participate

Not applicable

Consent for Publication

Not applicable.

Conflicts of Interest

The authors disclosed no conflict of interest.

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