

ANALYSIS OF LIVELIHOOD DIVERSIFICATION STRATEGIES ADOPTED BY THE FISHING COMMUNITIES ALONG SHIRORO AND KAINJI DAMS, NIGERIA

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Abstract

This study analyzed the livelihood diversification strategies adopted by the fishing communities along Shiroro and Kainji dams, Nigeria. Questionnaire was used to collect data from 460 respondents. Multi-stage and proportionate sampling techniques were used in selecting the respondents of the study. Descriptive statistics (frequency distribution count, percentages, mean and ranking) and inferential statistics (Simpson Diversification Index and Logit Regression) were used for data analysis. The results of the study showed that majority of the respondents were male (82.2%) and were within the age (51.3%) bracket of 29-41 years, indicating that respondents were middle aged fishers who fall within the active fishing age. Majority (87.0%) of the fishers were married with an average household size of 6 persons. Simpson index of (0.99) was obtained implying that fishers were well diversified into other income generating activities so as to attain sustainable livelihoods. Logistic regression analysis of the estimates of determinants of livelihood diversification shows that the coefficients of Age = (0.083) and Sex (2.818) were positively correlated with livelihood diversification and were statistically significant at 1% level of significance, implying that a unit increase in these variables will result to an increase in livelihood diversification. Membership of association = (-0.112) have a negative coefficient but is significant at 1% level, suggesting that a unit increase in this variable will lead to an increase in livelihood diversification. Level of education =(0.497) correlated positively with livelihood diversification at 5% level of significance, suggesting that increase in level of education will result to increase in the level of livelihood diversification. Conclusively, the research showed that, fishing activity is an important livelihood activity in the lives of the fishers along the two dams. The study therefore, recommended that as a way of complimenting the effort of the fishers and encouraging the identified relevance of diverse livelihood sources by fisher household, government should improve on the provision of basic infrastructures such as good roads, electricity, health facilities, schools and others. This will improve the variety of non-farming income generating activities that rural households can engage in to improve their income and meet their basic needs of life. Trainings and seminars on livelihood diversification strategies should be provided by private organizations with the necessary support of the government. This will enlighten the rural dwellers on how best to distribute their eggs among baskets and withstand shock that could arise from the failure of their major livelihood source.

Key Words: Livelihood Diversification, Strategies, Fishing Communities, Shiroro and Kainji Dams.

INTRODUCTION

The relevance of the fisheries sub-sector to the Nigerian economy and benefits derived by Nigerians from fish and other fish products led to the high consumption and hence the increased demand for fisheries products. The Nigerian federal government has tremendously implemented series of projects targeted at increasing the local supply of fish. Some of the projects include second and third phases of Fadama programmes, although some improvements were recorded in terms of output level of fish, but the gap between the demand and supply of fish keeps increasing as a result of the use of traditional fishing methods. It is notable that fish provides more than 60.0% of the world's supply of protein, especially in developing countries. Its importance could be felt directly and indirectly among rural and urban residents in Nigeria. In Nigeria, fisheries are particularly an important subsector that contributes about 3.00–5.00% to the agriculture share of the Gross Domestic Product (GDP). Despite the neglect of the artisanal fishery, it provides the largest proportion of domestic fish supply in Nigeria. Artisanal fisheries contribute to the livelihoods of the poor through improved food supply, employment and income (Dasuki *et al.*, 2014). One of the major roles played by artisanal fisheries in the economy of Nigeria is its contribution to the dietary needs of the populace. Animal protein is essential for proper growth, repair and maintenance of body organs and tissues (Awotide *et al.*, 2019).

Damilare (2014) posits that 43.5 million people were directly engaged in primary production of fish, either by artisanal fishing or in aquaculture. Most of the 43.5 million people who engaged in artisanal fishing are small-scale artisanal fishers, operating in coastal and inland waters. Artisanal Fisheries and aquaculture play an essential role in the livelihoods of millions of people around the world and contribute to food security and poverty alleviation (Anko and Eyo, 2001). The demand for fish has been rising rapidly in Nigeria as a result of increase in population, per capita income and price of alternative sources of animal protein (Balogun *et al.*, 2000). However, the domestic supply of fish does not satisfy the demand. Attempts to meet the demand have seen the country resorting to importation of fish. Nigeria's current annual national fish demand is in excess of 3.2 million metric tonnes (Baruwa *et al.*, 2018). The national production is about 1.1 million metric tonnes from all sources, including aquaculture, artisanal and industrial fishing sectors, leading to a supply shortfall/ supply gap of about 2.1 million metric tonnes (Baruwa *et al.*, 2018). Fish makes up around 40 per cent of Nigeria's protein intake (Tafida *et al.*, 2011). Artisanal fishing consists of various small-scale, low-technology, low-capital, fishing practices undertaken by individual fishing households (as opposed to commercial companies). Artisanal fishery has a great economic, social and cultural value, and is characterized by local systems composed of professional small-scale coastal fishing communities (Damilare, 2014). It is against this backdrop that this study hopes to answer the following research questions.

1. What are the socio economic characteristics of artisanal fishers?
2. What are the livelihood diversification strategies adopted by the fishers in the study area?
3. What are the determinants of livelihood diversification in the study area?

Objectives of the study

The broad objective of the study is to analyse the livelihood diversification strategies adopted by the fishing communities along Shiroro and Kainji dams, Nigeria. The specific objectives are to:

1. describe the socio economic characteristics of artisanal fishers
2. evaluate the livelihood diversification strategies adopted by the fishers
3. analyse the determinants of livelihood diversification among the fishers

METHODOLOGY

Study Area

Description of Shiroro dam

The study was carried out along Shiroro and Kainji Dams. The population of Shiroro is projected in 2020 to be 322,918 people using 3.2% growth rate (NPC, 2006). The climate, edaphic features and hydrology of the state allows sufficient opportunities for harvesting fresh water fish such as *Tilapia* spp, *Bagrus* spp, *Clarias* spp, *Gymnarchus niloticus*, *Heterotis* spp, *Labeo* spp, *Mormysus* spp, *Latesniloticus*, and permit the cultivation of most of Nigeria's staple crops such as maize, yam, rice, millet and sorghum. The Shiroro hydropower reservoir is a storage based hydroelectric facility located in Shiroro Local Government, Niger State at the Shiroro Gorge with approximately between Latitude 9° 57' 25N and Longitude 6° 49' 55E. It is located approximately 90 km southwest of Kaduna on River Dinya. The facility has an installed capacity of 600 MW (Oladimeji and Abubakar, 2020). The reservoir has a surface area of about 320 km² with a maximum length of 32m and a total storage capacity of 7 billion m³ of water (Usman and Ifabiyi, 2012). About 70% of inflows into the reservoir are from river Kaduna, with lateral contributions from rivers Dinya, Guni, Sarkin-Pawa, Erena and Muyi. Annual temperature around the reservoir varies between 27 and 35⁰C (Dasuki *et al.*, 2014).

It is owned by Power Holding Company of Nigeria (PHCN), and situated 550 meters downstream of the confluence of Kaduna River with its tributary, the Dinya. The dam is of the rock-fill type and stands 115 meters high above the original riverbed elevation, across Shiroro Gorge for a crest length of 700 meters. The width of the dam at its toe is over 300 meters while its crest, which accommodates a service road, is 7.50 meters wide. The crest of the dam has a heavy reinforced concrete parapet wall, more than 5 meters high, which is also designed to protect the top of the dam from the waves that will build up in the lake, under wind pressure.

Description of Kainji dam

Kainji Lake is located between latitudes 9°5' and 10°55'N and longitudes 4°21' and 4°45'E. It cuts across the Niger and Kebbi states, and is mostly located in Niger state. Kainji is the second largest lake and the largest man-made lake in Nigeria (Chilaka *et al.*, 2017). It was created in 1968 following the impoundment of the Niger River by the construction of the Kainji Dam at New Bussa, in Borgu Local Government Area of Niger State. The highest (about 30°C) and the lowest (about 25°C) monthly temperatures are recorded in March and August, respectively.

As shown by the studies conducted on the Lake basin, the socio-economic characteristics of the people are as follows: the majority of the fishers are *Sarkawa* sub-tribe of Kebbi Hausa, while others belong to such tribes as *Laru*, *Gungawa*, *Lopawa* and *Nupes*. Fishing is the major traditional occupation of these people whereas other occupations include: farming, livestock breeding and local entrepreneurship such as pottery, mat weaving, gear/craft making and servicing (Bryceson, 2016).

Sampling Procedure and Sample size

The study employed multi-stage and proportionate sampling techniques. Firstly, two dams in North central region where artisanal fisheries activities are widely practiced were purposively selected. The dams are Shiroro and Kainji. Secondly, 30 Villages were randomly drawn along Kainji dam and 20 along Shiroro dam, thereby giving a total number of 50 villages for the study. Thirdly, proportionate sampling technique was then employed to select 10% of the fishing population from each of the selected villages, thus making 240 fishers along Kainji dam and 220 along Shiroro dam, thereby giving a sample size of 460 fishers for the study.

The study identified 296 fishing villages along Shiroro dam and 550 fishing villages along Kainji dam. The fishing villages have a fishing population of about 3,632 in Shiroro and 3,823 in Kainji. These figures (3,632 and 3,823) represent the sampling frame out of which the sample size of the study was drawn. The basis for the random selection was that, names of all the villages were written on small pieces of papers and mixed accordingly in a container, thereafter 30 pieces of papers were drawn at random.

The rationale behind the selection of more fishers and fishing communities along Kainji dam than along Shiroro dam was that, Kainji dam have more concentration of fishers and fishing communities than Shiroro dam.

Method of Data Collection

Both primary and secondary data were used for the study. Primary data was obtained using structured questionnaires designed in line with the study objectives. The copies of which were administered to the respondents selected for the study. Secondary data were collected from relevant text books, internet, journals, seminar documents, conference articles, annual reports and other relevant materials.

Analytical Techniques

Data collected were analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency distribution count, percentages and mean were used to analyze objectives 1. Simpson Diversification Index and Logit Regression were used to analyse objectives 2 and 3 respectively.

Simpson Diversification Index

The Simpson Index of Diversification was used to achieve objective 6. Simpson index was used to measure the diversity of strategies adopted by households in the study area. The Simpson index was used because the index is simple to compute, robust and widely applicable. The formula for Simpson Index is given below:

The value of the Simpson index lies between 0 and 1. The value of the index is zero when there is a complete specialization and it approaches one as the level of diversification increases.

The formula for Simpson Diversification Index is given as:

$$SID = 1 - \frac{\sum n-1}{N(N-1)} \dots\dots\dots (1)$$

Where, SDI is Simpson Diversification Index, N is the total number of livelihood sources.

The values of SDI ranges from 0 and 1, where 0 depicts no diversification (complete specialization), and it approaches 1 as the level of diversification increases. Based on the SDI values, the level of livelihood diversification is defined as: No diversification (SDI = 0), Low level of diversification (SDI = 0.00001 - 0.2500, Medium level of diversification (SDI=0.2501-0.4500), High level of diversification (SDI= >0.4501).

Linear Regression Analysis

Specification of the model

Linear Regression Analysis (LRA) was employed to analyze objective 3. The Linear model is an inferential statistical regression model that describes the relationship between a censored continuous dependent variable Y_i and a vector of independent variables X_i .

Y_i is the dependent variable and $X_1 - X_{10}$ are the independent variables

The general linear regression model is mathematically expressed as:

$$Y = \alpha + \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \dots + \beta_{10} X_{10} + U \dots\dots\dots (2)$$

Where Y = Livelihood Diversification (1 for diversified livelihood, 0 for otherwise)

X_1 = Age (Years)

X_2 = Sex (1 for male, 0 otherwise)

X_3 = Fishing Experience (Years)

X_4 = Marital Status (1 for married, 2 for single, 3 for divorced, 4 for widowed)

X_5 = Household size (Number)

X_6 = Level of education (Years spent in school)

X_7 = Membership of association (1 for Membership, 0 otherwise)

X_8 = Access to extension (1 for access, 0 otherwise)

X_9 = Access to credit (1 for access, 0 otherwise)

X_{10} = Income per month (N)

U = Error term

β_i = Constant term

$\beta_i - \beta_{10}$ = Regression coefficients estimated

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

Table 1 indicated that 2.8% of the respondents which is the least in the age distribution structure fell within the age grade of 16-28years, 51.3% are within the age bracket of 29-41 years, 24.1% fell within the ages of 42-54 years and 21.7% grouped within the ages of 55years and above with a mean of 46. It is evident from the table that majority of the respondents are middle aged young fishers who fell within the active fishing age with high vigour and energy to contribute meaningfully to fishery development. The age distribution of the respondents as shown in the table 1 indicated that most of the fishers fell between 16 and 28 years of age with a mean age of 2.8. This implies that most people engaged in artisanal fishing enterprises were still active and physically fit to paddle the canoes. The implication is that the respondents were within the productive and economic active age, and are able to increase fishing productivity and improve livelihood of the fishing households. This is consistent with other fisheries studies such as (Bolarinwa, 2014). This also shows that most of the fishers in this age grade have the ability to engage intensively in artisanal fisheries activities that will enhance their food security status, income and general standard of living. The result equally indicated that most of the fisher folks were within the economically active age of the population and therefore, constitutes a good labour force in artisanal fisheries since efforts are being made to increase fish output from the artisanal sector by the Federal Government of Nigeria in recent years. There is a sharp decline in the number of fishers that were between the age range of 16-28 years and 55 years above. However, those fishers that were between the ages of 55years and above who are supposed to be dependent age group were still active in fishing. The implication of this might be due to the fact that the fishers took fishing as a way of life because majority of them are into the business because they inherited it from their parents and many communities that are located near the dams depend on fishing for food and their livelihood (Baruwa *et al.*, 2018). The results in Table 1 also showed that 82.20% respondents were male while female formed the minority with only 17.8%. This is very clear because artisanal fisheries activities is male dominant with female mostly found in processing and marketing of fish. Male respondents dominate the activity of diving in water to catch fishes. This research is in tandem with Awutide *et al.*, (2019) who posits that majority (58%) of the respondents in their study were male indicating that male were more in artisanal fishing activities in the study area which revealed that male dominate artisanal fishing industry.

As regards marital status, 87.0% of the respondents were married, 8.9% were single, 1.3% were divorced, 0.9% widows and 2.0% widowers. It is revealed from this result that greater percentage of the respondents were married indicating that they were saddled with the responsibility of

meeting their family basic needs of life such as ensuring that their households are food secured. This agrees with Bryceson (2018) who also found out that majority (73%) of the artisanal fishers were married indicating that many of them were faced with family responsibilities and as such have the tendency of abandoning artisanal fisheries if enough financial proceed to take care of their family is not forth coming. The findings of Awutide *et al.*, (2019) also conform to this study which reported male dominance of artisanal fishing. The result revealed that majority of the respondents 73.3% were married, while 25.8% were single, only 1% of the respondents were separated. The results in table 1 showed that 14.1% of the respondents acquired only primary school education, 16.3% had only junior secondary school, 32.6% schooled up to senior secondary school, 7.4% obtained tertiary education and the rest of the respondents with 29.6% had no formal education but only had either Qur'anic or adult education. This may to some extent have a bearing on their livelihood. This low level of education implies that the demand and access of the respondents to bank credit and contact with extension agents would be affected. This finding is supported by Baruwa *et al.*, (2018) which in his studies showed that majority of artisanal fishery operators studied up to only secondary school.

The result in Table 1 revealed that 15.0% respondents have a household size of less than 6 persons, 40.2% which is the majority has 6-13 persons in their households, 36.1% respondents have a household size of 14-21 members and another 15.0% respondents have a household size of 22 and above members. Large household size is associated with the availability of timely, free and cheap labour for the fishing households; in this case larger families are likely to be more effective and productive. Although this helped to increase the output of fish, substantial amount of fish was also consumed by the household causing a reduction in the overall households' income. The results further revealed that 25.0% respondents belongs to one fishing association or the other while greater percentage of respondents accounting to 75.0% does not belong to any form of fisher association. It can be seen from the findings that majority of the fishers do not belong to any form of cooperative association and cooperative associations are very important to fishers as it can be a source of credit, source of training/information for improved fishing techniques, source of motivation and source of fishing gears. This also implies that fishers who belong to organization through interaction could acquire information that could help them to improve their productivity (Consolata, 2016). Experience is very important in every enterprise, especially artisanal fishing. The view of the role of experience in fishing comes from the fact that it enables fishers to have information on fishing locations and water current. As shown in Table 1, the number of years the respondents have been engaged in fishing reveals that majority (48.7%) has more than 20 years of experience. 25.9% have between 13-19 years of fishing experience in enlightening fishers on new fishing techniques through periodic organization/arrangement of capacity building programmes targeted at improving fishing efficiency. However, majority of the fishers years while 22.6% have between 6 and 12 years' experience in fishing and the least respondents with 2.8% have less than 5 years' experience with a mean of 19.0. The results in table 1 further indicated that 84.6% respondents had no contact with extension agents while only 15.4% fishers had contact with extension services. Extension agents play a very vital role interviewed do not have access to extension agents and that had indirectly limited their level of productivity in terms of fish catch and other artisanal fisheries activities. Credit is important for the acquisition and maintenance of fishing crafts and gears. The results in this table as regards access to credit facility shows that 93.0% respondents who were the majority had no access to credit facility while only 7.0% fishers had access to credit.

Table 1: Socioeconomic characteristics of the artisanal fishers (n = 460)

Variables	Frequency	Percentage	Mean
Age			
16---28	13	2.8	
29 – 41	236	51.3	
42 – 54	111	24.2	46.0
55 and above	100	21.7	
Total	460	100	
Sex			
Female	82	17.8	
Male	378	82.2	
Total	460	100	
Marital Status			
Married	400	87.0	
Single	41	8.9	
Divorced	6	1.3	
Widow	9	0.8	
Widower	4	2.0	
Total	460	100	
Level of Education			
Primary Education	65	14.1	
Junior Secondary Education	75	16.3	
Senior Secondary Education	150	32.6	
Tertiary Education	34	7.4	
No Formal Education	136	29.6	
Total	460	100	
Household Size			
Less than 5	69	15.0	
6 – 13	185	40.0	12.0
14 – 21	166	35.0	
22 and above	40	10.0	
Total	460	100	
Membership of Association			
Member	115	25.0	
Non-Member	345	75.0	
Total	460	100	
Fishing Experience			
Less than 5	13	2.8	
6 – 12	104	22.6	
13 – 19	119	25.9	19.0
20 and above	224	48.7	
Total	460	100	
Access to Extension			
No	389	84.6	
Yes	71	15.4	
Total	460	100	
Access to Credit			
No	428	93.0	
Yes	32	7.0	
Total	460	100	

Source: Field Survey, 2023

Simpson index results on livelihood diversification strategies of the fishers

The Simpson index of diversification was used to measure the diversity of strategies adopted by households in the study area. An index of 0.99 was obtained implying that fishers were highly diversified in the study area. The study outlined typical livelihood activities apart from fishing that the fishers were engaged in the study area. The most common types of on-farm and off farm livelihood activities engaged by the fishers in addition to fishing were discussed in table 2. The findings in Table 2 shows diversified livelihood activities among fishers in the study area, farming (59.3%) is the most common form of livelihood activity engaged in by the fishers, closely followed by poultry rearing (50.2%), livestock rearing (45.9%), closely followed by night guard (31.0%). They combine both on-farm and off-farm activities as strategies to source more income for improved livelihood conditions even though fishing is the major occupation of most household along the two dams. The nature of rural livelihood diversity is highly diversified and this is expected because of the importance fishers place on livelihood diversification for improved living conditions. Many of the respondents adopt three or more sources of livelihood strategies and this concludes that the rural households have been able to fully harness all diversification options in order to cope with the current economic realities. This research is in agreement with the findings of Chilaka *et al.*, (2017) who presented the distribution of the sampled households based on the different activities they engage in to secure their livelihood in Oyo State, Nigeria. The results shows that the fishing households diversified their livelihood activities relying on both fishing and non-fishing activities to secure their livelihood attributable to the risks and uncertainties associated with enterprise. The identified economic activities were categorized into four including; farming, wage employment, carpentry and trading. More than three quarter (86.9%) of the sampled households engage in farming (including cropping, fishing, livestock and poultry production) as their primary source of livelihood. This study conforms to that of Baruwa *et al.*, (2018) whose findings revealed crop farming (mean = 3.47) as an agricultural livelihood strategies. He identified crop farming as the most important livelihood strategy among rural households. It is further held in evidence in view of small-scale backyard and outskirt farms in various rural communities in the study area with a combination of roots and tuber crops, fruit and vegetable crops, grain and cereal crops, tree and plantation crops. Rural households may have adopted crop farming as a livelihood strategy because the crops serve as common staples, propagules are easily sourced locally, cultural and agronomic practices have been developed and mastered over the years and the crops concerned appear to have adapted to local soil and environmental conditions.

Table 2: Simpson index results on livelihood diversification strategies of the fishers

Livelihood Activities	Number of people (N)	%	n-1	N(N)
Arable farming	273	59.3	272	74256
Poultry rearing	231	50.2	230	53130
Livestock rearing	211	45.9	210	44310
Night guard	143	31.0	142	20306
Hunting	141	30.7	140	19740
Sales of proc agric pro	128	27.8	127	16256
Petty trading	122	26.5	121	14762
Grinding	107	23.3	106	11342
Milling of processed agric products	102	22.2	101	10302
Shoe making	98	21.3	97	9506
Tailoring	95	20.7	94	8930
Water trading	95	20.7	94	8930
Carpentry	94	20.4	93	8742
Butchery	94	20.4	93	8742
Tree crop planting	93	20.2	92	8556
Barbing	92	20.0	91	8372
Transportation	81	17.6	80	6480
Cassava processing	77	16.7	76	5852
Food vending	62	13.5	61	3782
Black smithing	59	12.8	58	3422
LGA civil service	52	11.3	51	2652
Security operative	42	9.1	41	1722
Vulcanizing	41	8.9	40	1640
Teaching	40	8.7	39	1560
Nursing	20	4.3	19	380
N	2593		$\sum n - 1 = 2568$	N(N-1) = 353672
n-1	2568			
N(N-1)	353672			0.99273903504

Source: Field survey, 2023

$$SDI = 1 - \frac{\sum n-1}{N(N-1)} SDI = 0.99$$

Extent of livelihood diversification among fishers in the study area

Table 3 shows the extent of livelihood diversification among fishers. Simpson index of diversification was used to measure the diversification status of the households' livelihoods. Although, there are several indicators and indices that could be used to estimate livelihood diversification, Simpson diversification index was used because it is simple to compute, robust and widely applicable. Table 3 illustrates the distribution of fishers into different levels of livelihood diversification. The findings showed that the diversification index ranges from 0 (SID = 0.00) to above (SID = 0.53). The findings on the extent of livelihood diversification indicated that the household level of livelihood diversification (SID = 0.88) was obtained which implied high level of livelihood diversification among this group of fishers (85.43%). Findings further indicated that (SID = 0.14) representing 11.96% of fishers reported low diversity and an (SID = 0.51) had medium level of diversity showcasing 2.39% fishers. Lastly, (SID = 0.005) representing 0.22% fishers had no diversification at all.

The study conforms to that of Damilare, (2014) who in his study titled Evaluation of Choices of Livelihood Strategy and Livelihood Diversity of Rural Households in Ondo State, Nigeria showed that 73.3% of the respondents had more than one livelihood sources while 26.7% relied on one livelihood. The livelihood diversification index stood at 0.64. This is an indication of the moderately diversified nature of rural livelihood. The result is similar to the findings of Chilaka *et al.*, (2017) who stated that an average Nigeria rural household is risk neutral with diversification index of 0.53. The findings of Balogun *et al.*, (2000) are in tandem with the findings of this study. The results suggested that the household on-farm livelihood diversification index (SID = 0.05) is low, with 87.4% of the respondents reporting no diversification at all, and only 3.2% having a high livelihood diversification index. The respondents reported that they were more into non-farm livelihood activities than on-farm activities due to several challenges facing the latter, ranging from climate change to poor institutional support. These results are consistent with findings Awotide *et al.*, (2019) who also established that rural households in the Eastern Cape and KwaZulu-Natal provinces of South Africa are highly vulnerable to various kinds of climate, mainly because of a low level of diversification of farm activities.

Table3: Distribution of fishers into different levels of livelihood diversification

SID Range	Frequency	Percentage	Level of livelihood diversification
<0.01	1	0.22	No
0.01 - 0.25	55	11.96	Low
0.26 - 0.50	11	2.39	Medium
0.51-0.75	393	85.43	High
Total	460	100	

Source: Field Survey, 2023

Estimates of the determinants of livelihood diversification

The correlation analysis in Table 4 indicates the determinants of livelihood diversification by the fishers. The model predicted the determinants of livelihood diversification at 22.3 percent accuracy, according to the results of the regression provided in Table 4.4 in terms of predictive efficacy. The results also demonstrate that in understanding the drivers of livelihood diversification, the model was adequate. Four of the ten factors in the model (Age, Sex, Level of education and Membership of association) were found to be significant in determining livelihood diversification of the fishers in the study area.

Age of the fishers was found to be statistically significant at 1% level of significance with t-value 4. This indicates that as age of the fisher increases so also the likelihood of his increased livelihood diversification activities. Increase in age goes with increase in experience, therefore age is very crucial in determining livelihood diversification activities. Sex of the fishers was also found to be a significant factor in determining livelihood diversification activities at 1% level of significance with a t-value of 9.47. The implication of this is that sex is a determining factor in diversifying into non-farm activities. It was observed from the field work that women carried out some diversification activities such as pottery and tailoring while men carried out some other activities like transportation, bricklaying, barbing and many more. Dasuki *et al.*, (2014) observed that sex was significant to local trade, formal employment and migratory wage services in Ogun state, Nigeria. The result also implies that age determines diversification into these non-farm activities.

Most of the fishers diversify into non-farm activities in the area and were carried out by more of the younger household heads than the older ones. These activities include transportation,

trading, civil service, barbing, driving, bricklaying, tailoring and mechanical work. Level of education had significant relationship with non-farm activities at 5% level of significance with a t-value of 1.87. Level of education an individual possesses determines his ability to diversify into farm and non-farm activities. Bryceson, (2016) asserts that better-educated members of rural populations have better access to any nonfarm businesses. The analysis also reveals that membership of association was negative but statistically significant at 1% level of significance with a t-value of -5.02. The role of fishers' cooperative associations through their provision of service to its members could have possible influence on livelihood diversification activities. It is expected therefore that, fishers who are members of the cooperatives to be relatively more productive in terms of livelihood diversification activities.

Table 4: Logistic regression estimates of the determinants of livelihood diversification

Variables	Parameters	Coefficient	Std. Error	t-value	P-value
(Constant)	X ₀	1.334	.764	1.745	.082
Age	X ₁	.083***	.020	4.159	.000
Sex	X ₂	2.818***	.297	9.486	.000
Fishing experience	X ₃	.002	.023	.068	.946
Marital Status	X ₄	-.230	.167	-1.379	.169
Household Size	X ₅	.0116	.019	.850	.396
Level of Education	X ₆	.497**	.265	1.874	.062
Membership of association	X ₇	-.112***	.022	-5.023	.000
Access to Extension	X ₈	-.138	.338	-.408	.683
Access to Credit	X ₉	-.623	.476	-1.310	.191
Income per month	X ₁₀	1.003E-06	.000	.478	.633
R ²		22.3			
F		14.190			
Number of observations		460			

*significant at 10% level, **significant at 5% level, ***significant at 1% level

Source: Field Survey, 2023

Conclusion

Simpson Diversification Index (SID) was used to measure the diversity of strategies adopted by households in the study area and Farming was the most diversified form of livelihood activity engaged in by the fishers followed by trading and carpentry.

An index of 0.99 was obtained suggesting that fishers highly diversified their income portfolios in the study area in order to attain a sustainable means of livelihood.

Recommendations

The following recommendations will go a long way in improving the situation.

1. It is recommended that as a way of complimenting the effort of the fishers and encouraging the identified relevance of diverse livelihood sources by fisher household, government should improve on the provision of basic infrastructures such as good roads, electricity, health facilities, schools and others. This will improve the variety of non-farming income generating activities that rural households can engage in to improve their income and meet their basic needs of life.
2. Trainings and seminars on livelihood diversification strategies should be provided by private organizations with the necessary support of the government. This will

enlighten the rural dwellers on how best to distribute their eggs among baskets and withstand shock that could arise from the failure of their major livelihood source.

3. Government should also make formal credit available at one digit interest rate. This will encourage them and as well boost their standard of living by generating more revenue to the household.

References

- Awotide, O. D, Kehinde A. L., & Agbola, P. O. (2019). Poverty and Rural Livelihood Diversification among Farming Households in Southwest Nigeria. *Journal of food, Agriculture and Environment*, 8(1): Pp. 367-371.
- Balogun, J.K., Auta, J.A., Balarabe, M.L and Bako, S.P. (2000). Fisheries Management and Development Considerations for Small Reservoir: A Case Study of Zaria Reservoir: Paper Presented at the Fisheries Society of Nigeria (FISON). 15th Annual Conference, Jos, Nigeria.Pp.98
- Baruwa, O. I., Tijani, A. A. and Adejobi, A. O. (2018). Profitability and Constraints to Fishery Enterprises: A Case Study of Artisanal and Aquaculture Fisheries in Lagos State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*. 8(1):52-58.
- Bryceson, D. F. (2018). *Rural Africa at the Crossroads: Livelihood Practices and Policies*. Series 52. United Kingdom, Overseas Development Institute (ODI).Ekong, E.E. (2003). *Rural Sociology: An Introduction and Analysis of Rural Nigeria*. Second Edition. Uyo, Dove Educational Publishers. Pp. 341–369.
- Bryceson, D. F (2016). *Rural Africa at the Cross- roads: Livelihood Practices and Policies*. Series 52. United Kingdom, Overseas Development Institute (ODI). Pp 50-59
- Bolarinwa, J.B. (2014).Public Relations and Extension Services in Nigerian Fisheries Industry. *International Journal of Agricultural Research* 9(7):327-330.
- Bolarinwa, J.B. (2011).Diet Composition and Food habits of African Catfish, *Clarias gariepinus* in Fresh Water area of Epe Lagoon, Lagos State. *Journal of Vocational Education* 4 (1):23-28.
- Chilaka, O.M, Nwabeze, G.O and Odili, O.E. (2017). *Challenges of Inland Artisanal fish production in Nigeria: Economic Perspective*. Proceedings of 28th Annual Conference in Coastal and Artisanal Fisheries held at University of Ibadan between 3rd–5th September (2013). Pp. 1 – 3
- Consolata, M. (2016).*Factors Influencing Fish Production among Small Scale Farmers in Kenya: a Case of Hamisi Sub-County*. A Research Project Submitted in Partial Fulfillment as A Requirement for the Award of Degree of Master of Arts in Project Planning and Management of the University of Nairobi.Pp.41
- Damilare, I.O. (2014).*Survey of Artisanal Fishing Gears and Crafts. A Case Study of Kainji Lake Lower Basin, Nigeria*. A Thesis Submitted to the Faculty of Biosciences, Fisheries and Economics Antic University of Norway. Pp 60 – 66
- Dasuki, A., Dauda, A. B.; Oshoke, J. O.; Tiri, G. D.; and Bichi, A. H. (2014). A Survey of Artisanal Fisheries of Makera Zone of Zobe Reservoir, Katsina State. Proceedings of the 29th Annual Conference of Fisheries Society of Nigeria. Makurdi.24th – 28th November 2014. Pp 2 – 5.