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Socio-Economic Assessment of Fishers, Processors, and Market Dynamics in the River Yobe Fishery Value Chain, Nigeria

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ABSTRACT
The fishery of River Yobe is a critical source of livelihood, protein, and income for communities in northeastern Nigeria. However, the socio-economic conditions of its value chain actors and the system's profitability are poorly documented, hindering targeted development interventions. This study assessed the socio-economic status of fishers in relation to their gear and craft, evaluated processors in relation to their methods, and analyzed the marketing profitability and distribution channels. Data were collected for 18 months from three sites (Mashayan Bade, Usur, Nguru) using structured questionnaires administered to 1,395 fishers, 263 processors, and 354 marketers, alongside observational surveys. Results indicate a predominantly young, male fisher population with low formal education (35.91% with none), relying on personal savings (89.32%) and traditional gears (cast nets, drag nets, gill nets). Processors, including a significant proportion of women (30.04%), primarily use traditional methods (smoking, drying), with all funding sourced from personal savings (83.65%) or friends. Fish marketers operate through informal channels, selling in baskets (75.67%) and directly to consumers (52.47%). Profitability analysis reveals a mean profit margin of approximately ₦2,334 per small carton ("Zarma") and ₦2,083 per large carton ("Gwarzo") after accounting for transportation costs. Key constraints include limited access to capital, obsolete technology, inefficient distribution, and a complete lack of government support or regulation. The study concludes that the River Yobe fishery, while economically viable, operates far below its potential due to structural socio-economic and institutional challenges. Recommendations include cooperatives should be formed to ensure access to loans, establishing modern processing hubs, developing dedicated market infrastructure, and implementing supportive government policies to enhance sustainability and profitability.

Keywords: Artisanal Fisheries, Socio-Economic Status, Value Chain, Profitability, River Yobe, Nigeria

INTRODUCTION

The fisheries sector is a cornerstone of food security and livelihoods in Nigeria, supplying over 50% of animal protein intake and employing millions (Ahmed & Yusuf, 2014; Gordon et al., 2023). Inland water bodies like River Yobe are particularly vital, supporting thousands of artisanal fishers, processors, and marketers. Artisanal fisheries dominate Nigeria's domestic fish supply, contributing more than 70% of the total (Elezuo et al., 2024). Despite this importance, actors within the value chain often face profound socio-economic challenges, including poverty, limited education, inadequate capital, and reliance on inefficient technologies (Aminu et al., 2017; Atairet et al., 2024). These challenges are exacerbated by environmental pressures and a lack of institutional support, threatening the sustainability of the resource and the well-being of dependent communities (Adeniyi & Sulaiman, 2022).

River Yobe, a major tributary of the Lake Chad basin, is a critical aquatic ecosystem in northeastern Nigeria. Its fisheries provide essential income and nutrition for riparian communities (Jajere et al., 2022). However, the socio-economic conditions of those who depend on this river fishers, processors, and marketers emain inadequately studied. Understanding the interplay between their socio-economic status, the technologies they employ, and the economic viability of their enterprises is fundamental for designing effective policies for poverty alleviation, resource management, and sectoral development.

Therefore, this study aimed to:

i. Assess the socio-economic status of fishers in relation to gears and craft used in River Yobe.
ii. Ascertain the socio-economic status of processors in relation to fish processing methods along River Yobe.
iii. Assess marketing profitability and distribution channels of fish along River Yobe.

MATERIALS AND METHODS

Study Area

The study was conducted along River Yobe, which flows through the Sudan-Sahel zone of northeastern Nigeria. Three sampling sites, as shown in figure 1, were identified during the studies based on the activities at each site. Site I (Mashayan Bade) in Gashua is coordinated at 12º52'41"N 11º03'26"E and longitude 12º51'44"N 11º02'19"E and has an intensive agricultural activity (dry and rainy season farming and rearing of animals), dumping of domestics wastes and open defecation; Site II (Usur) is coordinated at 12º52'06"N 10º58'55"E and longitude 12º52'03"N 10º58'41"E and in addition to domestics' wastes, open defecation there is an indiscriminate fishing activities and Site III (Nguru) in Nguru, is coordinated at 12º52'34"N 10º28'15"E and longitude 12º51'18"N 10º26'28"E and the site experience

discharge of waste dump, open defecation, agricultural activities, indiscriminate fishing activities and it is a grazing site for livestock. The sites were selected based on the human activities observed at each location following preliminary studies.

Data Collection

The study employed a mixed-methods approach over 18 months (November 2021 – April 2023). Primary data was collected using pre-tested, structured questionnaires administered through face-to-face interviews.

i. **Fishers:** 1,395 fishers were randomly selected across the three sites to collect data on demographics, education, income, fishing experience, gear ownership and type (e.g., drag net, cast net, gill net), craft, capital sources, and perceived challenges.
ii. **Processors:** 263 fish processors were interviewed to gather information on demographic profile, processing methods (smoking, drying, etc.), facilities used, capital, market channels, and constraints.
iii. **Marketers:** 354 fish marketers were surveyed to obtain data on their operations, including buying and selling prices, units of measurement (e.g., basket, carton), transportation costs, distribution channels, and profitability.

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS version 26). Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize socio-economic characteristics and business practices. Profitability for marketers was estimated by calculating the gross margin using the formula, according to: Selling Price - (Purchase Price + Transportation Cost).

RESULTS AND DISCUSSION

Socio-Economic Status of Fishers in Relation to Gear and Craft

The majority of fishers (73.70%) were youths below 41 years, indicating a vibrant workforce. All respondents were male, reflecting strong gender specialization in the capture segment. A significant proportion (35.91%) had no formal education, which aligns with findings from other artisanal fisheries in Nigeria and can limit the adoption of improved practices (Yetunde et al., 2021). Fishing was often complemented by farming (60.65%) and trading (31.68%), highlighting its insufficiency as a sole income source.

Table 1: Demographic Information of Fishers

SN	Title	Options	Site 1	Site 2	Site 3	Frequency	Percentage
1	Age	>10	0	0	0	0	0.0
		10 to 20	97	68	83	248	17.78
		21 – 30	107	92	115	314	22.51
		31 – 40	201	109	156	466	33.41
		< 40	127	89	151	367	26.31
		Total	532	358	505	1395	100.00
2	Gender	Male	532	358	505	1395	100.00
		Female	0	0	0	0	0.00
		Total	532	358	505	1395	100.00
3	Marital Status	Single	159	74	149	382	27.38
		Married	353	277	330	960	68.82
		Widowed	4	2	3	9	0.65
		Divorced	14	4	18	36	2.58
		Separated	2	1	5	8	0.57
		Total	532	358	505	1395	100.00
4	Educational	No formal educ.	184	143	174	501	35.91
		Adult edu.	7	3	13	23	1.65
		Primary edu.	201	171	205	577	41.36
		Secondary edu.	129	37	103	269	19.28
		Tertiary edu.	11	4	10	25	1.79
		Total	532	358	505	1395	100.00
5	Tribe	Bade	89	47	64	200	14.34
		Mangawa	127	103	178	408	29.25
		Hausa	188	113	191	492	35.27
		Karai-karai	22	26	11	59	4.23
		Ngizim	31	37	20	88	6.31
		Fulani	57	32	39	128	9.18
		Ngamo	18	0	2	20	1.43
		Total	532	358	505	1395	100.00
6	Years in school	1-5years	7	3	14	24	1.72
		6-10years	201	171	205	577	41.36
		11-15years	129	37	103	269	19.28
		< 16years	11	4	9	24	1.72
		Total	348	215	331	894	64.09
7	Religion	Islam	525	355	497	1377	98.71
		Christianity	7	3	8	18	1.29

SN	Title	Options	Site 1	Site 2	Site 3	Frequency	Percentage
		Traditional	0	0	0	0	0.00
		Total	532	358	505	1395	100.00
8	Household size	1-5	337	210	354	901	64.59
		6-10	165	112	119	396	28.39
		11-15	21	18	20	59	4.23
		<16	14	9	16	39	2.80
		Total	537	349	509	1395	100.00
9	Otheroccupation	Farming	301	249	296	846	60.65
		Civil service	19	27	17	63	4.52
		Trading	183	78	181	442	31.68
		Vocational job	29	4	11	44	3.15
		Total	532	358	505	1395	100.00
10	Income per day	₦2000	172	102	137	411	29.46
		₦3000	201	198	199	598	42.87
		₦4000	114	37	121	272	19.50
		₦5000	12	9	21	42	3.01
		₦6000	11	7	8	26	1.86
		₦7000	9	3	8	20	1.43
		₦8000	7	1	4	12	0.86
		₦9000	4	1	4	9	0.65
		₦10000	2	0	3	5	0.36
		Total	532	358	505	1395	100.00
11	Member of	Yes	0	0	0	0	0.00
	cooperative	No	532	358	505	1395	100.00
	Society	Total	532	358	505	1395	100.00
12	Source of funds	Personal Saving	478	312	456	1246	89.32
		Friends/relative	54	46	49	149	10.68
		Cooperative society	0	0	0	0	0.00
		Bank loan	0	0	0	0	0.00
		Total	532	358	505	1395	100.00
13	How you have gears	Borrowed	103	71	98	272	19.50
		Rent	110	101	114	325	23.30
		Owned	319	186	293	798	57.20
		Total	532	358	505	1395	100.00
14	Fishing Experience	1-5years	138	182	98	418	29.96
		6-10years	211	127	217	555	39.78
		11-15years	92	34	104	230	16.49
		16-20years	79	11	68	158	11.33
		Above 21years	12	4	18	34	2.44
		Total	532	358	505	1395	100.00

Fishing Business Regulations in River Yobe

Capital formation was a major constraint. Most fishers (89.32%) relied on personal savings, with none belonging to cooperatives or accessing formal bank loans. This directly influenced gear acquisition: 57.20% owned their gear, while 23.30% rented and 19.50% borrowed. The most commonly used gears were a combination of hook and line, cast net, gill net, and dragnet (39.21%), followed by cast nets (21.22%) and drag nets (17.92%). The reliance on these mostly passive and traditional gears, often rented or borrowed, limits fishing efficiency and range, corroborating the findings of Abolude (2012) on the link between capital, gear, and profitability. Fishers reported an urgent need for government assistance, primarily in capital (38.92%), fishing gears (22.94%), and market access (20.65%), but noted a complete absence of such support.

Table 2: Fishing Business Regulations in River Yobe

SN	Response	Site 1	Site 2	Site 3	Frequency	Percentage
Reason for Going into Fishing Business						
1	Make profit	319	111	340	770	55.20
2	Augment profit	201	218	152	571	40.93
3	House consumption	12	29	13	54	3.87
Total	532	358	505	1395		100.00
Responses on Paying Tax/Revenue for Fishing Activities						
1	Yes	504	340	491	1335	95.70
2	No	28	18	14	60	4.30

SN	Response	Site 1	Site 2	Site 3	Frequency	Percentage
Total	532	358	505	1395	100.00	
Amount of Money Paid as Tax/Revenue by Fishers						
1	₦200	380	219	389	988	70.82
2	₦500	124	121	102	347	24.87
Total	504	340	491	1335		100.00
Fishers Responses on whether Government Regulate Fishing Activities in River Yobe						
1	Yes	0	0	0	0	0.00
2	No	532	358	505	1395	100.00
Total	532	358	505	1395		100.00
Fishers most need that want Government Assistance						
1	Capital	201	131	211	543	38.92
2	Fishing gears	123	97	100	320	22.94
3	Markets	91	74	123	288	20.65
4	Government to regulate activities	117	56	71	244	17.49
Total	532	358	505	1395	100.00	
Type of Fishing Gears Used by Fishers						
1	Drag net	93	83	74	250	17.92
2	Cast net	97	73	126	296	21.22
3	Hook and line	32	19	23	74	5.30
4	Gill net	76	88	64	228	16.34
5	All of the above	234	95	218	547	39.21
Total	532	358	505	1395	100.00	

Ways Fishing Business can be Improved in River Yobe

Across the three sites, a total of 1,395 responses were recorded regarding ways to improve the fishing business. The most frequently cited improvement was capital, mentioned 483 times (34.62%), followed by fishing gears with 373 responses (26.74%). Market facilities were identified by 277 respondents (19.86%), while government regulation of activities received 262 responses (18.78%). Site-specific totals were 532 responses from Site 1, 358 from Site 2, and 505 from Site 3.

Table 3: Ways Fishing Business can be Improve in River Yobe

SN	Ways	Site 1	Site 2	Site 3	Frequency	Percentage
1	Capital	191	113	179	483	34.62
2	Fishing gears	133	108	132	373	26.74
3	Market facilities	102	76	99	277	19.86
4	Government to regulate activities	106	61	95	262	18.78
Total		532	358	505	1395	100.00

Socio-Economic Status of Processors in Relation to Processing Methods

The processing sector showed greater gender inclusivity, with 30.04% female participation. Processors were slightly better educated than fishers, though 20.91% still had no formal Education. Like fishers, they depended on personal savings (83.65%) and lacked access to formal credit facilities. All processors were members of cooperative associations, a positive step for collective action, but this did not translate into financial access (Table 4).

Processing was overwhelmingly traditional. Smoking (45.63%) and drying (29.28%) were the dominant preservation methods, with 100% of processors using traditional facilities (e.g., open-fire smoking kilns, ground drying). The primary methods of fish preparation were gutting (45.25%) and scaling (32.32%). Processors sold their products mainly in baskets (75.67%) directly to consumers (52.47%) or retailers (28.14%). The major constraints cited were a crippling lack of modern processing and preservation facilities (e.g., refrigerators, storage rooms), which leads to high post-harvest losses, poor quality control, and limited market reach (Magawata et al., 2014). This finding underscores the critical gap in the value chain where significant value could be added through improved technology (Table 4).

Table 4: Information of Processors

SN	Title	Option	Site 1	Site 2	Site 3	Frequency	Percentage
1	Age	Below 10	0	0	0	0	0.00
		10 – 20	10	9	14	33	12.55
		21 – 30	24	19	27	70	26.62
		31 – 40	32	18	39	89	33.84
		Above 41	27	13	31	71	27.00
		Total	93	59	111	263	100.00
2	Gender	Male	78	21	85	219	69.96

SN	Title	Option	Site 1	Site 2	Site 3	Frequency	Percentage
		Female	15	38	26	44	30.04
		Total	93	59	111	263	100.00
3	Marital Status	Single	9	8	11	28	10.65
		Married	78	49	87	214	81.37
		Widowed	2	0	1	3	1.14
		Divorced	4	2	7	13	4.94
		Separated	0	0	5	5	1.90
		Total	93	59	111	263	100.00
4	Educational	No formal educ	18	14	23	55	20.91
		Adult edu.	3	1	8	12	4.56
		Primary edu	31	24	38	93	35.36
		Secondary edu	32	18	29	79	30.04
		Tertiary edu	9	2	13	24	9.13
		Total	93	59	111	263	100.00
5	Tribe	Bade	11	7	9	27	10.27
;		Mangawa	20	12	31	63	23.95
		Hausa	28	16	26	70	26.62
		Karai-karai	7	4	8	19	7.22
		Ngizim	4	2	5	11	4.18
		Fulani	12	10	19	41	15.59
		Kanuri	9	5	9	23	8.75
		Ngamo	2	3	4	9	3.42
		Total	93	59	111	263	100.00
6	Years in school	1-5years	3	1	8	12	4.56
		6-10years	31	24	38	93	35.36
		11-15years	32	18	29	79	30.04
		Above 16years	9	2	13	24	9.13
		Total	75	45	88	208	79.09
7	Religion	Islam	91	59	108	258	98.10
		Christianity	2	0	3	5	1.90
		Traditional	0	0	0	0	0.00
		Total	93	59	111	263	100.00
8	Household size	1-5s	34	16	32	82	31.18
		6-10s	28	14	39	81	30.80
		11-15s	24	21	29	74	28.14
		Above 16s	8	7	11	26	9.89
		Total	94	58	111	263	100.00
9	Other occupation	Farming	34	31	38	103	39.16
		Civil service	1	2	3	6	2.28
		Trading	56	26	68	150	57.03
		Vocational job	2	0	2	4	1.52
		Total	93	59	111	263	100.00
10	Member of cooper	Yes	93	59	111	263	100.00
	Society	No	0	0	0	0	0.00
		Total	93	59	111	263	100.00
11	Source of funds	Personal Saving	76	51	93	220	83.65
		Friends/relative	17	8	18	43	16.35
		Cooperative society	0	0	0	0	0.00
		Bank loan	0	0	0	0	0.00
		Total	93	59	111	263	100.00
12	Processor's	>20,000	17	5	19	41	15.59
	capital base	21,00-50,000	22	29	31	82	31.18
		51,000-100,000	34	18	31	83	31.56
		<100,000	20	7	30	57	21.67
		Total	93	59	111	263	100.00
13	Quantity of fish	>15kg	19	6	22	47	17.87
	Processed	30kg	21	27	30	78	29.66
		45kg	34	18	31	83	31.56
		<45kg	19	8	28	55	20.91

SN	Title	Option	Site 1	Site 2	Site 3	Frequency	Percentage
		Total	93	59	111	263	100.00
14	Processing	1-5years	7	3	14	24	9.13
	Experience	6-10years	27	18	34	79	30.04
		11-15years	31	21	32	84	31.94
		16-20years	19	10	20	49	18.63
		Above 21years	9	7	11	27	10.27
		Total	93	59	111	263	100.00

Processing Regulations in River Yobe

All 263 fish processors across the three sites (Site 1: 93, Site 2: 59, Site 3: 111) responded that they do not pay tax or revenue (100%), and all stated that the government provides no assistance in their fish processing business (100%).

All processors reported that their source of fish is the river (100%), with none sourcing from fish farms.

Regarding the method of fish processing, gutting was the most common (119 processors, 45.25%), followed by scaling (85, 32.32%), cutting (34, 12.93%), salting (20, 7.60%), and sticking (only at Site 3: 5 processors, 1.90% overall).

For the surface used in fish preparation, 152 processors (57.79%) used a table, while 111 (42.21%) used the ground**.**

Table 5: Processing Regulations in River Yobe

SN	Response	Site 1	Site 2	Site 3	Frequency	Percentage
Fish Processors Responses on Paying Tax/Revenue						
1	Yes	0	0	0	0	0.00
2	No	93	59	111	263	100.00
Total		93	59	111	263	100.00
Fish Processors Responses on whether Government Assist in Fish Processing Business						
1	Yes	0	0	0	0	0.00
2	No	93	59	111	263	100.00
Total		93	59	111	263	100.00
Fish Processors' Source of Fishes						
1	River	93	59	111	263	100.00
2	Fish farm	0	0	0	0	0.00
Total		93	59	111	263	100.00
Method of Fish Processing Employed by Processors						
1	Scaling	32	19	34	85	32.32
2	Gutting	41	27	51	119	45.25
3	Salting	8	5	7	20	7.60
4	Sticking	0	0	5	5	1.90
5	Cutting	12	8	14	34	12.93
Total		93	59	111	263	100.00
Surface for Fish Preparation						
1	Ground	35	34	42	111	42.21
2	Table	58	25	69	152	57.79
Total		93	59	111	263	100.00

Processors' Marketing Strategies in River Yobe

Regarding the type of fish processed and marketed, smoked fish was the most common (120 processors, 45.63%), followed by dried fish (77, 29.28%), fried fish (34, 12.93%), and fresh fish (32, 12.17%). All 263 processors (100%) reported using only traditional processing facilities, with none using modern facilities or a combination of both. In terms of how processors market their fish, the majority sold by the basket (199 processors, 75.67%), followed by batch sales (34, 12.93%) and kilogram sales (30, 11.41%). When asked whom they normally sell to, consumers were the primary buyers (138 processors, 52.47%), followed by retailers (74, 28.14%) and wholesalers (51, 19.39%).

Table 6: Processors Marketing Strategies in River Yobe

SN	Type of fish processed	Site 1	Site 2	Site 3	Frequency	Percentage
Type of Fish Processed Marketed by Fish Processors						
1	Smoked	51	18	51	120	45.63
2	Dried	21	20	36	77	29.28
3	Fried	15	8	11	34	12.93
4	Fresh	6	13	13	32	12.17
Total		93	59	111	263	100.00
Type of Processing Facilities Processors Possess						
1	Modern facilities	0	0	0	0	0.00
2	Traditional facilities	93	59	111	263	100.00
3	Both	0	0	0	0	0.00
Total		93	59	111	263	100.00

SN	Type of fish processed	Site 1	Site 2	Site 3	Frequency	Percentage
How Processors Market Fish						
1	Batch	14	8	12	34	12.93
2	Kilogram	10	3	17	30	11.41
3	Basket	69	48	82	199	75.67
Total		93	59	111	263	100.00
Whom Processors Normally Sell Fish						
1	Wholesale	19	9	23	51	19.39
2	Retailer	23	11	40	74	28.14
3	Consumer	51	39	48	138	52.47
Total		93	59	111	263	100.00

Species of Fish Processed by Processors

Across the three sites, fish processors reported processing a variety of species. At Site 1 and Site 2, the same twelve species were processed: *Tilapia Zilli, Synodontis spp, Clarias gariepinus, Brycinus nurse, Bagrus docmac niger, Chrysichthys auratus, Marcuse nius petricolus, Hydrocynus brevis, Hemichromis fasciatus, Labeo parvus, Malapterurus electricus, Protopterus annectens, and Schilbe mytus*. At Site 3, processors handled a different set of thirteen species, listed with their local names: Cat fish (kurugu), Tilapia fish (karfasa), Silverside (kawara), Mud fish (tarwada), Silver-cat fish (musko), Silver-cat fish (karaya dan maimiyo), Crunk fish (tatar), Tiger fish (tsage), Jewel fish (kurkula), African crap (burdo), Electric cat fish (mingiriya), African lung fish (gaiwa), and Butter fish (lulu).

Table 7: Species of Fish Processed by Processors

SN	Site 1	Site 2	Site 3
1	*Tilapia Zilli*	*Tilapia Zilli*	Cat fish (kurugu)
2	*Synodontis spp*	*Synodontis spp*	Tilapia fish (karfasa)
3	*Clarias gariepinus*	*Clarias gariepinus*	Silverside (kawara)
4	*Brycinus nurse*	*Brycinus nurse*	Mud fish (tarwada)
5	*Bagrus docmac niger*	*Bagrus docmac niger*	Silver-cat fish (musko)
6	*Chrysichthys auratus*	*Chrysichthys auratus*	Silver-cat fish (karaya dan maimiyo)
7	*Marcuse nius petricolus*	*Marcuse nius petricolus*	Crunk fish (tatar)
8	*Hydrocynus brevis*	*Hydrocynus brevis*	Tiger fish (tsage)
9	*Hemichromis fasciatus*	*Hemichromis fasciatus*	Jewel fish (kurkula)
10	*Labeo parvus*	*Labeo parvus*	African crap (burdo)
11	*Malapterurus electrcus*	*Malapterurus electrcus*	Electric cat fish (mingiriya
12	*Protopterus annectens*	*Protopterus annectens*	African lung fish (gaiwa)
13	*Schilbe mytus*	*Schilbe mytus*	Butter fish (lulu)

Species Preference by Consumers

Among the 263 consumers across the three sites, the most preferred fish species was Tilapia (karfasa), chosen by 77 consumers (29.28%), followed closely by Cat fish (tarwada) with 76 consumers (28.90%). Silverside (kawara) was preferred by 47 consumers (17.87%), while Mud fish (mai mama) and Silver cat-fish (musko) were less preferred, with 36 (13.69%) and 27 (10.26%) consumers, respectively. Site-specific totals were 93 consumers at Site 1, 59 at Site 2, and 111 at Site 3.

Table 8: Species Preference by Consumers

SN	Specie	Site 1	Site 2	Site 3	Frequency	Percentage
1	Tilapia(karfasa)	32	16	29	77	29.28
2	Cat fish (tarwada)	29	14	33	76	28.90
3	Mud fish (mai mama)	13	9	14	36	13.69
4	Silverside (kawara)	10	12	25	47	17.87
5	Silver cat-fish (musko)	9	8	10	27	10.26
Total		93	59	111	263	

Problems Processors Encounter in Fish Processing

Across all three sites, fish processors reported facing the same two major problems. The first was a lack of modern processing facilities, and the second was a lack of preserving facilities such as refrigerators and structures to serve as storage. These challenges were consistently identified by processors at Site 1, Site 2, and Site 3.

Table 9 Problems Processors Encounter in Fish Processing

SN	Site 1	Site 2	Site 3
1	Modern processing facilities	Modern processing facilities	Modern processing facilities
2	Preserving facilities e.g., refrigerators, structures as store	Preserving facilities e.g., refrigerators, structures as store	Preserving facilities e.g., refrigerators, structures as store

Demographic Information of Marketers

A total of 354 marketers participated across three sites (Site 1: 141, Site 2: 74, Site 3: 139). The majority of marketers were above 41 years old (131, 37.01%), followed by those aged 31–40 (106, 29.94%), 21–30 (80, 22.60%), and 10–20 (37, 10.45%). None were below 10 years. Males dominated the marketing workforce (288, 81.36%), while females numbered 66 (18.64%). Most marketers were married (293, 82.77%), followed by single (27, 7.63%), divorced (17, 4.80%), widowed (10, 2.82%), and separated (7, 1.98%). The largest group had primary education (105, 29.66%), followed by secondary (99, 27.97%), no formal education (70, 19.77%), tertiary (47, 13.28%), and adult education (33, 9.32%). The most common tribe was Hausa (89, 25.14%), followed by Mangawa (71, 20.06%), Kanuri (62, 17.51%), Bade (56, 15.82%), Karai-karai (30, 8.47%), Fulani (25, 7.06%), and Ngizim (21, 5.93%). Among those who reported schooling (284 of 354, 80.23%), the largest group had 6–10 years (105, 29.66%), followed by 11–15 years (99, 27.97%), above 16 years (47, 13.28%), and 1–5 years (33, 9.32%). The vast majority were Muslim (325, 91.81%), with Christians making up 29 (8.19%). Most marketers had 6–10 persons per household (109, 30.79%), followed by 1–5 persons (95, 26.84%), 11–15 persons (79, 22.32%), and above 16 persons (71, 20.06%). Trading was the most common secondary occupation (195, 55.08%), followed by farming (90, 25.42%), civil service (52, 14.69%), and vocational jobs (17, 4.80%). The largest group had 6–10 years of experience (111, 31.36%), followed by 11–15 years (103, 29.10%), 16–20 years (63, 17.80%), 1–5 years (41, 11.58%), and above 21 years (36, 10.17%).

Table 9 Demographic Information of Marketers

SN	Title	Options	Site 1	Site 2	Site 3	Frequency	Percentage
1	Age	Below 10	0	0	0	0	0.00
		10 – 20	13	9	15	37	10.45
		21 – 30	30	21	29	80	22.60
		31 – 40	40	24	42	106	29.94
		Above 41	58	20	53	131	37.01
		Total	141	74	139	354	100.00
2	Gender	Male	112	64	112	288	81.36
		Female	29	10	27	66	18.64
		Total	141	74	139	354	100.00
3	Marital Status	Single	10	6	11	27	7.63
		Married	119	65	109	293	82.77
		Widowed	3	1	6	10	2.82
		Divorced	7	2	8	17	4.80
		Separated	2	0	5	7	1.98
		Total	141	74	139	354	100.00
4	Educational	No formal educ	27	14	29	70	19.77
		Adult edu	12	7	14	33	9.32
		Primary edu	42	24	39	105	29.66
		Secondary edu	41	21	37	99	27.97
		Tertiary edu	19	8	20	47	13.28
		Total	141	74	139	354	100.00
5	Tribe	Bade	25	14	17	56	15.82
		Mangawa	22	13	36	71	20.06
		Hausa	32	25	32	89	25.14
		Karai-karai	12	4	14	30	8.47
		Ngizim	7	3	11	21	5.93
		Fulani	10	6	9	25	7.06
		Kanuri	24	18	20	62	17.51
		Total	132	83	139	354	100.00
6	Years in school	1-5years	12	7	14	33	9.32
		6-10years	42	24	39	105	29.66
		11-15years	41	21	37	99	27.97
		Above 16years	19	8	20	47	13.28
		Total	114	60	110	284	80.23
7	Religion	Islam	127	70	128	325	91.81
		Christianity	14	4	11	29	8.19
		Total	141	74	139	354	100.00
8	Household size	1-5s	43	15	37	95	26.84
		6-10s	42	19	48	109	30.79
		11-15s	21	22	36	79	22.32
		Above 16s	37	18	16	71	20.06
		Total	143	74	137	354	100.00
9	Other occupation	Farming	38	17	35	90	25.42

SN	Title	Options	Site 1	Site 2	Site 3	Frequency	Percentage
		Civil service	21	12	19	52	14.69
		Trading	75	41	79	195	55.08
		Vocational job	7	4	6	17	4.80
		Total	141	74	139	354	100.00
10	Marketing Experience	1-5years	17	8	16	41	11.58
		6-10years	48	21	42	111	31.36
		11-15years	39	26	38	103	29.10
		16-20years	25	11	27	63	17.80
		Above 21years	12	8	16	36	10.17
		Total	141	74	139	354	100.00

Marketing Profitability and Distribution Channels

The marketing network was predominantly informal and fragmented. Marketers purchased fish from processors in two main units: a small carton ("Zarma") and a large carton ("Gwarzo"). The mean purchase price was ₦40,583 for a "Zarma" and ₦45,417 for a "Gwarzo". These were sold at mean prices of ₦42,917 and ₦47,500, respectively (table 10).

Transportation costs were informal and variable, averaging ₦367 for a "Zarma" and ₦417 for a "Gwarzo". All marketers (100%) reported problems with transportation and the absence of formal tariffs. The calculated gross profit margin per unit was approximately ₦2,334 for a "Zarma" (₦42,917 - (₦40,583 + ₦367)) and ₦2,083 for a "Gwarzo" (₦47,500 - (₦45,417 + ₦417)). This indicates that the marketing business is profitable, but margins are likely squeezed by high transportation costs and spoilage risks due to the lack of cold chains. The channel was short: Fisher → Processors → Marketers → Consumers/Retailers. Marketers actively sought market information, but their operations were vulnerable to stock fluctuations and poor infrastructure.

Table 10. Marketing Strategies and Transportations of Fishes

SN	Unit of Measurement	Price range (in naira)				Mean price
		Site 1	Site 2	Site 3		
Marketers' Response on the Price of Buying Fish						
1	Small carton (Zarma)	37,000-45,000(41,000)	35,500-44,000(39,750)	37,000-45,000(41,000)		40,583
2	Big carton (Gwarzo)	42,000-50,000(46,000)	40,000-48,500(44,250)	42,000-50,000(46,000)		45,417
Marketers' Response on the Price of Selling Fish						
1	Small carton (Zarma)	40,000-47,000(43,500)	40,500-43,000(41,750)	42,000-45,000(43,500)		42,917
2	Big carton (Gwarzo)	46,000-50,000(48,000)	44,500-48,000(46,250)	46,500-50,000(48,250)		47,500
Amount Pay for Transportation per Specified Unit						
1	Small carton (Zarma)	200-500 (350)	250-550 (400)	200-500 (350)		367
2	Big carton (Gwarzo)	250-550 (400)	300-600 (450)	250-500 (400)		417
Marketers' Response on whether there is Formal Transport Tariffs						
	Response on tariff	**Site 1**	**Site 2**	**Site 3**	**Frequency**	**Percentage**
1	No	141	74	139	354	100.00
2	Yes	0	0	0	0	0.00
Total		141	74	139	354	100.00
Marketers' Response on whether They Encounter Problem in Transporting Fish						
SN	**Response**	**Site 1**	**Site 2**	**Site 3**	**Frequency**	**Percentage**
1	Yes	141	74	139	354	100.00
2	No	0	0	0	0	0.00
Total		141	74	139	354	100.00
Marketers' Response on whether they Seek Market Information						
SN	**Response**	**Site 1**	**Site 2**	**Site 3**	**Frequency**	**Percentage**
1	No	0	0	0	0	0.00
2	Yes	141	74	139	354	100.00
Total		141	74	139	354	100.00

Type of Fish Marketed

Among the 354 marketers across the three sites (Site 1: 141, Site 2: 74, Site 3: 139), the most commonly marketed fish species was Tilapia fish (karfasa), reported by 77 marketers (21.75%). This was followed by Cat fish (kurugu) with 69 (19.49%), Silverside (kawara) with 62 (17.51%), and Mud fish (tarwada) with 37 (10.45%). Silver-cat fish (musko) was marketed by 22 marketers (6.21%), while Tiger fish (tsage) and African lung fish (gaiwa) each accounted for 15 (4.25%). African crap (burdo) was marketed by 11 (3.11%), Butter fish (lulu) by 10 (2.82%), and Jewel fish (kurkula) by 8 (2.26%). Crunk fish (tatar) and Electric cat fish (mingiriya) each had 6 marketers (1.69%), and Silver-cat fish (karaya dan maimayo) was marketed by 16 (4.52%).

Table 11 Type of Fish Marketed

Type of fish marketed	Site 1	Site 2	Site 3	Frequency	Percentage
Tilapia fish (karfasa)	30	13	34	77	21.75
Cat fish (kurugu)	23	15	31	69	19.49
Silverside (kawara)	26	12	24	62	17.51
Mud fish (tarwada)	15	8	14	37	10.45
Silver-cat fish (musko)	13	3	6	22	6.21
Silver-cat fish (karaya dan maimayo)	4	4	8	16	4.52
Crunk fish (tatar)	2	1	3	6	1.69
Tiger fish (tsage)	6	6	3	15	4.25
Jewel fish (kurkula)	3	3	2	8	2.26
African crap (burdo)	6	2	3	11	3.11
Electric cat fish (mingiriya)	3	1	2	6	1.69
African lung fish (gaiwa)	6	4	5	15	4.25
Butter fish (lulu)	4	2	4	10	2.82
Total	141	74	139	354	100.00

Discussion

Fishers

The socioeconomic status of the fishers in the study area revealed that most of the fishers in Mashayar Bade, Usur and Nguru were youth. This indicated that fishers are mainly within the economically active age fit for the labor market.. This finding agrees with the report of Ifabiyi, *et al.* (2023) who reported that the predominance of youth in fishing activities is influenced by factors such as aspirations for full-time employment in fisheries, migrant status, capacity building opportunities, etc. Conversely, challenges such as lack of capital and support from the government, modern fishing gears, rising temperatures and unpredictable fish availability impact their decisions to continue in the sector (Greener, 2022). Frequencies on marital status of the respondent indicated that majority of the fishers were married and, this implies that majority of the fishers shoulder a lot of family responsibilities. This result is in agreement with the finding of Ifabiyi, *et al.* (2023) that most of the fishers have family responsibility ties that will require more financial commitment which may serve as an impetus for them to enhance their fishing capacity and livelihood. The study revealed in respect of the fishers' educational level that most of them are not well educated. This finding implies that fishers in the study area were relatively low educated and this would have impact on their capacity to exploit latent opportunities in the fishing activities. This agrees with the findings of Yetunde, *et al.* (2021) that the low level of fishing education and social status of the fishers were some of the constraints to their fish catching levels and indeed their development

The finding of the study revealed that fishers in River Yobe have lower income levels and this is also in line with the generally observed trends that the income level of fishers in Nigeria varies widely depending on factors such as location, scale of operation, access to market and resources. And artisanal fishers tend to have lower income levels compared to those engaged in larger or commercial/industrial fishing activities (Ifabiyi, *et al.*, 2023). This finding is in line with the finding of Boro, *et al.* (2022) that majority of the fishers in Gokana local government area of Rivers State are artisanal fishers and have low-income levels which compels most of them engaged in other jobs. The socioeconomic status of fishers in Nigeria is also closely tied to the types of fishing gear and crafts they use. Most of the fishers in River Yobe used traditional fishing gears such as net, drag net, gill net, hook and line of which some of them rent or borrow from their friends. Fishing activity in River Yobe cut across various tribes and religions and this implies that there is a cordial relationship among the fishers which also brings about cultural knowledge exchange. This result agrees with the finding of Yetunde *et al.* (2021) which established that the fishers have a relatively large household size of 4-6 (36.6%) and 7-9 (36.0%) persons in Ogun waterside local government areas and therefore this is likely to boost the availability of family labour and the intensity of artisanal fisheries in the fishing communities (Akanni, 2010). The large family size has negative effect of putting economic burden on the fishers making them struggle with poverty which affect their quality of life, also leads to overfishing and depletion of fish stocks and forced their children into labour rather than attending school.

The finding also indicated that fishers in River Yobe are engaged in other occupations such as farming, trading, civil service, and other vocational jobs and this implies that fishing alone is not sufficient to meet their family financial obligations. This finding is in line with the findings of Onyango, *et al.* (2006) that the reason fishers engage in other income generating activities is to meet their daily needs and to subsidies on their income and to help stabilize household income. The study also revealed that 100% of the fishers in the study area are not members of any cooperative association. This has implication on their credit mobilization ability and consequently majority of them sources their funds from their personal saving while some from their friends and/or relatives. Therefore, without funds fishers cannot access essential fishing equipment leading to reduced fishing efforts and lower fish catch.

The study further revealed that fishers in River Yobe have considerable years of fishing experience. This is substantiated

by the findings of Aminu *et al.* (2017) who observed that fishing experience is important in determining the profit levels of fishers and contributes to the success of fishers.

The result also unveiled that fishers are paying tax/revenue for fishing activities in the study area. This finding affirmed the fishers' contribution to Nigerians economy not just in their more than 70% of the Nigeria's overall domestic fish production (Food and Beverage, 2024 and Sasu, 2024), but also in their contribution to GDP growth as the fishery sector contributed 1.09% of the national GDP in 2020 and 0.97% in the Q3 of 2021 and more than 2% in 2024 (Odioko and Becer, 2022 and NBS, 2024). However, the finding indicate that government do not regulate nor assist in fishing activities in River Yobe. The result also revealed that fishers need government to assist them with capital, fishing gears, access to market for their fish catches and they also require that government should regulate the fishing activities in the study area. These findings agree with the findings of Aminu *et al.* (2017) and Tanzania Coast Management Partnership (TCMP) (2001) who found that despite fisheries being an important source of livelihood for the majority of coastal households, has been plagued by poor fisheries management, lack of capital, poor and inefficient fishing gears and vessels, limited access to better market coupled with poor handling facilities, poor infrastructure, etc.

The result also revealed that the different species of fishes caught or harvested by the fishers in the study area are Tilapia, followed by Cat fish, Mud fish, Silverside, Silver-cat fish, Silver-cat fish, Crunk fish, Tiger fish, Jewel fish, African crap, Electric cat fish, African lung fish and Butter fish. This is in line with the finding of Ifabiyi, *et al.* (2023) that catching variety of fish species offers several benefits to fishers, fishing industry and the country at large. Therefore, catching different species of fish improves economic stability, supports sustainability, and enhances food security.

Fish Processors

The findings on socioeconomic status related to fish processors unveiled that most of the processors are youth and within their active age. This agrees with Olatinwo, *et al*. (2020) finding that 70.10% of the fish processors in Kwara state were within their active age of 15 to 50 years. However, this finding disagrees with the finding of Odioko and Becer (2022) that the number of youths involved in aquaculture is very small, because a vast populaton of youth goes into search of the white jobs. For aquaculture to reach its full potential there should be a considerable and active participation of a high percentage of youth in the sector (Ifeonu, *et al.*, 2020). Therefore, youth involvement in fish processing is a significant aspect of aquaculture value chain leading to economic growth and improved livelihoods. Majority of the fish processors are and married, very few are single, and insignificant number of divorced, separated and widowed. Like fishing business, fish processing business in River Yobe has cut across various tribes and religions and unlike fishers, fish processing involved both males and a good number of females. This is in agreement with Ayotunde and Oniah (2012) who found that as men catch fish, women undertake the processing and sale of the fish and this influences the status of the fishers in Cross River state.

The study in respect to fish processors' educational level showed that processors have relatively low levels of education and this has significant implications for fish processing in general and for fish hygiene behavior in particular (Adeyeye *et al.*, 2015). Education is also related to employment and income which influence access to household amenities and facilities.

The result of the study showed that all the fish processors in the study area were also involved in other occupations such as farming, trading, civil service, and vocational jobs. This implies that fish processing alone is not sufficient to meet their family financial obligations. This finding agreed with the finding of Ibrahim, *et al*. (2021) that fish processing business is seasonal leading processors to seek alternative employment to maintain a stable income. All the fish processors were members of cooperative association and they source their fund from personal savings and their friends and/or relatives. And the study further indicated that processors have little capital for the business. This is in line with the finding of Adeyeye *et al.* (2016) who found out that 87.5% fish processors contributed a mean of ₦51,324.86 and 12.5% contributed a mean of ₦55,775.26 as a start-up capital for their fish processing business. The finding is also in line with Ibrahim, *et al*. (2021) that lack of collateral found to be a constraint in obtaining bank loans by small-scale fish processors in Nasarawa State. Therefore, this financial limitation prevents processors from investing in modern equipment, improving storage facilities, and expanding their business. This situation also added that processor in River Yobe were not able to process much. Therefore, these requires a concerted effort from stakeholders, including government intervention to provide financial support, implement effective regulations, and promote sustainable practices within the fishery sector. And with the fish processors considerable fish processing experience as the result showed, fish processors can manage their processing business risk and make sound decision to enhance their business if they will have access to capital.

The study unveiled all the fish processors do not pay tax/revenue in the study area and that government does not assist them in their business. The result also showed that fish processors buy their fishes from the fishers in River Yobe. The finding related to fish preparation indicated that fish processors prepare their fishes on the table, and ground surface using gutting method, scaling method, cutting, salting and sticking method. Majority responded that smoked fish is the type of processed fish marketed by fish processors followed by dried fish, fried fish, and fresh fish. This finding agrees with the finding of Ogunji and Wuertz (2023) that smoked fish is the most widely consumed fish and highly popular in local markets in Nigeria. And all the fish processors possess traditional facilities for processing their fishes. The study revealed that processors market their processed fishes in basket, batch and in kilogram unit. Majority of processors responded that they mostly sell their fish to consumers then to retailers and few sell to wholesalers. The result revealed the different species of fish processed by the fish processors in the study area are Tilapia followed by Cat fish. Other fishes processed were Silverside, Mud fish, Silver-cat fish, Silver-cat fish, Crunk fish, Tiger fish, Jewel fish, African crap, Electric cat fish, African lung fish and Butter fish. The study also discovered that Tilapia fish is the most preferred processed fish in the study area, followed by Cat fish, Mud fish, Silverside and Silver-cat fish. Nevertheless, processors cited problems they often encounter in fish processing as lack of modern processing facilities and preserving facilities such as refrigerators, store etc.

Fish Marketers

The result regarding the socioeconomic status of fish marketers indicated that large proportions of the respondents were youth and adequately active, agile, and physically disposed to marketing activities. And this finding, according to Agbebi and Adetuwo, (2018), is very important in fish

marketing activities because age has a significant influence on the decision-making process of the marketers. As gender is an important socioeconomic parameter, this study revealed that fish marketing is dominated by male with also few females involved. This finding agrees with the finding of Sule and Raji, (2006) and Danbatta and Sogbesan (2015) who pointed out that fishing business is an exclusive business for male. However, this finding disagrees with the findings of Agbebis and Adetuwo (2018) and Olaoye *et al.,* (2015) that fish marketers are more dominated by female gender than male. Ogunji and Wuertz (2023) reported that both men and women actively participate and there is no gender preference in the different aspects of the trade. They further stated in their findings that women dominate the retail while men dominate the wholesale, large scale distribution and exports. The most men dominant in the marketing business in River Yobe may be due to traditional and culture of the study area as women are said to stay at home while men care for them. However, addressing gender disparities in access to finance, technology, and market opportunities could boost overall productivity in the fishery sector.

The result showed that fish marketing business is dominated married people leading to greater job commitment and responsibility. This implies that fish marketing in the study area is dominated by married people who according (Onubuogu, *et al.,* 2014). The result of the study revealed that marketers' level of education is good and this implies that marketers can process information on fish marketing activities. This is in line with the assertion of Agbebi *et al.* (2018) and Ibrahim, *et al.* (2021) that level of education determines how fast and concise an individual will decode or process information for effective and efficient productivity.

The result showed that fish marketers in the study area have large household size and this corresponded with the findings of Olaoye *et al.* (2015) who found that large household size compliment labour cost and minimizes scarcity for fish marketing and reduces the cost of hired labour. The marketers were also engaging in other occupations such as trading, farming, civil service and other vocational jobs. Fish marketers in Rver Yobe have satisfactory experience in fish marketing and this according to Agbebi *et al.* (2018) is a key factor in marketing efficiency and the longer the years of marketing experience, the more exposed the marketer becomes and the more efficient and effective the marketer is expected to be. All of the fish marketers in the study area responded that they encounter problems in transporting their fishes as there were no formal transport tariffs from the government for transporting their goods. The result further revealed that all the marketers seek market information to enable them make market decision. Types of fish marketers sells in the study area includes Tilapia fish, Cat fish, Silverside, Mud fish, Silver-cat fishes, Crunk fish, Tiger fish, Jewel fish, African crap, Electric cat fish, African lung fish and Butter fish.

CONCLUSION

This study provides a comprehensive insight of the socio-economic fabric of the River Yobe fishery value chain. Fishers are capital-constrained, young, and reliant on traditional gear, thereby limiting their productivity. Processors, though more organized, are trapped in a cycle of traditional methods due to a lack of modern technology and finance, which compromises product quality and shelf life. Marketers operate profitably but within an inefficient, informal system burdened by logistical challenges.

The entire chain operates in a policy vacuum, with actors receiving no government support in the form of credit, infrastructure, or regulation. This perpetuates poverty and threatens the sustainability of the fishery. There is a clear, interlinked need for intervention at all levels: improving fishers' access to capital and efficient gear, upgrading processing technology to reduce losses and add value, and developing market infrastructure to improve distribution efficiency.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

i. ***For Fishers:*** Promote the formation and strengthening of cooperative societies to facilitate access to microcredit and group purchase of improved fishing gear. Extension services should provide training on sustainable fishing practices and resource management.
ii. ***For Processors:*** Government and development partners should establish and subsidize modern processing hubs equipped with smoking kilns, solar dryers, and cold storage facilities. Financial institutions should develop loan products tailored to small-scale processors.
iii. ***For Marketers:*** Develop dedicated fish market infrastructure with storage facilities and establish structured, affordable transportation systems. Encourage the formation of marketers' associations to bargain for better services and market information.
iv. ***General Policy:*** The government should formulate and implement a supportive fisheries policy for River Yobe that includes regulation, extension services, and the provision of basic infrastructure. Integrating value chain actors into a cohesive, supported system is essential for sustainable development.

Conflict of Interest

The authors declare no conflict of interest.

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