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Influence of fishing gears used by fisherfolks on fish yield in River Benue, Nigeria

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Abstract
This study was carried out to ascertain the influence of fishing gear used by fisherfolks on the yield of fish in River Benue, Nigeria. The study was conducted in three fishing villages that are also landing sites. They are within Adamawa State axis with the Benue River passing through them. The selected villages are Boranji (Site 1), Damare (Site 2) and Hayin gada (Site 3). The study was conducted bi-monthly for three months from the month of July to September 2021. In the conduct of this study, both primary and secondary methods of data collection were used. A total of One Hundredand Forty (140) respondents were sampled with structured interview and questionnaire. The study showed that the fishing gears employed and operated in the study sites are used to capture different species of fish. Most prominent of the gearsu is the gill net and Malian trap. The study also revealed that Sixteen (16) fish species from seven (7) families were caught by the six artisanal fishing gears in all the sites. The study revealed the obvious neglect of the artisanal fisherfolks with regards to provision of infrastructural facilities despite the enormous contribution they give to the domestic fish output.

Keywords: Fish catch, fishing gear, fisherfolks, river Benue

1. Introduction
Artisanal fisheries constitute the most important fisheries sector in the world and contributes majorly to the fish supply in the developing world. However, all attempts to explore the full potentials in this sector have always failed due to the enormous poverty level of the fisherfolk, which always put them in economic stagnation and incapacitation (FAO, 2002) [7].

Artisanal fish production statistics in Nigeria is poor; the data is unreliable. Effective management requires information not only on fish stocks and how best to maximize yields, but also on their relative economic importance to the dependent community. Thus, the full economic and sociological impact of scientifically based management alternatives needs to be realistically evaluated and the best compromises sought regarding allocation of resources. Fishing regulations especially mesh size regulations and regulations of the use of chemicals should be taken into serious consideration. According to Ibrahim, *et al.* (2015) [10] Nigeria is blessed with abundant waterbodies amounting to over14 million hectares of reservoirs, lakes, ponds, and rivers and these water bodies can produce over 980, 000 metric tons of fish annually (Ibrahim *et al.*, 2015) [10].

Despite abundance in fisheries resources and the underlying potentials in Nigeria, the country remains a large importer of fish (Sotolu, 2011) [14]. Despite efforts by relevant agencies and institutions, there is still a wide gap between demand and supply in the fisheries sector that has not been bridged. Fish supply was put at just over 0.4 million tons compared to the 0.8 million tons demand (FAO, 2006) [6] and of supply of 1.7 million tons in 2010 (FDF, 2010) [8]. This makes Nigeria a large importer of fish in the developing countries, importing about 600 to 700 metric tons annually at a cost of US$0.4 billion, resulting in serious loss of domestic jobs (Peter *et al.*, 2015) [12]. These have been partly blamed on the fisher's use of unsustainable fishing practices and lack of knowledge of sustainable fishing practices (Nwabeze and Erie, 2013) [11]. The fishermen are not rich neither are they educated. They do not know or understand sustainability in the water body.

Fishes are a renewable resource that should be exploited rationally on sustainable manner. To derive maximum benefits from fish resource, it is important to apply rational effective

management that will make the resources available now, and in the future, any time they are needed in a very good and healthy condition, at affordable prices, and should improve the socio-economic well-being of the resource users and should be environmentally friendly.

The amount of catch in River Benue has depleted drastically over the years due to the use of some inappropriate gears. This is a big threat to the capacity of the ecosystems to continue to provide for the livelihood of many communities which are highly dependent on their harvest. The low catch has also affected the family of the fisherfolks. There is great divergence in the efficiency of different forms of fishing gear, in their adaptability to certain conditions, and their desirability for specific jobs. Over the years, traditional fishing methods have been developed to adapt to local conditions; fish species desired and targeted size.

Fisheries resources are renewable so, appropriate management strategies must be adopted to ensure their sustainability if fisheries must continue to play its role in food and nutrition security, job creation, income and foreign exchange earner and others in the Nigerian economy. It is imperative, to pay closer attention to artisanal fisheries now more than ever. Fisheries resources have been depleting for some years now. Fisheries statistics is the basis in policy making and fisheries management. It is necessary for Nigeria to improve artisanal fisheries statistics so as to improve management of the fishery resource.

The aim of the present work, therefore, is to ascertain the effects of fishing gear used by fisherfolks on the yield of fish in River Benue.

2. Materials and Methods

2.1 The study area

River Benue originates in the Adamawa mountains of the Central Cameroon and flows west-ward about 1,400 km meeting Niger River at about 450 km above the delta, near the city of Lokoja, Kogi State, Nigeria (Ashley, 2010) [2]. During rainy season, the Benue River overflows its banks and inundates the grassy riparian zones. However, during dry season the water level in river Benue recedes considerably to leave a silted river bed with clear shallow water (Solomon, *et al*., 2009) [13].

Fig 1: Map representation of the study area

2.2 Sampling units

The study was conducted in three fishing villages that are also landing sites. They are within Adamawa State axis with the river Benue passing through them. The selected villages are Boranji (Site 1), Damare (Site 2) and Hayingada (Site 3). The study was conducted bi-monthly for three months from the month of July to September 2021.

2.3 Methods of data collection

The method of data collection adopted for the study was the use of both primary and secondary sources of data. The primary data included the use of structured interview and questionnaires, while the secondary data include the use of journals, textbooks, bulletins, magazines, etc.

2.4 Population of the study

A total of One Hundredand Forty (140) respondents were sampled with structured interview and questionnaire. Thirty fisherfolks were also selected for the focus group discussion (FGD) in each of the study sites. Each of the stratified groups had two sessions of five discussants, at a time.

2.5 Sampling method

Simple random sampling technique was used to select the sampled population from each of the communities. Respondents were identified through household listing after which they were randomly selected. Samples were taken of the different kind of gears used at the landing sites, and also the catch that was made using those gears.

2.5.1 Semi-structured questionnaire
One hundred and forty (140) respondents were randomly selected after several visits to the community specifically twice every month and a questionnaire administered to them. The questionnaire requested for data on the type of fishing gears used by the fisherfolk in the community, as well as management practices being undertaken in the area.

2.5.2 Focus group discussion
Focused group discussion of thirty fisherfolk was organized. Using a checklist, data on the types and number of fishing gears, as well as management practices in the study area was validated.

2.6 Catch per unit effort
The catch per unit effort (CPUE) for the gears were taken based on the weight of fish caught during a fishing day (kg day^{-1} fishing unit^{-1}) for the different species combined. The catch efficiency of each gear employed in each fishing site was analyzed by comparing different gear on the basis of CPUE, i.e., the amount of fish caught for a certain period, (e.g. amount of fish caught per day). Fluctuations in the fish catch were also compared. The CPUE value was extrapolated to the mean catch gear^{-1} day^{-1} person^{-1}, mean catch crew^{-1} day^{-1} (MCCD) and mean catch boat^{-1} day^{-1}.

2.7 Statistical analysis
All the data collected during the study was analyzed using descriptive statistics; frequency distribution, total and percentages, which was used to determine differences between the sample attributes. Means of data that was generated was represented using tabular and graphical representations. The coefficient of variation (CV) analysis assessed the variability in the CPUE by gear types.

3. Results
3.1 Demographic characteristics and fishing livelihood of fisherfolks in the study area
The result of the demographic characteristics and fishing livelihood of fisherfolks in the study areas is presented in Table 1. According to the result, majority of the respondents in the study area were males (82.15%) while females were only 17.85%. Fisherfolks with age range between 20-30 years old recorded the highest value (25.71%) while fisherfolks with age range between 50 and above obtained the least value (20.00%). Majority of the respondents (45.00%) were single while divorcees were the least (7.1%) of the fisherfolks analyzed. Household size range of 4-6 recorded the highest value (54.28%) while that of 7 and above recorded the least (16.44%). With respect to language spoken in the study area, most of the fisherfolks speak Hausa (59.29%) but only 7.85% speak English language which recorded the least.
Most of the fisherfolks in the study area practice small-scale method of fish farming with 67.85% representation while only 8.57% practice the large-scale farming. Just about 23.58% of the fisherfolks practice both large-scale and small-scale farming.

Table 1: Demographic characteristics and fishing livelihood of the respondents

Variable	Category	Frequency	Percentage
Gender	Male	115	82.14
	Female	25	17.86
Age	<20	5	3.57
	20 - 30	36	25.71
	31 - 40	30	21.45
	41 - 50	41	29.28
	51 and above	28	20.00
Marital status	Single	63	45.00
	Married	50	35.00
	Divorce	10	7.1
	Widow	17	12.9
Household size	1 - 3	41	29.28
	4 - 6	76	54.28
	7 and above	23	16.44
Language spoken	English	11	7.85
	Hausa	83	59.29
	Others	46	32.86
Method of fishing	Small scale	95	67.86
	Large scale	12	8.57
	Both	33	23.57
How long have you been fishing?	1 year	36	25.71
	2 - 5 years	57	40.72
	6 years and above	47	33.57
How many fishing trips embarked?	Once	83	59.29
	Twice	42	30.0
	Thrice and above	15	10.71
Duration of fishing trips	1 - 2 hours	18	12.86
	3 - 4 hours	53	37.85
	5 hours and above	69	49.29

3.2 Types of fishing gears used in river Benue
The different types of fishing gears used by fishermen in the study area is presented in Table 2. A total of six (6) different gear types were identified and the most common ones used by fisherfolks at the different study sites were lift net (Akauji), longline (Rincha), fishing spear (Mashi), Malian trap (Gura/Malia), gill net (Taru) and cast net (Birgi). Of these 6 artisanal fishing gear types, four (4) are commonly used in

site A (Boranji) except for lift net and cast net. In site B (Damare), only cast net and gill net were not commonly used of the six gears identified, while five (5) gears were used in site C (Hayin Gada) where only fishing spear was not commonly used. Fig. 1 shows the occurrence/proportion of the different gears sampled in the different sites during the study period.

Table 2: Fishing Gears used by Fisherfolk in the Study Area

Gear	Local Name	Site A (Boranji)	Site B (Damare)	Site C (Hayin Gada)
Lift nets	Akauji	-	+	+
Longline	Rincha	+	+	+
Fishing spears	Mashi	+	+	-
Malian Trap	Gura/Malia	+	-	+
Gill net	Taru	+	-	+
Cast net	Birgi	+	+	+

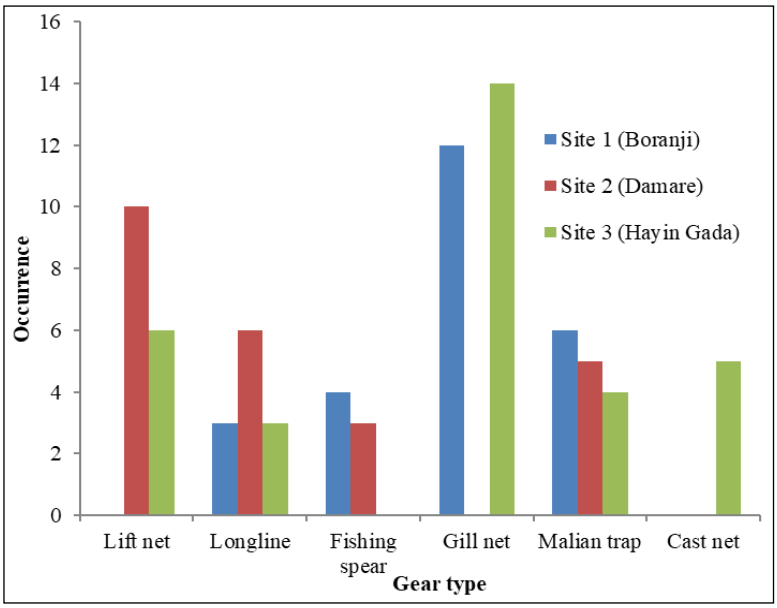

Fig 1: Distribution of fishing gears across the study sites

3.3 Determination of different catch made using the gears

The different catches made using the different six (6) gears identified in the study sites is presented in Table 3. A total of seven (7) families of fish and sixteen (16) species of fishes were identified. Site 2 (Damare) landing site had the highest number of fish catch followed by site 1 (Boranji) while site 3 (Hayin Gada) had the least number of catches.

Table 3: Common catches of the different fishing gears used in the study areas

Family/species	Gill net	Cast net	Lift net	Long line	Malian trap	Spear	Abundance
Site 1							
Cichlidae							
Oreochromis niloticus	+	+	+	+	+	+	300
Sarotherodon galileus	+	+	+	+	+	+	200
Claridae							
Clarias gariepinus	+	+	+	+	+	+	320
Heterobranchus bidorsalis	+	-	+	-	+	-	10
Claroteidae							
Auchenoglanis occidentals	+	+	+	+	-	-	22
Alestidae							
Alestes spp	+	+	+	+	-	-	540
Site 2							
Cichlidae							
Oreochromis niloticus	+	+	+	+	+	-	415
Coptodon zilli	+	+	+	+	+	-	100
Claridae							
Clarias gariepinus	+	+	+	+	+	+	400
Heterobranchus bidorsalis	+	-	-	-	+	+	2
Citharinidae							
Citharinus citharus	+	+	-	+	+	-	22
Mormyridae							
Mormyrops anguivoides	+	+	+	-	+	-	10

Mormyrus rume	+	-	-	-	+	-	5
Mochokidae							
Synodontis schall	+	+	+	+	+	-	40
Synodontis budgetti	+	+	+	-	+	-	12
Alestidae							
Alestes spp	+	+	+	-	-	-	652
Hydrocynus forskalii	+	+	+	-	-	-	436
Site 3							
Cichlidae							
Oreochromis niloticus	+	+	+	+	+	+	295
Coptodon zilli	+	+	+	+	+	+	70
Tilapia zilli	+	+	+	+	+	+	100
Claridae							
Clarias gariepinus	+	+	+	+	+	+	235
Heterobranchus bidorsalis	-	+	+	-	-	-	15
Citharinidae							
Citharinus citharus	+	+	+	+	-	-	24
Mormyridae							
Mormyrus rume	+	+	+	-	+	-	17
Mochokidae							
Synodontis schall	+	-	+	+	-	-	62
Synodontis budgetti	+	+	+	-	-	-	15

3.4 Fishing Yield in the Study Area

The effect of the different fishing gears on the yield of the catch in the different study sites is presented in Table 4. The average yield (kg) obtained in the sampled sites showed that the Cichlidae family had the highest value (785.43 kg) while Mochokidae family had the least value of (180.83 kg). However, there was a variation between the % number and % weight of the different catch. The Differential weight (gm) of the fish catch was highest in Mochokidae family and least in Alestidae.

Table 4: Variations in fishery yields across the study sites of River Benue

Family	Yield (kg)	% Number	% Weight	Differential weight (gm)
Cichlidae	785.43	30.84	20.87	729.5
Claridae	693.5	21.14	16.9	1318.7
Citharinidae	305.8	13.7	11.2	754.3
Mormyridae	415.3	12.4	15.94	582.6
Mochokidae	279.85	4.84	5.38	793.4
Alestidae	458.98	12.43	11.58	250.0
Claroteidae	298.10	2.8	14.37	237.3
Bagridae	180.83	1.85	3.76	439.7
Total	3,417.79	100	100	5,105
Mean	427.22	12.5	12.5	638.19
S. Deviation	317.93	23.9	9.7	541.9

4. Discussion

According to results obtained of the demographic characteristics of the respondents in Table 1, majority of the respondents in the study sites were males (82.15%), which reveal the predominance of the male gender in fishing business in the study area. This could be related to the associated risk involved, masculine, and tough nature of artisanal fishing. This agrees with the findings of Dauda *et al.* (2018) [4]. Most of the respondents in the study area (29.28%) were within their active age (41-50 years), which could enhance productivity since age is an important factor that affects fishing productivity (Nwabeze and Erie, 2013) [11]. At this age range, fishers have been reported to be more active and fishing becomes attractive business as reported by Nwabeze and Erie (2013) [11]. Majority of the respondents (45.00%) were single and 35.00% were married with 4-6 persons per household, which is in line with the report of Dauda *et al.* (2015) [3]. Majority of the respondents (59.30%) speak Hausa, this may be due to the fact that the sites are predominantly Hausa communities. Also, majority of the respondents' method of fishing were small-scale with 67.85%.

As indicated in Table 1, fish artisans in the study sites used different gears ranging from cast nets, gill net, lift net, fishing spear, Malian trap, and long line for their fishing activity. Usually, fishing gear usage is a function of fish species diversity, fish abundance, and the nature of water body. Due to different habits and habitats of the different fish species in a particular environment, different gears are also employed for fish capture (Tagago *et al*., 2011) [15]. The findings of this study are in line with the findings of Ibrahim *et al.* (2015) [10] who opined artisanal fisheries activities in Benue River of Nigeria are majorly noted with diverse species and multiple gear activities.

Cast net and long line were widely used among the fish artisans who attest to their availability and within their reach; they are effective for catching small bait or forage fish, and have been in use for thousands of years, even though with various modifications. Alegbeleye *et al*. (2003) [1] asserted that cast nets are used all year round, night and day and the catch per unit effort could be great, though the operation is somehow very exerting. Reports however showed that gillnet is the most important gear used by fishermen in the Northern part followed by long lines and cast nets (Emmanuel, 2019) [5]. Generally, Malian traps are not destructive for the water body except fishing with setting up of barrier on the path/migratory route of fish movement which does not allow selectivity and could cover a large area. This result agrees with the findings of Ibrahim *et al.* (2009) [9] who reported the use of gillnet, cast net, hook and line, Malian/Gura, clap net and Giwa net in Northern Nigeria. The dominance of these gears widely used in artisanal fisheries could be adduced to their result in efficiency, relatively inexpensive and capable of catching higher amount of economically valuable fish.

Sixteen (16) fish species from seven (7) families were caught by the six artisanal fishing gears in all the sites including Boranji, Damare and Hayin Gada (Table 3). Majority of the species caught in the study areas are of high commercial value while only a few were of low value. The target fishes caught

by the gears are primarily Bagrids, Schilbeids, Clariids, Mochokids, Characids, Citharinids, Heterotis and host of others. These findings is similar to that of Dauda *et al.* (2018) [4]. Also, the findings shows that Cichlidae family had the highest weight (kg), and number of fish catch while the least were Mochokidae family. This agrees with the findings of Solomon *et al.* (2009) [13].

5. Conclusion

The fishing gears employed and operated in the study area are used to capture different fish species. The most prominent of the gears is the Gill-net and Malian trap. Cast net is used and selects suitable water body and thus fishermen at the study area enjoy its usage during the high-water level with low current. Most of the fishing gears have significant variations and modifications aimed solely to capture targeted species. Sixteen (16) fish species from seven (7) families were caught by the six artisanal fishing gears in all the sites. The study revealed obvious neglect of the artisanal fisherfolks in terms of infrastructural facilities despite their immense contribution to the domestic fish output.

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