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Assessment of the capture efficiency of the artisanal fishing gears employed at upper Benue Basin, Nigeria

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Abstract
The study was carried out to assess the capture efficiency of the artisanal fishing gears employed at Mayo Ranewo and Lau fishing point of the Upper Benue Basin, Nigeria. Water samples were collected the fishing points twice monthly and subjected to physicochemical parameters analysis. Sampling of gear types and fishes captured by the gears was by direct observation. Coefficient of Variation was used for the assessment of variability in the Catch Per Unit Effort (CPUE) by gear types. The mean water temperature recorded is 25.375. The water pH of the water from the dam were most basic (pH = 6.2). Transparency was 0.730. Dissolved Oxygen levels is 3.82mg/L. Alkalinity level is 571.8mg/L while Conductivity is 438.84µmhos/cm, Ammonia level is 0.032mg/L while CO_2 level is 5.20mg/L. A total of 5 different gear types were identified to include: Malian trap – Gura/Malia; Longline – Rincha; Gill net – Taru; Lift net – Akauji; Cast net – Birgi. The result further indicated that Coefficient of Variations (C.V) differ with the gear used. The study therefore recommends that further investigation on the efficiency of the nets over a longer period (for at least 2 seasons) should be carried out.

Keywords: Assessment, capture efficiency, artisanal fishing, gears, upper benue basin

Introduction
The artisanal form of fishing constitutes the most essential and important sector of fisheries in Nigeria [1]. It accounts for the major fish supply in the developing world [2]. According to Raw Materials Research and Development Council [3], over 10 million people are directly or indirectly engaged in artisanal fishery in Nigeria. A high percentage of landed fish in Nigeria is from artisanal catch. According to Emmanuel [4] artisanal catch made up about 40% of all the fish consumed in Nigeria, in order to improve in the catching efficiency, there is need for good knowledge of fishing gears availability and its efficiency [1]. The great divergence in the efficiency of different forms of fishing gear, in their adaptability to certain conditions, and in their desirability for specific job is important [5]. Traditional fishing arts have been developed over the years to adapt to local body conditions; the species of fish desired and targeted size. The most successful fishing methods of an area or a region are those that have stood the test of time [5]. The artisanal fishermen apart from fishing engage in other economic activities such as farming and tailoring which in turn improves their socioeconomic status. Large population of the artisanal fishermen rely mainly on the predominant use of small fishing gears like gill nets, cast nets, clap net, Malian trap (Gura), hook and line etc to harvest fishery resource in the various fishing grounds (inland rivers, streams, lakes, reservoirs, lagoons and creeks) of Nigeria [6]. To this end, there is need to protect, manage and conserve the fishery resource in the streams, rivers, reservoirs, ponds, etc for the community. In order for this to be done effectively, detail knowledge of the fishing gears employed in harvesting the fishery resource is of great importance. Furthermore, Understanding the efficiency between the various fishing gears most commonly employed in the catch will be of particular interest. There are few published studies [1] focusing on the fishing gears used in the Upper Benue River Basin and relating it to specific linkages between the targeted fish, gear, the markets and the Catch per Unit Effort. These are the main justification of the present study

Materials and Methods
Description of Study Area
The study was carried out at the Upper Benue River Basin in Ardokola and Lau LGAs of Taraba State, North-East Nigeria.

The study point located in Ardokola LGA (Mayo Ranewo) is between latitude 8°47' to 8°53' N and longitude 10°50' to 10°55' E while that of Lau lies between latitude 8°56' to 9°40' N and longitude 11°5' to 11°4' E.

Method of Data Collection

Water samples were collected twice every month from the Upper Benue River during morning hours of 7:00am – 8:00am for a period of 3 months for physicochemical parameters analysis. Frame and Catch Assessment Survey was used to collect data on fish of the Upper Benue River. The study areas were visited twice monthly for a period of 3 months (November-December, 2019 and January, 2020) for data collection.

Statistical Analysis

The data obtained were analyzed using descriptive statistics. Coefficient of Variation was used for the assessment of variability in the Catch Per Unit Effort (CPUE) by gear types [7].

Results

Table 1 shows the physical and chemical parameters of the study areas. The mean water temperature recorded is 25.375. The water pH of the water from the dam were most basic (pH = 6.2). Transparency was 0.730. Dissolved Oxygen levels is 3.82mg/L. Alkalinity level is 571.8mg/L while Conductivity is 438.84µmhos/cm, Ammonia level is 0.032mg/L while CO_2 level is 5.20mg/L Six (6) artisanal fishing gear types were identified and categorized in the study. Of the gears, six (6) are commonly used in Mayo Ranewo while five (5) were used in Lau location as seen in Table 2. Of these gears, two (2) are active while four are passive gears all targeting Bagrids, Schilbeids, Clariids, Mochokids, Characids, Citharinids and Heterotids. Table 3 shows the Mean, Standard Deviation (SD) and Coefficient of Variations (C.V) of the Catch Per Unit Effort (CPUE) for each artisanal fishing gear for the location studied. The analysis of variation between the location and types of artisanal fishing gear showed no significant variation difference. The highest Coefficient of Variations (C.V) of 84% was recorded in Mayo Ranewo location for Longline.

Table 1: The mean, standard error of the physico-chemical parameters of Rivers

Study Location	Means of physicochemical parameters							
	Alkalinity (mg/L)	Ammonia (mg/L)	CO_2 (mg/L)	D.O (mg/L)	pH	Temperature (˚C)	Transparency (NTU)	Conductivity µS/cm
Mayo Ranewo	566.3[a]	0.0203[a]	4.02[a]	3.9625[a]	6.2275[a]	25.375[a]	0.9050[a]	504.79[a]
Lau	571.8[a]	0.0320[a]	5.20[a]	3.7875[a]	5.9187[a]	25.625[a]	0.3900[b]	438.84[a]
WHO	-	-	-	5.00	6.5 – 8.5	25	5.00	50 – 1500
USEPA	-	-	-	-	6.5 – 8.5	-	-	300
SE +	86.02	7.359	4.054	0.2087	0.2062	0.5428	0.1654	52.561

*abcd values with the same letters in the column did not differ significantly at $P< 0.05$
*WHO: World Health Organization (2006)
*USEPA: United States Environmental Protection Agency (2017)

Table 2: Classification of Artisanal Fishing Gears used by fishermen in the study areas

Gear	Local name (Hausa)	Gear classification	Location	
			Mayo Ranewo	Lau
Malian Trap	Gura/Malia	Passive	+	+
Lift net	Akauji	Passive	+	-
Longline	Rincha	Passive	+	+
Gill net	Taru	Passive	+	+
Cast net	Birgi	Active	+	+
Spear	Mashi	Active	+	+

Note: (+) means "presence" of such gear; (-) sign means "absence" of such fishing gear

Table 3: Catch Per Unit Effort (CPUE) of the study sites

Gear	Mayo Ranewo			Lau		
	MEAN	S.D	C.V	MEAN	S.D	C.V
Malian Trap (Taru)	31.9	24.8	77	25.5	21.0	82.1
Longline	22.0	18.3	84	16.2	10.1	62
Gill net	7.65	2.69	35	8.03	2.83	35
Lift net	5.84	3.03	52	6.08	2.55	42
Cast net	6.19	20.8	46	5.96	2.77	47
Spear	0.0	0.0	0	0.0	0.0	0

Discussion

The temperature range in the study areas during the study period corresponded to the temperature range in the studies conducted by Usman *et al.,* [8] in Kashimbila River; Adelakun *et al.,* [9] in Jebba River Basin, Niger State. These conform to the temperature range adopted in the tropics (1966). pH values recorded were between 5.30 - 6.20 and falls within the WHO [10] standard and correlates positively significantly with the conductivity. This showed that the study areas are a little acidic and a little alkaline. The pH values recorded during the period of study was optima for fish and other aquatic organisms [11, 12, 13]. High transparency was recorded in the month of December due to dry season which in turn increase photosynthesis and hence primary productivity as a result of increase in light penetration into the water and this correspond to the work of Usman *et al.,* [8]; Fonge *et al.,* [10] and Adeyemi [13]. The value for Dissolved Oxygen content of the study areas falls within the range of 3.76 – 3.96mg/L. The range is in line with the studies conducted by Bonjoru *et al.,* [1] in Upper Benue River Basin, Nigeria; Usman *et al.,* [8] in Kashimbila River; Adeyemi [13] in Ajeko stream, Northern Nigeria; Indabawa and Abdullahi [14] in River Hadejia, Jigawa State, Nigeria and Adeyemi *et al.,* [15] in Gbedikere Lake, Kogi State, Nigeria.

The capture efficiency of gear type is directly associated to the possibility that a fish will encounter and be caught in the gear [5]. According to Portt *et al.,* [16], efficiency varies among gear types. There is variation in efficiency of the fishing gear used by the fishers in Mayo Ranewo and Lau; this efficiency variation may be influenced by the mesh size of the gear, which may invariably have greater influence on the size of species caught [16]. This may be attributed to the behavioral pattern of the gear itself (passive or active) and even be related to materials used in the fabrication of the fishing gear [17]. Malian trap has a mean of 31.5 and 25.5 of the gears used in Mayo Ranewo and Lau respectively by the fishers corresponds to the work carried out by Adeyemi *et al.* [18]; Solarin *et al.,* [19]. The fishes caught in Malian Traps are

diverse in shape, ecological riches and behavioural characteristics [1, 20, 21, 4]. They comprised the pelagic fishes such as Alestes and Tilapias and bottom dwellers such as *Labeo coubie, Clarias gariepinus*. The many species caught may be attributed to the baits as well as the traps themselves, since fish could also get into unbaited traps in the course of search for food [21]. The difference in the relative quantities of each type of fish caught in the Malian trap was due to the influence of the baits. The results of the study shows that baiting the trap particularly with food remnants and sometimes corn/rice bran enhanced the gear efficiency and this could be explored for increased catch per unit effort and profit [20]. The efficiency of the other gear types is influenced by mesh size, exposed net area, flotation, mesh shape and hanging ratio, visibility and type of netting material in relation with stiffness and breaking strength [1, 22].

Conclusion

The fishing gears employed and operated in the Upper Benue River Basin, are used to capture fish species in the study areas. Malian trap, Longlines, Gill nets, Cast nets and Lift nets are typical gears employed in the Upper Benue Basin. The most prominent among them is the Malian trap and longline. The longline and Malian trap have great potential if fully utilized in the study area and further research is required to determine the most appropriate size of hooks for the longline and number and size of valves, mesh size of the net for the Malian trap. To this end, the study recommends a concise and comprehensive guideline to the usage of fishing gears to enable optimum yield without affecting the future of the fisheries resource of the wetlands. Also a there's need of government to legislate and pass laws banning the use of harmful gears.

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