



Capture Efficiency of Some Artisanal Fishing Gears Employed At Upper Benue River Basin, Nigeria

R. Bonjoru^{1*}, K. A. Abubakar², F. H. Bonjoru³, V. R. Ndeham⁴ and S. O. Amadu¹

¹*Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria.*

²*Department of Zoology, Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria.*

³*Department of Agric, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria.*

⁴*Department of Fisheries, Federal Polytechnic, Mubi, Adamawa State, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. Authors RB and KAA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors FHB and VRN managed the analyses of the study. Author SOA managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI:10.9734/JALSI/2019/v21i230098

Editor(s):

(1) Dr. Vasil Simeonov, Laboratory of Chemometrics and Environmetrics, University of Sofia "St. Kliment Okhridski", Bulgaria.

Reviewers:

(1) João Pedro Barreiros, Universidade dos Açores, Portugal.

(2) John Walsh, RMIT University, Vietnam.

Complete Peer review History: <http://www.sdiarticle3.com/review-history/49198>

Original Research Article

Received 09 March 2019

Accepted 24 May 2019

Published 10 June 2019

ABSTRACT

This study was carried out to compare the capture efficiency of some artisanal fishing gears employed at Upper Benue Basin, Nigeria. The study was carried out for a 6 months period running from July to December 2017. Sampling was by Direct observation of the Fish at the landing sites and the gears used by the fishermen. Coefficient of Variation is used for the assessment of variability in the Catch Per Unit Effort (CPUE) by gear types. Other data were analyzed using Analysis of Variance (ANOVA). A total of 5 different gear types were identified to include: Gill net – Taru; Malian trap – Gura/Malia; Lift net – Akauji; Cast net – Birgi; Longline – Rincha. 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; government should take immediate action through public awareness and education to regulate fishing activities such that adequate numbers of fishermen should be licensed to fish in a particular water body, together with their gear and craft nets; and a minimum of 3" mesh size has been recommended for all inland net fishing. This is to protect the spawning stock of commercially valued species.

*Corresponding author: E-mail: bonjoru13@gmail.com;

Keywords: Capture efficiency; artisanal fishing; gears; upper Benue basin.

1. INTRODUCTION

Fish catching methods have been known since humanity's earliest days [1]. The artisanal form of fishing constitutes the most important sector of fisheries. 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 fishery in Nigeria. Artisanal fishery is the harvesting of fish from rivers, streams, lakes and ponds by small scale fishermen using both traditional and modern fishing gears. It is the most important of fish production in Nigeria and accounts for over 90% of her fish production [4].

A high percentage of landed fish in Nigeria is from artisanal catch. According to Emmanuel [5] artisanal catch made up to 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 effectiveness. 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 [6].

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 [6]. 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 [7]. Hence the study compared the capture efficiency of the Artisanal fishing gears and the acceptability of the different fishing techniques used.

2. MATERIALS AND METHODS

2.1 Study Area

Mayo Ranewo is located in the Southwestern part of Ardokola LGA of Taraba State, Nigeria. It is located at the confluence of River Fan Mangel

with the Benue River. The town is roughly located between latitude 8°47' to 8°53' N and longitude 10°50' to 10°55' E. The town has a population of about 11,000 people according to the National Population Census [8]. There are about 25 fishing ponds in the community. The largest is the Mariwo. Others include Abarku, Anji, Kinkau, Na-huta, Ruwan Barau, Ruwan Juma'a, Kambari, Yoride, Nubi, Ji, FaranKaya, Dogon Yashi, Jimdakoli and soon.

2.2 Method of Data Collection

The study was carried out for a 6 months period running from July to December 2017. The study area is characterized by wetlands and River Benue and thus has different landing sites. The study area was categorized into three sites: site A, B and C. Site A (fishing, farming, washing, bathing, other commercial activities). Site B (fishing farming, commercial activities site), while site C (fishing and farming). The sites were sampled twice monthly for fish species and the gears used. Sampling was by: Direct observation of the Fish species and gears at the landing sites.

2.3 Statistical Analysis

Coefficient of Variation is used for the assessment of variability in the Catch per Unit Effort (CPUE) by gear types [9]. Other data were analyzed using Analysis of Variance (ANOVA).

3. RESULTS

Table 1 and Fig. 1 identified the various artisanal fishing techniques identified to be used by the fishermen. A total of 5 different gear types were identified and the commonest ones used by fishers at the study area were Gill net – Taru, Malian trap – Gura/Malia, Lift net – Akauji, Cast net – Birgi and Longline – Rincha.

Table 4 shows the Mean, Standard Deviation (SD) and Coefficient of Variations (C.V) of the Catch Per Unit Effort (CPUE) for each artisanal fishing gear in respect to the sites studied. The analysis of variation between the sites and types of artisanal fishing gear showed no significant variation difference. The highest Coefficient of variations (C.V) of 84% was recorded in Site A for Longline.

Fig. 2 shows the mean monthly estimate (kg)/gear across the study sites for the six

months surveyed. It is observed that the highest total catch is recorded in October.

4. DISCUSSION

The gear types found in this present study are: Gill net – Taru, Malian trap – Gura/Malia, Lift net

–Akauji, Cast net – Birgi and Longline – Rincha. All these gear types have been acknowledged by researchers such as du Feu et al. [10]; NIFFR [11] during previous surveys of the inland water bodies in Nigeria. The artisanal fishing gears are the commonest gear in Kainji Lake [10,12]; Lake Alau [13] Lake Chad Basin [14] Tabatu floodplain

Table 1. Fishing gears identified at the study sites

Gear	Local name	Site A	Site B	Site C
Gill net	Taru	+	+	+
Cast net	Birgi	+	+	+
Lift net	Akauji	+	+	+
Longline	Rincha	+	+	+
Malian Trap	Gura/Malia	+	+	+

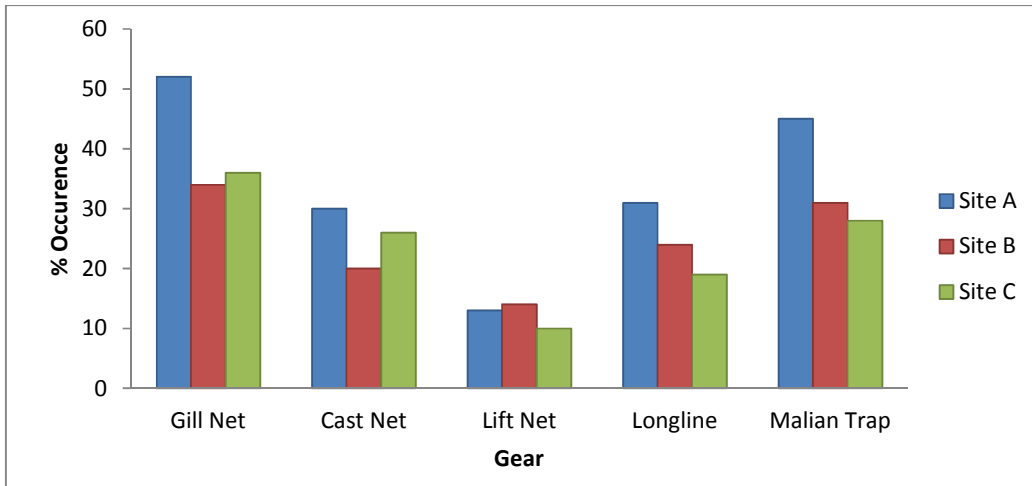


Fig. 1. Fishing gears distribution across the study sites

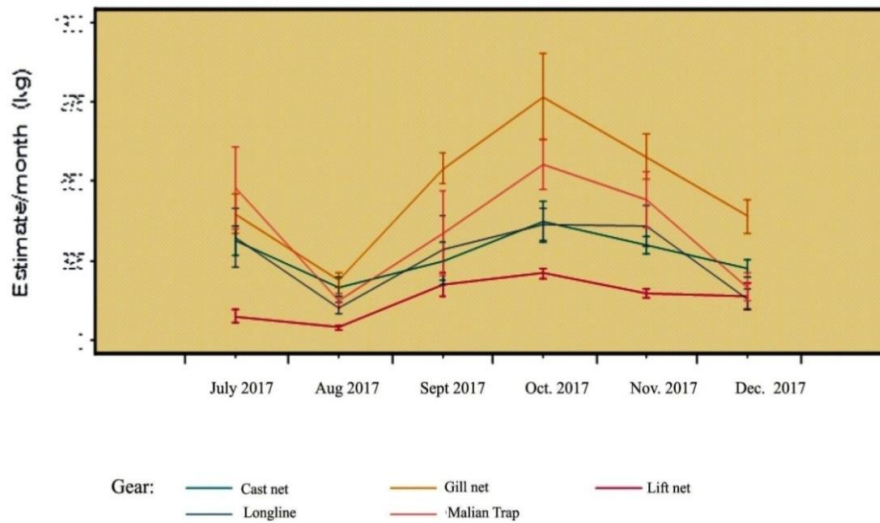


Fig. 2. Mean Month estimate (kg)/gear across the study sites from July – December, 2017

Table 2. Gears types, specification and period of operation

Gear name	Local name	Parameter			Age of gear (yrs)	Target species	Period of operation
		Length of net(m)	Depth of net (m)	Mesh size (cm)			
Gill net	Taru	50-100	1-5	1-4	1-3	All	Sept – Dec.
Cast net	Birgi	1-5	1-5	1-2	1-2	All	Year Round
Lift net	Akauji	3-5	1-3	≤1	1-2	All	Sept – Dec
		No. of hooks	Size of hook (inch)				
Longline	Rincha	100 - 500	15-17		1-3	Carnivores	July – Dec.
		Width (cm)	Height (cm)	Entrance Valve diameter (cm)	Mesh size (cm)		
Malian Trap	Gura	10 – 65	10 – 90	8 – 10	1 – 4	Economic fish	July – Dec.

Table 3. Choice of the artisanal fishing gear in the study sites

Reason(s) for gear usage (n=65)	Site A	Site B	Site C	Total	Mean	S.D	% Total sum
Area to be Fish	1	0	1	2	1.00	0.00	0.91
Cost of Gear	1	1	1	3	1.00	0.00	1.30
Efficiency	19	15	11	45	15.00	4.00	19.30
Fish to be caught	21	17	18	56	18.66	2.08	24.00
Freshness of catch	27	18	12	57	19.00	7.54	24.50
Live catch	1	1	1	3	1.00	0.00	1.30
Safety at operation	1	0	1	2	1.00	0.00	0.91
Season	30	21	14		21.66	8.02	100.0

Table 4. Catch per unit effort (CPUE) of the study sites

Gear	SITE A			SITE B			SITE C		
	MEAN	S.D	C.V	MEAN	S.D	C.V	MEAN	S.D	C.V
Gill net	7.65	2.69	35	8.03	2.83	35	6.92	2.77	40
Cast net	6.19	20.8	46	5.96	2.77	47	4.38	1.81	41
Lift net	5.84	3.03	52	6.08	2.55	42	6.03	2.69	45
Longline	21.8	18.3	84	16.2	10.1	62	12.1	8.07	67
Malian Trap (Taru)	32.0	24.8	77	25.5	21.0	82.1	19.71	12.6	64

[15] all in Nigeria. Gill net and Malian Trap is ranked as the most important and the most used fishing gear among the fishers. The dominance of gill net and Malian Trap followed by Lift net can be traced back to the mid 70's as it has been earlier reported [16]. Gill nets and Malian traps are widely used in artisanal fisheries in developing countries because they are efficient, relatively inexpensive and capable of catching higher amount of economically valuable fish than other artisanal gears [6]. The efficiency of these net 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 [1,5,6]. Despite acceptance of the gears in the study area, fishermen switch gear during fishing activities, a practice that is in consonance with the research conducted in Lake Chad and Nguru-Gashua wetlands of North East Nigeria by Neiland et al. [14]. For instance, a fisherman could own one gill net, one cast net, one set of hook & line as well as some traps and any of them can be used anytime the fisher want [14]. This may be as a result of fishing patterns (mixed fisheries) of the region but is also a reflection of the flexibility in nature utilization and lack of rigid fishing regulations as has been reported by Tagago and Ahmed [15], different gears are used for targeting fish because of habitat changes. According to du Feu et al. [10], and Bankole et al. [13], fishers used different kind of fishing gear because of seasonal variations in species availability. Kingdom and Kwen [6] also reported that more than 70% of fishers in the lower creek of the Niger Delta had more than three fishing gears in-use. Emmanuel [17] stated that gill nets were the main gears used by local fishers, followed by longlines and castnets. Emmanuel et al. [18] also found gill nets and cast nets as dominant gears in Lagos lagoon and its adjacent creeks in Nigeria. Kingdom and Kwen [6] also observed that majority of the artisanal fisher folks are characterized by utilization of low cost craft/gear, usually one-three gears. Furthermore, Solarinand Okorie [19], reported nets as constituting the most abundant Small Scale

fishing gear in Nigeria. Gill net was the commonest gear in River fishing in the Niger Delta in Nigeria [6].

The efficiency of gear is directly associated to the possibility that a fish will encounter and be caught in the gear [6]. According to Portt et al. [20], efficiency varies among gear types. There is variation in efficiency of the fishing gear used by the fishers in the study area, 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 [20]. 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 [1].

The mean CPUE for all fishing gears in study area differs because the CPUE is affected not only by environmental factors (e.g. water level, water quality, productivity, turbidity), but also by fishing gears, fishing pressure and the fishers' preferences [9]. The reasons for the significant differences in the CPUE were dependent on the size of the nets, the total number of hooks used, bait and the experiences of the artisanal fishers. Another reason for the difference in the fish catches was the location. According to Abu Sayeed et al. [9], the environmental factors such as waves, turbidity, wind direction, rainfall and weather most times affect catches. Furthermore, the CPUE showed an increased and decreased trends over the study period. This is because the month of July was the water entering period, therefore, fishes entered with flood water in the Upper Benue Basin and this results to fish abundance. More so, the high yield recorded in October maybe as result of minimal water level.

5. CONCLUSION

Gill nets, Cast nets, Lift nets, Longlines and Malian trap are typical gears employed in the Upper Benue Basin. The most prominent among them is the Gill-net and Malian trap. The Lift net which is used during the high water can

encourage a fishing festival to be introduced during high water period.

The gill net at appropriate mesh size (1-4cm) proof highly efficient and it is durable when properly maintained. It has no discrimination in selecting species to be entangle or gilled into the net, hence fishermen enjoy the usage. As a passive gear it can be set and other daily activities can be possible for the fishermen such as farm and marketing.

Longline is an efficient gears, it hook mostly the carnivorous fishes. But it is labour intensive, time wasting, both during construction and operation. But the fishermen enjoyed the high market value of the catch.

Cast net (an active gear) is used seasonally, and selects suitable water body and thus fishermen at the study area enjoy its usage during the high water level with low current. It catches species such as *Tilapia zilli* *Mormyrus spp*, *Citharinus spp* and *Heterotis niloticus*.

However, 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

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Binyotubo TE. A guide to fishing gear technology. National Institute of Freshwater Fisheries Research, New-Bussa, Niger State, Nigeria. 2011;345.
2. Food and Agricultural Organization, FAO. Sample-based Fishery Surveys. FAO Fishery Technical Paper. No. 425; 2012. [ISBN 92-5-104699-9.pp 144]
3. Raw Materials Research and Development Council Fishery Issues Potentials. 2007; 7(1):15-20.
4. Ogunbadejo HK, Alhaji T, Otubusin S. Productivity of labor in artisanal fish farming in Nigeria. African Journal of Applied Zoology & Environmental Biology. 2007;9:74-77.
5. Emmanuel BE. The artisanal fishing gears, crafts technology and their efficiency in Lekki lagoon, Nigeria. Unpublished Ph.D. Thesis. University of Lagos. 2009;256.
6. Kingdom T, Kwen K. Survey of fishing gear and methods in the lower Taylor Creek Area, Bayelsa State, Nigeria. In: World Journal of Fish and marine Sciences. 2009;1(4):313-319.
7. Adeleke BA, Ayeloja AA, Popoola MA, Jimoh WA, Olawepo KD, Rifhat AO. Assessment of fishing gear and crafts utilized by fishermen in Eleyele Lake, Ibadan, Oyo state. Proceedings of 28th Annual Conference of the Fisheries Society of Nigeria, Abuja. 2013;5-20.
8. Taraba State Official Diary. A property of Taraba State Investment and Property Limited (TRIP Ltd), Jalingo; 2016.
9. Abu Sayeed MD, Salam MA, Hossain MAR, Wahab MA. Efficiency of fishing gears and their effects on fish biodiversity and production in the Chalan Beel of Bangladesh. European Scientific Journal. 2014;10(30):294-309.
10. du Feu TA, Abayomi OS, Seisay MDB. Fishing Gear Survey, Kainji Lake, Northern Nigeria. Nigeria German Kainji Lake Promotion Technical Report. 1997;6-20.
11. National Institute for Freshwater Fisheries Research, NIFFR. National surveys of fishing gears and crafts on Nigerian inland water bodies. NIFFR occasional paper No.4. 2002;ix:4. [ISSN 0794-2451, ISBN 978-177-051-1]
12. Damilare IO. Survey of artisanal fishing gear and craft: A case study of Kainji Lake lower basin, Nigeria. Unpublished Master Thesis in International Fisheries Management submitted to the Faculty of Bioscience, Fisheries and Economics, The Arctic University, Norway; 2014.
13. Bankole NO, Raji IA, Adikwu OA, Okwundu EC. Fishing gear survey of Lake Alau, In: Eyo AA, Ajao EA (Eds), Proceedings of the 16th Annual Conference of the Fisheries Society of Nigeria (FISON). Maiduguri. 2001;99-103.
14. Neiland AE, Jaffry S, Ladu BMB, Sarch MT, Madakan SP. Inland fisheries of north east Nigeria including the upper River Benue, Lake Chad and the Nguru-Gashua Wetlands. I. Characterization and analysis of planning suppositions. 2000;229-243.
15. Tagago TA, Ahmed YB. Fishing gear survey of Tatabu floodplain, In: Koko RJ, Orire AM (Eds). Proceedings of the 26th Annual Conference of the Fisheries Society of Nigeria (FISON). 28th

- November-2nd December, Minna, Niger State, Nigeria. 2011;109-116.
16. Seisay MDB. The cast net fishery, Kainji Lake, Nigeria, 1970-1997. Nigerian-German (GTZ) Kainji Lake fisheries promotion project. Technical Report Series 12. 1998;28. [ISSN: 1119- 1449]
 17. Emmanuel BE. Assessment of fishing practices in a tropical low brackish lagoon ecosystem in southwestern Nigeria. Journal of Life and Physical Sciences. 2010;4(2):13-17.
 18. Emmanuel BE. Gill net selectivity and catch rates of pelagic fish in tropical coastal lagoonal ecosystem. African Journal of Biotechnology. 2008;7(21): 3962-3971.
 19. Solarin BB, Okorie PV. Nigeria fisheries at a time of economic paradigm shift. Proceeding of the 22nd annual conference of the fisheries society of Nigeria (FISON); 2007.
 20. Portt CB, Coker GA, Ming DL, Randall RG. A review of fish sampling methods commonly used in Canadian freshwater habitats. Canada Technical Report of Fisheries and Aquatic Sciences. 2007;4(1): 2604-2608.

© 2019 Bonjoru et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sdiarticle3.com/review-history/49198>