E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 76.37
(GIF) Impact Factor: 0.549
IJFAS 2023; 11(4): 123-128

www.fisheriesjournal.com
Received: 27-06-2023
Accepted: 02-08-2023

Bonjoru R
Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria

Henry GB
Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria

Kyani ZA
Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria

Kazy L
Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria

Bagauda DA
Department of Zoology, Federal University of Agriculture, Makurdi, Benue State, Nigeria

Corresponding Author:
Bonjoru R
Department of Biology, College of Education, P.M.B 1021, Zing, Taraba State, Nigeria

Assessment of fishing gear types and their influence on Catch Per Unit Effort (CPUE) in the upper Benue river Basin, Nigeria

Bonjoru R, Henry GB, Kyani ZA, Kazy L and Bagauda DA

DOI: https://doi.org/10.22271/fish.2023.v11.i4b.2833

Abstract
This study investigated the relationship between catch per unit effort (CPUE) and fishing gear type in River Taraba, Nigeria. The study was carried out for a 6 months period running from July to December 2022. The fish specimens used for the study was obtained through catch statistics at the three major landing sites of the study area. The sites were sampled twice monthly for fish species. Sampling was by: Direct observation of the Fish species and gears at the landing sites. Fish identifications as well as measurement of weight and number of fishermen were taken. The results showed that Gill net (Taru), Cast net (Birgi), Lift net (Akauji), Longline (Rincha) and Malian trap (Gura/Malia) are the most preferred fishing gears used by fishermen in Upper Benue River Basin at Mayo Ranewo; the results further revealed number of fishers in the 6 months study period ranged between 13 to 22 while the efforts (fishing hours) ranged from between 17 to 29 hrs/day. The average weight of fish caught per fisher per day ranged between 16 to 26 kg. September and October have the highest Catch Per Unit effort range of between 19.36 and 20.30 kg/hr while the lowest catch per unit effort is recorded in August with range of between 11.28 to 12.78 kg/hr. These findings have important implications for the management of River Taraba fishery, and can be used to inform policies and regulations to ensure the sustainability of the fishery. Therefore, this study recommends that fishers are encouraged to adopt more sustainable fishing practices, such as avoiding sensitive areas or using less harmful gear.

Keywords: Catch, effort, gear, fishers, upper Benue

1. Introduction
Fish production is vital to ensuring global food and nutritional security. Fish is a rich source of nutrients such as protein, omega-3 fatty acids, vitamins, and minerals, and is an important component of many diets, particularly in coastal communities and low-income countries. It is also a vital source of livelihoods for millions of people across the world, and is important for the health and well-being of many coastal ecosystems [1, 2, 3]. According to recent data, global per capita fish consumption has reached a new high of 20.5 kilograms per person, while total fish production has reached approximately 179 million metric tons. This growth is driven by factors such as rising incomes, population growth, and urbanization, which are expected to continue to boost demand for fish. As a result, the importance of the fisheries sector is likely to increase in the future, creating new challenges and opportunities for the sector. While global fish production and consumption are on the rise, the situation in Africa is concerning. Sub-Saharan Africa has the lowest per capita fish production and consumption rates, and it is the only region in the world that has seen a decline in production. This has serious implications for food and nutritional security, economic development, and the livelihoods of millions of people in the region [4, 28]. The decline in fish production in Sub-Saharan Africa is primarily due to a number of factors, including unsustainable management of rivers, overfishing, pollution, poor governance, and a stagnation in capture fish production. This has been further exacerbated by the increasing population of the region, putting additional pressure on already-stressed resources. It's clear that a concerted effort is needed to address these issues and ensure a sustainable future for the fisheries sector in Africa [4, 5, 29]. To address the rate of decline in fish production.

Bonjoru *et al*., [4], Solomon *et al*., [5], WorldFish Center [30], Béné & Heck [31] and the World Bank [6] estimated that in order to achieve a per capita fish consumption of 20.2 kg in sub-Saharan Africa, an increase in fish production and supply of 27.7% is required. To ensure that capture fisheries remain the primary source of fish sustenance for Africans, it is vital to consistently support, promote, and protect small-scale labor-intensive fisheries. These fisheries have the potential to generate significant social, economic, and nutritional benefits for the region [5, 32]. In order to sustain fisheries, especially in inland areas where land and water resources are under increasing pressure and experiencing significant environmental degradation, investments are needed in improved environmental management. This could include measures such as watershed management, improved water quality, and restoring degraded habitats. These measures are crucial to safeguard the future of fisheries and the livelihoods they support [5, 33]. Improving the state of rivers and inland waters creates a thriving ecosystem for a diverse range of aquatic organisms, including fish. This, in turn, contributes to socioeconomic activity in the communities living around these waters. By improving the condition of these ecosystems, we can not only protect fish stocks, but also support sustainable livelihoods and boost the economy [5, 7]. While adopting strategies such as closing fishing areas and regulating fishing gear can have some initial costs, they can lead to greater returns in the long run. For example, a 12-year study off the coast of Kenya found that restrictions on fishing in certain areas resulted in a significant increase in the catch of high-value fish, leading to higher incomes for fishers. Thus, investments in the long-term sustainability of fisheries can be a sound economic decision [8]. Sustainable fishing regulations have proven effective in promoting stock replenishment. Implementing Measures such as catch restrictions, minimum size limits, and seasonal fishing closures can allow species populations to regenerate, benefiting not only fishers but also consumers and the ecosystem as a whole. By implementing such measures, we can ensure that fisheries are sustainable in the long term, providing benefits for the present and future generations [5]. The case of Lake Albert, Uganda, is a good example of the benefits of fishing restrictions. During a 20-month fishing ban that was put in place between March 2010 and January 2011, fishers in the area observed a significant transformation in the fish population and experienced first-hand benefits from the restrictions. This illustrates how effective policies can have a positive impact on fisheries and the livelihoods of those who depend on them [9]. During the 20-month fishing ban, some fish species that were previously rare became the dominant catch in Lake Albert. This led to a 40% decline in market prices for these fish, illustrating how restrictions on fishing can have a positive impact on fish populations and help keep prices stable for consumers.

A thorough assessment of fishery resources is a key component of sustainable fisheries management and the conservation of aquatic ecosystems. It helps to understand the current state of the fisheries and inform decisions about appropriate management strategies. This can ensure that fishing activities are sustainable and do not negatively impact the aquatic ecosystem [10, 4]. Catch per unit effort (CPUE) is a key indicator in fisheries science that measures the efficiency of fishing gear and provides insights into the abundance and distribution of target species in a given area. By measuring CPUE, scientists and managers can monitor the health of fish populations and make decisions about appropriate fishing practices [11, 12]. he CPUE metric is not only important for understanding changes in fish populations over time, but also for comparing fishing performance between different areas, fisheries, and types of fishing gear. This information is essential for making informed decisions about fishing regulations, conservation measures, and the overall management of fisheries [4]. One factor that has a significant impact on CPUE is the type of fishing gear used. Different gear types have specific characteristics that determine their selectivity, efficiency, and potential impacts on non-target species. For example, cast net tend to be less selective and have greater potential to cause bycatch and damage to the river floor, while longline gear is more selective but may be less efficient in catching target species [10, 4].

To this end, this research examines the concept of catch per unit effort (CPUE) and its role in fisheries assessment. It analyzes the various factors that can influence CPUE, such as the type of fishing gear used. The study also explores the relationship between fishing gear type and CPUE in different fishing sites in the study area, providing insights into how this relationship may vary depending on location.

2. Materials and Methods

Study Area

Mayo Ranewo is located in the southwestern region of Ardokola Local Government Area (LGA) in Taraba State, Nigeria. It is situated at the confluence of River Fan Mangel and the Benue River. The town is approximately positioned between latitude 8°47' to 8°53' N and longitude 10°50' to 10°55' E. According to the National Population Census, Mayo Ranewo has an estimated population of around 11,000 inhabitants [13].

Method of Data Collection

The study was conducted over a 6-month period, from July to December 2022. The research area experiences two distinct seasons, the Dry and Rainy seasons, which directly impact fish production based on the water volume during each season. Additionally, the study area is characterized by wetlands and is surrounded by River Benue, resulting in various landing sites.

To facilitate the research, the study area was divided into three sites: Site A, which involved fishing, farming, washing, bathing, and other commercial activities; Site B, where fishing, farming, and commercial activities occurred; and Site C, where fishing and farming were the primary activities.

The fish specimens utilized for the research were acquired from catch statistics documented at the three primary landing sites located within the study area

The sites were sampled twice monthly for fish species. Sampling was by: Direct observation of the Fish species and gears at the landing sites. Fish identifications, as well as measurements of weight and the number of fishermen, were directly conducted at the landing sites using identification keys provided by Olaosebikan and Raji [14]. These identification keys served as reference guides to accurately classify and measure the fish species encountered during the study

Statistical Analysis

Catch per unit effort was determined using the formula:

$$CPUE = \text{No. of fishing days} \times \frac{Total\ weight\ of\ fish\ caught}{No.of\ boats\ or\ fishermen}$$

3. Result

The result of Gear types used and catch per unit effort is presented in Tables 1–4 below. Table 1 showed that Gill net (Taru), Cast net (Birgi), Lift net (Akauji), Longline (Rincha) and Malian trap (Gura/Malia) are the most preferred fishing gears used by fishermen in Upper Benue River Basin at Mayo Ranewo. Table 2 shows the Catch Per Unit Effort (CPUE) of fish in Study site A recorded between July to December, 2022 ranged between 12.25 to 19.36 kg/hr while table 3 showed that the Catch Per Unit Effort (CPUE) of fish in Study site B ranged between 11.28 to 20.30 kg/hr. Table 4 showed the Catch Per Unit Effort (CPUE) of fish in Study site C, which ranged from 12.78 to 18.13 kg/hr. Throughout the six-month study period, the total weight of fish caught in each month varied across the three landing sites. Site A had a total weight range of 18 to 70.83 kg per hour, Site B recorded 23.48 to 44.00 kg per hour, and Site C showed 27.79 to 42.00 kg per hour. The study also provided insights into the number of fishers involved during the six months across the three landing sites, with a range of 13 to 22 individuals. Additionally, fishing efforts, measured in fishing hours per day, varied from 17 to 29 hours per day. Regarding the average weight of fish caught per fisher per day, the study revealed a range of 16 to 26 kg across all three sites. These findings give valuable information about the fishing activities and productivity levels at each landing site during the study period. September and October have the highest Catch Per Unit effort range of between 19.36 and 20.30 kg/hr for Site 1 and 2 while the lowest catch per unit effort is recorded in August with range of between 11.28 to 12.78 kg/hr

Table 1: Fishing gears used in the study and the fishermen choices

Fishing gears used	Local Name (Hausa)	Site A	Site B	Site C
Gill Net	Taru	+	+	+
Cast net	Birgi	+	+	+
Lift net	Akauji	+	+	-
Longline	Rincha	-	-	+
Malian trap	Malia/Gura	+	+	+

Table 2: Catch Per Unit Effort (CPUE) for site A

Month	No. of Fishers	Hours fishing	No of Days fishing in a Month	Average wt Caught/fisher/day (kg)	No of Days in Month	Catch wt/ month (kg)	Total hours fishing	CPUE kg/hr
July	16	24	20	19	24	6,080	456	13.33
August	14	24	21	22	15	6,468	528	12.25
September	15	20	23	19	25	6,555	380	17.25
October	16	19	23	23	24	8,464	437	19.36
November	14	23	22	19	25	5,852	437	13.39
December	17	22	21	26	23	9,282	572	16.22

Table 3: Catch Per Unit Effort (CPUE) for site B

Month	No. of Fishers	Hours fishing	No of Days fishing in a Month	Average wt Caught/fisher/day (kg)	No of Days in Month	Catch wt/ month (kg)	Total hours fishing	CPUE kg/hr
July	14	23	20	16	24	4,480	368	12.17
August	13	25	21	15	15	4,231	375	11.28
September	15	17	23	19	25	6,555	323	20.30
October	14	19	23	20	24	6,440	380	16.94
November	14	22	22	15	25	4,620	330	14.00
December	15	19	21	25	23	7,875	475	16.57

Table 4: Catch Per Unit Effort (CPUE) for site C

Month	No. of Fishers	Hours fishing	No of Days fishing in a Month	Average wt Caught/fisher/day (kg)	No of Days in Month	Catch wt/ month (kg)	Total hours fishing	CPUE kg/hr
July	17	26	20	24	24	8,160	624	13.07
August	14	23	21	20	15	5,880	460	12.78
September	19	27	23	23	25	10,051	621	16.18
October	22	29	23	22	24	11,132	638	17.44
November	20	26	22	21	25	9,240	546	16.92
December	19	22	21	24	23	9,576	528	18.13

4. Discussion

The current study identified various types of fishing gear employed in fishing activities, such as Gill net (Taru), Cast net (Birgi), Lift net (Akauji), Longline (Rincha), and Malian trap (Gura/Malia). These gear types have been previously recognized in surveys of inland water bodies in Nigeria [4, 15, 16], and they are commonly utilized in different Nigerian locations, including Kainji Lake [15, 17], Lake Alau [18], Lake Chad Basin [19], and Tabatu floodplain [20]. Among these gear types, Gill net and Malian Trap were found to be the most significant and frequently used fishing gear among the fishermen in the study area. This dominance of gill nets and traps, followed by Lift net, has remained consistent since the mid-70s [21]. Gill nets and traps are widely favored in artisanal fisheries in developing countries due to their efficiency, affordability, and capacity to catch economically valuable fish in larger quantities compared to other artisanal gears [22].

The efficiency of these net types is influenced by several factors, such as mesh size, exposed net area, flotation, mesh shape and hanging ratio, visibility, and the type of netting material in relation to stiffness and breaking strength [23, 24, 22]. Despite the popularity of these gear types in Mayo Ranewo, fishermen still switch between different gears during their fishing activities, a practice similar to what has been observed

in other regions like Lake Chad and Nguru-Gashua wetlands of North East Nigeria [19]. For example, a fisherman may own one gill net, one cast net, one set of hook & line, as well as some traps, and they may use any of these gears depending on their preference [19]. This flexibility in gear usage is likely due to the mixed fisheries pattern of the region and the absence of strict fishing regulations, as reported by Tagago and Ahmed [20]. The catch per unit effort (CPUE) analysis in this study revealed that the highest fish catch occurred during September and October. This can be attributed to the high volume of water in the river during the rainy season, leading to the dispersion of fish species across a larger surface area [5]. This discovery is in line with the findings of a study conducted in Ikwori Lake [25], which also reported higher densities of ichthyofauna during September and October. The assumption is that increased water levels and subsequent flooding facilitate reproductive activities, making fish species less susceptible to capture due to restricted movement [5]. This assumption is consistent with the report by Willoughby and Tweddle [26], who observed that early rainfall and rising water levels stimulate spawning activities among most fish species in African water bodies. The monthly variation in CPUE may be related to differences in the number of fishers, the amount of time spent fishing (man hours), and the types of fishing gear used. This correlation agrees with the findings of McClanahan, Kaunda-Arara, and Omukoto [27, 5] in their study on CPUE of closed and open-access landing sites.

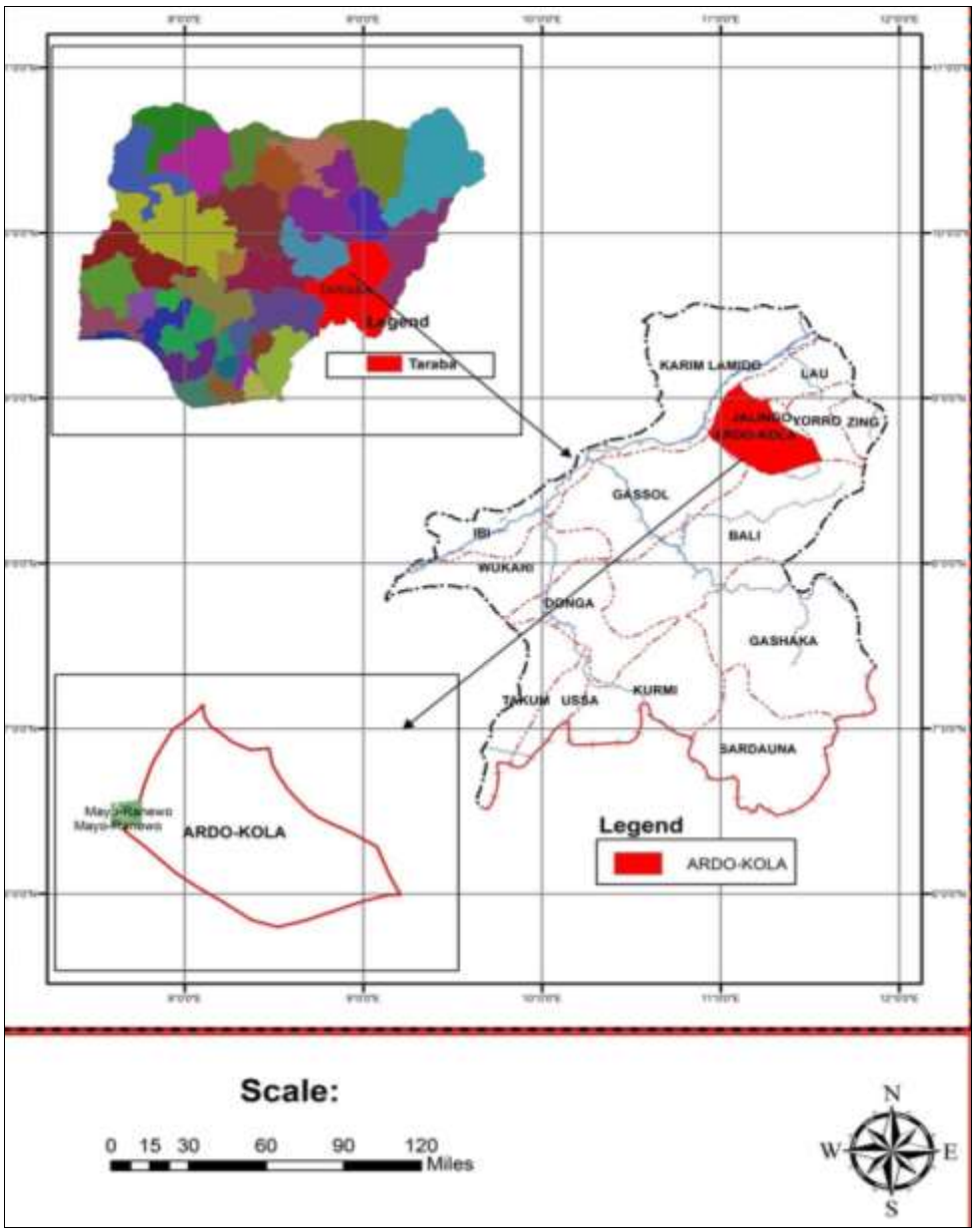

Fig 1: Location Map of the Study area

5. Conclusion

The study investigated the correlation between catch per unit effort (CPUE) and different fishing gear types in River Taraba, Nigeria. The findings indicated that Gill net and Malian trap proved to be the most effective gear types in terms of CPUE. These results hold significant implications for the management of the River Taraba fishery, and they can serve as valuable input to inform policies and regulations aimed at ensuring the long-term sustainability of the fishery. Based on the study's outcomes, it is recommended that fishers be encouraged to adopt more sustainable fishing practices. This may include avoiding fishing in sensitive areas or using less harmful gear types. Furthermore, promoting the use of Gill net and Malian trap fishing gears over other types is

advised, as these gear types were found to be the most effective and sustainable options for fishing in the River Taraba. By implementing these recommendations, the fishery can be better managed, leading to improved conservation and long-term viability of fish stocks in the region.

6. References

1. Kawarazuka N, B´en´e, C. Linking small-scale fisheries and aquaculture to household nutritional security: an overview. Food Security. 2010;2(4):343–357. https://doi.org/10.1007/s12571-010-0079-y.
2. Hicks C, Cohen P, Graham AJ, Nash K, Allison E, MacNeil MA. Harnessing global fisheries to tackle micronutrient deficiencies. Nature. 2019;574:95–98.
3. Food and Agriculture Organization, FAO. The State of World Fisheries and Aquaculture: Sustainability in Action. Food and Agriculture Organization of the United Nations, Rome; c2020.
4. Bonjoru R, Abubakar KA, Bonjoru FH, Ndeham VR, Amadu SO. Capture Efficiency of Some Artisanal Fishing Gears Employed at Upper Benue River Basin, Nigeria. Journal of Applied Life Sciences International. 2019;21(2):1-7. Article no.JALSI.49198
5. Solomon SG, Ayuba VO, Tahir MA, Okomoda VT. Catch per unit effort and some water quality parameters of Lake Kalgwai Jigawa state, Nigeria. Food Sci Nutr. 2018;6:450-456. https://doi.org/10.1002/fsn3.57
6. World Bank. World Development Indicators. Washington, DC: 2004; The World Bank; c2004.
7. Fawole OO. Morphometery diet of mormyrus rume in the Lekki lagoon, Nigeria Rev. Biology Tropical. 2002;50:689–694.
8. Spore. The magazine for Agricultural and Rural development in African, Caribbean and Pacific (ACO) Countries No. 2010, 150. http://spore.cta.int
9. Spore. The Magazine for Agricultural and Rural Development in African, Caribbean and Pacific (ACP) Countries; c2012. http://spore.cta.int
10. Xu P, Mujiao X, Weiguo Z, Anning S. Research on Fishery Resource Assessment and Sustainable Utilization (FRASU) during 1990–2020: A bibliometric review. Global Ecology and Conservation. 2021;29:e01720.
11. Kishor KT, Mrityunjoy KU, Sabuj KM. Diversity of fishery resources and catch efficiency of fishing gears in Gorai River, Bangladesh. Heliyon. 2021;7(12):https://doi.org/10.1016/j.heliyon.2021.e08478
12. Max A. A Catch Per Unit Effort (CPUE) Spatial Metric with Respect to the Western North Atlantic Pelagic Longline Fishery. Master's thesis. Nova Southeastern University. Retrieved from NSUWorks, Oceanographic Center; 2015. p. 36. https://nsuworks.nova.edu/occ_stuetd/36
13. Taraba State Official Diary. A property of Taraba State Investment and Property Limited (TRIP Ltd), Jalingo; c2016.
14. Olaosebikan BD, Raji A. Field Guide to Nigerian Freshwater Fishes. Revised Edition. Published by Lubar Press, Lagos, Nigeria; c2013. p. 450.
15. du Feu TA, Abayomi OS, Seisay MDB. Fishing Gear Survey, Kainji Lake, Northern Nigeria. Nigeria German Kainji Lake Promotion Technical Report; c1997. p. 6-20.
16. National Institute for Freshwater Fisheries Research, NIFFR. National surveys of fishing gears and crafts on Nigerian inland water bodies. NIFFR occasional paper No.4.ix, 2002, p 4. ISSN 0794-2451, ISBN 978-177-051-1.
17. 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; c2014.
18. Bankole NO, Raji IA, Adikwu OA, Okwundu EC. Fishing gear survey of Lake Alau, In: A.A. Eyo and E.A. Ajao (Eds), Proceedings of the 16th Annual Conference of the Fisheries Society of Nigeria (FISON). Maiduguri, 4th-9th November; c2001. p. 99-103.
19. 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; c2000. p. 229-243.
20. Tagago TA, Ahmed YB. Fishing gear survey of Tatabu floodplain, In: R.J. Koko and A.M. Orire (Eds), Proceedings of the 26th Annual Conference of the Fisheries Society of Nigeria (FISON). 28th November-2nd December, Minna, Niger State, Nigeria; c2011. p 109-116.
21. Seisay MDB. The cast net fishery, Kainji Lake, Nigeria, 1970-1997. Nigerian- German (GTZ) Kainji Lake fisheries promotion project Technical Report Series. 1998;12:28. ISSN: 1119- 1449:
22. 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.
23. Binyotubo TE. A Guide to Fishing Gear Technology. National Institute of Freshwater Fisheries Research, New-Bussa, Niger State, Nigeria. c2011. p.345.
24. Emmanuel BE. The artisanal fishing gears, crafts technology and their efficiency in Lekki lagoon, Nigeria. Unpublished Ph.D. Thesis. University of Lagos, 2009; 256p.
25. Offem BO, Ayotunde EO, Ikpi GU, Ochang SN, Ada FB. Influence of seasons on water quality, abundance of fish and plankton species of Ikwori lake, South Eastern Nigeria. Fisheries and Aquaculture Journal. 2011;13:1-18.
26. Willoughby NG, Tweddle D. The Ecology of the catfish *clarias gariepinus* and *clarias senegalensis* in the shire valley. *Malawi journal of zollogy*: London. 1978;186:507–534.
27. McClanahan TR, Kaunda-Arara B, Omukoto JO. Composition and diversity of fish and fish catches in closures and open-access fisheries of Kenya. Fisheries Management and Ecology. 2010;17:63-76. https://doi.org/10.1111/j.1365-2400.2009.00717.x
28. OECD/FAO. Agriculture in Sub-Saharan Africa: Prospects and challenges for the next decade", in OECD-FAO Agricultural Outlook. 2016-25, OECD Publishing, Paris. DOI:http://dx.doi.org/10.1787/agr_outlook-2016-5-en
29. FAO. The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation. Rome, FAO; c2022. https://doi.org/10.4060/cc0461en
30. WorldFish Center. Fisheries and the Millennium Development Goals: Solutions for Africa. WorldFish Center, Penang, Malaysia; c2005.

31. Béné C, Heck S. Africa and West Asia Programme. WorldFish Center – Egypt. NAGA, WorldFish Center Quarterly. 2005;28(3):4.
32. Belton B, Shakuntala HT. Fisheries in transition: Food and nutrition security implications for the global South. Global Food Security. 2014;3:59–66.
33. Welcomme RL, Bartley DM. An evaluation of present techniques for the enhancement of fisheries. Available at: https://www.fao.org/3/W8514E/W8514E01.htm.