**Impact of artisanal fishing gears on the fisheries stock of Lake Geriyo, Adamawa State, Nigeria**

**ABSTRACT**

This study was carried out to ascertain the Impact of artisanal fishing gears on the fisheries stock of Lake Geriyo**,** Adamawa State, Nigeria. The study was conducted monthly for four months from August to November, 2023. In the conduct of this study, both primary and secondary methods of data collection were used. A total of Eighty (80) respondents were sampled with structured interview and questionnaire. Data obtained were analysed with descriptive and inferential statistics. There were seven different fishing gears employed by fishermen to exploit fish in Lake Geriyo. Most prominent of the gears are the gill net and Cast net. Fish are abundant during the rainy season but catch quantities and sizes are decreasing. There were some missing fish species in Lake Geriyo. Most fishermen were not aware of any law that forbids catching of small-sized fish. Among various reasons for catching smallsized fish include: abundance and monetary gains. The study also revealed that thirteen (13) fish species from seven (7) families were caught by the seven artisanal fishing gears in the Lake. 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. Therefore, fishermen should be encouraged to fish responsibly for the sustainability of Lake Geriyo fisheries. Addressing these issues will require a combination of stricter fishing regulations, better enforcement mechanisms, and the promotion of selective fishing gear to prevent the depletion of fish populations.

**Keywords: F**ishing gear, fisherfolks, Fisheries Stock, Lake Geriyo

**Introduction**

Artisanal fisheries constitute the most important fisheries sector in the world and contribute majorly to the fish supply in the developing world. According to Bonjoru *et al.* (2019) “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” (Ogunbadejo *et al*., 2007). “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” ( Bonjoru *et al.*,2019). “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” (Tzihe *et al*., 2022; FAO, 2002). “Many fish stocks are now classified as overfished due to continuous overfishing and use of obnoxious fishing methods such as the use of small mesh size, unselective fishing gears, fish poisons and explosives” (Olapade *et* *al*., 2017, Ajagbe *et al*., 2020). “These types of fishing methods are not ecosystem friendly and responsible. This is in contrast to FAO code of conduct which states that the right to fish carries with it the obligation to do so in a responsible manner to ensure effective conservation and management of the living aquatic resources” (Tzihe *et al*., 2022).. “Therefore, fisheries management should adopt measures to protect biodiversity of aquatic habitats and ecosystems and ensure that endangered species are conserved and protected” (FAO, 1995).

“Artisanal fish production statistics in Nigeria is poor; the data is unreliable” (Tizhe *et al*., 2022). “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” (Ibrahim, *et al.* 2015). 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) “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. The amount of catch in Lake Geriyo 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 that 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” (Tizhe *et al*., 2022).

“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 this present work, therefore, is to assess the impact of artisanal fishing gears on the fisheries stock of Lake Geriyo, Adamawa State”. (Tzihe *et al*., 2022).

 **METHODOLOGY**

**Study Area**

The research was conducted in Lake Gerio Yola**-**North Local Government Area of Adamawa State, Nigeria. It lies between longitude 12º and 12º 28′ east of Greenwich and Latitude 9º16′ and 9º19′ north of the equator. The area is between 150 and 180 m above sea level. It is bounded in North-East by the River Benue, Jimeta in the South West and Namtari Forest Reserve on the West. Yola falls within savannah climate with distinct wet and dry season (Adebayo and Tukur, 1999). It has a total population of 199,674 persons (NPC, 2006). The area has a mean annual temperature of 34.6ºC, the coldest and driest months are December and January with an average temperature of 15.2º and relative humidity drops to 13% during these periods. The hottest months are March and April which has an average temperature of about 42.8ºC. The mean annual rainfall is 79mm in the northern part and 197mm in the southern part of the state. The wettest months are August and September (Adebayo and Tukur, 1999). Yola North is bounded by Girei Local Government Area to the north and Yola South to the South, East and west (Fig 1).

**Figure 1; Map of Lake Gerio (the study area)**

Source: Adamawa Geographic Information Systems (AGIS), Laboratory Geography department MAUTECH, 2019.

**Sampling units and Methods of data collection**

The research was conducted in fishing village of Lake Geriyo at the landing site. The study was conducted monthly for the period of four months (i.e August to November, 2023). 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.

**Population, Sampling method, Questionnaire and Focus group discussion**

Random sampling technique was used to administer interview guides on the fishers in the fishing village. The interview guide was designed to collect information on status of fishery resources, socio-economic characteristics, fishing gears, different catch using the gears andconstraints faced by fisher folks in Lake Geriyo. The interview guides were administered with respect to the number of fishermen in the fishing village. Out of 90 structured interview guides administered, 80 were elicited and analysed. Also, focus group discussion (FGD) and observation were employed to obtain more information about the fishers and fishing activities.

**Data Analysis**

Data obtained from interview guide, observations and contact interview were analysed with descriptive and inferential statistics using IBM SPSS Statistics 20. The response of the fishermen in each variable were weighted e.g. Yes = 1; No = 0 and in multiple answers 1, 2, 3.. Then these were summed up together and analysed with aid of SPSS.

**RESULTS**

**Socio-economic characteristics of the artisanal fishers in Lake Geriyo**

The socio-economic characteristics of the respondents are presented in (table 1). According to the result, majority of the respondents in the study area were males (83.75%) while females were only 16.25%. Fisherfolks with age range between 31-40 years old recorded the highest value (40.00%) while fisherfolks with age range between 20-30 years old had the least value (13.75%). The respondents (50.00%) attended secondary education while the least respondents (5.00%) attended tertiary education. Majority of the respondents (45.00%) were single while widowers were the least (20.00%) among the fisherfolks analyzed. Household size range of 4-6 recorded the highest value (46.25%) while that of 1-3 recorded the least (21.25%). Most of the respondents (41.25%) in the study area had 6-10 years’ experience while respondents (11.25% ) had 1-5 years’ experience in fishing.

**Table 1: Socio-economic Characteristics of the Respondents (n=80)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables |  Frequency. | Percent  |   |  |
| **Sex**Male 67 83.75Female 13 16.25**Age**<20 020-30 11 13.7531-40 32 40.0041-50 21 26.25 51 and above 16 20.00  |  |
| **Education**FSLC 20 25.00Secondary 40 50.00 Quranic 16 20.00Tertiary 4 5.00  |  |
| **Marital Status**Single 36 45.00 Married 28 35.00Widow 16 20.00**Household Size**1-3 17 21.254-6 37 46.25 7 and above 26 32.50**Fishing Experience**1-5 9 11.256-10 33 41.2511-15 27 33.7515 and above 11 13.75**Total 80 100** |  |

**Different types of fishing gears used in Lake Geriyo**

The different types of fishing gears used by fishers in the study area is presented in Table 2. A total of 7 different gear types were identified and the commonest ones used by fishers at the study area were Gill net (*Taro*), Cast net (*Birigi*) and Hooks and line (*Kujiya*). The other gears included Traps (*Gura*), surrounding net, fishing fence and lift net (*Atala*). Gill net was the most important gear type used by the fishers (22.39%), surrounding nets and lift nets fishing gears were only used by a few respondents. Individual fisher claimed that gill net are more efficient, followed by cast net and hook and line respectively. Cast net and hook and line had quite similar trends among the fishers, the percentage usage of these gears are very close.

**Table 2: Different types fishing gears used in Lake Geriyo**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables |  Frequency. | Percent  |   |  |
| Gill net 30 22.39Cast net 27 20.15Hooks and line 24 17.91 |  |
| Traps (*Gura*) 20 14.93Surrounding net 12 8.96Fishing fence 7 5.22lift net (*Atala*) 14 10.45 |  |
| **Total 134 100** |  |
|  |  |

**Determination of different catch made using the gears**

The different catches made using the seven (7) different gears identified in the study area as presented in Table 3. A total of seven (7) families of fish and thirteen (13) species of fishes were identified during the study period. The fish species abundance revealed that *Oreochromis, niloticus* was the highest with (486), followed by *Clarias gariepinus* (350) while the lowest were *Synodontis budgetti* and *Heterobranchus bidorsalis* with (12) and (13) respectively.

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

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Family/species | Gill net | Cast net | Lift net | Surrounding net | Traps (*Gura*) | Hooks and line | Fishing fence | Abundance |
| Cichlidae |  |  |  |  |  |  |  |  |
| *Oreochromis niloticus* | + | + | + | + | + | + | + | 486 |
| *Sarotherodon galileus* | + | + | + | + | + | + | + | 222 |
| *Coptodon zilli* | + | + | + | + |  + | + | + | 80 |
| Claridae  |  |  |  |  |  |  |  |  |
| *Clarias gariepinus* | + | + | + | + | + | + | + | 350 |
| *Heterobranchus bidorsalis* | + | + | + | + | + | + | + | 13 |
| Claroteidae |  |  |  |  |  |  |  |  |
| *Auchenoglanis occidentals* | + | + | + | + | + | + | + | 24 |
| Alestidae |  |  |  |  |  |  |  |  |
| *Alestes spp* | + | + | + | + | + | + | + | 344 |
| *Hydrocynus forskalii* | + | + | + | + | + | + | + | 298 |
| Citharinidae |  |  |  |  |  |  |  |  |
| *Citharinus citharus* | + | + | + | + | + | + | + | 27 |
| Mormyridae |  |  |  |  |  |  |  |   |
|  *Mormyrops anguivoides* | + | + | + | + | + | + | + | 14 |
| *Mormyrus rume* | + | + | + | + | + | + | + | 10 |
| Mochokidae |  |  |  |  |  |  |  |  |
| *Synodontis schall* | + | + | + | + | + | + | + | 45 |
| *Synodontis budgetti* | + | + | + | + | + | + | + | 12 |

**Fisheries status of Lake Geriyo**

The results in Table 4 revealed the status of fisheries in Lake Geriyo. Majority (80%) of the fishers indicated that there is abundant catch of fish during the raining season. (56.25%) of fishers indicated that there were some fish species that are missing among the fish resources in Lake Geriyo. Fishers indicated high abundance of some fish species in the early history of Lake Geriyo but their abundance has decreased. Majority of the fishers disagreed that catch quantity and sizes are increasing. The result showed that 53.2% of fishers catch all sizes of fish against 28.75% of fishers caught small sized fish. (50%) of the fishers indicated that small-size gillnet was used to catch small sized fish, while 21.25% indicated trap. Among various reasons for catching small-sized fish include: small sized fish are in abundant (38.75%), fishermen catch small sized fish when they are in need of money (10%) and they catch small-sized fish due to the design of their fishing gears (51.25%). Majority (62.50%) were not aware of any law that forbid catching of small-sized fish. Many (55%) fishers have more than 61% of their catch as small-size fish.

**Table 4: Fisheries status of Lake Geriyo**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** |   | **Frequency** **(n=80)** | **Percentage (%)**  |
| Abundant catch of fish: Rainy season 64 80.00 Dry season 10 12.50  Both 6 7.50Some fish are missing: Yes 45 56.25 No 35 43.75Catch quantity is increasing: Yes 23 28.75 |
|  No 57 71.25Catch size is increasing: Yes 26 32.50 No 54 67.50Size of fish catch: Small size 23 28.75 Medium 15 18.75 All sizes 42 52.50 Fishing gear catching Gill net 40 50.00small sized fish: Cast net 2 2.50 Hook and line 7 8.75 |
|  Trap 17 21.25 Surrounding net 2 2.50 fishing fence 11 13.75 lift net 3 3.75Reasons for catching Small fishes are abundant 31 38.75small fish: In need of money 8 10.00 The gear type 41 51.25Law forbid catching of Yes 30 37.50 of small fish: No 50 62.50 % of small sized fish in 0-20 8 10.00Catch: 21-40 11 13.75 41-60 17 21.25 > 60 44 55.00 |
|  |

**Constraints faced by fisher folks in Lake Geriyo**

Fishers in Lake Gerio identified a number of challenges to their occupation, but (17.28%) stated high costs of fishing materials, followed by theft of gear and lack of access to credit facilities, were the most important. Others include decline in fish caught in recent time, lack of good fishing materials and inability to repair craft and gear (Table 5).

**Table 5: Constraints faced by fisher folks in Lake Geriyo**

|  |  |  |
| --- | --- | --- |
| **Challenges**  | **Frequency**  | **Percentage(%)** |
| Lack of access to credit facilitiesHigh cost of fishing materialsStealing of fishing equipment/catchesCatch declineInadequate of fishing materialsInability to repair craft and gearFloodWater currentProblem of water plantFish spoilagePoor durability of fishing materialsGear inefficiency**Grand total**  | 19 282519142168116311**162**  | 11.7317.2815.4311.738.641.239.884.946.793.701.856.79**100** |

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**DISCUSSION**

The results obtained on the demographic characteristics of the respondents in Table 1, majority of the respondents in the study area were males (83.75%), which revealed 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 agree with the findings of Dauda *et al.* (2018). “Most of the respondents in the study area (40%) were within their active age (31-40 years), which could enhance productivity since age is an important factor that affects fishing productivity” (Nwabeze and Erie, 2013). At this age range, fishers have been reported to be more active and fishing becomes attractive business as reported by Nwabeze and Erie (2013). 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). Majority of the respondents have fishing experience 6-10 years (41.25%). Individuals with extensive fishing experience often contribute significantly to the local fisheries. They may possess traditional knowledge, sustainable practices, and insights into fish behavior, which can enhance the overall productivity of fishing activities.

“The fisher in the study used different gears ranging from cast nets, gill net, lift net, Traps (*Gura*), Fishing fence, Surrounding net, Hooks and 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” (Tizhe *et al*., 2022; Tagago *et al*., 2011). The findings of this study are in line with the findings of Ibrahim *et al.* (2015) who opined that “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”. Tizhe *et al*. (2022) and Alegbeleye *et al*. (2003) 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 fishers in the Northern part of Nigeria followed by long lines and cast nets” (Emmanuel, 2019). Generally, Malian traps are not destructive to 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 agree with the findings of Ibrahim *et al.* (2009) 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”.

Thirteen (13) fish species from seven (7) families were caught by the seven (7) artisanal fishing gears in the area (Table 3). Majority of the species caught in the study areas were 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 are similar to that of Dauda *et al.* (2018) . Also, the findings shows that *Cichlidae* had the highest number of fish catch while the least were *Mochokidae*. This agree with the findings of Solomon *et al.* (2009).

As indicated in Table 4 a significant majority of respondents (80%) observed that fish catches were more abundant during the rainy season, whereas only 12.5% reported similar abundance in the dry season. This pattern is consistent with research in Nigeria, which suggests that the rise in water levels and nutrient enrichment during the rainy season create favorable conditions for fish reproduction and growth as also observed by Adebayo and Adedeji, (2017). In contrast, the dry season, characterized by reduced water levels and increased fishing pressure, likely contributes to the decline in fish abundance (Owolabi *et al.*, 2020). A decline in fish biodiversity is another concern, as 56.25% of respondents reported that certain fish species were missing. This loss could be attributed to factors such as overfishing, habitat destruction, and changing climatic conditions, which have been similarly documented by Udo and Ekpo, (2016). Furthermore, the study found that 71.25% of respondents noted a decrease in the overall quantity of fish caught, while 67.5% observed a reduction in fish size. This decline in fish stocks may stem from excessive fishing pressure, the capture of juvenile fish before they reach reproductive maturity, and the widespread use of non-selective fishing methods (Ezenwaji and Okey, 2019). The size composition of fish catches varied among respondents. While 52.5% reported catching fish of all sizes, 28.75% primarily caught smaller fish. This trend could be linked to the type of fishing gear used, as the study found that 50% of respondents relied on gill nets, which are known for trapping fish indiscriminately. Other fishing methods included traps (21.25%), fishing fences (13.75%), and hook and line (8.75%). The study further revealed that 51.25% of respondents identified their fishing gear as the primary reason for catching small fish, while 38.75% attributed it to the natural abundance of small fish in the lake. Similar findings have been reported by Akinrotimi *et al.,* (2021), where the type of fishing gear plays a crucial role in determining the size of fish caught. The issue of regulatory enforcement also emerged in the study. A significant proportion (62.5%) of respondents stated that there were no laws prohibiting the capture of small fish. The absence of strict regulations may be contributing to the continued decline in fish populations and the predominance of small-sized fish in catches. More than half (55%) of respondents indicated that over 60% of their catch consisted of small fish. This aligns with research in by Adewumi and Olaleye, (2022), which highlights the growing trend of juvenile fish dominance due to unregulated fishing activities and inadequate enforcement of conservation measures Overall, the findings from Lake Geriyo paint a worrying picture of declining fish stocks, shrinking fish sizes, and the prevalence of juvenile fish in catches. These trends are consistent with broader research on Nigerian inland fisheries, which identifies overfishing, weak regulatory frameworks, and environmental changes as key challenges to sustainable fishery management (Ajani *et al*., 2020).

“The challenges confronting the fishers at Lake Geriyo are not new, but are common to other inland water fisheries in the country and other developing countries of the world. This might suggest that these are the major problems encountered by artisanal fishers in most parts of Nigeria” (Kwen *et al*., 2013). “Most of these challenges has been documented, and they are well represented in the literature” (Kingdom *et al*., 2008; Kingdom and Kwen, 2009; Tagago and Ahmed, 2011). “Results have been made to resolve some of these challenges by the government but lacked continuity” (Ita, 1982). Lack of access to credit facilities to purchase fishing inputs is a problem often raised by the fishers in the region and has been highlighted by kwaji *et al.,* (2015) in artisanal fisheries in Lake Ribadu.

**Conclusion**

Fisheries in Nigeria are a common property resource. As such, they are subject to possible over-exploitation in the absence of proper management. The fishing gears employed and operated in the study area are used to capture different fish species. The most prominent of the gears are the Gill-net and Cast net. Cast net is used and selects suitable water body and thus fishers 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. This is due to non-selectivity of most of gears used for the exploitation of fish in the Lake. Fishing regulations are not fully enforced. Most fishermen use lower mesh size below the recommended size. This encouraged exploitation of fish that had not recruited into Lake Geriyo fisheries. Therefore, the fishers of Lake Geriyo should be trained on the consequence of their activities on fishery resources. Thirteen (13) fish species from seven (7) families were caught by the seven artisanal fishing gears in the lake. The study revealed obvious neglect of the artisanal fisherfolks in terms of infrastructural facilities despite their immense contribution to the domestic fish output. They should be encouraged to fish responsibly for sustainability of Lake Geriyo fisheries.

Addressing these issues will require a combination of stricter fishing regulations, better enforcement mechanisms, and the promotion of selective fishing gear to prevent the depletion of fish populations.

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