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Research paper

A Study on the Environmental Impact of Fishers Activities in Kiri Dam, Shelleng Local Government Area, Adamawa State, Nigeria

***[1]Amos, J. T., [2]Ali, Ja'afaru, [1]Agbo, O. J., [1]Dawuda, B. M. and [3]Stephen, F. T.**

[1]Department of Biological Sciences, Faculty of Pure and Applied Sciences, Federal University Wukari, Taraba State, Nigeria.
[2]Department of Zoology, School of Life Sciences, Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria.
[3]Department of Fisheries and Aquaculture, Faculty of Agriculture and Life Sciences, Federal University Wukari, Taraba State, Nigeria.
*Corresponding Author E-mail: jummaiat@gmail.com

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The study was conducted to determine the environmental impact of fishing activities in Kiri Dam, Shelleng Local Government Area of Adamawa State, Nigeria. Fishers were randomly selected through stratified sampling techniques using a structured questionnaire and a scheduled interview was administered to 360 respondents as sample size. Descriptive analysis such as frequency counts and percentage distribution were used for data analysis and 4-point Likert Scale rating was used to calculate the mean score. The highest respondents on educational level had 40% secondary education. 19.44% respondents had the highest combination of gear type used which was Gillnet and Hook and Line. *Citharinus citharus* species were found to be the most threatened (17.78%), while the cause of the disappearance of some species was attributed to water pollution (14.17%). The effectiveness rating of fishing regulations showed that, ban on the use of poison was very effective with a mean score of 3.77 and payments of revenue mean score of 3.10. There is, therefore, the need for urgent involvement of the government to enforce regulations guiding such water bodies and dams to ensure conservation.

Keywords: Kiri Dam, Fishing gear, Environment, *Citharinus citharus,* Water pollution

INTRODUCTION

The current pressure for ecosystem based on fishery management is pushing managers particularly expert fisheries to address the environmental impact of fishing activities. According to the Food and Agricultural Organization of the United Nations, a quarter of the world's Fish stocks are fished at an unsustainable level. Half of all stocks are fully exploited, with no scope for further increases in catches (FAO, 2005a). The ability of these stocks to recover from human pressure or from natural disturbances is severely compromised. Reports indicate that about 90 million people in the world depend on fish for their daily source of protein and as a source of income (FAO, 2005b). In developing countries, fish consumption provides about 19 percent of the protein intake. Food and Agriculture Organisation (FAO, 2003) reports that the nature of inland fisheries is changing. The threat of the collapse of major global fisheries and ecosystem has caused a strong international reaction. Wrong methods of fishing pollute and otherwise damage natural environments, including fish habitats, bringing significant change to the life of residents. As a result of increasing environmental damage, there have been calls by some conservation groups for restrictions on some or all the activities that affect these inland waters. These restrictions sometimes benefit fisheries, but may also limit fishing and, as a result, cause problems for fishing communities.

There is widespread concern that Nigeria`s arid zone

fisheries are overexploited (NEAZDP, 1991), resulting in a loss of socio-economic benefits, to the rural community involved. Factors such as increasing commercialization of fisheries production are thought to have contributed to the eradication of traditional management system, while the modern management system have proved to be unworkable for various reasons such as poor government funding for the fisheries administration, ineffectiveness of fishing regulations among others (Madakan and Ladu, 1996). According to FAO (2000) the role of management institutions is to: collect information, analyze information, ensure participation of stakeholders, provide training and capacity building, ensure coherence of local management plans with national policy objectives, monitor, control and put in place surveillance to encourage compliance with the fishing regulations. The activities of the fishers contribute to the nation economy by ways of fishing, type of fishing gear used, species caught, method of processing and preservation, transportation and marketing of the stock (FAO, 1999). The potentials of fisheries to modify ecosystem cannot be over emphasised because fishing has altered a lot of target resources and species associated with or dependent on the targeted resources as well as trophic relationships within the ecosystem in which the fishing occurs. The fishing sector is progressively adopting economical technologies and approaches to environmentally acceptable fishing practices. Although the prospects for improvement are good, much remains to be accomplished to make fisheries resources both renewable and sustainable (FAO, 2014). There is the need for awareness on environmental impacts of fishing activities which greatly increased both in the fisheries sector and among the public (FAO, 1999), hence, the need to ascertain these facts. The objective of this study was to determine the environmental impact of fishing activities in Kiri Dam in Shelleng Local Government Area of Adamawa State.

MATERIALS AND METHODS

Study area

Kiri Dam is in Kiri village built on River Gongola in Shelleng Local Government Area of Adamawa State, is about 20Km away from Numan town, (Figure1). It has an estimated terrain elevation of 158m above sea level, located on latitude 9° 40' 47" N and longitude 12° 0' 51.01" E. The Dam which is 1.2km long, 20m high zoned embanked within an internal clay blanket. The reservoir was mainly completed in 1982. The reservoir has a capacity of 615 million m^3 (U.B.R.B.D.A, 2012).

Sampling techniques

A combination of descriptive and analytical approaches was employed in the methodology used in this study. The data was collected from interviews and observations on the fishers' activities along the reservoir area with the help of a schedule containing both structured and unstructured questions. The fishers were randomly selected using the stratified sampling technique and 362 structured questionnaires were administered to the respondents for the study at three different locations. Planning was made for field visits combined with resource persons including the Fishery Officer and leader of the fishers (Sarki Ruwa) and the objectives of the study were made clear to them. Further enquiries and observations were made during subsequent visits to the reservoir. Various field exercises were conducted to gather information like population, dependency on reservoir, uses of the canoe, types of fishing gear among others. The identification of the fish species was done using Babatunde and Raji, (2013). Secondary data were also collected from newspapers, fisheries bulletins, and journals and published books.

Data analysis

Data was analyzed descriptively which involved frequency counts and percentage distributions. Using a 4-point Likert Scale rating (very effective, effective, ineffective and very ineffective) to determine fishing regulations with the calculated mean, items that had mean scored of 2.50 and above were rated as effective, while less than 2.50 were ineffective (Boone and Boone, 2012).

RESULTS

Distribution of respondents by educational level

Figure 2 shows the educational level of fishers. The secondary level had the highest respondents with 144 (40.0%) and the least 8 (2.22%) were uneducated.

Types of gear combinations used by fishers in Kiri Dam

Table 1 shows different types of fishing gear used in Kiri Dam. Result showed that Gillnet, Hook and Line combination was the highest, 70(19.44%) and the least combination was gillnet, hook and line, double-chambered cane trap was 2(0.56%).

Effectiveness of fishing regulations

Table 2 shows the effectiveness of fishing regulations in kiri Dam. The highest mean score of 3.24 indicated that, ban on the use of poison was very effective. While restricted season and area had the least mean score of

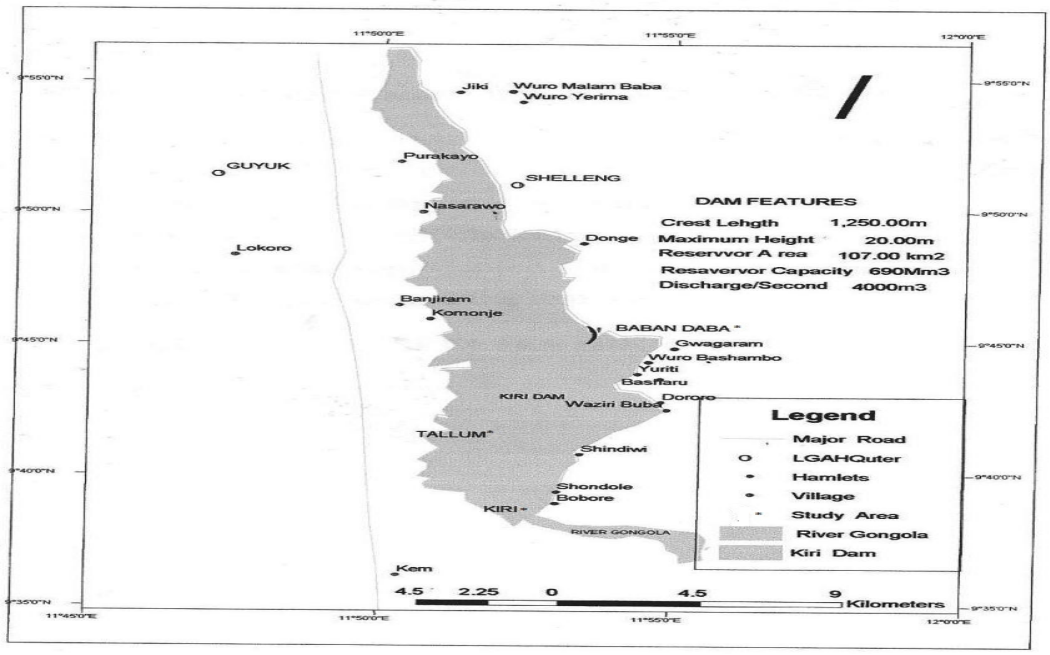

Figure 1. Map of Shelleng LGA showing Kiri Dam.

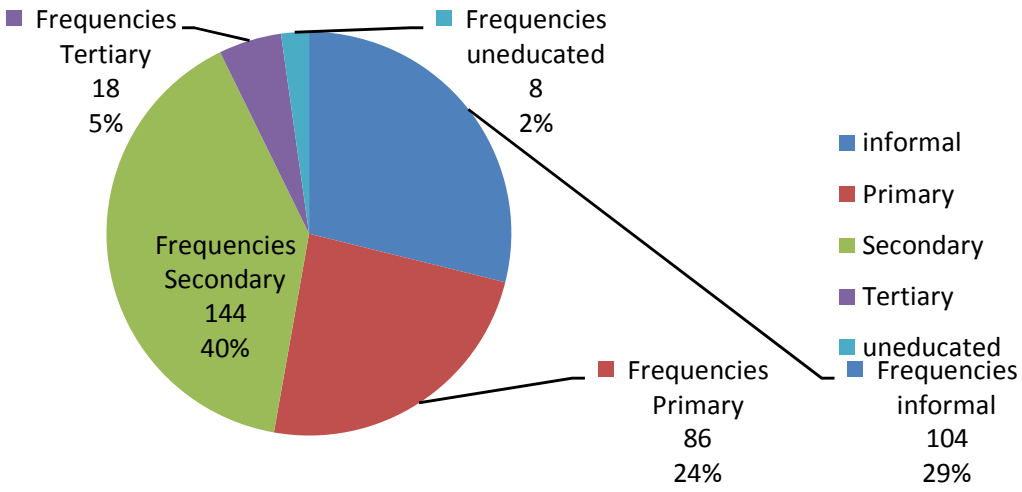

Figure 2. Distribution of respondents by educational level.

1.19 indicated ineffectiveness.Table 3 shows the species of fishes that were threatened in the study area. About 64(17.78%) said that *Citharinus citharus* were the most threatened species while only 2(0.56%) of the respondent agreed that *Labeo senegalensis*, *Petrocephalus bane*, *Heterotis niloticus* and *Mormyrus macrophthalmus* were threatened respectively.The remaining of the respondents said 166 (46.11%) of the species were not threatened.

Causes of threat to fish species

Table 4 shows the causes of threat to fish species. The result showed, 51(14.17%) responded that, pollution by human activities was responsible for the threat to the fish species while only 8 (2.22%) responded that over

Table 1. Combination of gear used by fishers in Kiri Dam.

Combination of gear	Frequency	(%)
Gillnet	61	16.94
Hook and Line	6	1.67
Dragnet	19	5.28
Gillnet, Hook and Line	70	19.44
Gillnet, Dragnet	39	10.83
Gillnet, Cast net	12	3.33
Gillnet, Woven trap	3	0.83
Hook & Line, Dragnet	6	1.67
Gillnet, Hook and Line, Dragnet	55	15.28
Gillnet, Hook and Line, Cast net	24	6.67
Gillnet, Hook and Line, Woven trap	3	0.83
Gillnet, Malian trap, Woven trap	5	1.39
Gillnet, Hook and Line, Hooks and Lines	3	0.83
Gillnet, Dragnet, Cast net	20	5.56
Gillnet, Hook and line, Double-chambered cane trap	2	0.56
Gillnet, Hook and Line, Dragnet, Cast net	32	8.89
Total	360	100

Table 2. Effects of fishing regulations

Regulation	Very effective	Effective	Ineffective	Very ineffective	Mean Scores
Ban on use of poison	292(3.24)	58(0.48)	10(0.05)	0(0.00)	3.77
Prohibition of fence	145(1.61)	42(0.35)	68(0.37	27(0.07)	2.40
Gear control	19(0.21)	93(0.77)	86(0.47)	162(0.45)	1.90
Fishing frequency	15(0.16)	31(0.25)	175(0.97)	139(038)	1.76
Payment of Revenue	132(1.46)	164(1.36)	38(0.21)	26(0.07)	3.10
Restricted season and area	0 (0.00)	8(0.06)	59(0.32)	293(0.81)	1.19

population of the fisher's exploitation and flooding of the Dam were responsible for the threat in each case.

Frequency of fishing in relation to quantity of fish caught per day

Table 5 shows the frequency of fishing in relation to quantity of fish caught per day in the Dam. Those that enter twice daily had the highest respondents 252(70%), followed by once daily with 72(20%) and the lowest was thrice daily 36(10%).

DISCUSSION

The result (Figure 2) indicated that educational level of the fishers with majority having secondary education (40%) and the least percentage were uneducated (2.22%). Similar observation was made by Faishal *et al.* (2015) who reported that educational qualification deeply influences individual preferences and behavioural patterns which in turn influences one's performances, skills and capabilities. Rabbani, (2007) having observed that majority of the fishers in his survey had only attended primary and secondary levels of education, mentioned that fishers were compelled to enter the fishing profession in their early stage due to poor economic status of their parents and lack of awareness about education. These findings disagree with the finding of Islam *et al.* (2013) who reported that majority of the fishers in his survey were illiterate with 48%, constituted the highest percentage of the total fishers sampled. This could be due to difference in location and awareness as maintained by Faishal *et al*. (2015).

The result reveals that gillnet was the commonly used gear in Kiri Dam. This could be as a result of availability, low cost and number of fishes they caught. The combination of gear types used by fishers' reveals that gillnet and hook and line had the highest percentage (19.44%) while the lowest combination was gillnetted, hook and line and doubled chamber cane trap (0.56%). It was observed during this research that the materials used in the construction of these fishing gear and crafts were locally made and available. These materials were trunks of hard woods, palms, vines, canes, lianas, reeds, grasses, barks of plants and trees, as well as nylons. This agrees with the works of Reed *et al.* (1967), and Udolisa, (1995) who reported that, the cost of making these gear and crafts is low, therefore, could easily be afforded by most traditional fishers. This places traditional

Table 3. Fish species threatened in the Dam.

Scientific name	Hausa name	Frequency	Percentage
Citharinus citharus	Pallia	64	17.78
Lates niloticus	Giwan ruwa	10	2.78
Marmyrops deliciosus	Milgi	4	1.11
Bagrus docmac	Dinko	46	12.78
Bagrus bayad macropterus	Doza	4	1.11
Labeo senegalensis	Bakin data	2	0.56
Alestes nurse	Kawara	4	1.11
Petrocephalus bane	Farinwata	2	0.56
Clarotes macrocephalus	Barushe	2	0.56
Heterotis niloticus	Bargi	8	2.22
Labeo cabie	Domi	4	1.11
Chrysichthys longifilis	Sarkinkwata	4	1.11
Mormyrus macrophthalmus	Gandaga	2	0.56
Aphysosemion calliurum	Dono	10	2.78
Heterobranchus bidorsalis	Jerri	28	7.78
None		166	46.11
Total		360	100

Table 4. Causes of the threatened fish species.

Causes	Frequency	Percentage
Water Pollution	51	14.17
Blockage	49	13.61
Overfishing	18	5.00
Gears used	24	6.67
Over population	8	2.22
Flooding	8	2.22
Poison	20	5.56
Torchlight& stick	16	4.44
None	166	46.11
Total	360	100

Table 5. Frequency of fishing in relation to quantity of fish caught per day.

No.of fish caught	1 time No (%)	2 times No (%)	3 times No (%)	Total (%)
1-200	50(26.31)	120(63.16)	20(10.53)	190(100)
201-400	8(13.11)	47(77.05)	6(9.84)	61(100)
401-600	0(0.00)	22(84.61)	4(15.38)	26(100)
601-800	0(0.00)	6(60)	4(40)	10(100)
801-1000	4(20)	14(70)	2(10)	20(100)
›1000	10(18.87)	43(81.13)	0(0.00)	53(100)
Total Quantity	72(20)	252(70)	36(10)	360

gear and crafts at an advantage over the improved and imported fishing gear, which are costly and cannot be afforded by our poor fishers.

The result reveals that ban on the use of poison and payments of revenue were effective regulations, this could be because of the effect of poison on both the fish stock and human being which could hamper on their health. The ineffectiveness of the fishing regulations could be due to lack of alternative livelihood thereby causing the fishers to frequent the reservoir, it could also be negligence on the side of the government to enforce and monitor the fishing practice in the reservoir. The mesh of fishing gears used could cause drastic effect on the reservoir. This agreed with Madakan and Ladu, (1996)

who reported that factors such as increasing commercialization of fisheries production are thought to have contributed to the eradication of traditional management system have proved to be unworkable for various reasons such as poor government funding for the fisheries administration and ineffectiveness of fishing regulation etc.

The results on species of fishes that were threatened in the study area, showed that *Citharinus citharus* were the most threatened species (17.78%) while only (0.56%) of the respondents agreed on *Labeo senegalensis*, *Petrocephalus bane*, *Clarotes macrocephalus* and *Mormyrus macrophthalmus* were threatened in each case with the least (0.56%). It was observed that most of the respondents said None of the fish species were threatened with (46.11%). This could be as a result of the fishers not being observant, or they do not want to reveal the disappearance of the fish species in the Dam. This agrees with the findings of David *et al.* (2015) who said that marine ecosystems are in global decline. The main reason is unsustainable fishing practices, which follow from six factors: inappropriate incentives, high demand for limited resources, poverty, inadequate knowledge, ineffective governance, and interactions between fishery sector and other aspects of the environment (FAO, 2002).

The causes of disappearance of some species showed that water pollution was responsible for the threat of the fish species in the area while others said over population of fishers and flooding were the caused. Torchlight and stick could be responsible for the threat of the fish species. It was observed that torchlight and stick affect spawning period of the fish as reported by the fishers, who said that some individuals move to the Dam then light and heat the bark, which in return affect spawning and may cause migration of the fish. Neiland *et al*. (2000) observed that, many State Fisheries Departments in Nigeria have been constrained for various reasons including financial under-resourcing in their ability to assume the responsibilities of overseeing and regulating fisheries in their areas.

There is paucity of data on fish stocks resulting in over dependency on pre-cautioned approach as the only management option in the country. The analysis reveals that those who fish twice daily had the highest catch as compared to those who fish once; this could be as a result of right timing. Catherine, (2019) reported that the best time for fishing is in the morning and evening when the environment is quiet.

The Malian trap and hook and line are selective in their catches, bigger mesh size is also selective. During the study it was observed that those who used small mesh size caught different size of fish species including fry (shinkafa/gamre).

The findings agreed with the work of Kimathi *et al.* (2013) who reported that fishing gear are selective in the size and quantity of fish caught.

Conclusion and Recommendation

The highest educational level was secondary education and the highest combinations of gear types used by fishers were gillnetted and hook and line. *Citharinus citharus* species was found to be the most threatened while the cause of the disappearance of some species was attributed to water pollution. There is, therefore, need for urgent involvement of the government in awareness and enforcement of fisheries regulations guiding water bodies, which will result in conservation of threatened species, and the sustainability of fisheries resources for improved protein supply, and enhanced livelihood of the fisher folks.

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