AN INVESTIGATION ON THE FISHING METHODS AND THEIR IMPLICATIONS FOR A SUSTAINABLE ENVIRONMENT IN RIVER DONGA TARABA STATE, NIGERIA

J. T. Amos[1]*, A. Ja'afaru[2] and K. A. Abubakar[2]
[1]Department of Biological Sciences, Federal University Wukari, Taraba State, Nigeria
[2]Department of Zoology, Modibbo Adama University of Technology Yola, Adamawa State, Nigeria
*Corresponding author: jummaiat@gmail.com

Abstract: An investigation on the fishing methods and their implications for a sustainable environment in River Donga Taraba State Nigeria. Decline in water quality can increase in the price of food fish, this seriously affect the nutritional status of the population. The technology of fish exploitation in the Nigeria inland fisheries is mainly characterized using simple fishing gear and techniques. Analysis of global fisheries data by FAO shows decrease in the mean size of individual fish species and in the value of the catches. Data were collected using structure questionnaire which was administered to 130 fishers at random selection. Observations were made on the methods of fishing. The results were analysed by simple descriptive statistics such as tables, frequencies distribution and bar chart. The results showed that the highest gear used was gillnet/size with 2(32.3%) as highest and least 5(13.5%). Dragnet has highest respondent of size 2(49.1%) and lowest 3(21.1%) while cast net highest 2(41.2%) and lowest 1(06.7%). Other gears used were hook and line with highest 2(25.1%) and lowest of 6(02.6%), while calabash or "gura" had 09(60%) respondent and hooks and lines had 06(40%) respondents. The commonest size of gear used by fishers were 2 inches. Response from the fisher folks showed that the causes of endangered species were used of poison having 60(46.2%) and disturbances 5(3.8%) as the lowest. The most endangered species was *Citharinus citharus* with 56 (22.6%) respondents while the lowest were 6(2.1%) having *Hemibagnis wyckii*, *Anguilla japonicum* and "*Garza*", respectively. It is believed that the crude technique of fishing which was widely practiced in our communities had not only brought a serious decline into fisheries but has also introduced hazards of various magnitude to the consumers and the entire aquatic environment. However, crude method should be prohibited from using among the fisher folks for realization of sustainable environment. Organizing workshop and seminars for fishers in order to up-date their knowledge on modern fisheries. These workshops and seminars can also help to acquaint the local fishers with the benefits accruable from the use of modern fishing techniques and the hazards associated with the continued use of crude methods.

Keywords: Fishers, fishing methods, endangered, *Citharinus citharus,* environment

Introduction
Fish and fishery products are generally regarded as important part of a healthy diet. In developing world, fish and fishery products apart from being a source of cheap animal protein, are widely consumed for their high quality protein, essential nutrients, low saturated fat and contain omega 3 fatty acids (FAO, 2014). Decline in water quality leads to increase in the price of food fish that seriously affect the nutritional status of the population. The technology of fish exploitation in the Nigeria inland fisheries is characterized using simple fishing gear and techniques.

Analysis of global fisheries data has shown decrease in the mean size of individual fish species and in the value of the catches (FAO, 2014). The fishing sector progressively is adopting economically technologies and approaches to environmentally acceptable fishing. Abundance of fish species provide useful indication of environmental and pollution stress. The studies on the biology of fish are indispensable aspect of sustainable management and conservation of fish biodiversity. It has been reported that mean annual diversity of fish is inversely related to the amount of toxic materials in waste water. According to the International Bank for Reconstruction and Development, the Food and Agricultural Organization of the United Nations monitors trends in the world fisheries (FAO, 2005).

The continuing depletion of the world's marine fisheries is a key indicator of a critical decline in ocean health and a global issue of increasing concern. The use of biological protocols provides invaluable alternative to water quality assessment. This involves the use of any group of organisms to examine the biological condition of a river. The technique and the fishing gears employed may pose some hazards to the fishes, the aquatic environment and the society at large. The use of poisons or chemicals like Gamalin 20, Didimore 25 and poisonous roots and fruits of some toxic plants can cause water pollution thereby making the water unsafe for human use. The use of hooks, spears, cutlasses at times inflict physical damage on fishes and this accelerates the rate of decay of the fish as a result of bacterial invasion on the damaged parts (Olaniyan, 2015).

Recent studies have shown that because of high rates of pollution in aquatic environments especially in developed world as a result of increased urbanization and industrialization activities, fishes and fishery products contain traces of heavy metals which can be detrimental to the health of consuming public. Therefore, humans who consume significant amount of fish may also be at risk.

The main objective of the present work is to investigate the fishing methods and their implications for a sustainable environment in River Donga in Taraba State, Nigeria. The specific objectives of the study include identification of the various type of fishing gears/sizes used by fishers, assessment of fish species that are no longer found and ascertain the causes of disappearance of some fish species in River Donga.

Materials and Methods
Study area description
Donga River is in southern Taraba State in North-Eastern Nigeria. It is located on latitude $8^0 19'00"$ N and longitude $9^0 58'00"$ E of the equator. The river rises from the Mambilla Plateau in Northeast Nigeria, forms part of the international border between Nigeria and Cameroon and flows northwest to eventually merge with the Benue River in Nigeria (Fig. 1). The Donga watershed is 20,000 square kilometres (7,700 sq mi) in area. At its peak, near the Benue River delivers 1,800 cubic meters (64,000 cu ft) of water per second. The river is often brownish in colour during wet season and clear during dry season. The communities use the water for several purposes including drinking, irrigation, fishing, laundry, bathing and transportation etc. It is located at an elevation of 113 meters above sea level.
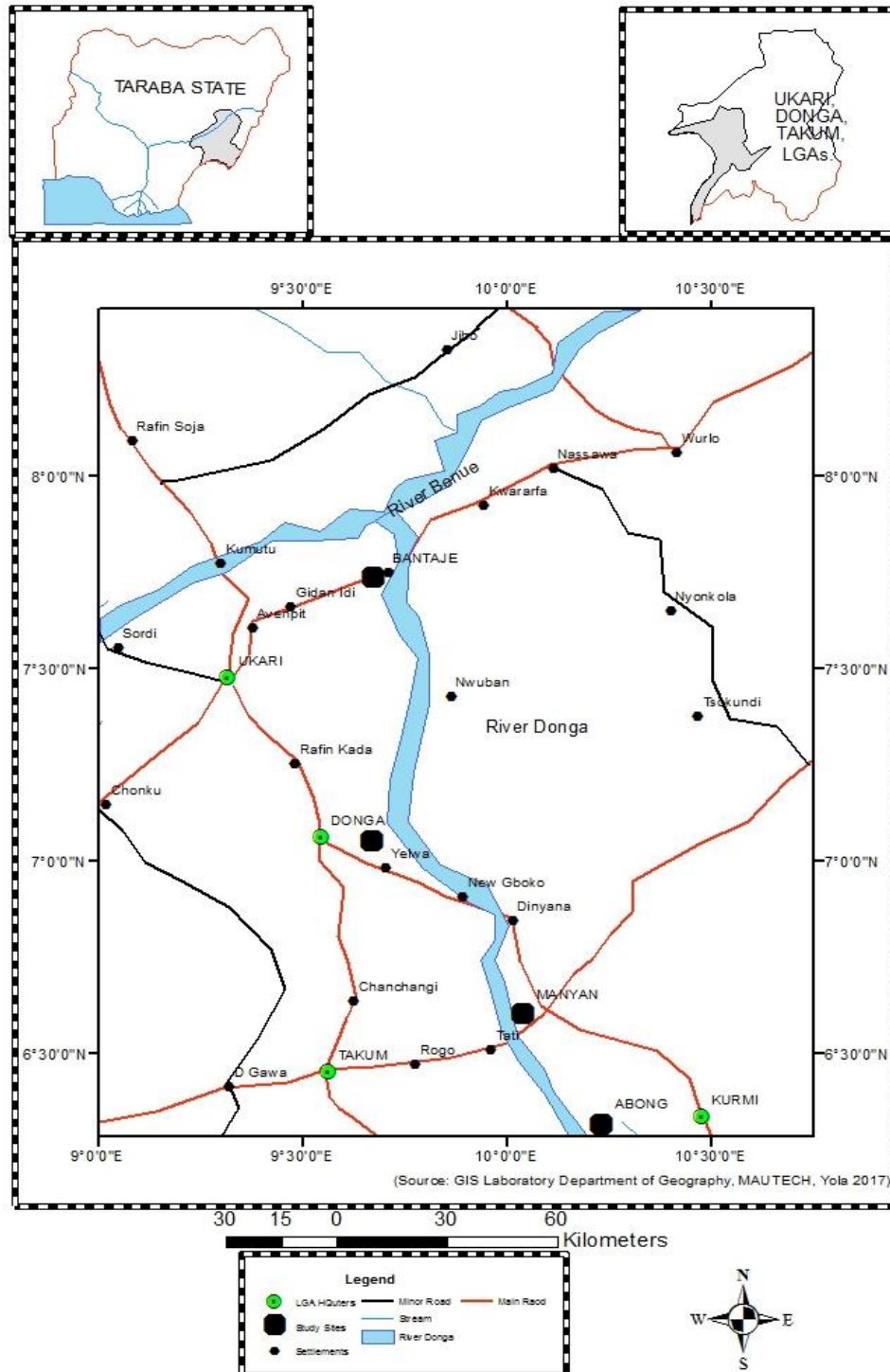
FUW Trends in Science & Technology Journal, www.ftstjournal.com
e-ISSN: 24085162; p-ISSN: 20485170; April, 2020: Vol. 5 No. 1 pp. 130 – 133

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Fig. 1: Map of the study area

Sampling techniques

The method that was used in this study were combination of descriptive and analytical. Different data were used with a combination of interviews and observations on the fishers' activities along the river area and with the help of a schedule containing structured and unstructured questions. The Fishers were selected at random and questionnaire was administered to them from four different landing sites. Planning was made for subsequent field visits combined with resource persons, the purpose and objectives of the study were made clear to them. Various field exercises were conducted to gather information like population dependency on river, types of fishing gears used, processing, marketing and distribution of fish product etc. All species that were no longer found in the River were identified *in-situ* using field guideline prepared by Babatunde and Raji (2013) and data collected were recorded.

Data analysis

The data collected were analysed by sample descriptive statistics such as tables, frequencies distribution, percentage and bar chart.

FUW Trends in Science & Technology Journal, www.ftstjournal.com
e-ISSN: 24085162; p-ISSN: 20485170; April, 2020: Vol. 5 No. 1 pp. 130 – 133
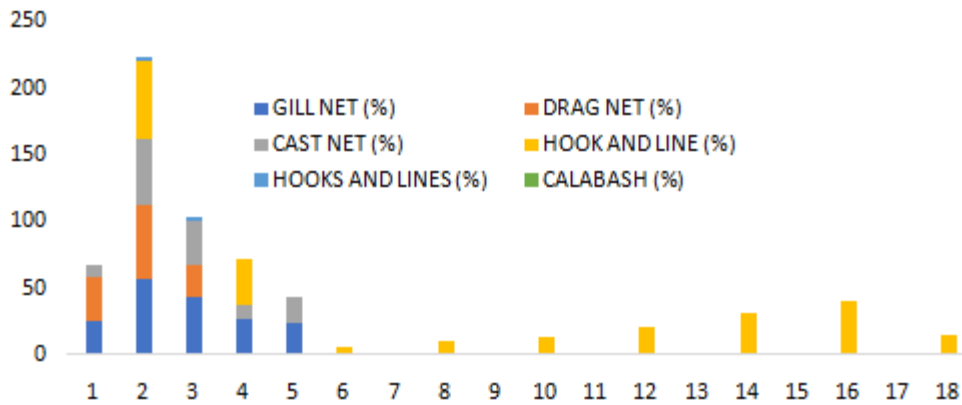
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Results and Discussions

The results obtained for the distribution of fishing gears and sizes used by fishers is presented in Fig. 2. Results obtained from the assessments of causes and types of endangered fish species in Donga River are presented in Table 1 and 2.

Table 1: Causes of endangered species

Causes	Respondents	Percentage (%)
Season	12	9.2
Poison	60	46.2
Over population	26	20.0
Frequencies of Catch	09	6.9
Lack of flow	11	8.5
Disturbance	05	3.8
Food shortage	07	5.4
Total	**130**	**100%**

Field Survey (2018)

Figure 2 shows that in the distribution respondents of fishers by fishing gears/sizes used, gillnet had the highest respondents of gear size 2 inches with 57 respondents and the commonest. Amos *et al.* (2019) opined that the commonest gear used by fishers was gillnet because of its availability, low cost, and number of fishes they caught. Fishing gears like dragnet, cast net and hook and line highest size used was 2 inches, respectively. This signifies that size 2 inches was the commonest gear used by the fisher's folk because of its selectivity in nature. This could also be that the gear size catches good sizeable fishes. Moreso, it is the recommended size of gears for fishing by the traditional fishers. The lowest was hooks and lines with 6 respondents. This could be because of its nature of low catches.

Fig. 2: Distribution of fishing gears/size used by Fishers

Table 2: Endangered fish species

English name	Scientific name	Hausa name	Respondents	Percentage (%)
Freshwater sting ray	*Dasyatis garouaensis*	Kunaman ruwa	36	12.68
Moonfish	*Citharinus citharus*	Paliya	56	19.72
Freshwater rat tails	*Gymnarchus niloticus*	Yauni	27	9.51
Elephant fish	*Marcusenius mento*	Lali	18	6.34
Nile perch	*Lates niloticus*	Giwan ruwa	18	6.34
Electric catfish	*Malapterurus beninensis*	Minjiriya	42	14.79
African lungfish	*Protopterus annectens*	Mai mama	24	8.45
African bonny tongue	*Heterotis niloticus*	Bargi	09	3.17
Tiger fish	*Hydrocynus vittatus*	Tsage kurmi	09	3.17
Robber tetras	*Brycinus longipinnis*	Karkara	09	3.17
Yellow catfish	*Pelteobagrus fulvidraco*	Tando	18	6.34
Catfish	*Hemibagrus wyckii*	Sarkin kwata	06	3.17
		Garza	06	3.17
Eel	*Anguilla japonicum*	Sarkin ruwa	06	3.17
Total			**284**	**100**

Field survey (2018)

Table 1 showed that the used of poison or chemical for fishing was the highest cause of disappearance of some fish species in the river (46.2%). The lowest was food shortage (5.4%). The use of poison or chemical can cause sudden mortalities of organisms. Zahra (2017) and Amos *et al.* (2017) opined that, fish larva and fingerlings are the most vulnerable life stages of fish which could be severely affected by (pesticides) chemical as non-target organisms. The advanced effect of using poison for fishing would cause the threat on such species that are being targeted, making them vulnerable or going extinct, which may alter the ecosystem food chain and food web.

These also agreed with Olaniyan, (2015) who reported that the use of poisons or chemicals like Gamalin 20, Didimore 25 and poisonous leaves, roots, and fruits of some toxic plants cause water pollution thereby making the water unsafe for human. He also opined that use of Hooks, Spears, cutlasses inflict physical damage on fish and this accelerates the rate of decay of fishes as a result of bacterial invasion on the damaged parts.

Over population which had (20%) was next from response by fishers to be the caused for the endangered species. This could result in high pressure on the aquatic causing threats to the

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e-ISSN: 24085162; p-ISSN: 20485170; April, 2020: Vol. 5 No. 1 pp. 130 – 133

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species involve. Amos *et al.* (2017) reports that, heavy fishing pressure which can be termed as overfishing can change the genetic characteristics of a population by selecting for or against in extinction if proper management policies are not put in place. Some believed that is season, food shortage, frequencies of catching, lack of flow. It could be true as such that all causes indicated by the fisher's folk in their opinion may have advance effect on the aquatic ecosystem.

Table 2 shows that, the most endangered fish species was the moon fish (*Citharinus citharus*) (19.72%) while the lowest was African Bonny tongue (*Heterotis niloticus*), Tiger fish (*Hydrocynus vittatus*) and Rubber tetras (*Brycinus longipinnis*) (3.17%) each. All the causes mentioned collectively contribute to the destruction of the aquatic environment. According to Tejas *et al.* (2015) due to such factors, the present attempt provides data concerning the assemblage structure and diversities of endemic and threatened fish species. These agreed with Amos *et al.* (2019) who reported that, the effect of poison on both fish stock and human being could hamper on their health. There is an urgent need to take a concrete decision towards the conservation of fish species. If the present trend continues, the adverse conditions might lead to the loss of the fauna.

Conclusion and Recommendations
The believed that traditional method of fishing which was widely practised in communities had not only brought a serious decline to the economy but has also introduced hazards of various magnitude to the consumers and the entire aquatic environment. Traditional fishing method also made fishing a time-consuming venture with little or no harvest to show for the time wasted. The introduction of modern fishing technique has not boasted fish supply, but has brought appreciable positive effect on protein consumption, also preventing lot of health hazards associated with the consumption of poisoned fishes. Modern method is a good and reliable avenue for improving the nation's economy and a good source of job creation. However, traditional method should be guided among the fish folks for realization of sustainable environment. In line with this; the following recommendation are suggested:

(i) Provision of adequately trained manpower to train the local fishers in the use of modern fishing equipment and soft loans to procure the equipment's at affordable prices.

(ii) Organizing workshops and seminars for fishers to update their knowledge on modern fisheries so as to help acquaint the local fishers with benefits accruable from the use of modern fishing techniques and hazards associated with continue use of crude methods.

Conflict of Interest
Authors declare that there is no conflict of interest related to this study.

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FUW Trends in Science & Technology Journal, www.ftstjournal.com
e-ISSN: 24085162; p-ISSN: 20485170; April, 2020: Vol. 5 No. 1 pp. 130 – 133

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