International Academic Research Consortium Journals (IARCJ)
International Journal of Agricultural Science and Technology
ISSN: 2360-9888. Volume 9, Number 4
Pages 93-105 (October, 2021)
www.iarcj.org, www.arcnjournals.org

Frame Survey and Fish Species Composition of Hadejia Jama'are Komadugu River Basin, Northern, Nigeria

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Abstract: *A frame survey with a complete census based approach and fish composition assessment were carried from August to December 2019. The objective of the study was to provide information on the number of fishing unit, fishers, fishing boats, and number of fishing Gourds and the fish composition and distribution some selected fishing communities' in Hadejia Jama'are Komadugu Yobe (HJKY)in Northern Nigeria. Purposively selection of some fishing communities and canoes from landing sites were adopted. A total of sixty two (62) landing sites, (3320) fisherfolk, (1365) of fishing boats, (20) non-fishing boats,1414 gourds and (2353) fish assistance were identified in 32 fishing communities. The highest number of fishing unit, fishers, fishing boats, and number of fishing Gourds were recorded in Hadejia river basin, followed by Komadugu Yobe River basin while, Jama'are river recorded the least numbers of landing sites, fisher, fishing boats and gourds respectively. Fishing traps of different design and size (Mali traps, Sankiya Ndurutu) were the most important gear type used by the fisherfolk with the 51%, followed by gill net (kalli) which pooled 22.5%. Hooks and line (Kujiya) of various size ranged from number 1-14 were also commonly used in all the fishing communities with18%. While, cast net (Birigi), beach seine nets and clap nets recorded (2.8, 2.5 and 1.7 %) respectively. A total of (4312) fish belonging to fifteen (15) families, twenty-five genera and thirty-four (34) species were observed in the course of this study with Orechromis niloticus the most abundance fish species. The fish biodiversity in HJKY River basin has seriously decline and urgent measures are required. Harmonization and enforcement traditional fish law and straightening the fishing committee to patrol illegal fishing is vital to improve the biodiversity of fisheries of Hadejia Jama'are Komadugu Yobe basin.*

Keyword: *Frame Survey, Fish Composition, River Basin*

Introduction

The importance of fisheries as a source of food and nutrition cannot be overstated, especially in the face of population growth and increasing demand for animal protein (Adewole and Olaleye, 2014, FAO, 2016 and Azrita *et al*., 2020). Fish constitutes about 30-40% of animal protein component of the diets in the majority of communities in Nigeria.

The Hadejia Jama'are Komadugu-Yobe basin System (HJKY) is a sub-system of Lake Chad and one of the most extensive wetland areas in the Northern part of the Nigeria covering about six northern states which are Plateau, Bauchi, Jigawa, Kano, Yobe and Borno and has gained international recognition because of the regular presence of migrant birds (Ladu et al., 2013).

In Nigeria, several factor such as degradation of land over exploitation, Climate change, increasing demand for fish and inadequate management of the inland water bodies has attributed to decline in fish catch and abundance.

In a studies on fish and fisheries of Hadejia Jama'are Komadugu Yobe river basin, some commercially important species such as *Gymnarchus, Citharinus, Lates, and Hydrocynus etc.* are reported being threatened, due to improper management system, unregulated number of fishermen, unregulated and uncontrolled fishing methods, degradation of fish habitats associated with excessive inputs of nutrients and contamination, damming of river for non-fisheries purpose, degradation of wetland, infestation by the water hyacinth and overfishing (Ladu *et al.,* 2013).

For sustainability of these resources, an adequate knowledge of number of fishers and species composition is vital. The objective of the paper was to provide information on the number of fishing unit, fishers, fishing boats, and number of fishing Gourds and the fish composition and distribution some selected fishing communities' in Hadejia Jama'are Komadugu Yobe (HJKY)

Materials and Methods

Study Area

The Hadejia Jama'are Komadugu Yobe (HJKY) River Basin has a total area of about 84,000 km^2 and is situated in the Northern part of Nigeria. It traverses six States namely Bauchi, Borno, Jigawa, Kano, Plateau and Yobe. The main rivers of the basin are the Hadejia and the Jama'are, which meet in the Hadejia-Nguru Wetlands from where they continue as the Yobe Basin. Fisheries and aquaculture activities account for 50% of the livelihood and is being carried out throughout the year (Birdlife international, 2015).

The Hadejia Jama'are Komadugu Yobe (HJKY) River Basin has a total area of about 84,000 km^2 and is situated in the Northern part of Nigeria. It traverses six States namely Bauchi, Borno, Jigawa, Kano, Plateau and Yobe. The main rivers of the basin are the Hadejia and the Jama'are, which meet in the Hadejia-Nguru Wetlands from where they continue as the Yobe Basin. Hospitalia Consultaire (2017). The rivers Hadejia and Kano, arising in Kano state, and the Jama'are river's arising in Plateau and Bauchi states, drain into the Yobe, which flows into Lake Chad. The portion of the floodplain where the Hadejia and Jama'are rivers meet is known as the Hadejia- Jama'are wetlands. Most of the flow in the Hadejia River system is controlled by Tiga and Challawa Gorge Dams. The Jama'are River is presently uncontrolled but a controversial plan exists to build a dam on the river at Kafin Zaki (Ladu *et al.*, 2013: Hospitalia Consultaire, 2017).

The Komadugu-Yobe subsystem, which forms the border between Nigeria and Niger over the last 60km, is the only perennial river that flows into the Northern pool of the Lake Chad in North East Nigeria, contribute less than 2.5 percent of the total inflow into the Lake Chad. Solomon (2016).

According to Birdlife International (2015), Ladu *et al*. (2013) and Solomon *et al.* (2014) Hadejia Jama'are Komadugu Yobe basin is a major economic hob for pastoralists, fishing and farming. Blench (2013) reported that nineteen species of fish are the regularly caught in

the wetlands, but according to previous reports some forty-four species where found, this signify a decline the fish diversity. Fishermen and farmers in the HNW represent about 75% of the indigenous community population and the wetlands represent their entire source of livelihoods through farming and fishing activities. Fisheries and aquaculture activities account for 50% of the livelihood and this is carried out throughout the year (Birdlife international, 2015).

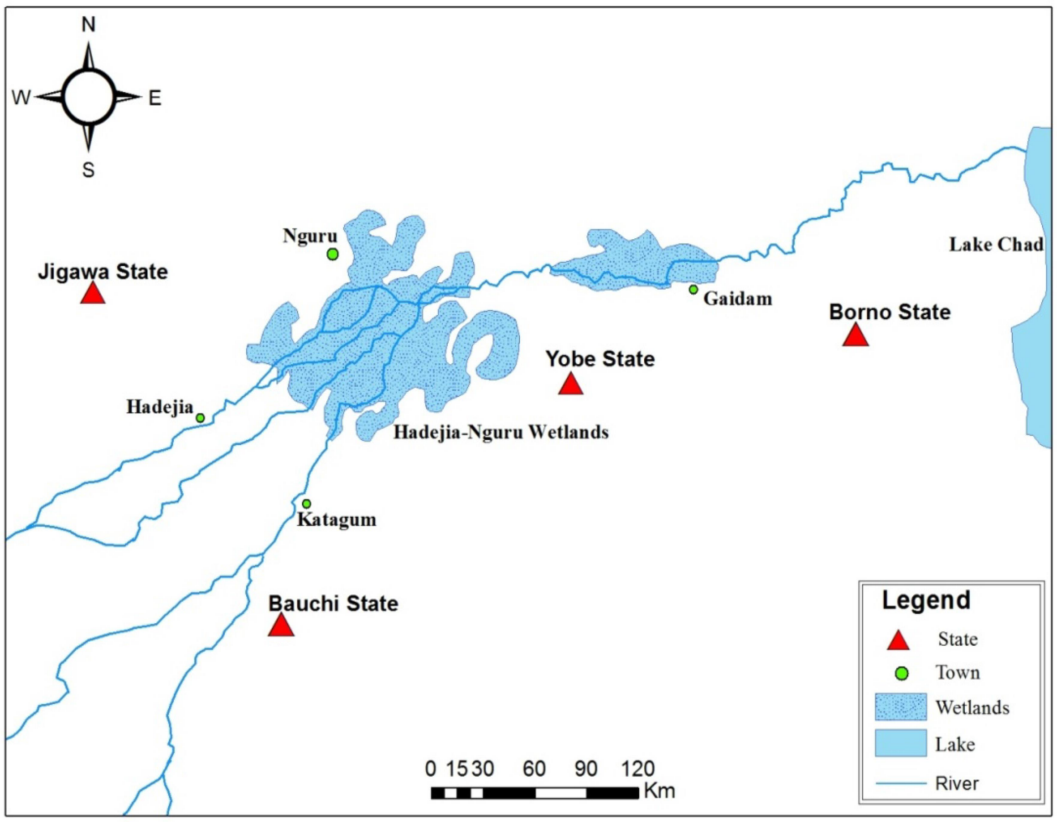

Figure 1. Location of Riparian State and Rivers

Source: Easton and Sarch (1993)

Sampling Technique

The study utilized a multi-stage sampling procedure. In the first stage, Purposive sampling of 32 fishing communities within the riparian river was Selected followed by random sampling of thirty (19) fishing villages. The criteria used in selection were based on the fact that all the fishing communities were within the Hadejia jama'are Komadugu Yobe river basin. Hence, a total of 19 fishing villages

Methods of Data Collections

A frame survey of fishing communities was carried out. A complete census technique of frame survey was carried out from August to December 2019. During the survey, all landing sites and the facilities available, fishers, fishing crafts and fishing gears by type along the entire length of the rivers (HJKY) basin were identified and counted. The number of fishermen and their assistance, fishing crafts (Canoes and Gourds), fishing gears were also counted, questions were asked verbally read in English and when necessary, translated into the major local language of the fishermen.

Catch assessment survey was conducted in each of the randomly selected fishing communities. During the catch assessment survey, fish catches at landing sites were assessed. The fish caught in each net were removed and transferred into container (bowls) and sorts out according to species and weighed using top loading weighing balance to determine the fish weight, while measuring board was used to take the standard length of the fish. The catches in terms of number were estimated. Fish were identified using identification keys provided Olaosebikan and Raji (2004) and Reed (1976).

Results

Distribution of Fishing unit, Fishermen and Fishing Crafts and their assistance

A total of sixty – two (62) number of landing sites or fishing units, three thousand three hundred and twenty (3320) fisherfolk, one thousand three hundred and sixty-five (1365) of fishing boats, twenty (20) non-fishing boats. One thousand four hundred and fourteen 1414 gourds with total of two thousand three hundred and fifty-three (2353) fish assistance were identified in 32 fishing communities within the studies area (Table1). Hadejia River basin constituted the highest number of fishing unit, fishers, fishing boats, and number of fishing Gourds, followed by Komadugu Yobe River basin, while Jama'are river recorded the least numbers of landing sites, fisher, fishing boats and gourds respectively.

The gear types found in this present study were gill nets, cast nets, hook and line, Traps Clap nets and. beach seine-net and other (Figure 1). Fishing traps of different designed and size (Mali traps, Sankiya Ndurutu) were the most important gear type used by the fisherfolk with the 51%. The second most popular fishing gear used among the fisherfolk was gill net (*kalli*) which pooled 22.5%. Hooks and line (*Kujiya*) of various size ranged from number 1-14 were also commonly used in all the fishing communities with18%. While, cast net (*Birigi*), beach seine nets and clap nets recorded (2.8, 2.5 and 1.7 %) respectively. Other fishing gear used but, occasionally by the fisherfolk in the study area were (rod and line, scoop net, spears, cutlasses, lift nets) 1.5%

A total of four thousand, three hundred and twelve (4312) fish belonging to fifteen (15) families, twenty-five genera and thirty-four (34) species were observed in the course of this study as shown in Table 2. These families include Bagridae, Characidae, Centropomidae, Clariidae, Cichlidae and Schilibedae among others. The family Clariidae and Mormyridae are the families with higher number of species (5 species) and followed by the family Cichlidae with four (4) species. The family Centropomidae, Distichodontidae, Citharinidae, Lepidosirendae, Polypteridae, Osteoglossidae and Malapteruridae were the family with least species of one (1) each in the Hadejia Jamare Komadugu Yobe river basin. The result showed

that *O. niloticus* and B. nurse are the most abundant species with a total number of seven hundred and twenty-eight (728) and seven hundred and twenty-four (724) individuals which accounted for 16.88% and 16.79% respectively of the total species observed in Hadejia jamare Komadugu Yobe river basin. The abundance of *C gariepinus* and *L. coubie* were also fairly high with a total number of two hundred and ninety-three (293) and two hundred and fifty-six (256) which accounted for 6.79% and 5.94% respectively. The abundance of *C. citharus, D. rostratus* and *C. nigrodigitatus* were found to be very low during the study with a total number of nine (9), thirteen (13) and twenty (20) and abundance percentage of 0.21%, 0.30% and 0.46% respectively. Other species with abundance percentage that is below 1 are *P. pellucid* (0.49), *A. occidentalis* (0.63%), *L. niloticus* (0.65%), *M. electricus* (0.65%), *H. longifilis* (0.67%), *S. galilaeus* (0.67%) and *H. bidorsalis* (0.81%)

Table1 Distribution of Fishing Unit, Fishers and Fishing Crafts in Hadejia Jama'are Komadugu Yobe River Basin

Parameters	Hadejia	Jama'are	Komadugu Yobe	Total
Number of fishing units	37(59.7)	10 (16.1)	15 (24.2)	62
Numbers of fisherfolk	1801 (54.2)	697 (21)	822 (24.7)	3320
Number of fishing boats	910 (66.7)	129 (9.4)	326 (23.9)	1365
Number of non-fishing boats	16 (80)	0 (00)	4 (20)	20
Number of gourds / calabash	730 (51.6)	293 (20.7)	391 (27.6)	1414
Number of assistance	1492 (63.4)	305 (13)	556 (236)	2353

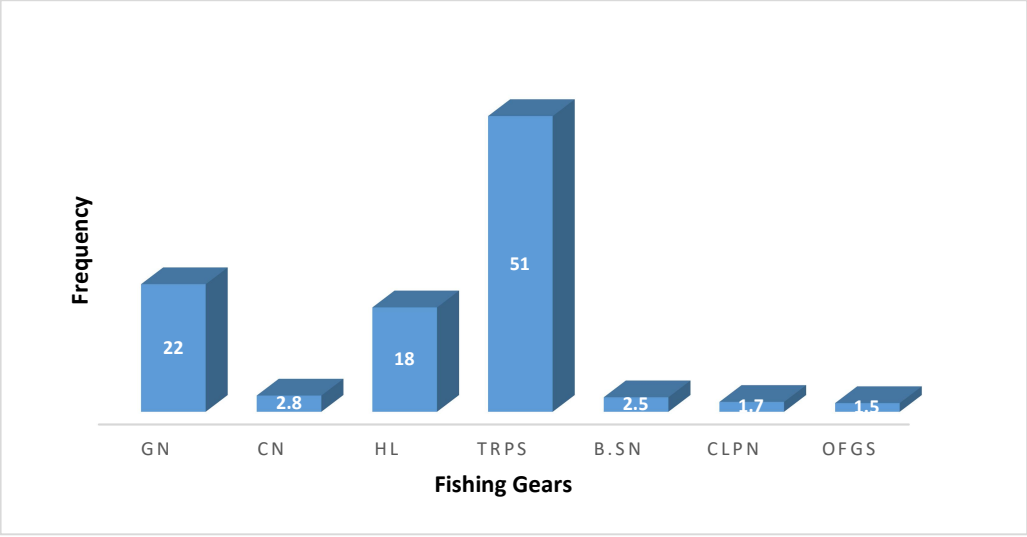

Figure:1 Fishing Gears Distribution in Hadejia Jama'are Komadugu River Basin

Keys:

GN=Gillnet,

CN=Cast-net,

H=Hook and line,

CLPN=Clap net

B.SN=Beach Seine net

OFGS= (Hand line, Scoop-net, Spear and cutlass lift nets).

Table 6: Total Fish Species Composition and Abundance in Hadejia Jama'are Komadugu Yobe River basin

FAMILIES	Genus	*SPECCIES*	Total Abundance	% abundance
Characidae	Brycinus	*Brycinus nurse*	724	16.79
	Hydrocynus	*Hydrocynus forskali*	108	2.50
Bagridae	Auchenoglanis	*Auchenoglanis occidntalis*	27	0.63
	Bagrus	*Bagrus bayad*	121	2.81
		Bagrus filamentous	134	3.11
		Chrysichthys nigrodigitatus	20	0.46
Centropmidae	Lates	*Lates niloticus*	28	0.65
Claridae	Clarias	*Clarias anguillaris*	156	3.62
		Clarias gariepinus	293	6.79
		Clarias macromystax	45	1.04
	Heterobranchus	*Heterobranchus longifils*	29	0.67
		Heterobranchus bidorsalis	35	0.81
Cichlidae	Hemichromous	*Hemichromisbinaculatus*	95	2.20
	Oreochromis	*Orechromis niloticus*	728	16.88
	Tilapia	*Tilapia zilli*	137	3.18
	Sarotherodon	*Sarothedon*	29	0.67
Cyprinidae	Labeo	*Labeo coubie*	256	5.94
	Barbus	*Barbus macrops*	174	4.04

Distichodontidae	Distichodus	*Distichodus*	13	0.30
Citharinidae	Citharinus	*Citharinus citharus*	9	0.21
Lepidosirendae	Protopterus	*Protopterus niloticus*	97	2.25
Polypteridae	Polypterus	*Polypterus*	68	1.58
Osteoglossidae	Heterotis	*Heterotis niloticus*	64	1.48
Malalapteridae	Malapterurus	*Malalapterus electricus*	28	0.65
Mormyridae	Gnathonemus	*Gnathonemus seneglensis*	106	2.46
	Hyperopisus	*Hyperopisus bebe*	52	1.21
	Mormyrop	*Mormyrop delicious*	95	2.20
	Mormyrus	*Mormyrus rume*	54	1.25
	Petrocephalus	*Petrcephalus*	52	1.21
Mochokidae	Synodontis	*Synodontis filamentous*	114	2.64
		Synodontis nigrita	119	2.76
		Synodontis clarias	120	2.78
Schilibedae	Schlibe	*Schlibe mystus*	161	3.73
		Parailia pellucid	21	0.49
Total			**4312**	**100**

DISCUSSION

Number of fishing unit, active Fishermen and Fishing Crafts and their assistance.

During the period of this study, a total of 62 landing sites were identified in HJKY basin, about 1374 fishing boat were counted out of which 9 are non-fishing boats. In addition, about 1414 gourds were also recorded. Three thousand three hundred and twenty (3320) and 1365 fishers employing various fishing gear/method in the study area gave an average of 4 fishers per boat (Table 1). The average of 4 fishers per boat observed in this study is higher than 2 and 3 fishers per boat reported by (Ita *et al.,*1984; Sikoki and Hart, 1999). The increased in number of fishing crafts within the basin could have been because of an increased in number of internally displaced person (fishermen) as results of insurgency in Lake Chad shore. The finding is similar to findings of Van der Knapp *et al*, (2014) who reported that, an influx of displaced peoples and refugees returned to the basin seeking their ancestral fishing grounds has increased the number of fisher in Lake Tanganyika.

The most popular fishing craft in the present study is the un motorized wood plank canoe with flat bottom designed which was built locally by the fisherfolk within the fishing communities. The flat bottom canoe is easy to paddle in shallow river and wetland and can last for more than three years if there is proper maintenance as confined by this study. Taabu *et al.,* (2012) also reported that, flat bottomed type called *Congo barque*, constituted 97% of the 6,216 fishing crafts operating on Lake Albert. This finding is contrary to NIFFR (2002) who reported the use of some V-bottom shaped crafts is more popular to fishermen.

Non fishing boats were also reported in negligible numbers in the present study, probably because of high cost of motorized boats and the shallow nature of the river and wetlands. This result substantiates the finding of Damilare (2014) who reported that, fishers in Kainji Lake lower basin are mainly not motorized probably, because of their low cost compare to the motorized ones. (NIFFR 2002; Ago and Tafida, (2005) also identified the problem of not using motorized craft as a result of high price of outboard engines. Kabiru *et al.,* (2017) also confirms high number of un motorized craft in Gurara dam in Kaduna state.

Another important fishing craft observed in this study is gourds. This craft is common among low earned fishermen. It is used as floats for subsistence fishing by fisher folk. Ago and Tafida, 2005; Bawa, *et al.,* (2018) also identified dug-out type and gourd/calabash craft at the lower basin of Kainji lake. The price of Gourd varies in size.

The study finds it difficult to obtained previous data on number of fishing units, number of boats and their assistance for comparison with the current finding. This finding confirmed the report of De Graff (2014) who reported chronic problems of insufficient human and financial resources allocated for data collection have often resulted in poor-quality information that has further led to non-use or limited use of statistics for fisheries management and policy development. Generally, the fishermen in the study area used (simple fishing gears and equipment, and they catch in small quantity, which is just enough for their subsistence purpose and small scale commercial purpose which is the characteristic of artisanal fisheries Tafida *et al*., (2011) confirmed that, the fishermen of Kainji Lake in New Bussa in Nigeria also belong to the group of artisanal fishermen.

Fishing Gears and fishing Crafts

The gear types found in the present study are gill nets, cast nets, hook and line (Long line), Traps, Clap nets and other gears such as rod and line, scoop nets, spears and lift net are also identified in negligible number. Those fishing gears fell under FAO (2010) checklist of 11 fishing gears. These gears are the commonest gear in Lake Alau (Bankole *et al*., 2003) and Lake Chad basin (Bene and Neiland, 2003). National institute of freshwater fisheries research (NIFFR), (2002) also acknowledged these fishing gears in Nigeria.

Assorted traps of different design, shape and size constituted the important fishing gear among the fishers in HJKY basin. The different fish traps observed during the period of this study include; ‘‘Sankiya, Ndurutu, Mali and Chakko. They are set in the flood plains, canals or river shores with or without bait.

The dominance of Mali traps in the study area may be attributed to the availability of construction materials, cost effectiveness and catching efficiency, especially when hundreds of Mali traps (Dumbas) were set across channels, rivers draining the floodplain areas, it catches variety of fish species. Another reason for use of Malian fishing trap according to

respondents, the gear can also be operated from shallow to large depth, marshy or open river and can be used for fishing on rough bottom distinctively from cast nets. This finding is in line with (De Graff, 2014) in base-line report of catch assessment survey of Lake Chad basin, he revealed that, Mali traps are gears used to catch a large variety of fish species in all the fishing seasons, due to their small mesh size they collect large numbers juveniles.in comparison to other fishing gear.

Gill net and hooks of various sizes are also important fishing gears found in this study. Gill net and Hook and line can be traced back to the mid-70s, as it has been earlier reported by Seisay, (1998). Gill nets 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 (Valdez-Pizzini, 1992). The prominent gillnet found in this study are monofilament gill net of small size range from ¾ to 2½ inch mesh size. However, gill net mesh sizes of (¾ to 2.5 cm) found in the present study fell short of the FAO, (2010) gill net mesh sizes of 3.17 cm - 7.62 cm. This might have contributed to the small size and immature ones caught thereby leading to growth over fishing in the area.

Another fishing net used in open water is seine-net and introduced by fishermen from Mali for catching clupeids along the Upper Niger. This gear is also common during the period of the study. This net, popularly called "Dala" net, is made of mosquito netting material with 3 mm mesh. It has a head rope of 100 – 150 metres with a depth of about 5 metres. The head rope is fitted with floats made of haffia bamboo poles at about 15 cm intervals. This gear is the common source of conflict among fishermen in the study area.

In addition to the major pre-dominant fishing gears such as traps, gillnets hook and cast nets, there are other occasional fishing gears and methods used by the fishers' folk. These includes; Clap nets, spears, Scoop nets, lift nets etc. Clap nets is occasionally used during receding and festival days (drying) periods in depressions (fadama) or residual pools in riverbeds.

In comparison, it has been noted that there is variation in type of gear uses and seasonality between the selected fishing communities in the study areas. For instance, Mali traps and fence are commonly used in Hadejia, Nguru-Gashua wetland than jama'are basin probably because of marshy nature of wetlands and open water of jama'are river. In other hand cast net is widely used in jama'are basin than Hadejia and Bade fishing communities of Komadugu. Another reason for low use of Cast nets in Komadugu Yobe may be attributed to the official ban of the use of castanets.

Similarly, beach seine nets are also predominately used in jama'are basin than Nguru –Gashua and Hadejia wet land, the predominant use of beach seine nets in jama'are might be due to open river system, suitable landing sites and Scanty of aquatic vegetation in comparison with marshy nature of landing sites for beach seine nets.

Due to seasonal variation, active gears such as cast net were used more commonly during the receding flood and during the low water (period rising). Cast nets, long lines (baited) and gillnets are used in permanent water bodies by professional fishermen in the study are.

In the present study, it was observed majority of the fishermen used multi gear, i.e., one fisherman could own one or more fishing gears such as, one cast net, one set of hook and line as well as some traps and any of them can be use anytime the fisher wants. According to reported by ago *et al*. (2011), different gears are used for targeting fish because of habitat

changes. According to Bankole (2003), fishers used different kind of fishing gear because of seasonal variations in species availability. 1 – 3 inches for gillnets.

Fish Species Composition and abundance

Species composition and diversity is a useful parameter for the comparison of communities under the influence of biotic disturbances or to know the state of succession and stability in the community (Olawusi-Peters and Ajibare, (2014). The thirty-four (34) species diversity encountered in Hadejia Jamare Komadugu river basin is an indication of good species diversity which is higher than the 27 families reported from Asejire dam by Ipinmoroti (2013); 25 from Oramiri-Ukwa river by Adaka (2014); 12 from Gbedikere Lake, Bassa, Kogi state by Adeyemi *et al*. (2010) and 18 from Geriyo lake by Adedeji *et al*., (2017).

However, Zira *et al* (2015) reported 47 species from Kiri dam while Mohammed *et al.* (2013) encountered 63 species from Halda river of Bangladesh. The fifteen (15) families encountered in this present study can be said to be fair when compared to family composition of water bodies of similar status. Adaka *et al*, (2014) reported twenty-one families from Oramiri-Ukwa River, southeast Nigeria. Mohammed also reported twenty-one families from Halda River of Bangladesh.

Changes in species composition and diversity has been discussed and reported to be influenced by biotic and a biotic factor, types of the ecosystem, age of the water body, depth and volume of the water, water level fluctuations (Sukhla and Singh, 2013), gradual and abrupt changes in physical parameters, river zonation and river continuum with increased human activities. The differences in the observed fish composition and diversity in this study compared to others in the same or different ecozones may be attributed to the extended period of investigation (Teugels *et al.*, 1992) as this study covers a period of twenty-four months. The number of efforts or researchers in the collection or sampling of species has also been reported to influence species distribution and composition (Teugels *et al.*, 1992) as only two (2) fishers per station were employed during this present study.

The fish species abundance in the present study was relatively lower to the earlier reports of (Tabor 1973; Matthes ,1990) who reported 46 fish species before construction of Tiga dam for the lower Yobe River and 40 species fish excluding about 30 unidentified species.

low species recorded may also be attributed to overfishing and alterations in the environmental condition e.g. the construction of dams (Challawa Gorge, Tiga, Hadejia and proposed Zaki dam) across river, invasion of aquatic weeds basin. Welcome, (2009) reported that construction of dams interferes with migratory pathway of species of fish that need to move within the channel to breeding ground or dry season refugia (an area in which a population of organisms can survive a period of unfavorable conditions).

Lemly *et al*., (2000) who reported that fishermen in Hadejia Jama'are basin have reported that catches are reducing significantly due to invasion of aquatic weeds (*Typhadomingensis)* which prevent fishermen from having access to other parts of the wetlands.

The dominance of *Oreochromis niloticus* (Cichlidae) may also be linked to their high reproductive capacity (Solomon *et al*., 2016). The prolific breeding of tilapia enables them to easily populate water bodies especially at locations of least abundance of predators (Ikpi and Okey 2010) This finding is also similar to findings of Solomon *et al.*, (2017) in kalgwai lake in Jigawa state; Stephen Dada (2015) in Dogon Kamuku national park, Birinin Gwari, Kaduna state.

Conclusion and Recommendations

The fish biodiversity in HJKY River basin has seriously decline and urgent measures are required. Issue to improve the sustainability of fish biodiversity such as harmonization and enforcement traditional fish law, development of community based fisheries management plan, establishment of protected area, straightening the fishing committee to patrol illegal fishing is vital to improve the sustainability of fisheries in Hadejia Jama'are Komadugu Yobe basin.

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