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Stock Assessment of *Oreochromis niloticus* and *Clarias gariepinus* from River Hadejia, Jigawa State

Kabir Muhammad[1, 2], Nasir Mudassir[2], Tahir Abubakar Tahir[2], Ashiru Rabi Muhammad[2], Isah Zakar Muhammad[1, 2], Umar Auwal Malam Madori[2], Ibrahim Umar[2]

[1]Department of Biological Science, Sule Lamido University, Kafin-Hausa, Nigeria

[2]Department of Animal Science, Kano University of Science and Technology, Vudil, Nigeria

Email address:
Kmuhammed1013@gmail.com (K. Muhammad)

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Abstract: The study aimed at assessing the fisheries potentials of Hadejia River. Data on the captured of the fishes were collected over a period of five weeks using gill nets of various mesh sizes, with the assistance of the fishermen. A total of twenty five different fish species belonging to 14 families were identified. The family Cichlidae dominated the fish fauna with 54%. The families Claridae constituted 20%, while the others were the least with only 26%. The fish caught per day was about 1,308 from six landing sites, with 14 fishermen operating averagely from each site. The study also revealed that the river was partially over-fished. Fish samples were collected weekly for five weeks period, from the sampling station using fishing gears of various mesh sizes (3, 4, 5, 6, 7, 8 centimeters), with the assistance of the fishermen. Fish samples were identify and weighed fresh, at landing sites to the nearest gram. Standard and total lengths were taken using a measuring board and also the diversity of fish recorded in this study indicates that the River has relatively high fish diversity. The number and biomass of fish caught during the study is considered high, when compared to other Nigerian Rivers. The sizes of fish recorded also indicate that the River is been over fished. It is therefore recommended that the government and other donor agencies should provide support for research and studies to collect analyze and synthesize information and harmonize existing policies, edicts and byelaws that conform to Integrated Water Resources Management (IWRM) principles, including establishing criteria for water use. The artisanal fishermen should also be encouraged to maintain the use of mesh size regulation.

Keywords: Fish, Nets, Gears

1. Introduction

Water bodies differ in origin, function and geographical locations and exhibit marked differences in fish production. Many workers have carried out studies on the effect of different physico-chemical parameters on fish production at different times and in different areas of the world. Such works include those on Temperature [8] pH [16] salinity [39] turbidity [27] and dissolved oxygen [31]. A positive correlation between phytoplankton, zooplankton and productivity in lakes has been described and used to estimate fish yield [36].

According to [22], the basic purpose of fish stock assessment is to provide advice on the optimum exploitation of aquatic resources such as fish. Living resources are limited but renewable, and fish stock assessment may be described as the search for the exploitation level, which in the end gives the maximum yield in weight from the fishery [25]. The term "stock" in fish stock assessment means a sub-set of one species having the same growth and mortality parameters and inhabiting a particular geographical area. [35] Defined a stock as "a population of organisms which, sharing a common gene pool is sufficiently discrete to warrant consideration as a

self-perpetuating system which can be managed" while [28] defined stock as "an intras-pecific group of randomly mating individuals with temporal or spatial integrity. Perhaps the most suitable definition in the context of fish stock assessment was given by [12] who stated that for fisheries management purposes, the definition of "unit stock" is an operational matter, i.e. a sub-group of a species can be treated as a stock.

Fish stock assessment should be made for each stock separately [2]. The results may (or may not) subsequently be pooled into an assessment of a multispecies fishery [15]. Fish stock assessment involves some basic steps. The first step is to collect data on the fishery, which often have to be supplemented by assumptions or qualified guesses [21]. The data is then processed by applying a model to estimate the growth and mortality parameters. The data on the fishery i.e. original data may be research survey data (Frame survey), data from samples drawn from the commercial fisheries or a combination of both.

Nigeria is blessed with numerous inland water bodies. There are over 323 man-made lakes in the country occupying 137,802 hectares of the land [29]. The need for sustainability of fishing resources prompted researchers to investigate the potentials of the water bodies for fish production [1]. Stock assessment of fish in the tropics has been carried out by researchers such as [11, 24, 39, 18, 1]. Despite these studies, there is still insufficient information on stocks of lentic water bodies of the tropics as compared to the extensive

The rapid growth of Nigerian population has lead to insufficiency in supply of animal protein source food [4]. Consequently, this also has lead to tremendous efforts resulting in increasing animal production. Fish is a major source of animal protein source and an essential food item in the diet of many people in Nigeria [32]. Fish is also a good source of thiamine, riboflavin, vitamins A and D, phosphorus, calcium and iron. It is also very high in polyunsaturated fatty acids which are important in lowering blood cholesterol level. It is therefore suitable for complementing high carbohydrate diets typical of the low income group in Nigeria [6]. Apart from being food, fish is also an important source of income to many people in developing countries including Nigeria [23]. [22] Confirms that as much as 5% of the African population (some 35 million people) depends wholly or partly on fisheries sector for their livelihood.

The consumption and demand for fish as a cheap source of protein is on the increase in Africa [33]. The vast majority of the fish supply in most countries comes from the rivers in the continent as capture fisheries based on species that are presently exploited seem to have reached their natural limits [22]. [23] In "The State of the World Fisheries and Aquaculture" concludes that developments in world fisheries and aquaculture during recent years have continued to follow the trends that were already becoming apparent at the end of the 1990s; capture fisheries production is stagnating and aquaculture output is expanding faster than any other animal-based food sector [38, 26]. Thus, development policies increasingly perceive aquaculture as an engine for economic growth and prospect for future fish supply.

Nigeria is richly endowed with numerous natural resources-rivers, lakes, swamps, large expanse of brackish and marine waters, fadamas etc to develop her fisheries [13]. However, the nation is today a net importer of fish and has been ranked a protein deficient country [6]. Also, potentials abound in Africa to develop and expand Aquaculture (viable fish farming) but there are limitations [43, 19, 7, 17]. For many years, water quality has been the most important limitation to fish production. However in recent years, nutrition is increasingly regarded a key limitation to increased production efficiency as well as the growth and propagation of "new" species. However, success of aquaculture depends on amount of nutritional information available and the development of effective and appropriate hatchery management techniques relevant to fish farmers' needs [41]. [40] Confirmed that inadequate quantity and quality fish fingerlings of culturable fish species and efficient feed are the two major constraints to increased fish production especially in developing countries including Nigeria. [34] Also stated that among the pre-requisites for successful fish farming is the availability of suitable artificial feeds formulated from locally available and cheap ingredients that contain all nutritional requirements of culture fish. [27, 37, 9] showed that ponds including cage system have their maximum standing crop, when the fish makes use of all food without any gain or less in weight and consequently, length and depth. In addition, [5] proved that total yield per unit area is dependent upon stocking mass per unit area.

Objectives of the study

The main objective of this study was to determine the diversity and abundance of the fish species in the river with the aim of estimating the fisheries potential of the river.

Specific objectives were

1. To determine the diversity and abundance of the captured fish species in the river.
2. To determine the effects of physico-chemical parameters over the production of fish species.
3. To determine the length-weight relationship of fish species.

2. Material and Methods

2.1. Study Area

The Hadejia River is a river in northern Nigeria and is a tributary of the Yobe River (Komadugu Yobe). Among the cities and towns lie on or near its bank are Hadejia and Nguru.

Damming of the river for the purpose of irrigation has led to decrease the amount of water in the Hadejia and Nguru wet lands, which the river forms along with Nguru Lake. The Hadejia River is now 80% controlled by the Tiga and

challawa Gorge dams in Kano state.

The Hadejia River in North West Zone of Nigeria lies about latitude 9° to 14N and longitude 3.5° to 12°E.

2.2. Fish Sample

Fish samples were collected weekly for five weeks period, from the sampling station using fishing gears of various mesh sizes (3, 4, 5, 6, 7, 8 centimeters), with the assistance of the fishermen. The sampling station were selected based on the intensity of human activity, Fish samples were identify and weighed fresh, at landing sites to the nearest gram. Fish identification was done using various reference materials such as Reed et al., (1967) and Leveque et al., (1992). Standard and total lengths were taken using a measuring board as described by Lagler et al., (1977). The numbers of fishermen operating on the river were counted and the types of gears they used were identified. Oral interviews were also conducted with the fishermen to estimate the fish stock of the river.

2.3. Length and Weight Measurement

Sampled fishes were measured fresh, both standard length; the length of a fish measured from the tip of the snout to the posterior end of the last vertebra or to the posterior end of the midlateral portion hypural plate. And total length; the length of fish measured from the tip of the snout to the tip of the longer lobe of the caudal fin. While, standard weight in fish is the typical or expected weight at a given total length for specific species of fish.

2.4. Data Collection

The data is collected from the fishery itself, using both commercial and recreational sources, which was obtained from the recorded landings. Landings are a record of the amount of fish sold and the numbers are typically reported in total weight.

2.5. Length-Weight Relationship ($w=aL^b$)

The length- weight relationship and condition factor was investigated from the sampled species of O. niloticus and C. gariepinus in river Hadejia for five weeks from March 2, 2014 to March 31, 2014. The experimental fish range from 13.0 – 50.0cm & 100 – 6700.5g for tilapia and 23.0 – 60.0cm & 300 – 2,000g for Clarias respectively.

2.5.1. Condition Factor K

Most of the fishes caught are in healthy condition as observed from the length and weight measurement, the rate of mortality is very few. And also the parameters are suitable for fish production.

2.5.2. Water Quality Monitoring

All the aspects of physico-chemical parameters were observed and measured as well as transparency and color of the water.

2.6. Data Analysis

Regression analysis was used to establish the length-weight relationship with the aid of statistical package for social scientists, (SPSS) version.

Table 1. *Shows the Diversity and abundance of fish species of the River Hadejia.*

Fish species	Family	local name
Oreochromisniloticus (Linnaeus 1758)	*Cichlidae*	*Nile tilapia (sakiya)*
Tilapia zilli (Gervais 1848)	*Cichlidae*	*Kurwa*
Sarotherodongalilaeus (Pellegrin 1903)	*Cichlidae*	*Tilapia (fararwala)*
Clariasgariepinus (Burchell 1822)	*Claridae*	*Mud fish (tarwada)*
Heterobranchus bi-dorsalis (E. Geoffroy 1809)	*Claridae*	*Spotted cat fish (zari)*
Synodontisvermiculatus (Daget 1954)	*Mochokidae*	*Cat fish (kurungu)*
Synodontiscourteti (Pellegrin 1906)	*Mochokidae*	*(kurungu)*
Synodontisnigrita (Valenciences 1840)	*Mochokidae*	*(karaminkaraya)*
Synodontismembraceus (Geoffr. 1809)	*Mochokidae*	*(karaya)*
Gnathonemuspetersii (Gunther 1862)	*Mormyridae*	*(faya)*
Marcuseniuscyprinoides (Ruppell 1832)	*Mormyridae*	*(tatar)*
Shilbemystus (Linnaeus 1758)	*Shilbedae*	*(lulu)*
Siluranodonauritus (Geoffr 1809)	*Shilbedae*	*(lafar)*
Auchenoglanis	*Occidentalis* (Pelleg. 1909) *Bagridae*	*(gwami)*
Bagrusbayad (Forskal 1775)	*Bagridae*	*Silver cat fish (musko)*
Leptocyprisniloticus (Joannis 1835)	*Icthyboridae*	*(saro)*
Barbusoccidentalis (Boulenger 1911)	*Icthyboridae*	*(burdo)*
Hydrocynusbrevis (Gunther 1864)	*Characidae*	*Tiger fish (tsage)*
Citharinuscitharus (Geoffr. 1809)	*Chitarinidae*	*(kausa)*
Brycinus nurse (Ruppell 1832)	*Characidae*	*(kawara)*
Protopterusannectens (Owen 1839)	*Lepidosirenidae*	*African lung fish (gaywa)*
Mormyropsanguilloids (Linnaeus 1758)	*Mormyridae*	*(mulgi)*
Latesniloticus (Linnaeus 1758)	*Centroponidae*	*Nile perch (barya)*
Heterotisniloticus (Cuvier 1829)	*Osteoglossidae*	*Bony tongue (bargi)*
Malapteruruselectricus (Gmelin 1789)	*Malapteruridae*	*Electric cat fish (minjirya)*

3. Result

Table 2. *Weekly number of fish recorded at Hadejia River.*

Weeks	Species	
	O. niloticus	***C. gariepinus***
1	824	484
2	818	772
3	804	776
4	824	584
5	810	242
Total	4,080	2,858

Table 2 presented the weekly captured fishes with the highest number recorded in the first week and the lowest number recorded in the third week for *O. niloticus,* while the highest number of fishes recorded for *C. gariepinus* was in third week and the lowest in week five.

Table 3 Stated the amount of fishes caught by each gear. The result shows the abundance of tilapia over Clarias. The gears like seine net, gill net cast net and hook and line has the higher number of fishes caught, while the Malian trap and cane traps were the least.

Table 3. *Estimated fishes caught for each gear.*

Gear	***O. niloticus***	***C. gariepinus***
Seine net	1,451	554
Gill net	951	407
Cast net	723	419
Scoop net	213	201
Hook and line	318	980
Malian trap	49	41
Woven trap	-	-
Cane trap (large)	276	200
Cane trap (medium)	64	30
Cane trap (small)	35	26

Table 4 indicated the regression parameters of the two species encountered from the data obtained from the length and weight measurement of the samples measured.

Table 4. *Regression parameters of O. niloticus and C. gariepinus.*

Species	n	a	b	SE of a	SE of b	r
O. niloticus	150	1.89	2.91	0.81	1.18	0.781
C. gariepinus	150	2.13	3.05	0.98	0.79	0.809

Were, a, b=regression parameters of estimate
r=correlation coefficient
SE=standard error
n=number of fish sample

Table 5 shows the means physico-chemical parameters of the study area.

Table 5. *Physico-chemical parameters of River Hadejia.*

Weeks	Parameters		
	Temp. °C	pH	DO
1	27	6.8	6.0
2	28	6.8	5.0
3	29	6.8	6.0
4	28	7.0	6.0
5	27	6.7	6.0

4. Discussion

It was obvious from the results that Hadejia River showed fish abundance in terms of number and weight, and there was relatively high species diversity. The catch number of 1,308 in the first week was an indication of high productivity, which was also higher than the 5.8kgobserved by Henderson and [42] for 31 African Lakes. The fish diversity of 14 fish families and twenty five different fish species was also higher than fish diversities observed from small lakes such as Bakalori, Goronyo and Tiga, [29]. Kangimi [11], Dan-Zaria [34], Doma, [37].

The dominance of fish family Cichlidae in Hadejia River compares favorably with dominance ofthe cichlids in Lakes Kainji, Tiga, Bakalori and other African Lakes and Rivers [30, 10, 11, 37, 10]. The order Cichlidae, Bagridae, Characidae reported for Lakes Kainji, Tiga and Bakalori [10] was in contrast to the order of Cichlidae, Claridae, Osteoglosidae and Mormyridae observed in Hadejia River.

The use of gillnets by the majority of fishermen in Hadejia River, and their use of certain mesh sizes indicates that the fishermen are to a certain extent lightened on the conservation of fish species. The fishes caught at Hadejia River are relatively larger than the average at Kainji Lake. This is attested to, by the studies of [3] who opined that 96% of the fishes caught in Kainji Lake contravened the fifth schedule section 11 of the Kebbi and Niger States fisheries Edict of 1997. The Edict prohibits the catching of individual fishes shorter than 12cm. According to [3], some important factors influencing the efficiency and selectivity of gillnets are mesh size, exposed net area, floatation, mesh shape and hanging ratios, visibility and type of netting material in relation to stiffness and breaking strength. [3] Suggested that the existing minimum limits of gillnets mesh size (76.2mm) should be reviewed, in view of the small sizes of fish caught in Lake Kainji. This may not be unconnected with changes in physico-chemical properties brought about as a result of infestation by aquatic macrophytes. [14] showed that there was reduced fish yield in water bodies that are infested by Typha.

5. Conclusion

The diversity of fish recorded in this study indicates that the River has relatively high fish diversity. The number and biomass of fish caught during the study is considered high, when compared to other Nigerian Rivers. The sizes of fish recorded also indicate that the River is been overfished.

6. Recommendations

It is therefore recommended that the government and other donor agencies should provide support for research and studies to collect analyze and synthesize information and harmonize existing policies, edicts and byelaws that conform

to Integrated Water Resources Management (IWRM) principles, including establishing criteria for water use. The artisanal fishermen should also be encouraged to maintain the use of mesh size regulation.

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