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The Feeding Habits and Some Aspects of the Biology of Fish (*Oreochromis niloticus)*

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Abstract

This study focused on the feeding habits and some aspects of biology of fish (Oreochromis niloticus) from Girzhiva stream, Muchalla area, Mubi zone, Nigeria. It was conducted for a period of four months (4) Starting from February,2023 and ended in May,2023. Water was collected from three (3) different sites twice a month and was analyzed using standard methods for quality and fish sample determination. The sites mean and monthly mean water temperature, conductivity, Dissolved Oxygen DO, Hydrogen Ion Concentration pH, Transparency, Total Dissolved Solid TDS, and Ammonia ranged from [26.20±0.79-25.83±0.79 and 27.53±0.18-25.50±0.06, 147.67±1.00-177.67±1.00 and 243.59-186.01±1.00, 3.73+0.31-4.33±0.31 and 3.96±0.34-4.42±1.00, 7.60±1.00-7.97±0.52 and 7.24±0.34-7.70±0.34, 31.67±1.00-48.00±1.00 and 31.19±0.11-49.90±1.00, 62.00±1.00-174.67±0.32 and 1.80±1.00-76.41±1.00, 0.26±0.24-0.28±0.24 and 0.13±1.00-0.26±0.84] respectively. The monthly water qualities were within the range set up by FEPA and WHO. The results obtained for length weight relationship regression are r^2=0.6378, x=1.2206 y=1.8835. The results obtained for stomach contents based on frequency of occurrence and total point method are 26.60%, 84.12 plants materials, 20.52%, 71.75% digested food materials, 18.92%, 57.01% unidentified materials, 17.63%, 46.43% insect materials and 16.41%, 48.31% detritus. The ratio of male to female obtained was 7:5. The fecundity results obtained 14086±1.00--25100±1.00 at site and 9943±1.00—28519±1.00. These indicate that the fish are prolific. It was recommended that a continuous monitoring of water quality of Girzhiva stream should be done to examine their level of pollutions.

Keywords: *Fish farming, Feeding habit, Oreochromis niloticus*

Introduction

Fish species need a balanced diet to perform growth, reproduction, and other physio-logical functions as described by Temesgen *et al*. (2022). The scientific studies on fish food and feeding habits provide successful management of both capture fisheries and aquaculture which recognize the trophic relationships available in water ecosystems by finding the diet structure, composition, and stability of food webs (Otieno *et al*., 2014; Tesfahun and Temesgen, 2018). In natural water bodies, plankton (phytoplankton and zooplankton), macrophytes, aquatic insects and their larvae and pupae, nematodes (round and flatworms), and sediment are the primary food items of *O. niloticus* (Hussian *et al*., 2019). The presence of quality foods in water bodies governs the fish's health, growth performance, and fecundity potential (Gebru, 2020).

Wagaw *et al*. (2022) also confirmed that the condition factor and length-weight relationship of fish are determined by the prey availability in the water bodies. Length-weight relationships (LWRs) of fishes are important in fish biology because they allow the estimation of the average by establishing a mathematical relationship between the relative wellbeing of the fish population. The stream of Girzhiva serves many purposes which include irrigation (dry season farming), fishing, as well as a source of domestic water used by the community and as a source of drinking water for cattle. A number of miscellaneous water users also participate in this value chain. The great commercial food value of this stream has brought impact to the human life of this community. So far, very limited data/information on water quality conditions of this stream has been documented.

Materials and Methods

The Study Area

This study was carried out in Muchalla and Girviza River, Adamawa State. It lies between latitude 9º 00' N to 11º 00' N and longitude 13°00 'E to 14°00'E of the Greenwich meridian with a total land mass of 506.4Km^2 and a population size of 682,026 people (NPC 2006). The area experiences a tropical climate influenced by the Inter Tropical Convergence Zone and relief. Rainfall starts in April and peaks in July/August, with high intensity. Fishing and fishery activities are predominant in these rivers (Adebayo and Tukur 2020).

Sample Sites and duration of sampling

For the purpose of this research, Girzhiva stream as one of the major fishing locations was divided into three (3) sites. These include inlet of the stream as site A, middle of the stream as site B and outlet of the stream as site C. The study was conducted bi-monthly in triplicate for the period of four months (120 days) starting from February-May 2023. Water and fish samples were collected from the sites.

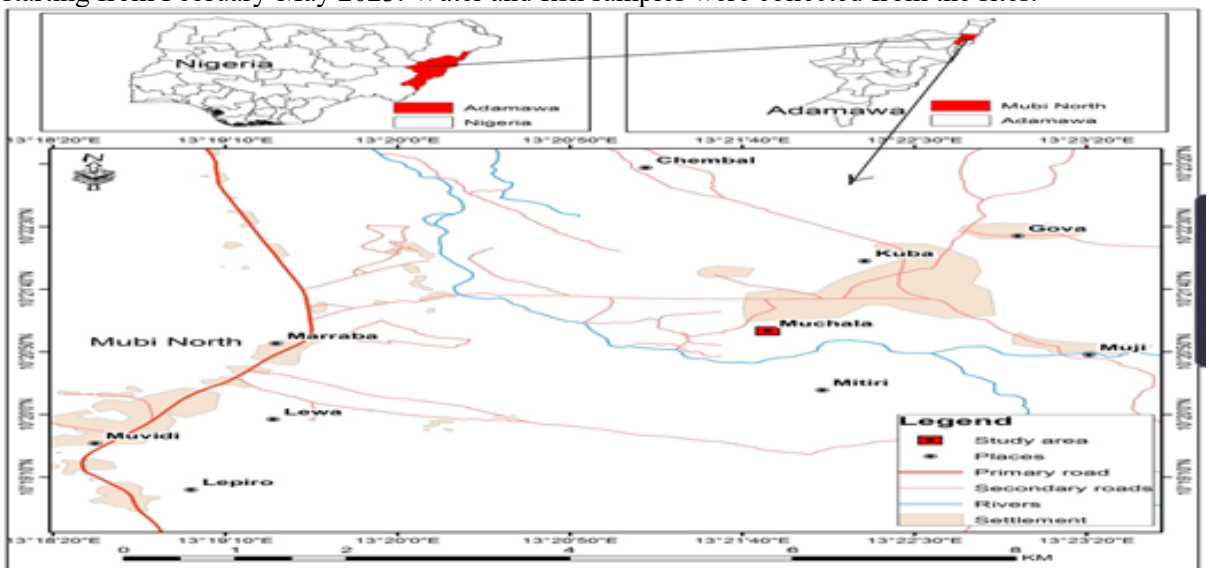


Fig 1: Map of the Study Area

Fish Sampling

Nine (9) *O. niloticus* were purchased from the fishermen at the study area bi-weekly in triplicate for the period of four months.

Length and weight Determination

Total length and standard length of fish was determined from the mouth snout to the tip of caudal fin and the hypural bone respectively using a measuring board reading was taken in centimeters (cm) as recommended by Reed *et al*, (1967). Weight of the fish was determined with electronic weighing balance

record was taken in grams (g), the length weight relationship was determined using a formular described by Bagenal and Tesch. (1978).
$W = aLogb$
Was logarithmatically transformed into log
$W = \log a + b \log L.$
W = weight of fish in grams,
L = total length of fish in centimeters,
a = proportionality constant and
b=allometric coefficient both estimated by method of least squares.

Condition factor

Condition factor (CF) was determined using the expression by Ritcher (2007):
$K = W100 / L^3$
K=condition factor,
W = total weight and
L = total length.

Stomach Contents

Stomach contents were determined by dissecting the fish lengthwise and the stomach was removed and dissected under dissecting microscope then the stomach contents was washed into a petri dish and observe under a microscope recording each food items in the stomach of fish. The frequency of occurrence and point method was used as recommended by Hynes (1950).

Fecundity Determination

Gravimetric method was applied to determine the fecundity of *O.niloticus.* (Lagler, 1956). The fecundity (F) was calculated by the gravimetric method on gonad developmental stage IV with equation as shown below (Nichol and Acuna, 2001): In this method, the weight of two ovaries was measured on an electric weighing balance and recorded as W, then small portion of the two ovaries was taken and measured and recorded as w. Then the small portion which was recorded as w was gently counted and recorded as n. The formula below was then used to calculate fecundity;
$F= W \times n/w$
Where, F is fecundity, W is the weight of ovaries, n is number of eggs in subsample w is weight of subsample egg.

Data Analysis
All data obtained was subjected to Analysis of Variance (ANOVA) to test the level of significance among stations and monthly means, while Stomach contents was subjected to descriptive statistics i.e simple percentage.

Results
Length-Weight Relationship and Condition Factor of *O. niloticus* of Girzhiva Stream
The result of length and weight relationship is presented in Tables 1 and 2. Total length was lowest at site B (9.57 ± 0.28^a) while site C (10.83 ± 0.28^a) recorded the highest total length; the lowest weight was recorded at site A (18.90±0.43a) while the highest weight was recorded at site C (21.10 ± 0.43^a). The monthly total length was recorded lowest in February (9.42 ± 0.49^b) while April (13.12 ± 1.00^a) recorded the highest total length, the lowest monthly mean weight was recorded lowest in March (16.06 ± 0.22^a) while the highest monthly mean weight was recorded in April (21.65 ± 0.22^a) There was no significant difference $P>0.05$ of total length between sites but differs significantly $P<0.05$ across months. Standard length was lowest at site B (8.13 ± 0.35^a) while highest standard length was recorded at site C (8.97 ± 0.35^a). The monthly standard

length was in February (7.83±57[b]) while April (11.49±1.00[a]) recorded the highest standard length. There was no significant difference P>0.05 of standard length between sites but differs significantly across months. The results for regression r^2=0.6378, x=1.2206 y=1.8835.

Table 1: Lenth-weight Relationship of *O. niloticus* of Girzhiva stream

Parameter	Site A	Site B	Site C	SEM
Total length (cm)	9.78±0.28[a]	9.57±0.28[a]	10.83±0.28[a]	0.417
Standard length (cm)	8.50±0.35 [a]	8.13±0.35[a]	8.97±0.35[a]	0.307
Weight (g)	18.90±0.43[a]	21.00±0.43[a]	21.10±0.43[a]	0.951

Means with the same superscript in the row are not significantly (P>0.05) different.

Table 2: Monthly Length-Weight relationship *O. niloticus* from Girzhiva Stream

Month	Total length	Standard length	Weight
February	9.42±0.49[b]	7.83±0.57[b]	17.56±0.22[a]
March	9.54±0.49[b]	8.32±0.57[b]	16.06±0.22[a]
April	13.12±1.00[a]	11.49±1.00[a]	21.65±0.22[a]
May	10.28±0.49[b]	8.41±0.57[b]	19.63±0.22 [a]
SEM	0.557	0.521	0.337

Means with the same superscript in the row are not significantly different (P>0.05).

Condition Factor of *O.niloticus* from Girzhiva Stream

Results obtained for condition factor of both sites and months are presented in Tables 3 and 4 the lowest condition factor was recorded in site C (0.94) while the highest condition factor was recorded at site A (1.84). The lowest monthly condition factor was recorded in April (1.13) while the highest monthly condition factor was recorded in May (1.93).

Table 3: Condition Factor of *O. niloticus* from Girzhiva stream

Sites	**No. of fish examined**	**Mean length (cm)**	**Mean weight (g)**	**Condition Factor (k)**
A	24	11.02	24.6	1.84
B	24	11.2	23.2	1.65
C	24	13.5	23.1	0.94

Table 4: Monthly Condition Factor of *O. niloticus* from Girzhiva stream

Months	**No. of fish Examined**	**Mean length (cm)**	**Mean weight (g)**	**Condition Factor (k)**
Feb.	18	9.8	17.6	1.87
Mar.	18	9.4	16.7	1.89
Apr.	18	12.8	23.8	1.13
May	18	10.7	23.9	1.93

Food Identified in the Stomach of *O. niloticus* from Girzhiva Stream

The various food items Identified are shown in Table 5 Plants materials dominated the dietary items with a percentage of frequency of occurrence and total point of about (26.60% and 84.12%). Digested food materials come second with a percentage of frequency of occurrence and total point of (20.52% and 71.75%). Unidentified materials had (18.92% and 57.01%) frequency of occurrence and total point. Insect materials had (17.63% and 46.26%) percentage of frequency of occurrence and total point. Detritus has the lowest percentage of frequency of occurrence and total point (16.41% and 48.36%).

Table 5: Stomach content of *O. niloticus* based on percentage of frequency of occurrence and total point

Food items	% of frequency of Occurrence	% of Total point
Plant materials	26.60	84.12
Insect material	17.63	46.26
Ditritus	16.41	48.36
Unidentified material	18.92	57.01
Digested food material	20.52	71.75

Fecundity of *O. niloticus* from Girzhiva Stream

Tables 6 and 7 showed the fecundity of *O. niloticus.* The total number of female fish was lowest at site B (7.33 ± 0.57^{a}) while the highest was at site C (11.33 ± 0.57^{a}). The monthly total number of female fish was in May (7.00 ± 0.28^{a}) while the monthly total number of female fish was highest and uniform in February, March and April (8.00 ± 1.00^{a}). There was significant difference $P<0.05$ of total number of female fish between sites and months. The total number of eggs was lowest at site C ($14,0861\pm1.00^{c}$) while site A ($25,100\pm1.00^{a}$) recorded the highest number of eggs. The monthly number of eggs was lowest in April ($9,943\pm1.00^{a}$) while February ($28,519\pm1.00^{a}$) recorded the highest number of eggs. There was significant difference $P<0.05$ between sites and months. Number of female fish without eggs was lowest at site B (1.00 ± 0.18^{a}) while site C (7.00 ± 1.00^{a}) recorded the highest. The monthly number of female fish without eggs was lowest in February (1.00 ± 1.00^{a}) while the highest was recorded in May (4.00 ± 0.27^{a}). There was significant difference between sites $P<0.05$ but not differs significantly across months. Number of female fish with eggs was lowest at site C (4.00 ± 1.00^{a}) while site A (10.00 ± 12^{a}) recorded the highest number of female fish with eggs. The monthly number of female fish with eggs was lowest in May (3.00 ± 1.00^{c}) while February (7.00 ± 1.00^{a}) recorded the highest number of female fish with eggs. There was significant difference $P<0.05$ across site and months.

Table 6: Fecundity of *O. niloticus* from Girzhiva stream

Parameter	Site A	Site B	Site C	SEM
Total no. of female fish	12.00 ± 0.57^{a}	7.00 ± 1.00^{b}	11.00 ± 0.57^{a}	0.830
Total no. of eggs	25100 ± 1.00^{a}	19726 ± 1.00^{b}	140861 ± 1.00^{c}	1606
No.of female without eggs	2.00 ± 0.18^{b}	1.00 ± 0.18^{b}	7.00 ± 1.00^{a}	0.779
No. of female with eggs	10.00 ± 0.12^{a}	6.00 ± 0.16^{b}	4.00 ± 1.00^{a}	0.879

Means with the same superscript in the row are not significantly (P>0.05) different

Table 7: Monthly sex identification and fecundity of *O. niloticus* from Girzhiva stream

Months	Female	Fish with eggs	Fish without eggs	Total number of eggs
Februar y	8.00 ± 0.28^{a}	7.00 ± 1.00^{a}	1.00 ± 01.00^{a}	28519 ± 1.00^{a}
March	8.00 ± 0.28^{a}	5.00 ± 1.00^{b}	3.00 ± 0.27^{a}	13379 ± 1.00^{b}
April	8.00 ± 1.00^{b}	5.00 ± 1.00^{b}	3.00 ± 0.27^{a}	9943 ± 1.00^{d}
May	7.00 ± 0.28^{a}	3.00 ± 1.00^{c}	4.00 ± 0.27^{a}	10344 ± 1.00^{c}
SEM	0.279	482	0.411	2293.74

Means with the same superscript in the column are not significantly different (P>0.05).

The analysis of Length-Weight relationship of *O. niloticus* showed that the mean standard length and weight of male were higher than that of female as reported by David *et al.,* (2010). Results obtained in this study agreed with the report of Kefas *et al*. (2020), in which he reported a mean length of 9.9cm-15.9cm, and the report of Endalh *et al*. (2016). The parameters of the length-weight relationships (LWRs) might be affected by various factors including season, sex, differences in the length range of the caught specimens, population density, sexual maturity, age, habitat, stomach fullness, food quality or quantity, preservation techniques,

fish health or environmental conditions (Cox and Hinch, 1997). The regression between length and weight for both males and females were closer to 1. This means that the relationship between length and weight of both males and females were higher as the length of the fish increase.

Results obtained for condition factor in this study agreed with the report of Laurat *et al*. (2019) from lower river Benue and with the report of Omitoyin *et al*. (2013), Surrjya *et al*. (2013), Getso *et al*. (2006). It contradicted the report of Bagenal and Teach, (1978). According to Laurat *et al*., (2013) condition factor closes to, or above 1is good for fish survival. This showed that the fish in this study area are in good condition.

Analysis of the stomach content was also carried out during the period of investigation to determine the diet or type of food ingested by *O. niloticus.* Frequency of occurrence method and total point method was used to indicate the proportion of diet ingested by the fish. The results of the stomach contents analysed revealed that *O. niloticus* species were herbivorous feeder in which their diet comprised of plants materials which dominated the stomach of the fish species, insect materials, detritus, unidentified materials and digested food materials. The results obtained in this study are in relation with the one reported by Vand*i et al.* (2019) in Kiri reservoir and the report of Kefas *et al.* (2020) in lake Geriyo and that of Abidemi-Iromini (2018) in Lagos.

Results obtained for fecundity was within the range with Shoko *et al.,* (2015) the variation fecundity in both sites and months can be due to difference in food abundance as reported by Innocent *et al*. (2023). Another author revealed that within a given species, fecundity might vary because of difference in adaptation to environmental habitat Witthames *et al.,* (1995). Even within the stocks fecundity varies annually and undergoes a long-term change and has been observed to be proportional to fish size and condition (Kjesbu *et al.,* 1998).

Conclusion and Recommendation

It was concluded that the length weight relationship regression was close to 1 and food identified in the stomach revealed that *O. niloticus* species are herbivorous feeders, while the fecundity of *O. niloticus* from Girzhiva stream showed that they are prolific. The study thus recommends that a continuous monitoring of water quality of Girzhiva stream should be done to examine their level of pollutions.

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