Original Research Article

Condition Factor, Food and Feeding Habit of *Chrysichthys nigrodigitatus* (Siluriformes:Bagridae) from Lower River Benue, Makurdi, Nigeria

ABSTRACT

Background and Objective: The feeding habit as well as the condition factor of *Chrysichthys nigrodigitatus* from lower river Benue was studied between July 2015 and September 2015. **Materials and methods:** The natural food of the fish in the Lower River Benue was studied from stomach contents of the fish. A total of 100 stomachs were randomly examined and analyzed using two methods; the frequency of occurrence and point methods. About 92 had food items while 8 were empty. Analysis of variance (ANOVA) was used to test for significant difference at 95% confidence limit in the food eaten by these species and also the degree of stomach fullness. **Results:** Food items encountered using frequency of occurrence method include fish parts (47.62%), seeds (40.49%), sand/mud (30.09%), detritus (30.95%), digested food (29.76%), insect parts (27.38%), mollusk (25.00%) and algae (22.62%).

Conclusion: C. *nigrodigitatus* had a euryphagous food habits and based on condition factor the fish were in good health.

Keywords: *Chrysichthys nigrogrodigitatus, food and feeding habits, condition factor and lower river Benue.*

1.0 INTRODUCTION

Freshwater is a very important natural resource crucial for the survival of all living beings. UNESCO[1] reported that water is the most vital resource for all kinds of life on earth and essential

for sustainability of the earth's crust ecosystem. The quality of life depends on the quality of water. Physico - chemical factors are important in estimating the constituents of water and concentration of pollutants or contaminants. These factors are interrelated and interdependent with biological factors (plants and animals). Similarly, these factors immensely influenced the uses as well as the distribution and richness of biota[2]. The freshwater Nile silver schilbeid catfish, *Schilbe mystus*, (Order: Siluriformes, Family: Schilbeidae) and the freshwater Bagrid catfish, *Chrysichthys nigrodigitatus*, (Order: Siluriformes, Family: Claroteidae) constituted one of the most dominant fish species in Nigeria inland waters. They are among the frequent commercial fish catches in these rivers; caught mostly with drag net, hook and line, bottom-set gillnet as well as bottom-set traps, since they are bottom dwellers. *C. nigrodigitatus* has been investigated for possibilities of its culture Ekanem[3] which throughout West Africa is carried out largely in brackish water environment throughout life. Knowledge of the growth rate, reproductive biology and physiological characteristics of this species in response to salt diets are important for management, sustainable utilization and to ensure successful culture of this species in different conditions in both fresh and brackish water environments[4]. It is reasonable to expect that diet is an important source of salts that could satisfy the osmoregulatory requirements of the fish in freshwater or low saline water

The dietary habits of fish, based on stomach analyses, are widely used in fish ecology as an important method to investigate trophic relationships in aquatic communities[5]. Food and feeding habits of some species of *Chrysichthys* in Nigeria have been studied in River Ase[6], River Ethiope[7], Cross River[8] and Kainji Lake[9].

The study of condition factor is important to understand the life cycle of fish species, and contributes to an adequate management of the species and to the maintenance of the ecosystem

equilibrium[10]. Condition index may be used to determine the reproductive time of fish species without sacrificing the organisms, and this could be a valuable tool to develop monitoring programs for the species fisheries and culture programs[11]. Condition index may be used to determine the reproductive time of fish species without sacrificing the organisms, and this could be a valuable tool to develop monitoring programs for the species fisheries and culture programs[10].

There is no information available on the food and feeding habit and condition factor of *Chrysichthys nigrodigitatus* in lower River Benue.

This study aims to give information on the condition factor and feeding habits of *C. nigrodigitatus* from the lower river Benue, which could be useful in the sustainable exploitation of this species thereby adding to the existing knowledge of the biology of the species.

FIG 1: ***Chrysichthys nigrodigitatus***

2.0 MATERIAL AND METHODS

2.1 Study Area

The research lasted for three (3) months (July – September 2015). This study was carried out in Makurdi, the capital of Benue state of Nigeria. The state is bounded by Taraba to the East, Nassarawa to the North, Kogi to the West, Enugu to the southeast and Cross River to the South. This area lies between latitude and longitude 7.7322°N and 8.5391°E.

River Benue, as the second largest river in Nigeria, has great influence on the commercial activities of the area. Inhabitants of the river take fishing as a means of livelihood because of the numerous and diverse fish that abound in the River.

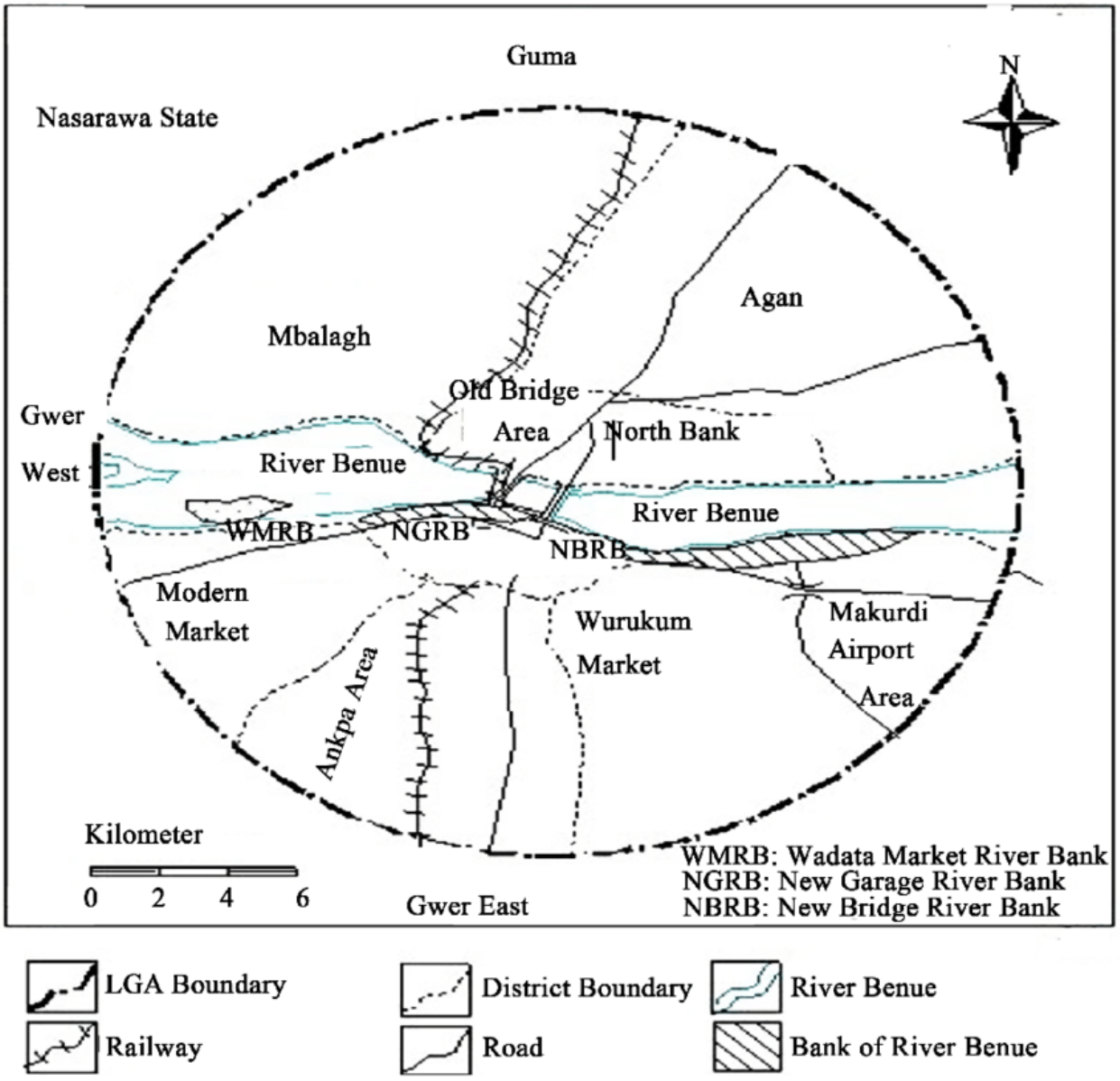

FIG 2: Map showing of lower River Benue, Makurdi showing sample collection point

Source: Google map

2.2 Collections of Samples

The fish specimens used for the study were obtained from the fish landing site at Wadata Market in Makurdi, Benue state. About 100 *C. nigrodigitatus* were randomly sampled throughout the study period and usually in the morning between 7:00 am to 9:00 am. Collected samples were fixed in an ice chest and moved to the department of fisheries and aquaculture laboratory where they were serially numbered before measurements of Length and weight.

2.3 Sample Measurement

Total length (TL), were measured in centimeter (cm) using a measuring board. This was taken from the tip of the anterior-most part of the snout to the tip of caudal fin for total length.

2.4 Laboratory procedure: In the laboratory, each specimen was dissected to remove the gut. The entire stomach of the fishes was removed and graded according to fullness. The graded stomach of each specimen was dissected lengthwise and emptied into a petri-dish for examination and identification. Each stomach content was dispersed with a small amount of distilled water; sub-samples were taken from the stock and observed under a stereo zoom binocular dissecting microscope.

Point method: The point method involves scoring points to different food items depending on their numbers and sizes, one large organism being equivalent to many small organisms. All the points accumulated by each food item were summed-up and expressed as a percentage of the total number of points accumulated by all the food items as follows:

$$\text{Points (\%) of a food item} = \frac{\text{No. of points of the particular food item}}{\text{Total No. of points of all food items}} \times 100$$

The frequency of occurrence method: Here, food items occurring in each of the stomachs were examined. The food organisms were identified using keys[12]. The frequency of occurrence is the

number of times a particular food item occurred in the stomach is counted and expressed as a percentage of the total number of stomachs with food (empty stomachs excluded).

This is expressed as:

$$\text{Occurrence of a food item (\%)} = \frac{\text{Total No. of stomach with the particular food item}}{\text{Total No. of stomach with food}} \times 100$$

This method presents the food spectrum of the species. Hence, the importance of the food items relative to the population of the species could probably be guessed.

2.5 Condition Factor (K)

Fulton's condition factor (K) of *C. nigrodigitatus* was calculated using Pauly[13] equation,

$K = W/L^3 \times 100$, where W is the total weight (TW-g), L is the Total length (TL-cm) and 3 is a constant.

2.6 Statistical Analysis

Two ways Analysis of variance (ANOVA) was used to test for significant difference at 95% confidence limit in the food eaten by these species and also the degree of stomach fullness.

3. RESULTS

3.1 Analysis of food items stomach of silver catfish *(C. nigrodigitatus)* by frequency of occurrence and point method from the Lower River Benue

Variation in the empty stomach by size group (Table 1) indicated that the small size group of *C. nigrodigitatus* had the highest number of empty stomachs (15.15%), while the medium sized group had (8.11%) and the large sized group had no empty stomach. The relative contributions of the food items are expressed by the frequency of occurrence and point methods. A total of 100 stomachs were randomly examined. Eleven major items constituted the diet of *C. nigrodigitatus*. In Frequency of occurrence analysis fish part were dominant and composed of 47.62% of the items in the stomach, seeds made up 40.49%, while sand/mud 38.09%, detritus 30.95%, digested

153 food 29.76%, insect part 27.38%, mollusc made up 25.00%. Algae were the least with 22.62%
154 (Fig. 3).
155 In point analysis fish parts were dominant and composed of 27.03% of the items in the stomach,
156 seeds made up 19.73%, while plant parts was 16.41%, insect parts, 12.31%, detritus 7.62%,
157 mollusc 6.35%, sand/Mud 6.15%, digested food 3.27%. Algae were the least with 1.12% (Fig.
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Table 1. Variation of the empty stomach by the size of Silver catfish (*C. nigrodigitatus*) from the Lower River Benue

Size/total length (cm)	Number examined	Number with the Empty stomach	%-tage stomach
Small size (10.3-17.3)	33	5	15.15
Medium size (17.4-22.4)	37	3	8.11
Large size (22.5-27.5)	30	-	-

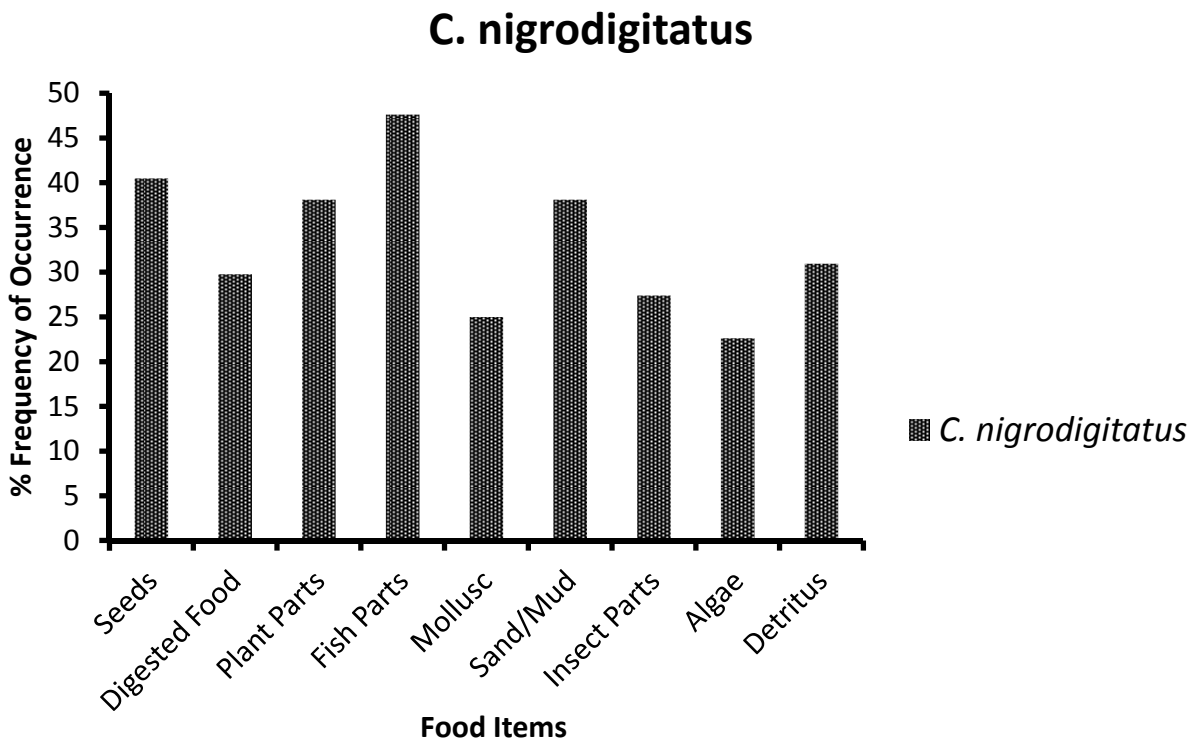

Fig. 3: Frequency of occurrence of food items in the stomach of silver Catfish *(C. nigrodigitatus)*

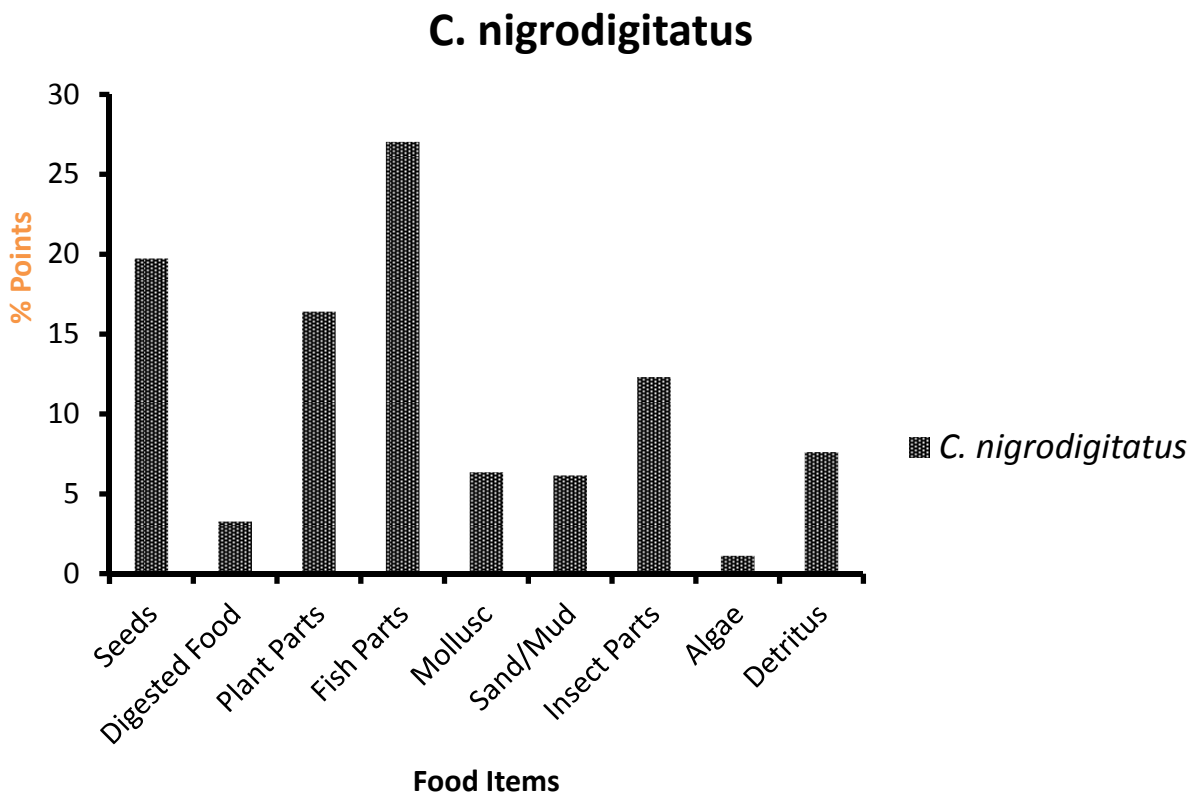

Fig. 4: Point Method of food items in the stomach of silver Catfish (*C. nigrodigitatus)* from Lower River Benue

3.2 Fulton's Conditon Factor (K) of *C. nigrodigitatus* from the Lower River Benue

Fulton's condition factor (K) determined for two hundred (100) specimens of *C. nigrodigitatus* (Table 2) showed that mean condition factor of male and female *C. nigrodigitatus* in July was 2.08 ± 0.04^{a} and 2.01 ± 0.06^{a}; August was 1.13 ± 0.05^{a} and 1.99 ± 0.04^{a} while September was 1.63 ± 0.02^{a} and 2.10 ± 0.01^{a} respectively. For pooled sex of *C. nigrodigitatus*, condition factor was 2.00 ± 0.02^{a} (July), 1.97 ± 0.07^{a} (August) and 1.99 ± 0.04^{a} (September).

Table 2: Monthly mean condition factor of male, female and pooled sex of *C. nigrodigitatus* from the Lower River Benue

Month	Male	Female	Pooled Sex
July	2.08±0.04[a]	2.01±0.06[a]	2.00±0.02[a]
August	1.13±0.05[a]	1.99±0.04[a]	1.97±0.07[a]
September	1.63±0.02[a]	2.10±0.01[a]	1.99±0.04[a]

The condition factor was subjected to T-test to determine difference between the sexes for the species studied

DISCUSSION

The stomach content analysis of has shown that *C. nigrodigitatus* fed on the various food items ranging from plant parts, detritus, seeds, digested food particles, fish parts, mollusc, sand/mud, insect parts and algae. This indicates that *C. nigrodigitatus* is an omnivorous bottom feeder since; fish parts and sand/mud dominated most of the food items of animal origin. A similar result was reported by Thomas and Opeh[14]. The wide food spectrum exhibited by *C. nigrodigitatus* revealed trophic flexibility, an ecological advantage that enables a fish to switch from one food category to another in response to fluctuation in their abundance. It also enables species to utilize many different foods effectively. High proportion of non-empty stomachs showed that they could be frequent feeders.

C. nigrodigitatus have been reported to mass fed at night when food items were readily available. Also, Taiwo and Aransiola[15] reported that large number of *Chrysichthys* species spawned in the rainy season when there was plenty of food to feed the offspring. The availability of food items in any water body influences the diet of fish, which could result to shift in diet of fish species. Ekanem[3] reported that there was shift in diet composition of *C. nigrodigitatus* with increase in size. Larger species prefer fishes and shrimps in their diets where such are available,

while smaller fish has a broader spectrum of diet. Temporal changes in diet composition reflect the changes in abundance of food organisms in the water environment. In Lekki Lagoon where shrimps are scarce or absent, *C. nigrodigitatus* depends more on molluscs, insects, cladocera, ostracods and mysids for food[16].

The mean condition factor of 2.08, 1.13 and 1.63 obtained in this study for male *C. nigrodigitatus* is higher than 0.977 recorded for Cross River estuary[3]. Thomas et al.,[17]. reported the mean condition factor of 2.08, 1.96 and 1.92 in the study for female *C. nigrodigitatus* from lower river Benue.

Condition factor which could be used to reflect the health status of water bodies is influenced by factors such as age, sex, food availability, and environmental conditions. Low condition factor in fish may be attributed to poor environmental conditions and reduced availability of food and prey items[18,19].

CONCLUSION

C. nigrodigitatus in Lower Benue River feeds on a wide range of food ranging from plants and animal food items which could make it be regarded as an omnivore. Future attempts to culture this species must be taken into cognizance of its food habits in the wild.

SIGNIFICANCE STATEMENT

This study discovered the food and feeding habit as well as the general well being of *C. nigrodigitatus* that can be beneficial for fish farmers wishing to embark on the culture of this species. This study will help the researchers to uncover the critical areas of improving fish feed formulation which may enhance high growth performance of cultured *C. nigrodigitatus* that many researchers were not able to explore. Thus a new theory on improve feed composition that will enhance the growth performance of *C. nigrodigitatus* may be arrived at.

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