

Food and feeding habit of some selected fish species from Lower River Benue, Makurdi-Nigeria.

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Abstract

Studies on food and feeding habit of *chrysichthys nigrodigitatus*, *Bagrus bayad* and *Synodontis clarias* was conducted from July 2018 to June 2019 using frequency of occurrence, numerical and gravimetric methods the result of this investigation revealed that *Bagrus bayad* had 40%, full stomach, 31.6% empty stomach 10% quarter full stomach, 16.80% half full stomach and 1.6% three quarter full stomach. *Chrysichthys nigrodigitatus* had 26.03%, full stomach, 47.65% empty stomach 1.14 quarter full stomach, 14.43% half full stomach and 2.42% three quarter full stomach. *Synodontis clarias* had 31.62%, full stomach, 30.88% empty stomach, 10.29% quarter full stomach, 19.85% half full stomach and 7.35% three quarter full stomach. *Chrysichthys* had the lowest number of full stomachs (26.03) and highest number of empty stomachs (47.65) Stomach content in *B. bayad* for frequency of occurrence method ranged from 1.93-17.76, *C. nigrodigitatus* 3.06-15.24 and *S. clarias* 7.17-27.91. Numerical method *B. bayad* ranged from 5.48-17.81, *C. nigrodigitatus* 8.22-17.81, *S. clarias* 6.85-26.03. Gravimetric method *B. bayad* ranged from 19.13-95.88, *C. nigrodigitatus* 25.00-93.48 and *S. clarias* 8.70-30.43. The result of the index of relative importance showed that the food content from *B. bayad* ranged from 0.05-1.87, *C. nigrodigitatus* 0.3-1.47, *S. clarias* 0.13-1.3 respectively with animal parts been the highest and the lowest been plant parts this showed that these fish species are omnivores and a top predator.

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Key words; Food, Feeding and Habit

Introduction

Food is a fundamental element in the life of all living organisms including fish, being the source of energy and nutrients for growth, reproduction, movement that are vital activities for survival in the aquatic environment. Qualitative and quantitative compositions of fish diets are important to the growth, maturity and fecundity changes in fish.

Food study reveals the status of foraging, growth rate and seasonal life history changes in fish, which are useful for rational exploitation of the species (Ugwumba and Ugwumba, 2007).

The diet of the fish is a subject of continued research. Various studies had been conducted on feeding regimes, food preferences, diet of the species (Offem et al., 2008). Studies of the food and feeding habit are useful in determining the population level since the number of individuals in the population depends on the amount of food available (Okey et al., 2017).

The study of feeding habit of fish species in their natural habitat has been shown to promote useful information on positioning of the fish in the food web (Shinkafi et al., 2010), provide information about the niche of the particular fish in its ecosystem and contributes a better understanding of the trophic dynamics and food webs which is essential for appropriate fisheries management (Offem et al., 2009).

Stomach content analysis gives information on seasonal and life history changes of the fish because the types and magnitude of food available as well as the season it occurs plays an important role in the life history of the fish (Ekpo et al., 2015 and Okey et al., 2017). The quality of the available natural food influences the feeding habit of fish (Orihbabhor et al., 2019).

Therefore, investigating the food and feeding of the three commercial fish species (*Bagrus bayad*, *Chrysichthys nigrodigitatus* and *Synodontis clarias*) may help to identify habitats or sites and season of higher fish abundance for successful commercial capture thus increasing catch per unit effort.

Consequently, the study was conducted to assess the food items and diet preference of these species in the Lower River Benue, Nigeria. This would serve conservation purposes for the relevant fisheries agencies in putting appropriate measures in place for the conservation of fish species to avoid extinction of these commercial valued fish.

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MATERIALS AND MATERIALS

Study Area.

This study was conducted at the Lower River Benue, Wadata Market in Makurdi. Makurdi is the capital of Benue State in Nigeria, located at Longitude 7°43'N and Latitude 8°32'E. The town is divided into the North and the South bank by the River Benue. The samples were collected for further analysis at the general purpose Laboratory Department of Fisheries and Aquaculture University of Agriculture, Makurdi.

Stomach Fullness Classification

Stomach contents classification of the three species based on degree of fullness was determined as: Empty 0, Almost empty 1/4, Half full 1/2, Almost full 3/4, Full 1 (Hyslop, 1980).

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Stomach Contents Analysis

Stomach contents were analyzed using three (3) methods, frequency of occurrence, numerical methods and gravimetric methods (Bowen, 1983).

Frequency of Occurrence

The number of stomach in which each food item occurred was sorted out and expressed as percentage of the total number of fish stomachs examined.

$$F1 = 100 n_i / n \quad (\text{Bowen, 1983})$$

Where

F1: Frequency of occurrence of the i food item in the sample

n_i: Number of stomachs in which the i item is found

n: Number of stomachs with food in the sample

Numerical Method

The number of individual of each food item was counted in each stomach, sum up to give the total of each kind, then grand total of items was calculated and expressed as percentage of the overall items found in each stomach (Crisp *et al.*, 1978).

Gravimetric Method

The net weight of individuals per stomach in each food category was recorded for all stomach and the total is expressed as a percentage of the total net weight of all food categories (Crisp *et al.*, 1978).

Index of Relative Importance

Accordingly, dietary preference of each food item was evaluated by the Index of Relative Importance from the Pianka *et al*, (1971) formula.

$$IRI = \langle \%N_i + \%V_i \rangle * \%FO_i$$

Where: $\%N_i$ = Percentage number of food items

$\%V_i$ =Volume of food items

$\%FO_i$ =Frequency of occurrence of food items

Statistical Analysis

Microsoft excel was used to analyse data of stomach contents and fullness.

Results

Stomach Fullness

Figures 1-3 depicts the stomach fullness of the species observed during the study period. *Bagrus bayad* (figure 1) had 40%, full stomach, 31.6% empty stomach, 10% quarter full stomach, 16.80% half full stomach and 1.6% three quarter full stomach.

Chrysichthys (figure 2) had 26.03%, full stomach, 47.65% empty stomach 1.14% quarter full stomach, 14.43% half full stomach and 2.42% three quarter full stomach.

Synodontis (figure 3) had 31.62%, full stomach, 30.88% empty stomach, 10.29% quarter full stomach, 19.85% half full stomach and 7.35% three quarter full stomach. *Chrysichthys* had the lowest number of full stomach (26.03) and highest number of empty stomach (47.65)

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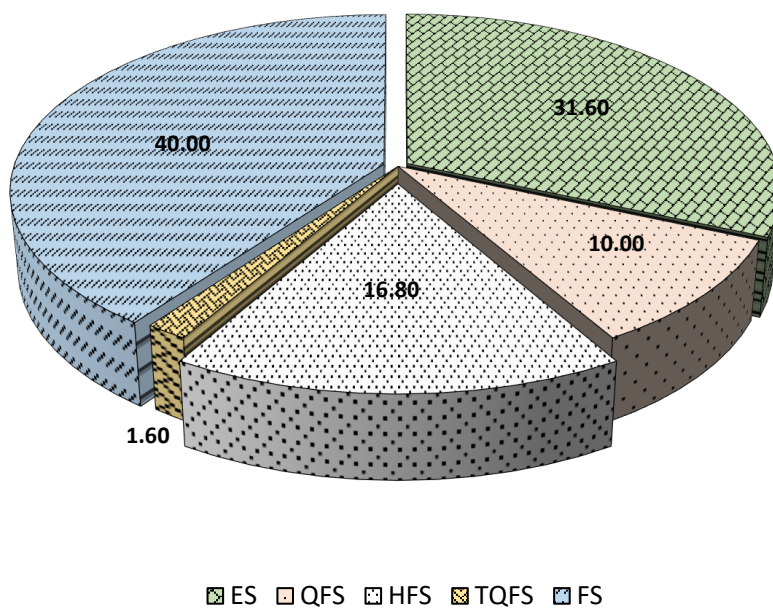


Figure 1 Stomach Fullness *Bagrus bayad* in Lower River Benue

ES: empty stomach, QFS: quarter full stomach, HFS: half full stomach, TQFS: three quarter full stomach, FS: full stomach.

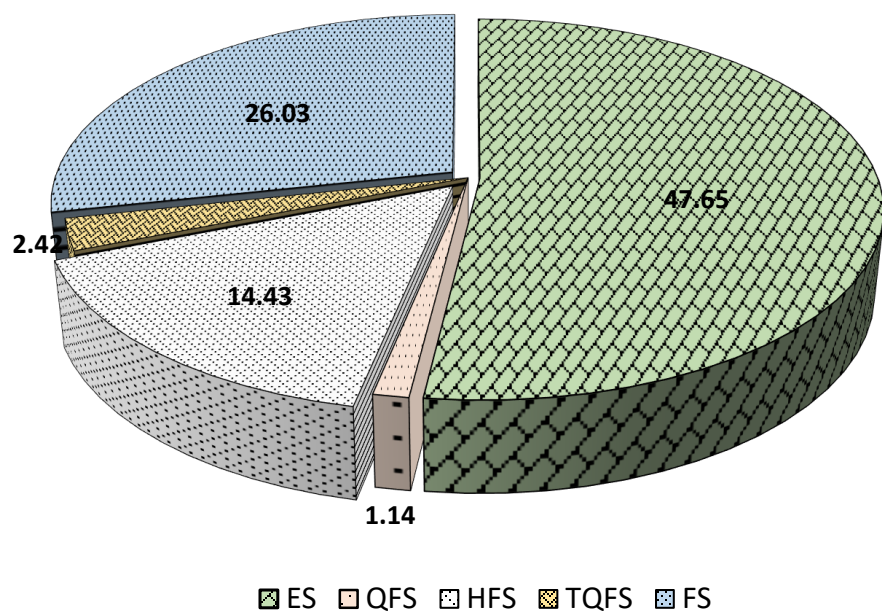


Figure 2 Stomach Fullness *Chrysitcthyis nigrodigitatus* in Lower River Benue

ES: empty stomach, QFS: quarter full stomach, HFS: half full stomach, TQFS: three quarter full stomach, FS: full stomach

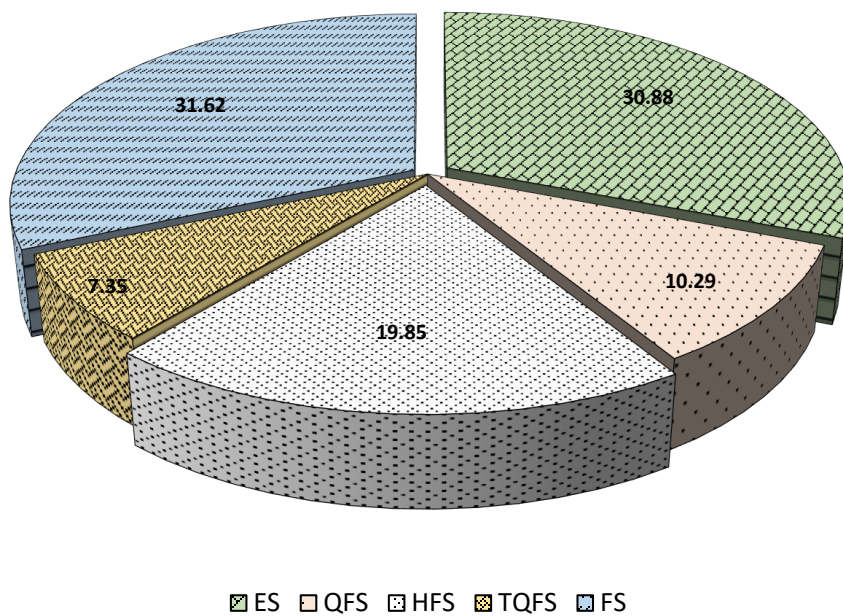


Figure 3 Stomach Fullness for *Synodontis clarias* in Lower River Benue

ES: empty stomach, QFS: quarter full stomach, HFS: half full stomach, TQFS: three quarter full stomach, FS: full stomach.

The result of the stomach content analysis of the three species that were studied from July 2018 – June 2019 using frequency of occurrence method, numerical method and gravimetric method revealed that the three species of fish were omnivores with their diets comprising of fish parts, plant materials, worms/Nematodes, crustaceans, Molluscs, insects/insect parts. Stomach content in *B. bayad* for frequency of occurrence method ranged from 1.93-17.76, *C. nigrodigitatus* 3.06-15.24 and *S. clarias* 7.17-27.91. Numerical method *B. bayad* ranged from 5.48-17.81, *C. nigrodigitatus* 8.22-17.81, *S. clarias* 6.85-26.03. Gravimetric method *B. bayad* ranged from 19.13-95.88, *C. nigrodigitatus* 25.00-93.48 and *S. clarias* 8.70-30.43 it was found that the prominent food items in all the methods was animal parts in all the three species and the three method that were considered.

Table 1 Frequency of Occurrence, Numerical, and Gravimetric of three species of fish from Lower River Benue

Food	Fish Species		
	<i>Bagrus bayad</i>	<i>Chrysichthys nigrodigitatus</i>	<i>Synodontis clarias</i>
Fish/fish parts	12.69	7.46	9.09
Plant Material	1.93	3.06	10.33
Worms/Nematodes	9.38	8.06	7.17
Crustaceans	8.88	15.24	16.38
Molluscs	8.58	11.93	10.30
Insects/Insect parts	7.61	8.53	18.81
Detritus	17.76	7.93	27.91
Numerical			
Fish/Fish parts	19.18	16.44	16.44
Plant Material	5.48	8.22	26.03
Worms/Nematodes	12.33	10.96	9.56
Crustaceans	15.07	13.70	8.22
Molluscs	10.96	17.81	6.85
Insects/Insect Parts	17.81	12.33	9.59
Detritus	16.44	12.33	23.29
Gravimetric			
Fish/Fish parts	70.65	76.09	30.43
Plant Material	19.13	51.09	12.50
Worms/Nematodes	66.85	93.48	9.24
Crustaceans	95.22	82.61	8.70
Insects/Insects parts	89.78	46.74	9.24
Deritus	39.40	25.00	23.37

Table 2 below presents the index of relative importance of the three species of fish. The result showed that the food content from *B. bayad* ranged from 0.05-1.87, *C.nigrodigitatus* 0.3-1.47, *S.clarias* 0.13-1.3 respectively with animal parts been the highest and the lowest been plant parts his showed that this fish species are predators.

Table 2 Index of Relative Importance (IRI) of three species of fish in Lower River Benue

Food	Fish Species		
	<i>Bagrus bayad</i>	<i>Chrysichthys nigrodigitatus</i>	<i>Synodontis clarias</i>
Fish/fish parts	1.87	0.69	0.43
Plant Material	0.05	0.18	0.40
Worms/Nematodes	0.74	0.84	0.13
Crustaceans	0.98	1.47	0.24
Molluscs	0.67	1.01	0.16
Insects/Insect parts	0.82	0.50	0.35
Detritus	0.99	0.30	1.30

Discussion

Feeding intensity of fish can be determined based on degree of fullness of stomach Yem et al. (2009). The high percentage of empty stomach in chrysichthys suggests that the quantity of food was low during the period of this study which does not agree with the finding of Yem et al. (2009). However, result of stomach fullness analysis of *Bagrus* and *Synodontis* are in line with findings of Yem et al. (2009) who recorded relatively high percentage of full stomach, which suggests that food was abundant throughout the period of study in Kainji Lake, Nigeria.

The stomach content analysis using frequency of occurrence, numerical and gravimetric methods showed that the three species of fish examined are omnivore in nature with their gut comprising also worms/nematodes, crustaceans, mollusk, insects/insect's parts and detritus. The results of this study is similar to the findings of Edwine et al. (2019) on *Synodontis* species from different African freshwaters that the species are omnivorous feeders and feed on a wide spectrum of food ranging from various types of plankton to invertebrates, plant parts and small fish (animal matter). materials with the animals component been dominant which explains why fish parts was dominant in the stomach of the three fish species in this study. The high diversity of the food composition in the stomach indicates a wide adaptability to the habitats in which they live. The high diversity of the food composition in the stomach of

the three species indicates a wide adaptability to the available food items in the Lower Cross River. The observed results is in line with the findings of Akombo et al., (2016) in Lower Benue River, where the food items of similar species of fish recorded plants and animal parts in their stomach. This also supports the findings of Wanyanga et al. (2016) equally reported that the diet of *S. victoriae* primarily comprise of molluscs, crustaceans, insects, detritus and fish scales.

From the result of the stomach fullness, species like *Synodontis* and *Bagrus* suffered less starvation across the available food resources in the environment. According to Owolabi (2008) the euryphagous characteristic of *Mochokids* such as *Synodontis* explains their wide distribution.

According to the dietary preference evaluation of each food item in the three species of fish, fish/fish parts were the most preferred in the diet of the species studied. This is in line with the findings of Asuquo (2000). The major food items for this species in order of importance consisted of fish, crustaceans, bivalves and gastropods which gave it the status of a top predator while the minor food items were some diatoms, mysids, euphausiids, amphipods, fruits, plant materials and detritus. The result is however at variance with Dadu and Araoye (2008) who reported plant material as major foods followed by mollusk, worms, insects ova, protozoans and fries while the least was sand grains.

Conclusion and recommendation

Based on the result of this study it was concluded that the three fish species are omnivores in nature and also a top predator, *Chrysichthys* and *Bagrus* suffered less starvation compared to *Synodontis*.

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This study also revealed that the three species of fish feed on a diverse food items preferably food items of animal origin. I recommend that various fish agencies should put in place measures for conservation of these fish species to avoid extinction.

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