Studies on the food and feeding habit of some selected fish species from Lower River Benue, Makurdi-Nigeria.

Abstract

Studies on food and feeding habit of *chrysitchthys nigrodidgitatus,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. Chrysitchthys 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 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. Chrysitchthys 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 from19.13-95.88, *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 predators. Based on the result of this study it was concluded that the three fish species are omnivores in nature and also a top predator, I therefore recommend that more studies on this species be conducted to ensure their domestication.

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). In addition, the study of food and feeding habits of fish based on stomach content analysis is commonly used in fishery ecology to show the position of fish within a food web and to provide information on the contribution of different prey items to the diets. Information about food habits of fish is also useful in defining predator-prey relationships, estimating trophic level and in the creation of trophic models as a tool to understanding complex ecosystem.

Fish may be classified on the basis of food habits as carnivores, herbivores and omnivores. The carnivores are flesh eaters, and are divided into two based on specialization. Those that rely solely on insects as their food are called insectivores and those that dwell entirely on fish are called piscivores. The herbivores exploit a wide range of plant materials that include plankton, diatoms, algae and large plants especially rooted aquatic plants.

The third category, omnivore, are those that feed on wide variety of food items that range from animal to plant materials. Most of fish species in this category eat almost anything they come across. (Welcomme, 2001). The diet of fishes, just like in many other vertebrates, also relates to the length of the gut or intestine. The structure, length and conformation of the intestine are closely related to the diet of the fish (Miller and Harley, 2002). Therefore, understanding this relationship is important to predict the diet of fishes, how fishes feed and the mechanism of feeding (Malami *et al*., 2007). Herbivores have longer and coiled digestive tract, carnivores have short digestive tract and omnivores have intermediate length of digestive tract. According to German and Horn (2006), all vertebrates on the category of herbivores have longer digestive tracts than do carnivores and that the pattern is consistent among mammals.This work seeks to examine the food and feeding habits of *Chrysitcthys nigrodigitatus,Bagrus bayad* and *Synodontis clarias* which are valued food

fish with high demand in the whole of West Africa. They have high commercial value and if carefully studied could add to the existing culturable fish species in the country.

MATERIALS AND MATERIALS

Study Area.

The study was conducted at the Lower River Benue, at Wadata Market in Makurdi. Makurdi is the capital of Benue State in Nigeria, is 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 ¼, Half full ½ ,Almost full ¾ ,Full 1

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 ni / n (Bowen, 1983)

Where

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

ni: 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.

Chrysitchthys (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. Chrysitchthys had the lowest number of full stomachs (26.03) and highest number of empty stomachs (47.65)

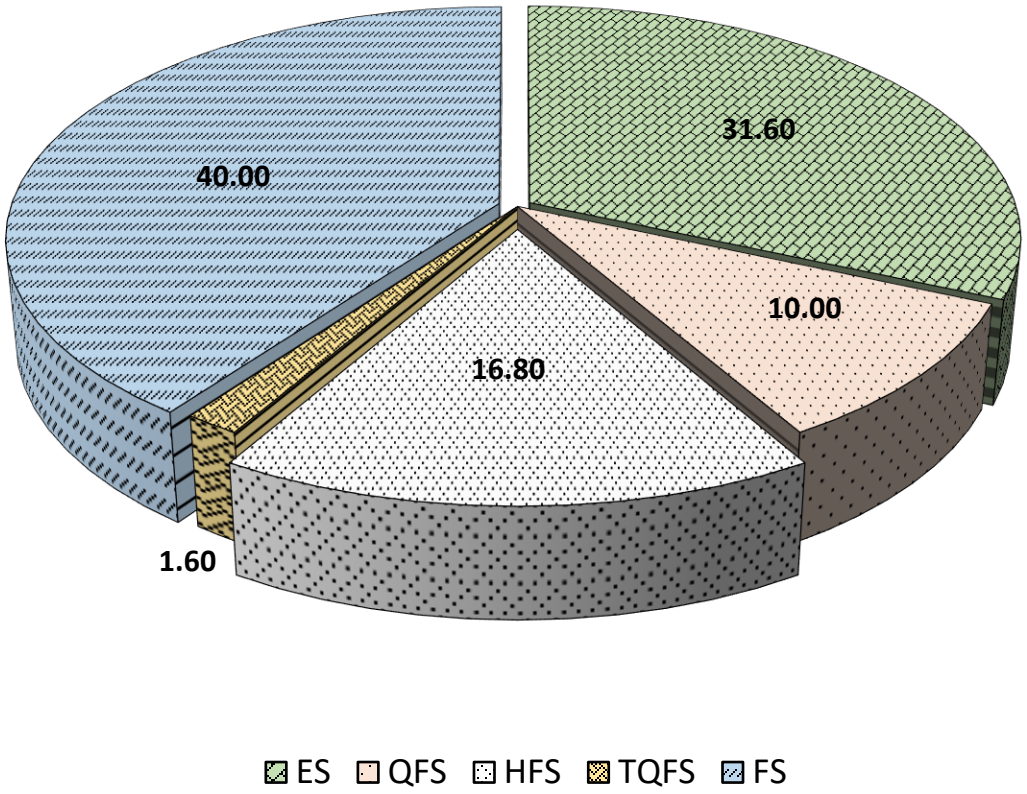

Figure 1 Stomach Fullness *Bagrus bayad* in Lower River Benue

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

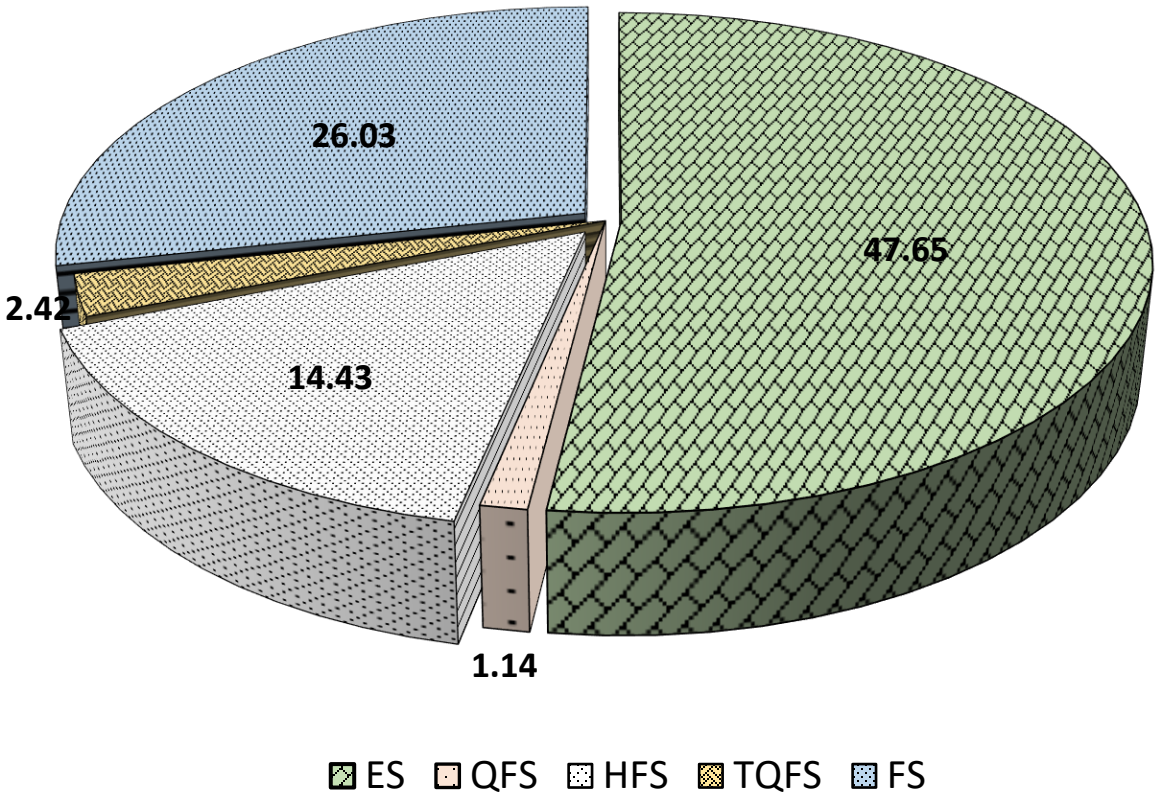

Figure 2 Stomach Fullness *Chrysitcthys nigrodigitatus* in Lower River Benue

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

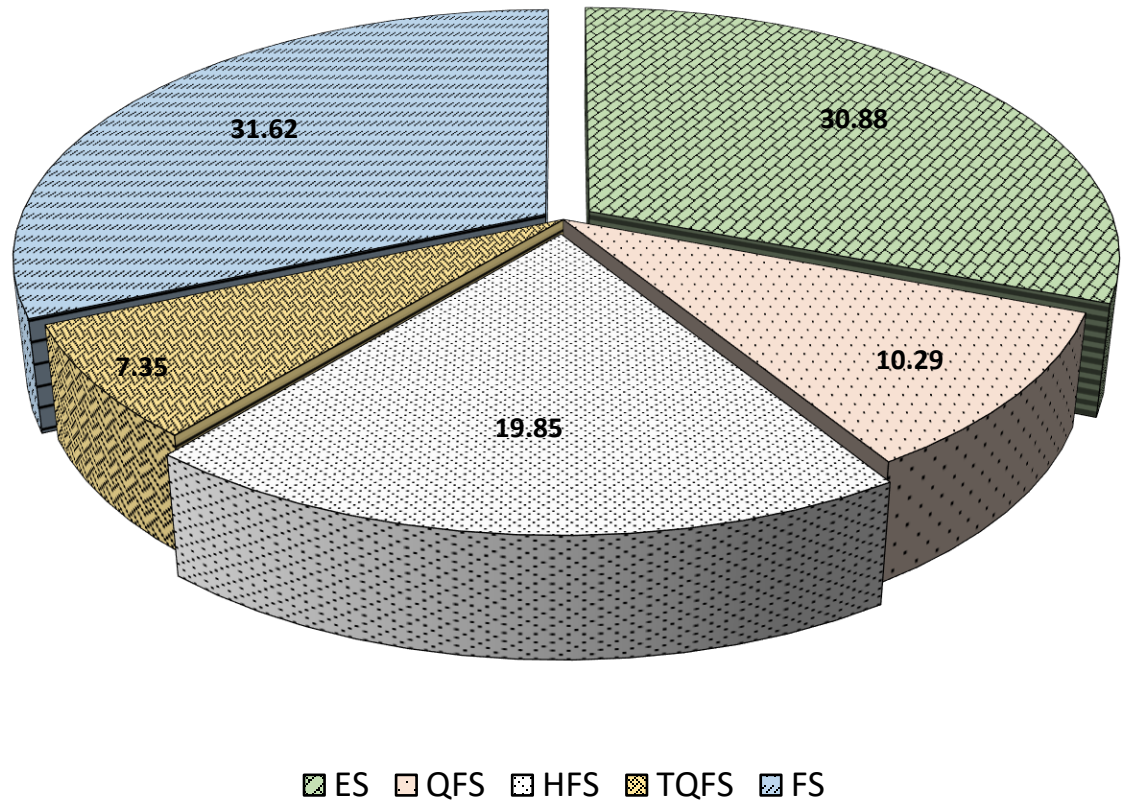

Figure 3 Stomach Fullness for *Synodontis clarias* in Lower River Benue

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 from19.13-95.88, *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		
	Bagrus bayad	***Chrysichthys nigrodigitatus***	***Synodontis clarias***
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
Mollucs	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**		
	Bagrus bayad	***Chrysichthys nigrodigitatus***	***Synodontis clarias***
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

The stomach content analysis using frequency of occurrence, numerical and gravimetric methods howed 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. Imevbore and Bakare (1970) reported that the food items in the stomach of Synodontis species includes insect larvae, bivalve,e mollusk, chironomid larvae and fish fry. Bishal and Abu-gideiri (1965b) and Nnaji *et al*., (2007 emphasized that *S. schall* lived on the bottom feeding on mollusk, crustaceans annelid worms and ate anything available. Asuquo (2000) reported that most cat fishes in the wild including C. nigodigitatus are largely benthic feeders but not completely so because of the presence of phytoplankton and zooplanktons in the stomach. The species according to Inyang and Ezenwaji (2004) feeds on both plant and animal 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. They can use just any food material available in their habitats. This is an important strategy for survival and advantage over the fish species competing for a specific food item (Laleye *et al*., 2006)

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 Araoye and Jeje (1999) Owolabi (2008) and Owolabi and Omotosho (1999) 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 thefindings 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 myside, euphausids, 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, I therefore recommend that more studies on this species be conducted to ensure their domestication

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