Original Research Article

Aspects of the Biology of Silver Catfish (*Chrysichthys nigrodigitatus*) in Nwaniba River, Southeast Nigeria.

Abstract

The Aspects of the Biology of the Catfish (*Chrysichthys nigrodigitatus)* were investigated from August to October 2015 in Nwaniba River, Akwa Ibom State, Nigeria. A total of two hundred (200) specimens were analyzed for gut contents using Numerical and Frequency of Occurrence methods. The results revealed that the species feed on various food items ranging from plant origin to animal materials with dietary preference classified into eight major groups consisting of Crustaceans 39 (23.2%), Fish parts 26 (15.6%), Detritus 23 (13.7%), Plant parts 20 (11.9%), Undefined 20 (11.9%), Mollusca 19 (11.3%), Insects 13 (7.7%), and Nematodes 8 (4.7%) respectively. Of the 200 stomachs examined, 35 (17.5%) were empty stomachs, 80 (40%) had quarter-full stomachs, 50 (25%) had half-full stomachs, 13 (6.5%) had three quarter-full stomachs and 22 (11%) had full stomachs. The condition factor calculated for the species varied during the studies period with a mean value of 0.77 in August, 0.72 in September and 0.73 in October. Based on the food items isolated in the gut, the species could be considered as an Omnivorous fish in Nwaniba River. Further research should be done to ascertain the food preference of the species over a longer period of time covering both wet and dry season. This will enable definite conclusion on its food preference.

Keywords: *Chrysichthys nigrodigitatus,* Diet composition, Condition factor, Nwaniba River,

Introduction

Fishes are sources of food for human beings and other animals, rich in proteins and vitamins, especially, vitamin A (Retinol) (Alune and Andrew, 1996; Osuigwe and Obiekezie, 2007; Fayeofori, 2013). Statistics have shown that fish accounts for more than forty percent of the protein diet of two–thirds of the global population (Eyo, 1992 and FAO, 1999). However, the protein requirement of most African countries still grossly outweighs its supply. In Nigeria, less than 40% of the total protein requirement by the people is met, out of which fish constitutes about 41% (Bernard *et al.,* 2011).

As the human population inevitably increases, the demand for fish as a source of protein will grow (Abolarin, 1996). Fishes such as those in the family Claroteidae are highly used and commercialized. The commercially important fish species in this family are the Catfish (*Chrysichthys species*) known as "Inanga" in Ibibio language. *Chrysichthys nigrodigitatus* (Lacepede 1802) is a common silver colored African catfish occurring in Nigeria and several West African countries. It is a highly valuable fish species amongst the indigenous African populations (Akinsanya *et al.,* 2007).

All fish require energy which must be obtained from its food sources for growth, reproduction and migration (Anupama, 2000; Oronsaye and Nakpodia 2005). Understanding food and feeding habits of fish is useful to all scientists who are concerned with any aspect of fisheries (FAO, 1992). The study of dietary habits of fishes based on stomach content analysis is widely used in fish biology and ecology to indicate the position of a species within a food web and to provide information on the contribution of different prey items to the diet

(Owolabi, 2008). It also help in understanding food consumption, feeding and assimilation rates, catabolism, habitat segregation (Gomos, 2002), defining predator-prey relationships, estimation of trophic level (Sa-a *et al*. 1997) and in the creation of trophic models as a tool for understanding complex ecosystems (Lopez-Peralta and Arcila 2002).

Chrysichthys species has been found to be a typical example of fish without strict feeding habit. It is regarded as an omnivore, because of its ability to use just any food material present in its environment (Yem *et al.*, 2009). Royle (2001) reported that potential food resources of fish consist of all materials present in its environment. Fishes have been known to feed on a wide variety of items ranging from sand particles, phytoplankton, zooplanktons, leaves, roots, crustaceans, insects, insect larvae, worms, fishes etc, (Omondi *et al.,* 2011; Shalloof *et al.,* 2009 and Yalcin *et al.,* 2001). The more so Idodo-Umeh (2002) reported that *C. auratus*, *C. nigrodigitatus* and *C. furcatus* were omnivorous bottom feeders.

Condition factor is also a useful index for monitoring of feeding intensity, age, and growth rates in fish (Ndimele, 2010). In fisheries science, it is used to compare the "condition", "fatness" or wellbeing of fishes. It is based on the hypothesis that heavier fish of a particular length are in a better physiological condition (Bagenal *et al*, 1978). It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live (Anene, 2005). Various works have been done on the diets of *Chrysichthys nigrodigitatus*, and other fish species from various rivers in Nigeria and few other lakes and reservoirs (Uneke, 2015; Fagbenro *et al.* 2000; Yem *et al.*, 2009; Idodo-Umeh 2002; Atobatele and Ugwumba, 2011; and Offem *et al.,* 2008). In Nwaniba River, few or no extensive work has been carried out on some aspects of the biology of commercial important species. Therefore, this present paper is a contribution to understanding the biology of *Chrysichthys nigrodigitatus* which include diet composition, stomach fullness and condition factor with a view to developing its aquaculture.

Materials and Methods

Study Area

Nwaniba River lies between $5^0$2'51" North of latitude and $8^0$2'41" East of longitude. The annual rainfall in this region is about 2500mm with a mean annual temperature of 32 ^oC and a relative humidity of 75%. The source of this river is traced to two flood plains; one flows from Itam River in Itu Local Government Area through Mbiakong River, while the other from Obot-Ifiayong creek down to this river, and runs through Otoh-nkemba where it flows to Ibiaku-uruan, Oron, Calabar, Cameroun and Atlantic Ocean.

The riverbank is covered with vegetation such as Elephant grass (*Pennisetum purpureum*), shrubs and trees, Screw pine (*Pandamus spp*), Mangrove palm (*Nypha fruticans*), Pneumatophorous plant with prop roots, and other tropical hydrophytes for example Water hyacinth (*Eichhorina crassipes*), Water lilies (*Nymphaea lotus*), *Ceratophyllum demersum,* and Bladderwort (*Utricularia spp*) e.t.c. The River also has a beach called Esuk Nwaniba, which serves as harbor for fishermen. It is at this beach that the fishes are sold out to the fish sellers for public consumption or other purposes.

Collection of Samples

Fish samples were collected with the help of local fishermen using traditional fishing gear such as hook and line, set gillnets and basket traps between August and October 2015. Fish

collected were transported with a chest box to the University of Uyo, Zoology laboratory where it was examined fresh.). Samples were identified using Olasebikan and Raji (1998) and Idodo-Umeh (2003). Each specimen was measured to the nearest 0.1 cm total length (TL) using a measuring board of 1-50cm (range) and weighed fresh using a digital balance to the nearest 0.1g. A longitudinal incision was made with the aid of stainless steel scissors and forceps along the mid-ventral line from the mouth to the anus to expose the visceral organs and the gut was carefully removed with pair of throngs. The stomach was cut off from the gut and scored 0%, 25%, 50%, 75% or 100% were recorded according to its fullness as described by Olatunde (1978).

Data Analysis

Data collected were analyzed using descriptive statistics (mean and standard error). The exponents (b) of L-W Relationship were tested for departure from isometry (b=3) using t–statistics.

Fulton's condition factor (CF) was determined using the expression according to Ricker (1975):

$K = (W/L3)100,$

K= condition factor,

W = total weight (g),

L =total length (cm) and

3 = the cubic relationship between length and weight.

Identification of Stomach Contents

The stomach content of each sample was split open and emptied into a Petri dish, The food materials were observed under low power magnification of binocular microscope and identified to the lowest possible taxon with the aid of keys provided by Mellanby (1975) and Quigley (1977). The diet components from each gut were enumerated and the total number noted for each diet group to enhance the determination of the relative percentage occurrence of each diet components from all the guts examined.

The relative percentage occurrence of each diet components was calculated from the formula, according to Marioghae, (1982)

$\%RA = n/N \times 100$

Where:

%RA = relative percentage occurrence
n = number of individuals diet components
N = total number of all diet components identified from the gut

4.0 RESULTS

A total of 200 species of *C. nigrodigitatus* was collected from Nwaniba River**.** Table 4.1 shows the numerical abundance and relative percentage occurrence of diet Composition. Of the 200 stomachs examined, 17.5% were empty stomachs, 40% had quarter-full stomachs, 25% had half-full stomachs, 6.5% had three quarter-full stomachs and 11% full stomachs (Table 4.2), while Table 4.3 shows the monthly diet composition. However, the morphometric parameters of *Chrysichthys nigrodigitatus* from Nwaniba River for the period of sample is shown on table 4.4.

Table 4.1: Numerical abundance and Relative percentage occurrence of diet Composition of *Chrysichthys nigrodigitatus* from Nwaniba River

Food items	**Numerical Abundance (N)**	**Relative percentage occurrence (%)**	**Total (%)**
DETRITUS			
Mud	13	7.74	13.7
Sand particles	10	5.95	
FISH PARTS			
Partially digested fish	21	12.5	15.5
Fish Scales	5	2.98	
PLANT PARTS			
Netrium	2	1.19	
Anabaena	6	3.57	11.9
Spirogyra	10	5.95	
Macrophyte matter	2	1.19	
CRUSTACEANS			
Corophium	3	1.79	
Neomysis	16	9.52	
Streptocephalus	1	0.59	23.2
Daphinia	13	7.74	
Mysis	2	1.19	
Estheria	4	2.38	
INSECTS			
Stonefly nymph	0	0	
Capnia	6	3.57	7.74
Perlinella	3	1.79	
Choroterpes	4	2.38	
NEMATODES	8	4.76	4.76
MOLLUSCA			
Ancylus species	13	7.74	11.3
Pisidium	6	3.57	

OTHERS *Diatoms* *Unidentified*	 8 12	 4.74 7.14	11.9

Table 4.2: Stomach fullness analysis of *Chrysichthys nigrodigitatus* from Nwaniba River

Month	Number of Stomach examined (N)	Empty Stomach (0%) fullness	¼ (25%) fullness	½ (50%) fullness	¾ (75%) fullness	4/4 (100%) fullness
August	80	17 (21.3%)	28 (35%)	17 (21.3%)	5 (6.2%)	13 (16.2%)
September	72	8 (11.1%)	31 (43.1%)	21 (29.1%)	5 (6.9%)	6 (8.3%)
October	48	10 (20.8%)	21 (43.8%)	12 (25%)	3 (6.2%)	3 (6.2%)
Total	200	35	80	50	13	22

Table 4.3: Monthly diet composition of *Chrysichthys nigrodigitatus* from Nwaniba River

Month	**Diet Composition**							
	Detritus	Fish parts	Plant parts	Crustaceans	Insects	Nematodes	Mollusca	Others
August	6 (11.1%)	10 (18.5%)	9 (16.7%)	10 (18.5%)	2 (3.7%)	0 (0%)	4 (7.4%)	13 (24.1%)
September	8 (13.1%)	9 (14.8%)	7 (11.5%)	19 (31.1%)	5 (8.1%)	3 (4.9%)	6 (9.8%)	4 (6.6%)
October	9 (16.9%)	7 (13.2%)	4 (7.5%)	10 (18.9%)	6 (11.3%)	5 (9.4%)	9 (16.9%)	3 (5.7%)
Total	23 (13.7%)	26 (15.6%)	20 (11.9%)	39 (23.2%)	13 (7.7%)	8 (4.7%)	19 (11.3%)	20 (11.9%)

Table 4.4: Morphometric parameters of *Chrysichthys nigrodigitatus* from Nwaniba River

Months	Parameters								
	No. of Samples	Length range (cm)	Mean length (cm) ±SE	Weight range (g)	Mean weight (g) ± SE	a	b	r	K
August	80	10.5 -22.2	15.134 ± 0.239	10.2-51.04	26.73 ±1.097	−1.271	2.271	0.868	0.77
September	72	11.2 -19.9	15.008 ± 0.221	12.1-50.02	24.21 ±0.916	−1.071	2.076	0.857	0.72
October	48	11.5 - 17.0	14.073 ± 0.189	13.4-37.54	20.34 ±0.674	−0.753	1.789	0.776	0.73

Where: *a = intercept on x axis,*

b = slope,

r = coefficient of regression,

K = condition factor,

SE = standard error, (p >0.05)

Discussion

The morphology of *Chrysichthys* is adapted for bottom feeding although stomach contents may prove otherwise as the variety of food items contained in the stomach often reflect the ability of the fishes to obtain food from different locations (Atobatele and Ugwumba, 2011). However, Idodo-Umeh (2003) in his research stated that morphological features couldn't limit *Chrysichthys* as exclusive bottom feeders, as stomach content indicates food items from different locations. The wide food spectrum of *C. nigrodigitatus* is an indication of flexibility in trophic level, which gives the fish ecological advantage to feed effectively on different categories of diet based on the availability of the food items (Warren, 1993; Offem *et al.,* 2008).

The result of this study shows that *Chrysichthys nigrodigitatus* from Nwaniba River fed on wide range of items from plant to animal materials where Crustacean is the predominant item. This is in agreement with findings of Atobatele, (2013) who reported that *C. nigrodigitatus* and *C. auratus* had similar food items, with Crustacean dominating in terms of percentage occurrence and numerical abundance. He further stated that both species might therefore be regarded as generalist meso-predators. Other food items included mollusks, plant parts, fish parts, insects, detritus and others, indicating that *C. nigrodigitatus* is an omnivorous. Similar results have been reported for *C. nigrodigitatus* from Lekki lagoon (Ugwumba and Ikusemiju, 1994; Idodo-Umeh 2003). The wide variety of items encountered

in the stomachs of the fish species show that they are non-selective in feeding and it appears that they are capable of utilizing different sources of food. Shep *et al*., (2013) observed that such feeding on a wide range of food comprising both plants and animal makes the fish euryphagous. However, Ekpo *et al.,* (2014) in their research also reported that the index of food dominance enables these fishes to be categorized into 4 broad groups: planktophaguous, herbivorous, predators and detritivores. The inclusion of sand grains in the stomach of fish has been attributed as an accidental ingestion along with other food items (Fagbenro *et al*. 2000).

Feeding intensity of fish can be determined based on degree of fullness of stomach (Yem, 2009). The relatively high percentage of almost empty stomach suggests that the quantity of food was low during the period of this study. However, result of stomach fullness analysis is not in line with findings of Yem, (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 result of *Chrysichthys nigrodigitatus* from Nwaniba River shows low value for Condition factor (K) between the periods of study. This agrees with findings of Atobatele and Ugwumba, (2011) who reported low condition factor for *C. nigrodigitatus* after the second peak in September and October and may be due to reduced availability of food and prey items. According to Bagenal and Tesch (1978), if the condition factor "k" ≥ 0.5, the fish is in a good condition but if the value of "k" ≤ 0.5, the fish is assumed to be in bad condition. In this study, the overall mean condition factor value "k" estimated was 0.74 which is > 0.5, indicating that the population was in good condition. However, Uneke, (2015) recorded overall mean condition factor value "k" to be 1.21, indicating that the population was in good condition. The exact relationship between length and weight differs within species and sometimes reflects food availability and growth within the period prior to sampling (Abowei and Ezekiel, 2013; Uneke, 2015). However, these conditions are variable and dynamic, individual average condition of each population varies seasonally and yearly.

Conclusion

Chrysichthys nigrodigitatus from Nwaniba River fed on wide range of food items from plant to animal materials and can therefore be said to be omnivorous, the high percentage of almost empty stomachs during period of sampling (i.e. from August to October), indicates low quantity of food materials, hence the fish exhibited allometric growth pattern. It is hoped that the present data will complement the limited information on the food, feeding habit, condition factor and length-weight relationship of *Chrysichthys nigrodigitatus* in Nwaniba River, and prove useful in the management and conservation of this important commercial fish species.

Further research should be done to ascertain the food preference of the species over a longer period of time covering both wet and dry season. This will enable definite conclusion on its food preference

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