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Food and Feeding Habits of Catfish (*Synodontis nigrita* Cuvier And Valenciennes) In River Rima, Sokoto, Nigeria

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ABSTRACT: The food and feeding habits of *Synodontis nigrita* (Cuvier and Valenciennes) from River Rima were studied. One hundred and three samples were collected from September to October 2006. The stomachs were analyzed using frequency of occurrence method. The mean total length of the samples was 13.04±2.55SD, mean total weight 30.42±21.84SD and mean gut length 39.57±8.92SD. The fish is an omnivore, feeding mainly on phytoplankton, zooplankton, detritus, plant tissues, insects, crustaceans and insect parts. The presence of detritus in almost all the stomachs indicated bottom feeding. The fish gut length was 3 times the body length.
Key words: *Synodontis nigrita*; Stomach contents; Gut length

INTRODUCTION: The fish Family Mochokidae is represented mainly by Genus Synodontis, commonly known as catfish. Reed *et al.,* (1967) described twenty Synodontis species found in Northern Nigeria, while Holden and Reed (1972) indicated that at least twenty one species have been identified in the Niger. The different Synodontis species vary in commercial status in different locations. Many are important food fishes while some have attractive hues and exhibit behavioral characteristics that make them potential ornamental candidates (Holden and Reed, 1972)

Synodontis accounts for an important part of the commercial catches in Northern Nigeria and, according to Reed *et al*. (1967) they are available throughout the year. In the River Niger, Synodontis accounted for 18.00% by number and 18.68% by weight of the total fish caught (Mortwani and Kanwai, 1970). Reed *et al.* (1967) stated that *Synodontis nigrita* was very common just like *S. eupterus*. In River Rima around the outskirts of Sokoto, *S. nigrita,* S. *clarias*, and *S. eupterus* are prominent in the catches of the fishermen, with S. *clarias* being the most abundant, and they are available throughout the year.

Reed *et al.* (1967) reported some natural food substances of some common Synodontis species. The food and feeding habits of ten species captured in River Niger have been investigated (lmevbore and Bakare, 1970). Olatunde (1989) conducted similar studies on *Synodontis Schall* in Zaria, Nigeria. Shinkafi and Ipinjolu (2001) also carried out similar studies on *Synodontis clarias* while Malami *et al.* (2005) studied the food habits of *Synodontis eupterus.* Both studies were conducted with samples from River Rima.

The state of knowledge on the various *Synodontis* species in Nigeria is largely on their gross anatomy and some behavioral characteristics. The available scientific investigations on their biology are still inadequate for their propagation and management. This paper presents the results of investigations conducted on the food and feeding habits of *S. nigrita* in River Rima, Sokoto

MATERIALS AND METHODS

Fish samples: Samples of *S. nigrita* were obtained from River Rima at Kwalkwalawa fish landing site along the permanent site of Usmanu Danfodiyo University, Sokoto. The samples were collected in batches from September to October 2006, and examined fresh, while those that could not be treated immediately were preserved in a freezer until the next day.

A total of one hundred and three samples were studied. The total length (TL, cm) of each sample was measured to the nearest centimeter on a measuring board graduated in centimeters. The gut of the fish was removed by making a longitudinal incision along the mid-ventral line from the mouth to the anus to expose the visceral organs. The gut was removed carefully by detaching it from other internal organs and fatty tissues. The gut length (GL) was then measured to the nearest cm on a graduated measuring board. The stomach was cut off from the gut and scored 0%, 25%, 50%, 75% or 100% according to its fullness as described by Olatunde (1978).

Identification of stomach contents: Each stomach was split open and the contents emptied into a Petri dish. The contents were then observed under a monocular microscope. The food materials were identified with the aid of keys provided by Mellanby (1975) and Quigley 1977).

Data Analysis

Stomach content analysis: The stomach contents were analyzed by frequency of occurrence method as described by Hynes (1950) and Laevastu (1965). Each food item was identified and the number of stomachs in which the food occurred was counted and expressed as a percentage of the total number of stomachs as follows:

P = (b/a) x 100, where:

a = total number of fish examined with food in the stomach; b = number of fish containing a particular food item; p = percentage of occurrence of each food item.

Total length-gut length relationship: The relationship between fish total length (TL) and gut length (GL) was computed using a linear regression model:

GL = a + b TL (Steel and Tourrie, 1980)

Where: GL = gut length (cm); TL is fish total length (cm); a = constant; b = exponent.

The regression and correlation analyses were carried out using SAS computer software package.

RESULTS

Food Contents: Analysis of the fullness of stomach showed that 81.6% had food contents while 18.4% were empty stomachs (Table 1). Samples with 50% stomach fullness were more than those with 100%.

Table 1: Categorization of stomach fullness of *S. nigrita*

Stomach fullness (%)	Number of samples	Percentage
O (empty)	19	18.4
25	18	17.5
50	31	30.1
75	20	19.4
100 (full)	15	14.6
Total	103	100.0

Table 2 shows the frequency of occurrence of the variety of food items in the stomachs of *S nigrita.* Different species belonging to two Phytoplankton families, Chlorophyceae and Bascillariophyceae accounted for a large percentage of the food items. The *Oedogonia sp* and *Diatoma sp* were the most abundant phytoplanktons and each represented up to 80%. Zooplanktons were also found in lower percentages, with K*erratela sp* (40%) more abundant than the other 2 species identified. Crustaceans were also found and the most abundant were the *Daphnia sp* (70%). Other food items found included detritus which was found in all the stomachs. Plant tissues were up to 95% while insect larvae and insect parts occurred in 62% of the stomachs. Unidentified objects were found in 75% of the stomachs.

Table 2: Frequency of occurrence of food items in the stomach of *S. nigrita* from River Rima

Food item	Frequency of occurrence	%
PHYTOPLANKTONS		
Chlorophyceae	5	4.85
Closterium sp	2	2.04
Oedogonia sp	11	10.68
Spirotaenia sp	2	2.04
Unidentified algae	5	4.85
Bascillariophyceae		
Diatoma sp	8	7.77
Gynodium sp	6	5.83
Synadra sp	5	4.85
ZOOPLANKTONS		
Rotifera		
Synchaeta sp	3	2.91
Philodina sp	2	2.04
Kerattela sp	4	3.88
CRUSTACEANS		
Daphnia sp	7	6.80
Syncaris sp	6	5.83
Eurycarus sp	4	3.88
OTHERS		
Detritus	100	97.09
Insects parts	63	61.17
Plant tissues	75	72.82
Unidentified objects	19	18.45

Note: Number and percentages not equal to 100 due to multiple scores.

Gut Length and Total Length Relationship: The gut lengths ranged from 20.6cm in an individual that measured 9.2cm total length and 7.8g total weight to 83.0cm in another that measured 21.0cm total length and 70.13g total weight. Gut length ranged from 20.6cm to 83cm while total length ranged was from 9.2cm to 21cm. The mean gut length and total length for all the fish samples were 39.57±8.92SD and 13.04±2.55SD, respectively. The total length to gut length ratio was 1:3.

Table 3 shows the regression equations and correlation coefficients of the fish total length and gut length for the whole samples, size class <12cm and size class ≥12cm. The b value of the GL-TL of the overall samples was 3.030, indicating an isometric relationship which suggests proportional increase in length of the gut and total body length. For samples <12cm the b value is 4.141, indicating positive allometry which suggest that increase in gut length is faster than in total length. In larger samples (≥12cm), the b value was 2.086 which show negative allometry, implying that total length increase at a faster rate than the gut length. There was highly significant (P<0.05) correlation between gut length and total length with r values of almost 1 in all the regression equations.

Table 3: Gut length-total length relationship of *S. nigrita* in River Rima

Parameter	No. of fish	a	b	S.E. of b	Test of b	Correlation coefficient(r)
All samples	103	10.059	3.030	0.174	*S	0.866
<12cm	29	0.472	4.141	0.491	*S	0.869
≥12cm	78	2.427	2.086	0.297	*S	0.740

Equation= GL = a + b TL; *S = Significant (P<0.05); S.E = Standard error

DISCUSSION

The variety of food substances found in the stomach of *S nigrita* shows that the species is an omnivore feeding on all types of phytoplanktons, zooplanktons and crustaceans that are typical of bottom fauna. Other items such as detritus, shell fragments and insect parts further point towards omnivorous bottom feeding nature of the *S. nigrita* species. The ventral location of the mouth may also be further indication of bottom feeding, while the simple horny structures around the mouth enable the species to adopt to filter feeding at the bottom and at the same time, enable the species to gnaw at any hard plant tissue or insect parts which form part of its rich diet (Welcomme, 1979).

The presence of 18.4% empty stomachs could be attributable to post harvest digestion. A similar proportion of empty stomachs were obtained in *Tilapia guinensis* (Fagade, 1978) and *Hyperopisus bebe occidentalis* (Ipinjolu *et al*., 1996), which are also omnivores.

In fish, gut lengths are known to be 0.2–2.5, 0.6–8.0 and 0.8–15.0 times the body length in carnivores, omnivores and herbivores, respectively (Smith, 1980). Therefore, the gut length of *S. nigrita,* which was found to be about 3 times the total body length, could be considered medium size for an omnivore. Shinkafi and Ipinjolu (2001) also reported medium sized gut length of 1.5 times the total body length for *S. clarias* from River Rima. Many fish species eat variety of food items that are sometimes ingested with other indigestible materials such as mud which often influences gut length (Smith, 1980). Perhaps the medium gut length and the variety of food items in the stomach of *S. nigrita* are further confirmation of omnivorous feeding.

Conclusion: *S. nigrita* is an omnivore feeding on diverse plant and animal food substances that are found in the bottom. The gut length was about 3 times the total body length which could be considered medium size and further suggestion of omnivorous feeding.

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