



FOOD OF AFRICAN BUTTERFISH, *SCHILBE INTERMEDIUS* (RÜPPEL, 1832) FROM AGBURA LANDING SITE, BAYELSA STATE, NIGERIA

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ABSTRACT

Food and feeding habits of fish are used in fish stock management as well as in fish feeding ecology as an important means of investigating trophic relationships in aquatic communities. The food of *Schilbe intermedius* (size range: 9.7-26.6cm; total length: 17.9 ± 3.2 cm; wet weight: 43.0 ± 24.3 g; mean \pm SD) from Agbura landing site, Bayelsa State, Nigeria was studied for a period of three months (May-July 2018). A total of a hundred and fifty four (154) stomach of *S. intermedius* were examined, out of which 20 were empty and 134 of the stomachs were with food. The numerical and frequency of occurrence method as well as the index of food significance of the stomach content were employed. The results showed that the food of *S. intermedius* consist of 63.89% animal origin (e.g., fish, water snails, crustaceans, worms, copepods and insects), while the remaining 36.11 % was made up by others (e.g., pepper seed, rice, plant, sand/mud and unidentifiable items). Parts of crustacean showed the highest (24.44%) in terms of % number of food items in the stomach followed by parts of fish (19.44%), the least was water snail (0.19%). For % occurrence of food items, parts of fish recorded highest (27.61%) followed by parts of crustacean (26.12%), the least were rice grains and water snail at 0.75% each. As indicated by the % index of food significance, the primary food items (i.e., IFS $\geq 3\%$) in decreasing order were parts of crustacean (39.47%) > parts of fish (33.19%) > parts of insect (14.93%) > parts of plant (4.31%) > pepper seed (3.33%). The secondary food items (i.e., IFS ≥ 0.1 to $< 3\%$) in descending order were worm (2.08%) > sand/mud (2.00%) > unidentified items (0.54%), while the remaining such as rice grains (0.09%), copepods (0.07%) and water snail (0.01%) were considered incidental (IFS $\leq 0.1\%$). In conclusion, *S. intermedius* is a predator but can readily adjust its diet based on availability of food items.

Keywords: Schilbeidae, *S. intermedius*, Ekole creek, predator, opportunistic feeder, facultative feeder, frequency of occurrence, index of food significance

INTRODUCTION

Food is important for the survival, well-being, migration and growth of living organisms. Food and feeding habits of fish is used in fish stock management as well as in fish ecology as an important means of investigating the natural history of a species and its role in the trophic (e.g., predator-prey) relationships in aquatic communities (Hyslop, 1980; Lindstrøm *et al.*, 1997; Braga *et al.*, 2012; Odo *et al.*, 2012). Stomach content analysis had been established as one sure way to determine the food of any animal (Hyslop, 1980). Information from such analysis serves as key element in the protection of species and ecosystems (Simpfendorfer *et al.*, 2011).

Schilbe intermedius (Ruppel, 1832) is a freshwater fish species found in Africa and Asia. It is commonly called the butter fish and belong to the family of Schilbeidae (De Vos, 1992; Idodo-umeh, 2003; De Vos, 2007). Although, *S. intermedius* are labeled as least concern in the International union of Conservation of Nature (IUCN) red list (FishBase team RMCA and Geelhand, 2016), the species it's of considerable commercial importance and serves as delicacy for many low income earners (Reed *et al.*, 1967). There are several report of food habits of several fish species in Nigerian waters but only a few on Schilbeidea. Examples includes *Schilbe mystus* (e.g., Ayoade *et al.*, 2008; Uneke, 2016) and *Parailia pellucida* (Allison and Sikoki, 2013) but none from Agbura landing site, Bayelsa State, Nigeria, hence this study. Moreso, the previous name (s) of the species is still in use in some of reported studies, it is important to note that the species previously term *Schilbe (Eutropius) niloticus* and *Schilbe mystus* is now *Schilbe intermedius*, Rüppel 1932 (De Vos, 2007).

MATERIALS AND METHODS

The Study Area and Choice of Fish Species

This work was carried out in Agbura landing site, along Ekole creek, Yenagoa Local Government Area, Bayelsa State. Ekole Creek lies between latitudes 5°.1 N and longitude 6°.4 E in the Niger Delta Area of Nigeria. The Creek is a tributary of the River Nun which arises from Southern Ijaw Local Government Area, Bayelsa State. The Vegetation is made up of submerged macrophytes such as *Lemma erecta*, *Utricularia species*, *Commelia species* etc. Human activities includes fishing, agriculture, sand mining and logging of timber. *Schilbe intermedius* (Africa butter fish) was selected for this study because it is normally caught without bait and are readily available (Udodo-Umeh, 2003).

Fish Sample collection and Identification

Schilbe intermedius landed catch was procured twice a month (May to July 2018) from artisanal fishers at the landing site. *S. intermedius* were immediately fixed in 10 % formaldehyde and transported to the Department of Fisheries and Aquatic Environment laboratory, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt

for further analysis. *S. intermedius* collected were labelled according to the date of collection, whole body weight (g) was taken to the nearest grams (g) on an electronic weighing balance after blot drying excess water with a clean napkin and total length (cm, tip of the snout to the tip of the caudal fins) was measured on a measuring board to the nearest centimeter (cm) as described (Chigeru and Amachree, 2019). *S. intermedius* was identified using keys and descriptions according (De Vos, 1992; Idodo-Umeh, 2003; De Vos, 2007).

Preservation of Stomach content and Analysis

Immediately after measurement, *S. intermedius* (size range: 9.7-26.6cm; total length: 17.9±3.2cm; wet weight: 43.0±24.3g; mean±SD) was excised and each stomach was separated. To avoid skewness in the data, stomachs were excised with the same technique throughout the sampling period. Stomachs were taken and preserved individually in already labelled containers containing 70% ethanol (Espinoza and Wehrtmann, 2008). Stomachs were analysed not later than 2 weeks from the date of collection. On the day of analysis, a longitudinal cut was made across the stomach and the content was emptied into a petri dish, examined under a light microscope (Olympus CK30-F200, Japan) and identified. Stomach contents were analyzed using the frequency of occurrence and number methods (Hyslop, 1980; Ugwumba and Ugwumba, 2007) while the importance of the food items was determined with index of food significance, IFS modified after Allison and Sikoki (2013). The equations are as shown below:

Frequency of Occurrence method

The Stomach contents were examined and the individual food items sorted and identified. Thereafter, the number of stomachs containing one or more of each food item are recorded and expressed as a percentage (%) of all stomachs containing the food items with the following equation:

$$\% \text{ occurrence of a food item} = \frac{\text{Total number of stomach with a particular food}}{\text{Total number of stomach with food}} \times 100$$

Number Method

The number of the individual food item in the stomach was sorted and counted. A total of all the food items was recorded and expressed as % number of individual food items in the stomach with the following equation:

$$\% \text{ number of a food item} = \frac{\text{Total number of a particular food item}}{\text{Total number of all food item}} \times 100$$

Index of Food Significance

The value of the number and frequency of occurrence methods were employed to calculate the Index of Food Significance (IFS) with the following equation modified after Allison and Sikoki, (2013):

$$IFS = \frac{\% \text{ Frequency of occurrence} \times \% \text{ number of method}}{\sum (\% \text{ Frequency of occurrence} \times \% \text{ number method})} \times 100$$

Where Food with $IFS \geq 3\%$ are regarded as primary; ≥ 0.1 to $< 3\%$ as secondary, whereas $\leq 0.1\%$ are considered as incidental.

RESULTS

Stomach content analysis of *S. intermedius*

The result of the stomach content analysis is shown (Table 1). Out of 154 stomachs of *S. intermedius* analysed, 134 (87.01%) contained food while 20 (12.99%) were empty. The majority of the food items were of animal origin others includes plant parts, rice grain, pepper seed, sand/mud and unidentified object items.

Number method

The result indicated that the parts of crustacean had the highest % number (24.44%, Table 1) of food item followed by parts of fish (19.44%) and the least was water snail (0.19%).

Frequency of Occurrence method

For the frequency of occurrence method, parts of fish (27.61%) showed the highest % occurrence followed by parts of crustacean (26.12%) while water snails and rice grains occurred the least at 0.75% each (Table 1).

Index of food significance (IFS)

The result of the IFS (Fig. 1) showed that the primary food items (i.e., $IFS \geq 3\%$) in decreasing order were parts of crustacean (39.47%) > parts of fish (33.19%) > parts of insect (14.93%) > parts of plant (4.31%) > pepper seed (3.33%). The secondary food items (i.e., $IFS \geq 0.1$ to $< 3\%$) in descending order were worm (2.08%) > sand/mud (2.00%) > unidentified items (0.54%), while the remaining such as rice grains (0.09%), copepods (0.07%) and water snail (0.01%) were considered incidental ($IFS \leq 0.1\%$).

Table 1. Composition and Analysis of the stomach content of *S. intermedius* from Agbura Landing Site during a three month (May-July 2018) sampling period .

Food item	No of item	No of stomach	% No of food item	% Occurrence of food item
Unidentified object	9	7	1.67	5.22
Sand/Mud	39	6	7.22	4.48
Pepper seed	65	6	12.04	4.48
Rice grains	10	1	1.85	0.75
Plant parts	72	7	13.33	5.22
Worm	27	9	5.00	6.72
Parts of crustacean	132	35	24.44	26.12
Parts of insect	76	23	14.07	17.16
Water snail	1	1	0.19	0.75
Copepod	4	2	0.74	1.49
Parts of fish	105	37	19.44	27.61
Empty stomach		20		
Total stomach with food		134		
Total food items	540			
Total Stomach		154		

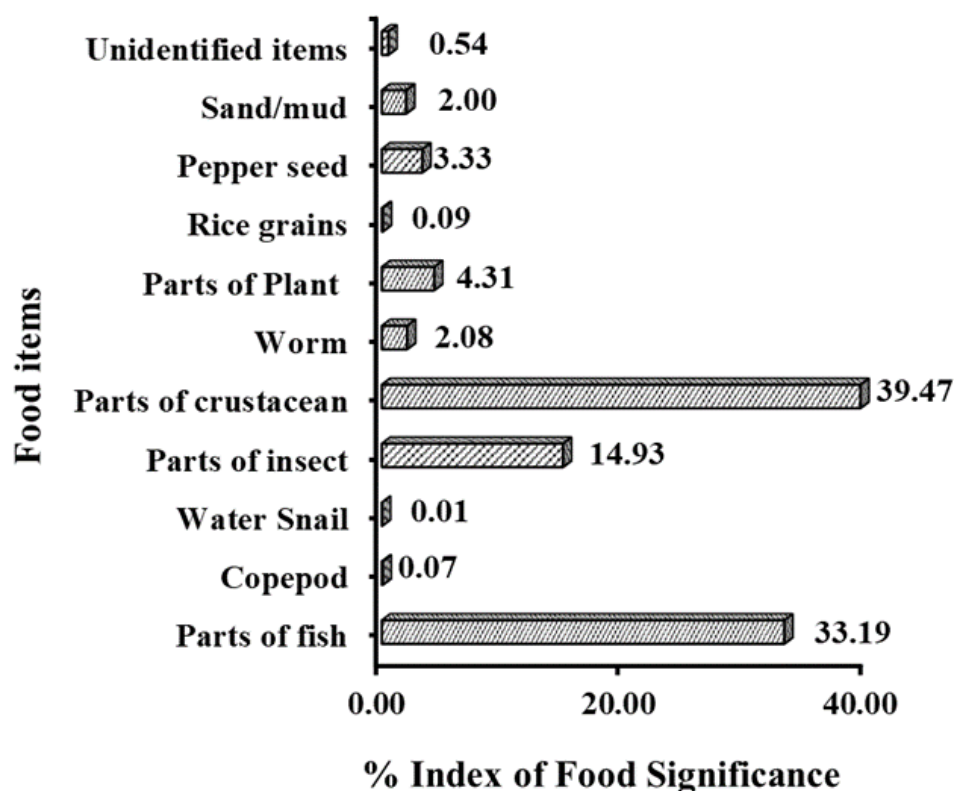


Figure 1. Index of food significance of the stomach content of *S. intermedius* from Agbura landing site during a three months (May - July 2018) sampling periods. Food with IFS $\geq 3\%$ are regarded as primary; ≥ 0.1 to $< 3\%$ as secondary; and $\leq 0.1\%$ are considered as incidental.

DISCUSSION

Stomach contents analysis of *S. intermedius*

The stomach contents of *S. intermedius* were analysed during a three month (May-July 2018) sampling period. The result of the present study showed that 87.01% had food in their stomach and only 12.99% stomach were empty. The result indicates that there were availability of food the study area and the food consumed had not been fully digested by the fish. The result is contrary to those reported earlier (Ayoade *et al.*, 2018) in their study with *Schilbe mystus* from two artificial lakes. Ayoade *et al.* (2018) reported more empty stomach and suggested that it might be due to less availability of food and digestion of the consumed food (mainly protein), which starts in the stomach. The results indicated that the food of *S. intermedius* consist mainly (61.85%) of animal origin (see Table 1 and Fig 1). The result is in line with those recorded (Merron and Mann, 1995) in the study with *Schilbe intermedius* in Botswana. According to Merron and Mann, (1995), *S. intermedius* diet consisting largely of fish (41%), aquatic larvae (25%), terrestrial insects (14%), aquatic insects (7%) and crustacean (5%).

The result indicated that *S. intermedius* from Agbura landing site, has great preference for parts of crustacean (39.47%); parts of fish (33.19%) and parts of insect (14.93%). Also, parts of plant (4.31%) and pepper seed (3.33%) were observed as primary food items in the study. The result is in line with Ayoade *et al.* (2008); Omondi and Ogari (1994), who recorded plants materials in the food of *Schilbe mystus*. Although, parts of plants and pepper seed were shown as primary food items (i.e., IFS \geq 3%), the authors thinks otherwise. This is because parts of insect which is the least preference in terms of animal origin is ~3.5 fold higher when compared to parts of plants and ~4.5 fold higher when compared to pepper seed. The stomach also contained sand/ mud particles, which is in line with Omondi and Ogari (1994) however, they suggested that the sand/mud particles were probably ingested accidentally with other food materials. Allison and Sikoki (2003) also reported sand particles in the stomach of *Parailia pellucida* (Schilbeidae) from Nun River but did not consider sand particles as food.

There is controversy on the food habit of *S. intermedius*. Some researchers classify the species as omnivore as plant materials were found in the stomach (Omondi and Ogari, 1994; Idodo-Umeh, 2003; FishBase team RMCA and Geelhand, 2016) while others (e.g., Merron and Mann 1995; Ayoade *et al.*, 2008) called them predators as the food is majorly on animal other than plant materials or detritus. However, one thing is common in all the reports, the species can change its diet based on the availability of food in the environment. Based on the ease at which the species changes its diet, it has been called facultative feeder (Omondi and Ogari, 1994); opportunistic omnivore (Idodo-Umeh, 2003; FishBase team RMCA and Geelhand, 2016); opportunistic

predator (Merron and Mann, 1995) and predator (Ayoade *et al*, 2008).

CONCLUSION

In conclusion, the present study agrees with earlier reports that *S. intermedius* is a predator as the majority of the food items observed in the stomach content are of animal origin and the species is not rigid in its feeding habit hence can readily adjust due to availability of food item in the environment.

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