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Food and Feeding Habits of *Auchenoglanis biscutatus* (Geoffrey St. Hilarie, 1827) in River Orogodo, Delta State, Nigeria

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Abstract: The stomach of 521 *Auchenoglanis biscutatus* (Geoffrey St. Hilarie, 1827) obtained from River Orogodo were examined for food items. About 472 (90.6%) had food items in them while 49 (9.4%) were empty. Food items encountered included detritus (67.95%) green filamentous algae (57.63%), desmids (42.37%) nematode worms (52.97%), ephemetoperan nymphs (87.91%) and Pentaneura larvae (48.37%) which were most important. Other of secondary importance included Coleopteran larvae (31.78%), isoptera (14.83%), setae of oligocheates (31.78%), Cladocera (9.53%) and Ostracoda (13.98%). *A. biscutatus* had a euryphagous food habits, feeding on a wide variety of food items ranging from insect larvae, detritus and green filamentous algae hence, the species in River Orogodo is considered as omnivorous bottom feeder. The feeding intensity showed seasonal variation as the mean Feeding Intensity (FI) was generally higher in the rainy season than dry season months. Similarly, the dry season months had highest percentage of empty stomachs than the rainy seasons. Generally, *A. biscutatus* fed more in the day than night however food items were consumed at varying proportion at both day and night.

Key words: Diel variation, consumption, diet, feeding habits, stomach, Nigeria

INTRODUCTION

The bagrid catfishes are among the dominant fish families in Nigerian waters contributing enormously to fish landing (Idodo-Umeh, 2002). Ikusemiju (1973) reported of the three species of Bagridae, *Chrysichthys filamentosus, C. walkeri* and *C. nigrodigitatus* comprising about 42.5% of total fish caught in Lekki Lagoon for 2 years. Members of this family are widely distributed in swamps, lakes and rivers throughout Africa (Reed *et al*., 1967; Lewis, 1974; Risch, 1986). In River Orogodo, they form a significant proportion of fish catch by local fishermen throughout the year. The nutritive value of this fish family is derived from the flesh which has high moisture content, oil, carbohydrate, lipid, protein and calcium (Abdullahi, 2001).

Most studies on the biology of Bagridae in Nigeria have been conducted in Kanji, a man-made Lake on the River Niger and in the brackish Lagoon of Lekki and Lagos (Ajayi, 1972; Fagade and Olaniyan, 1973; Ikusemiju and Olaniyan, 1977). Very little is known about the biology of bagrids in general and *Auchenoglanis biscutatus* in particular in Nigeria rivers. Published information on the genus *Auchenoglanis* included that of Abdullahi (2001), Idodo-Umeh and Victor (1991), Idodo-Umeh (2002) and Onimisi *et al.* (2009). Information on the present status of *A. biscutatus* in terms of food habits is not available for River Orogodo. Since, the prospects of culturing this commercially important bagrid in artificial ponds is on the increase there is therefore, the urgent need for a long term study on its food and feeding habits. This study presents the feeding ecology of *A. biscutatus* based on 2 years data in order to improve on the paucity of information of the species in the study area. It is hoped that the knowledge gained will be useful to acquaculturists and water management experts.

MATERIALS AND METHODS

Study area: River Orogodo (5°10[1]-6°20[1]N and 6°10[1]-6°6[1]E) (Fig. 1) is located in the Mid-Western Niger Delta area of Nigeria. It is an oligotrophic freshwater river with its source at Mbiri where it is fed principally by ground seepage from aquifer and secondarily by precipitation, municipal and surface run-off from the riparian communities. It flows South-westerly for about 45 km

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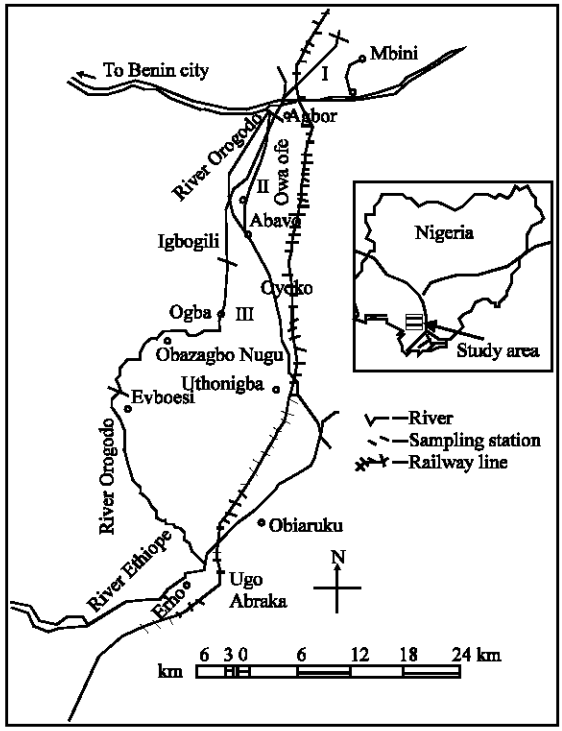

Fig. 1: The study area: a) Nigeria showing the location of Agbor and b) Study stretch showing the location of the sampling stations. Directorate of lands and surveys, govemors office, Asaba

through Agbor and Abavo, both in Ika South local government area, Delta state, Nigeria, to Obazagbon-Nugu and Evboesi both in Orihionmowon local government area, Edo State and finally empties into swamp near Abraka in Delta state. During the dry season months, this lower course dries up.

In the study area, two climatic seasons prevailed, namely the wet season (May-October) and the dry season (November-April). Some key physicochemical variables of the river during the wet and dry seasons are water temperature (20.1-32.7°C), dissolved oxygen (3.8-9.4 mg L^{-1}), conductivity (18-200.3 ms cm^{-1}), transparency (40.0-124.1 cm) and BOD5 (1.4-14.4 mg L^{-1}). The study stretch was demarcated into three sampling stations namely; Station I (upstream), Station II (midstream) and Station III (downstream) (Fig. 1).

Station I was located at Mbiri, the source of the river. It covers a distance of about 5 km with an average width and depth of 3.5 and 1.37 m, respectively. Dominant riparian vegetations are *Panicum repens, Vossial cuspidata*, *Echinochlea pyramidalis, Commelina and Nymphaea* sp. The flow velocity in this stretch relatively high with an average of 25-40 cm sec^{-1}. Station II called the midstream of the study stretch, spans from Agbor municipal to Owa-Ofie, about 2 km downstream of Station I. The average width of the river here is about 4.5 and a depth of 1.57 m. This section of the river has numerous abattoirs located along the stretch which discharge their wastes into the river. The station for most of its length is sparsely vegetated, the marginal vegetation is composed of grasses such as *Panicum* sp. and ferns.

There are also sparse population of macrophytes such as *Pistia stratiotes* and *Azoola africana.* The flow velocity is about 22-34 cm sec^{-1}. Station III was located at Abavo about 11 km downstream of Station II. It is heavily shaded and bordered by marginal vegetations such as bamboo trees *(Banbusa* sp.*)* and raffia palms. Average with and depth measured 6 and 70 m, respectively. The mid-channel of the river in this station is mostly open and the flow velocity is relatively slow (about 13-28 cm sec^{-1}). The substratum is predominantly sand and silt. Relevant human activities in the river included fishing, cow slaughtering, commercial sand dredging and discharge of domestic effluents.

Fish sampling, identification and examination: Routine sampling of fish from the study site was conducted on a monthly basis from January 2006 to December 2007. Sampling was conducted at both day and night. Total 5 methods of fish capture were regularly used: drag nets (1.5-2.5 cm stretch mesh size) gill nets (0.5-10.2 cm stretch mesh size), the traditional basket traps (25 cm in diameter and 80 cm deep), hook and line (nos. 1-4) and hand nets. The fish specimens were preserved in 10% formalin solution prior to examination in the laboratory. Each fish was weighed to the nearest 0.1 g and the total length was determined to the nearest 0.1 mm.

Stomachs were removed by dissection and stomach fullness of each fish was assessed on a point scale from 0-20. The stomach contents were removed and examined under a binocular microscope. Food organisms were identified to the lowest convenient taxon. Analysis of the stomach content was by frequency of occurrence and point method. The occurrence of food items was expressed as a percentage of the total number of stomach containing food. In the point method, each non-empty stomach was assigned 20 points which were shared among the variety of food items, taking into consideration their relative proportion by volume.

The mean point gained by each food item was determined and expressed as a percentage of the total point gained by all food items in the stomachs examined during the month. Feeding Intensity (FI) of the species for each month was computed after Fagade (1983) as:

$$FI = \frac{\text{Mean weight of stomach content}}{\text{Mean weight of fish}} \times 100$$

RESULTS AND DISCUSSION

Food items in the stomach of *A. biscustatus*: Table 1 shows the summary of the food composition in the stomach of *A. biscutatus*. Out of a total of 521 stomachs examined, 472 (90.6%) had food in them while the remaining 49 (9.4%) were empty. Ephemeropteran nymphs were the most frequently occurring food item amounting to 87.9%. This was followed by fine sand, detritus, green filamentous algae and nematode worms which occurred in 70, 67, 58.9 and 53%, respectively of the stomach. All other food items occurred in the range of 9-49%. By point method, detritus, fine sand and filamentous algae scored 23.9, 19.4 and 7.1%. Other items had points between 2.1-6.6%.

Monthly variations in feeding habit of *A. biscutatus*: Monthly variations in feeding habits for the period, January 2006 to December 2007 are shown in Fig. 2. Food items such as detritus and insects were consumed at all times of the year. Insects were the dominant food items and constituted >10% of food items in each month although, a relatively low quantity was consumed in February and April 2007.

Detritus and filamentous algae were also frequently consumed and their presence in the diet was relatively uniform throughout theperiod. The pattern of consumption of worms (nematodes or oligochaete) and other food items was almost similar while the presence of fine sand showed irregular fluctuations.

Monthly variations in mean feeding intensity: Figure 3 shows the monthly and seasonal variations in mean feeding intensity of *A. biscutatus*. The highest feeding intensity was recorded in August 2006 (18%) followed by July of the same year with a feeding intensity of 16.4%. The lowest mean feeding intensity was recorded in January 2006.

The rainy season months generally had higher feeding intensity than the dry season months. In 2007, the highest feeding intensity (14.9%) was recorded in July while the least (3.39%) was in February and March. As in the 1st year (2006), the rainy season months had higher feeding intensity than the dry season months.

Figure 4 shows the monthly variations in the percentage of empty stomach of *A. biscutatus*. The dry season months of January 2006 and February 2007 had the highest percentage of empty stomachs. All the fishes caught in July, August, September and December, 2006 had food in their stomachs. Similarly, there was no empty stomach in the fishes caught in January, April, May, August and October, 2007.

Diel variations in feeding habit: The diet habits were investigated using the entire samples of captured fishes as shown in Table 2. About 147 fishes were captured during the day and 374 at night. Of the day specimens, 138 (93.9%) of them had food in their stomachs while for the night specimens, the corresponding figure is 334 (89.3%). The diel food spectrum (Table 2) shows that 13 kinds of food items were ingested during the day. Coleopteran larvae, termites and rotifers were notably absent in the night samples. These food items appear to be of secondary importance. The occurrence of fine sand desmids, nematode worms and setae of oligocheates were significantly higher ($p<0.05$) in the night time specimens. On the other hand, the occurrence of detritus, green Filamentous algae, Ephemeropteran nymphs, Pentaneural larvae, Cladocera and Ostracode were significantly higher in the day time specimens than the night time ones. The points gained by each food item also follows the same pattern with day time points being higher in most cases than the night points. *A. biscutatus* is an omnivorous and versatile food consumer as can be seen in the wide range of food spectrum and high

Table 1: Summary of food habits of *A. biscutatus*

	Occurrence method		Point method	
Food items	Frequancy	(%)	Points	(%)
Fine sand	334	70	300	19.4
Detritus	316	67	370	23.9
Green filamentous algae	272	58	110	7.1
Desmids	200	42	85	5.51
Nematode worms	250	53	102	6.6
Setae of oligocheates	150	32	60	3.9
INSECTA				
Ephemeropteran nymphs	415	88	75	4.8
Pentaneural larvae	230	49	80	5.2
Coleopteran larvae	150	32	95	6.1
Isoptera (termites)	70	15	100	6.5
Cladocera	45	10	47	3.0
Ostracoda	66	14	92	5.9
Rotifera	42	9	32	2.1

No. of stomachs examined = 521; No. of stomachs with food = 472 and No. of empty stomachs = 49

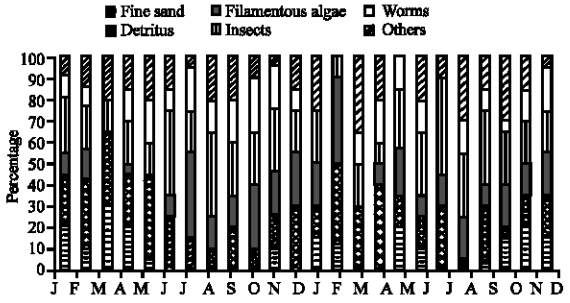

Fig. 2: Monthly variation in the feeding habits of *A. bisculatus* shown as relative percentage points in River Orogodo, Jannary, 2006 to December, 2007

Fig. 3: Monthly variations in mean feeding intensity of *A. biscutatus*

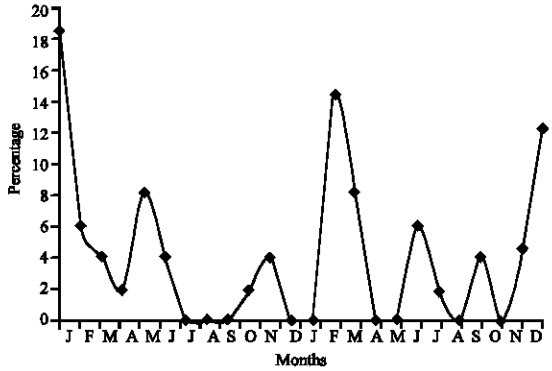

Fig. 4: Monthly variation in the percentage of empty stomach of *A. biscutatus* in River Orogodo, January, 2006 to December, 2007

Table 2: Diel variations in food habit of *A. biscutatus* from River Orogodo. The values shown for day and night are actual frequencies and points gained

	Occurrence methods				Points			
Food items	Day	Night	χ^2	p value	Day	Night	χ^2	p value
Fine sand	150	284	41.38	<0.05	60	240	108.00	<0.05
Detritus	280	36	188.4	<0.05	325	45	211.90	<0.05
Green filamentous algae	230	42	129.94	<0.05	80	30	22.72	<0.05
Desmids	50	150	50	<0.05	15	70	35.58	<0.05
Nematode worms	75	175	40	<0.05	22	80	33.00	<0.05
Setae of oligocheates INSECTA	30	120	54	<0.05	18	42	9.60	<0.05
Ephemeropteran nymphs	345	70	182.22	<0.05	60	15	27.00	<0.05
Pentaneura larvae	300	130	67.2	<0.05	70	10	45.00	<0.05
Coleopteran larvae	150	0	-	-	95	0	-	-
Isoptera (termites)	70	0	-	-	100	0	-	-
Cladocera	30	15	5.0	<0.05	35	12	11.26	<0.05
Ostracoda	60	6	44.18	<0.05	80	12	50.26	<0.05
Rotifera	42	0	-	-	32	0	-	-

No. of fish examined 0.521

proportion of stomach containing food (>90%). The species in this study could regarded as an omnivorous bottom feeder since, most of the food items of animal origin were dominated by bottom dwelling immature insects (Ephemenopteran larvae and Coleopteran larvae) and nematode worms. Similar finding has been reported for other members of the family bagridae.

Ajayi (1972) in Lake Kanji reported that *Chrysichthys autratus* as a bottom feeder feed on bivalves, insect larvae and sand while Idodo-Umeh (2003) in River Ase reported that this species fed on a words variety of food items including insects, detritus, worms and filamentous green algae. Onimisi *et al.* (2009) reported that *A. occidentalis* in Zaria was also an omnivorous bottom feeder. The preference of immature insects, plant materials and detritus to other dietary items is common among the bagrids irrespective of geographical location. For example, studies on the diet of *C. auratus* in Tiga Lake, Kano and in River Ase, Niger Delta (Idodo-Umeh) indicated they are also omnivorous.

However, Ajah *et al.* (2006) described *C. nigrodigitatus* as purely omnivorous at the juvenile stage and planktotrophic at the adult stage in Cross river. Variations in the food habits of the species in different habitats indicate flexibility and the accompanying ability to effectively utilize different available food (Onimisi *et al.*, 2009). The view gives credence to the suitability of *A. biscutatus* and other members of its family as good aquaculture candidates.

The broad food spectrum of *A. biscutatus* suggests that it feeds both in the surface water column and on or near the substratum. The sand grains which contributed substantially to stomach contents, might have been accidentally ingested along with other food items but the contribution to the nutrition of the species is not quite clear. However, it could be assumed that bacteria and protozoa associated with sand grains may be of nutritional benefit in terms of aiding in the digestion of cellulose. Other food items such as cladocera, ostracoda and rotifers were mainly supplementary.

The monthly survey of food items showed that insect larvae and detritus were ingested throughout the year by *A. biscutatus*, though very low quantities were ingested in February and April of the 2nd year (2007). The amount of food items selected by the fish at any time of the year seems to depend on their abundance and availability. The seasonal variation in food habits, however was not quite remarkable indicating the availability of most food items during both seasons and *A. biscutatus* was capable of exploiting these resources throughout the year. Feeding intensity was generally low between January and April each year but from May to October, the fish feeding intensity increased with a peak in July and August of both years.

As stated earlier, food habits were not remarkably different in dry and rainy season but the low mean feeding

intensity per fish gained during the dry season months (January to April) could be due to moderate availability of food items which augmented intraspecific competition. This observation was also supported by the high percentage of empty stomach recorded for this species during the dry season months. Similar, low feeding intensity in the dry season months was recorded for *A. occidentalis* in Zairia, Nigeria by Onimisi *et al*. (2009). The dry season months (January to April) corresponds to period of inadequate food supply. On the other hand, the high feeding intensity in the months of May to October coincides with the rains which bring in allochtonous materials through the flood as it is known with most tropical rivers (Tejerina-Garro and de Merrona, 2010).

Diel variations in food habits showed that *A. biscutatus* fed both during day and night. Therefore, it could be said that light is not a limiting factor in its search for food. Similar findings have been reported for this species and other bagrids by Ajayi (1972) and Idodo-Umeh (2002). Ajayi (1972) reported that the bagrid, *Chrysichthys auratus longifilis* used its sense of smell and barbells to detect its food. However, the consumption of most food items particularly during the day could be explained to indicate that the species appear to be more active during the day than the night as feeding activity is expected to be higher during such period of high activity of the species (Ajayi, 1972; Idodo-Umeh and Victor, 1991; Idodo-Umeh, 2002).

CONCLUSION

A. biscutatus in River Orogodo feeds on a wide range of food items which could make it to be regarded as an omnivore. Future attempts to culture this species must take cognizance of its food habits in the wild.

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