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Dietary Pattern of the Population of *Parachanna obscura* (Gunther 1861) in River Owo, South West, Nigeria

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ABSTRACT

The African snakehead, *Parachanna obscura* is important as food and aquarium fish. It also has a high potential for controlling unwanted fishes in ponds. In spite of its ecological importance, there is dearth of information on this specie for its exploitation in River Owo, a tributary of River Ogun which receives treated industrial and commercial wastes from Agbara Industrial Estate in Lagos and Ogun States, south west Nigeria. This study was carried out to investigate the trophic ecology of the species in River Owo. Three size groups (A: 12.0-20.4 cm; B: 20.5-24.9 cm and C: 25.0-43.0 cm) were identified in 210 specimens of *P. obscura* examined and the food of each size group was established using numerical, frequency of occurrence and gravimetric methods. The relative importance index was then used to summarize the food preference. The stomachs in group A were numerically dominated by fish eggs (38.1%) but by occurrence method, the group preferred insect parts (34.1%). Group B preferred fish eggs (54.0%) by number while by occurrence, fish fry had 20.6%. Group C had preference for fish eggs (51.8%) as well as fish fry (13.5%) by number; however, by occurrence, fish fry constituted 44.8%. The consumption of fish and fish eggs is a point in favor of use of this species in control of Tilapia stunting in a polyculture system where it can be used to control overpopulation of prolific breeders.

Key words: Diet, *Parachanna obscura,* river owo, food and feeding habits, predator

INTRODUCTION

The analysis of stomach contents of many African inland water fishes have been carried out with the aim of elucidating their food requirement in their natural habitats and also their interactions with their biotic environment (Adebisi, 1981; Alfred-Ockiya, 2000; Ekpo, 2004; Agboola *et al*., 2008; Emmanuel, 2008; Lawson, 2011). Some studies have also been carried out on other species outside Africa (Mamun *et al*., 2004; Islam *et al*., 2004; Mondol *et al*., 2005; Prabha and Manjulatha, 2008).

Parachanna obscura has its origin rooted in West Africa especially in Gambia, Congo, Nigeria, Benin Republic and Cameroon (Teugels and Daget, 1984; Bonou and Teugels, 1985; Teugels *et al*., 1992). It is commonly found in the vegetative swamps usually in great abundance shortly after the raining season when the river banks decreased. Although there are few reports of early life history except for species of commercial importance, it appears that as larval snakeheads mature to early juvenile stages, the diet changes to small crustaceans and insects, particularly insect larva. Presence of phytoplankton, plant material and detritus in the digestive system of young snakeheads, as well as adults, appears to occur from incidental ingestion (Lee and Ng, 1991).

Parachanna obscura are strictly carnivorous fishes feeding on earthworms, tadpoles, shrimps, smaller fishes and other aquatic animals (Chen, 1976). Reed *et al.* (1967) and Bardach *et al.* (1972) confirmed the feeding of the species as extremely voracious and predatory or carnivorous and having a piscivorous predation especially in the adult stage, therefore care should be taken in the selection of other fish to stock with them during polyculture. Mohsin and Ambak (1983) referred to *Parachana obscura* as carnivorous feeders, feeding on worms, prawns, frogs and especially other fishes while Lee and Ng (1991) referred to the fish as territorial ambush feeders. Conlu (1986) reported that the young feed on algae and protozoan; the juveniles on small crustaceans and adults are highly carnivorous and dreaded predators of other pond fishes usually used for the biological control of Tilapia population. Victor and Akpocha (1992) reported that small size specimens of *P. obscura* (10 to 16 cm SL) fed primarily on detritus and larval insects where as large size (16-24 cm SL) consumed fish parts and juvenile with insects and fish making up the bulk of the diet.

This study was carried out to investigate the food in the diet of the African snakehead, *Parachanna obscura* in River Owo, South west Nigeria.

MATERIALS AND METHODS

Study area: The study area, River Owo, a tributary of River Ogun in Ogun State opens into Ologe lagoon which is a form of fresh water at Oto-Awori in Ojo Local Government in Lagos State. The courses of River Owo and River Illo mark Lagos State boundary with Ogun State through Agbara town and drain into Ologe lagoon which is a lagoon of ecological importance to the West African coasts because it opens to the Atlantic Ocean via Lagos Harbour and Badagry Creek (Fig. 1).

Materials: During the period of study, a total of 210 specimens of *Parachanna obscura* were collected from local fishermen fishing who used hooks, long line and traps for obtaining the species on River Owo. After each collection, samples were taken to the laboratory of the Department of Fisheries, Faculty of Science, Lagos State University, Ojo, Lagos-Nigeria immediately for measurements, labeling and analysis of stomach contents.

Methods: Each fish collected was given a registration number which indicates date of capture, sex, weight and length. The body lengths (total length and standard length) were measured on a measuring board graduated in cm. Fish body weights were taken to the nearest gram on a top loading Mettler balance.

Each specimen was dissected, the gut removed and the gut content extracted, blotted and kept in labeled vials containing 4% neutral formalin. The content of each vial was poured into a Petri dish and observed under a low magnification of the light microscope for detailed identification of the contents of each stomach.

Three methods of analysis namely the numerical, frequency of occurrence and gravimetric methods were used to analyze the contents of the guts in order to establish the food habits of this species. The results obtained were used to compute the Relative importance index for different food items.

Numerical method: The number of each of the food items contained in the stomachs were counted and recorded and the total number of individual food items was expressed as a percentage of the

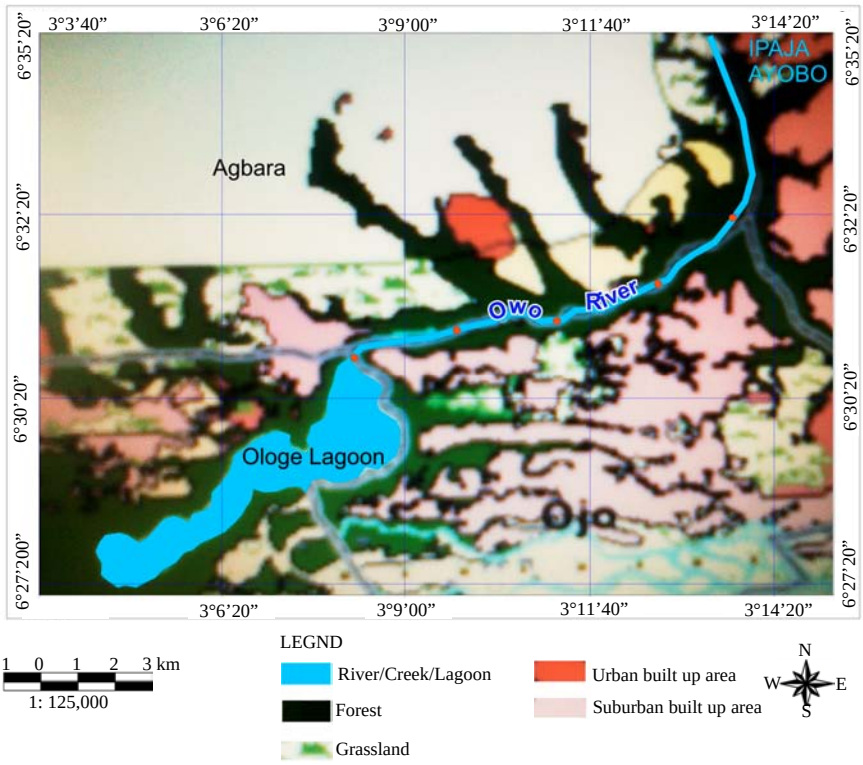

Fig. 1: Map of River Owo, South West Nigeria

total number of food organisms found in all the stomachs examined. The quotient of this gives the percentage by number of each type of food item.

Frequency of occurrence method: Here, the number of stomachs where certain food items occurred was noted and expressed as a percentage of total number of stomachs containing food. This method indicates the type of food items the fish feed upon.

Gravimetric method: The weight of each item of food found in the stomach of all specimens containing food was taken and expressed as a percentage of total bulk of all food items in all the stomachs.

Relative importance index: The Relative importance index (RI) of each group of food organism was also computed using the below mentioned expression (Hyslop, 1980):

$$RI = \frac{100 \times AI}{\sum_{i}^{n} AI}$$

where, AI = Absolute importance index = % Frequency of occurrence + % Numerical + % Gravimetric methods and n = Number of different food items.

RESULTS

One hundred and forty nine specimens (71%) had food in their stomachs while 61 stomachs (29%) were empty. The number of empty stomachs was low for each month throughout the period of study indicating that the species fed throughout the year. Variety of food items found in the stomach is shown in Table 1-4.

In Table 1, the food item found in most of the stomachs (54) was earthworm/annelid worms accounting for 36.2% and arthropod appendages had 47 by occurrence constituting 31.5% while fish had 42 by occurrence making up 28.2%. This is preceded by arthropod larvae/pupae which recorded 19 by occurrence (12.8%). Other food items include fish eggs which had 19 by occurrence (12.8%), shrimps which recorded 17 by occurrence (11.4%), algae which had 12 by occurrence (8.1) and finally copepods and small crabs had 10 by occurrence (6.7%) each, respectively.

In Table 2, where food analysis by frequency of occurrence method for the different size groups were recorded, the small sized specimens (TL 12.0-20.4 cm) had insect appendages as the most frequent in 30 (34.1%) followed by earthworm/annelid worms which had 20 by occurrence (22.7%). There were no fish at all in all the stomachs of the small size group.

In the medium sized specimens (TL 20.5-24.9 cm), 14 stomachs had fish in them (20.6%) and arthropod appendages occurred in 13 specimens (19.1%) while earthworms/annelid worms were encountered in 12 stomachs (17.6%). By frequency of occurrence method, arthropod larvae and

Table 1: Summary of food items found in the stomach of *Parachanna obscura* in River Owo

	Numerical method		Freq. of occurrence method	
Food items	No. of food	Percentage	No. of stomach	Percentage
Fish	44	5.7	42	28.2
Tilapia zilli (28)				
O. niloticus (16)				
Fish scales	20	2.6	5	3.4
Fish eggs	373	48.6	19	12.8
Arthropod appendages	82	10.8	47	31.5
Arthropod larvae and pupae	50	6.5	23	15.4
Earthworms	65	8.5	54	36.2
Copepods	10	1.3	10	6.7
Algae	28	3.7	12	8.1
Cladophora	6			
Pediastrum	4			
Spirulina	8			
Diatoma spp.	5			
Navicula	5			
Plant materials	28	3.7	15	10.1
Shrimps	21	2.7	17	11.4
Unidentified food materials	37	4.8	26	17.5
Small crab	10	1.3	10	6.7
Total	768		100.0	

Table 2: Summary of food items found in the stomach of *Parachanna obscura* by size groups River Owo

	Size groups											
	12.0-20.4 cm				20.5-24.9 cm				25.0-43.0 cm			
	Numerical method		Frequency method		Numerical method		Frequency method		Numerical method		Frequency method	
Foot items	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fish (Cichlids)	-	-	-	-	14	4.4	14	20.6	30	13.5	3.	44.8
Tilapia zilli					(10)				(18)			
O. niloticus					(04)				(12)			
Fish scales	4	1.7	1	1.1	7	2.2	2	2.9	9	4.1	2	2.9
Fish eggs	88	38.1	10	11.4	170	54.0	2	2.9	115	51.8	2	2.9
Arthropod appendages	40	17.3	30	34.1	30	9.5	13	19.1	12	5.4	5	7.5
Arthropod larvae and pupae	15	6.5	10	11.4	25	7.9	5	7.4	10	4.5	2	2.9
Earthworms	20	8.7	20	22.7	30	9.5	12	17.6	15	6.8	6	9.0
Copepods	10	4.3	10	11.4	-	-	-	-				
Algae	22	9.5	5	5.7	06	1.9	3	5.0	-	-	-	-
Cladophora	(5)				(1)							
Pediastrum	(4)				-							
Spirulina	(5)				(3)							
Diatoma spp.	(5)				-							
Navicula	(3)				(2)							
Plant materials	16	6.9	8	9.1	10	3.2	5	7.4	2	0.9	2	2.9
Shrimps	-	-	-	-	07	2.2	2	2.9	14	6.3	8	11.9
Unidentified food materials	18	7.8	5	5.7	14	4.4	3	5.0	7	3.2	2	2.9
Small crab	-	-	-	-	2	0.6	2	2.9	8	3.6	8	11.9
Total	23	100	88		315	100	68		222	100	67	

No. of stomachs examined = 210. No. of stomachs containing food = 149 (71%). No. of stomachs empty = 61 (29%). Total length range = 12.0-42.8 cm and Total weight range = 17.5-734.0 g

pupae as well as plant materials were encountered in 5 specimens each accounting for 7.4%, respectively.

In the large sized specimens (25.0-43.0 cm), fish was found in 30 specimens (44.8%) followed by shrimps and small crabs which were encountered in eight specimens each making up 20.9%, respectively.

Food analysis by gravimetric method: In Table 3, where the weight of each food item found in the stomach of *P. obscura* was recorded and expressed as a percentage of total weight of all food items, it was found that fish item had the highest weight of 162 and this accounted for 40.9% of total weight of food. Arthropod larvae and pupae were next to fish in terms of weight and the value obtained was 60 g (15.1%) while this is preceded by fish eggs which weighed 53.3 g and making up 13.4% of total weight of food. Arthropod appendages weighed 40 g making up 10.1% while earthworm and annelid worms weighed 32 g accounting for 8 g of total weight of food. Other food items weighed included shrimp (27.3, 6.9%), crab (12, 3%) and copepod (10.2 g, 2.57%).

Table 3: Summary of weight of food items found in the Stomach of *Parachanna obscura* in River Owo

Food item	Weight of food (g)	% weight of food
Fish	162.8	40.90
Fish eggs	53.3	13.40
Shrimp	27.3	6.90
Crab	12.0	3.00
Earthworms	32.0	8.00
Insect appendages	40.0	10.10
Insects larvae and pupae	60.0	15.10
Copepod	10.2	2.57
Total	397.6	99.97

Table 4: Summary of the stomach contents of *P. obscura* (with RI values) from River Owo

Food items	% Number	% Occurrence	% Weight	Relative importance index (RI)
Fish	5.7	28.2	40.9	19.27
Fish eggs	48.6	12.8	13.4	19.27
Fish scales	2.6	3.4	-	1.54
Insects appendages	10.8	31.5	10.1	13.49
Insects larvae and pupae	6.5	15.4	15.1	9.53
Earthworms	8.5	36.2	8.0	13.58
Copepods	1.3	6.7	2.6	2.72
Shrimps	2.7	11.4	6.9	5.41
Crabs	1.3	6.7	3.0	2.83
Plant materials	3.7	10.1	-	3.56
Unidentified food	4.8	17.5	-	5.74

Although plankton occurred in the stomachs, they were not weighed as their weight would be insignificant.

The result of the computation of the RI of the various food items found in the stomach of *P. obscura* as shown in Table 4 shows that fish and fish eggs were the most important food items with RI values of 19.27 for each food item.

The next prominent food item was earthworm/annelid worm which recorded RI value of 13.58 while insect's appendages and insect's larvae and pupae had RI values of 13.49 and 9.53, respectively. The RI value for unidentified food materials was 5.74 that of shrimp was 5.41 while that of plant materials was 3.56. Crabs also recorded RI value of 2.83 while the least important food items were copepods and fish scales having RI values of 2.72 and 1.54, respectively.

DISCUSSION

Out of the 210 fishes studied for food and feeding habits from the wild, 149 samples (71%) had food in their stomachs while 61 stomachs (29%) were empty. Adebisi (1981) and Ekpo (2004) also noted high percentage of empty stomachs in *P. obscura*. The occurrence of a high percentage of empty stomachs is a characteristic feature of predatory fishes which is associated with their rapid rate of digesting food. This phenomenon may also be related to regurgitation of large food items from stomach of predatory fishes by pronounced development of striated muscles of oesophagus extending to the stomachs (Lagler *et al*., 1977).

Bardach *et al*. (1972) reported that the food habits of the young *Ophiocephalus* sp. comprised of earthworms, tadpoles and young fish. The sub-adults (fry and fingerlings) of the Asian

snakeheads feed on insects, dipteran larvae and fish fry (Jhingran, 1984). Adebisi (1981) observed that the juveniles of *Channa obscura* preyed primarily on prawns, aquatic insect larvae and copepods. Also, Kori-Siapere *et al.* (2005) concluded that weight of food ingested by *P. obscura* did not vary significantly ($p>0.05$) with the size of fish, but with the type of diet consumed by the fish. Energy contents of ingested food by this fish also did not vary significantly with increase in fish body weight. The energy contents in food of wet season specimens were higher than those of the dry season specimens, through this difference was observed not to be statistical ($p>0.05$). The relative importance of different food items ingested by this fish is documented by Kori-Siapere *et al.* (2005).

The present results partially agree with the earlier results obtained in this direction but totally conforms with Ekpo (2004), who reported that small fish specimens (TL 12.0-26.0 cm) preferred insects (90.2%) as food to fish (37.5%) while the larger specimens (TL 27.0-41.0 cm) preferred fish items (62.5%) to insects (9.8%).

CONCLUSION

The low incidence of fish food and its conspicuous presence in the diets of the medium and large fish is a function of the physical environment which determines its availability.

The relative importance index of the various groups of items in the diet of *P. obscura* in River Owo as calculated (Table 4, Fig. 1) further confirmed fish fry to be the prominent and most preferred food consumed by *P. obscura*.

Certainly, *Parachanna obscura* is a good candidate for aquaculture and as a predator can be used to control overpopulation of cichlids in polyculture system of fish farming.

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