FOOD AND FEEDING HABITS OF *CLARIAS GARIEPINUS* (BURCHELL 1822) IN EGBE RESERVOIR, EKITI STATE, NIGERIA

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ABSTRACT

The food and feeding habit of the catfish Clarias gariepinus in Egbe Reservoir in Ekiti State, Nigeria was studied using 450 Clarias samples collected between January 2010 and November, 2010. Analysis of the stomach contents was done using numerical, frequency of occurrence and volumetric methods. The fish fed mostly on phytoplankton (Cyanophyceae, Chlorophyceae, Euglenophyceae) constituting 97.10% by numerical method. Other food items found in the stomach include insects, zooplankton, arthropod parts, detritus and crustaceans which were of secondary importance. Clarias gariepinus in Egbe Reservoir is an omnivore and females had more empty stomachs (55.60%) than the males (44.40%). This gender bias could be due to intra-specific competition for the available food in the habitat. The information gathered from this present study serves as a guideline for further research on the reservoir.

Keywords: Food and feeding habits, *Clarias gariepinus,* Stomach contents, Omnivore, Insects, Egbe Reservoir, Nigeria

INTRODUCTION

Clarias gariepinus is a catfish of the family Clariidae. The food of *Clarias gariepinus* in its natural habitat has been previously studied and a wide range of food components have already been observed in several parts of Africa. Adeyemi *et al.* (2009) reported that the juveniles in Gbedikere Lake, Kogi State, Nigeria fed on fish and zooplankton. They reported that the food of the adult was also as diverse as the young ones and that fish remains constituted the major part of the food components. Dadebo (2002) reported that *C. gariepinus* in Lake Awassa, Ethiopia, are carnivorous feeding mostly on juveniles of other fish species in which *Oreochromis niloticus* accounting for 91% of the food eaten by the juvenile catfish and 77.5% of the food by the adult catfish. Yalcin *et al.* (2001) reported that the stomach composition of *C. gariepinus* in River Asi, Turkey was dominated by dipterans, while plant like Crysophyta and Chlorophyta were also found in considerable amount. Studies on diet composition are important in community ecology because the use of resources by organisms has a major influence on population interaction. Studies on stomach contents could provide useful information with regards to positioning of fishes in food web in their environment and in formulating management strategy option in multispecies fishery (Adeyemi *et al.,* 2009).

C. gariepinus constitute an important part of the commercial fishery in Nigeria freshwaters, especially in Egbe Reservoir, where it is of high commercial importance. Despite this, no work has been carried out on the food and feeding habits of this species in the reservoir. The objective of this study was to study the food and feeding habit of *C. gariepinus* in Egbe Reservoir in order to contribute to the existing knowledge of the biology of the fish.

MATERIALS AND METHODS

Study Area: Osse River, a major river that takes its source from Kwara State, Nigeria and runs through Ekiti State to Ondo State was dammed at Egbe Ekiti, forming a reservoir called Egbe Reservoir (Figure 1).

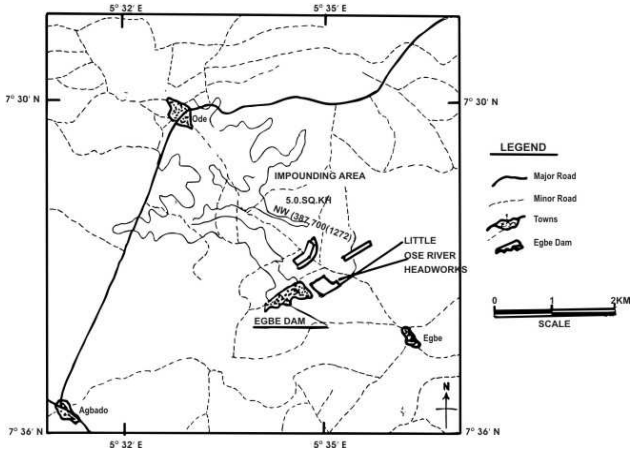

Figure 1: Map of Egbe Ekiti showing the location of the reservoir

The reservoir was constructed in 1975 and commissioned in 1989. Egbe reservoir is the major source of domestic water supply to the people of Gboyin Local Government Area of Ekiti State and part of Akoko area in Ondo State. The transverse survey is 26.5 hectare and the depth of the reservoir is 64m. During raining season, run off from the highland surrounding the reservoir supplies more water to the reservoir. The reservoir lies between latitude $7^0$36 and $7^0$39N and longitude $5^0$32 and $5^0$36E of the equator. Around the reservoir, the vegetation consists mainly of a stretch of thick forest and crop plants. Major activities being done around the reservoir are fishing, agriculture, cattle rearing and fish drying.

The reservoir is used for irrigation of farm lands and as a means of livelihood for local fisherman. Artisanal fishery is also practiced at the reservoir using traps, set and cast nets, hook and line etc. Species of fish in the reservoir include *Tilapia zillii, Sarotherodon niloticus, S. galilaeus; Clarias gariepinus, C. anguillaris, Parachanna obscura, Hepsetus odoe* and *Mormyrus rume.*

Collection of Fish Sample: A total of 450 catfish samples were collected from the fishermen between January 2010 and November 2010. These were harvested with gill net and cast nets. The gill net used was 100 metres long with mixed meshes of 25mm, 51mm and 102mm and 107mm, while the cast net had 7.6mm mesh size. Fish sampling was done once weekly and immediately after collection, the fish were taken to the laboratory of the Department of Zoology, Ekiti State University, Ado-Ekiti, where the morphometric parameters of each specimen was taken. The fish was killed and dissected to expose the viscera and the digestive system was removed using forceps. The digestive tract was preserved in 4% formalin pending examination of stomach contents. The digestive track was further cut into sections for easy handling. Stomach fullness was graded by the method of Ugwumba and Adebisi (1992) and the content was then emptied into a Petri dish for examination. The organisms were identified and counted under a stereoscopic binocular microscope at varied magnifications. Analysis was carried out using the numerical, frequency of occurrence and volumetric methods (Hynes, 1950; Lagler, 1956; Hyslop, 1980).

Numerical Method: The number of each type of food item encountered in each stomach was recorded. This value was expressed as a percentage of the total number of all food items consumed by the fish. Percentage number of food item was calculated thus: %N = Total number of particular food item / Grand total number of all food items x 100.

Frequency of Occurrence Method: The number of stomach samples in which a given food item found is expressed as a percentage of all non-empty stomach examined. It gives an estimate of the proportion of the population that feed on a particular food item. %F = Total number of stomach with particular food / Total number of stomach with food x 100.

Volumetric Method: The volume of each food item was determined by knowing the volume of

the stomach alone using water displacement method and subtracting it from the volume of stomach with food content. The volume of each food item was then expressed as a percentage. %V = Volume of each food item / Total volume of all food items x 100.

Values from the three different methods were employed in calculating the relative importance index (RI) thus: RI = 100 x AI / ∑ AI, where AI = AI= %N + %F + %V.

RESULTS

Four hundred and fifty (450) catfishes, whose size ranged from 13.5 to 37.2 cm total length (TL), 11.4 to 33.10 cm standard length (SL) and 57.2 – 273g body weight were examined. A total of 68.5% of the specimen got were obtained during the dry season (January – March 2010), while 31.5% were obtained in the wet season (April – September 2010). It was observed that 417 catfish stomachs out of 450 catfish caught had food items, while the remaining catfishes had empty stomachs. The dry season catches had higher percentage of fish with empty stomach than the wet season (Figure 2) and the frequency of empty stomachs in the female fish was higher than that of males (Figure 3).

The items encountered in the stomach of the catfish examined include phytoplankton, zooplankton, insects, detritus, crustacean, higher plant materials, nematode worms, arthropod parts, sand grains and unidentified mass/mud (Table 1). *C. gariepinus* fed majorly on phytoplankton (Cyanophyceae, Chlorophyceae and Euglenophyceae). Cyanophyceae was the major phytoplankton food item of the species. Phytoplankton (Cyanophyceae) had 68.7% by number, 21.5% by volume and occurred in 28% of the stomach. Chlorophyceae accounted for 15.6% by number, 7.3% by volume and occur in 6.3% of the stomachs. Euglenophyceae account for 12.8% by number, 5.5% by volume and occur in 5.2% of the stomach (Table 2). It was also observed that unidentified mass/mud were common in the stomach content of the specimen, making up to 41.3% by volume and occurred in 28.5% of the stomach.

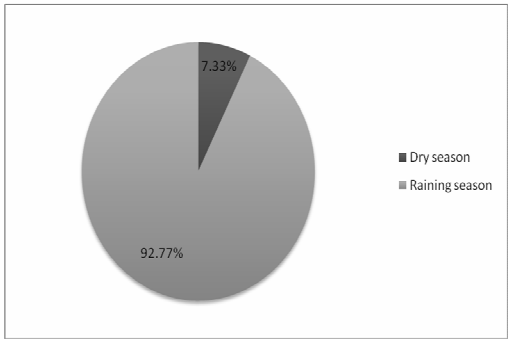

Figure 2: Seasonal variation in percentage of *C. gariepinus* from Egbe reservoir with empty stomachs

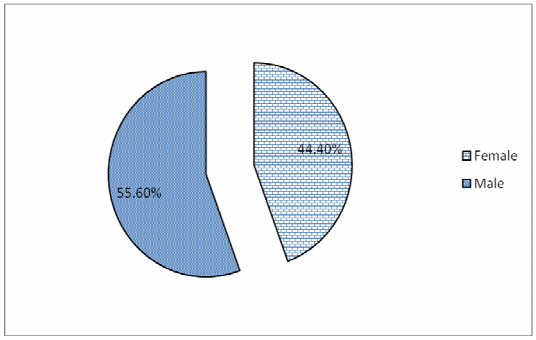

Figure 3: Sexual dimorphism in percentage of *C. gariepinus* from Egbe reservoir with empty stomachs

Higher plant materials were fed on extensively and were represented by 10.2% volume, occurring in 6.6% of the stomach. Detritus and sand grains were represented in the stomach and occurred in 1.3% and 11.5% of the stomach, making up 0.4% and 2.2% by volume of the stomachs respectively. Insects, as well as crustaceans were consumed in small quantities. Insect occurred in up to 2.4% of the stomach by volume, accounted for 2.7% by number, 4.8% by volume and occurred in 1.3% of the stomachs. Arthropod parts, zooplankton and nematode worms; each occurred in 5.2%, 2.4% and 1.3% of the stomachs, and represented in 28%, 0.9% and 0.19% by volume respectively (Table 2).

The RI indicated that phytoplankton is the most important food items of *C. gariepinus* in the reservoir and constituted 89.2%, while crustacean and insect rank next with 3.4% and 3.16%, respectively.

Table 1: Major food items in the stomach of *Clarias gariepinus* from Egbe Reservoir

Food Items	Numerical method		Frequency of occurrence method		Volumetric method	
	No	%	No	%	No	%
Phytoplankton						
Cyanophyceae						
Coelospharium	137	18.4	5.7	7.5	182	5.7
Nostoc	102	13.7	4.3	6.0	136.6	4.3
Oscillaoria	171	22.9	7.10	9.0	227	7.2
Pediastrum	102	13.7	4.2	5.5	136.4	4.3
Chlorophyceae						
Closterium	66	8.9	2.7	3.5	133	4.2
Ulothrix	33	4.4	1.4	1.8	66	2.1
Chlamydomonas	17	2.3	0.7	1.0	33	1.0
Euglenophyceae						
Phacus	95	12.8	4.0	5.2	175	5.5
Zooplankton						
Rotifer						
Asplanchua	3	0.4	0.6	0.8	9.7	0.3
Filinia	3	0.39	0.6	0.8	9.6	0.3
Brachionus	3	0.4	0.6	0.8	9.7	0.3
Insect						
Monomorium minimum	6	0.8	1.5	2.0	16	0.5
Conocepalus fasciatus	1	0.13	0.3	0.4	70	2.2
Detritus	-	-	1.0	1.3	13	0.4
Crustacean	3	0.4	1.0	1.3	152	4.8
Higher plant	-	-	5.0	6.6	324	10.2
Nematode	2	0.27	1.0	1.3	6	0.19
Arthropod parts	-	-	4.0	5.2	90	28.0
Sand grains	-	-	8.8	11.5	71	2.2
Unidentified mass/mud	-	-	21.7	28.5	1310	41.3

Table 2: Class of food items in the diet of *Clarias gariepinus* from Egbe-reservoir

Food Items	Methods		
	Numerical (%)	Frequency of Occurrence (%)	Volumetric (%)
Cyanophyceae	68.7	28.0	21.5
Chlorophyceae	15.6	6.30	7.30
Euglenophyceae	12.80	5.20	5.50
Zooplankton	1.19	5.20	0.90
Insect	0.93	2.40	2.70
Crustacean	0.40	1.30	4.80
Nematode worm	0.27	1.30	0.19
Detritus	-	1.30	0.40
Arthropod parts	-	5.20	28.0
Higher plants	-	6.60	10.2
Sand grains	-	11.50	2.2
Unidentified mass	-	28.50	41.3

Table 3: The relative importance index (RI) of the food items in the diet of *Clarias gariepinus*

Food Items	RI (%)
Phytoplankton	89.2
Zooplankton	2.37
Insect	3.16
Crustacean	3.4
Nematode	1.73

DISCUSSION

In Egbe Reservoir more fish were caught in the dry than in the wet seasons. The total length of *C. gariepinus* in the reservoir ranged from 13.5 cm - 37.2 cm and was far lower than the total length ranges of *C. gariepinus* in Opa reservoir (Abayomi *et al.,* 2005). This might be related to availability and abundance of food items in Opa reservoir compared with Egbe reservoir. Abundance of fish in dry season might probably be due to the fact that water volume increased during the raining season due to flooding, thus making fish population widely dispersed. This flooding also leads to influx of food organisms from catchment area, thus explaining the increase in the percentage of stomach fullness, during the raining season. It was also found that the percentage of empty stomach in female was higher than that of the male. This could be due to gender-biased intra-specific competition on limited food resources in the habitat in which males out-compete the females.

The stomach of *C. gariepinus*, in this reservoir was found to contain high percentage of unidentified materials/mud. This confirmed its name "mudfish" indicating that the fish is a bottom dweller, as was also observed by Ayinla (1988) and Abayomi *et al.* (2005). The data obtained in this study indicated how successful the fish population has been in exploiting the available food resources in the reservoir. The stomach content analysis indicated that *C. gariepinus* fed on a wide range of food items. Generally, fishes are not rigid regarding the particular type of food they eat and will utilize the most readily available food item (Fagbenro *et al.,* 1991). The food and feeding habit of some other *Clarias* species have been reported. Reports on the food and feeding habit of *Clarias mossambicus* in four habitat types in the northern Lake Victoria basin indicated that the preferred food items varies from area to area. In the lake, rivers and swamps, *C. mossambicus* fed mainly on fish, particularly *Haplochromis* species. In fish ponds, crustaceans and insects were the main food items. The author further reported that the extent of ingestion by *C. mossambicus* of a given type presumably reflect the availability and abundance of the food in the habitat (Mbawaza, 1984). The quantity and quality of food item fed on by the fish may also vary with size, age, sex and time of feeding (Ugwumba, 1993; Idowu, 2007).

The fish exhibited the characteristics of an omnivore in Egbe reservoir. Ecological studies in some reservoirs (Abayomi *et al.,* 2005) and ponds have shown that juveniles of *C. gariepinus* fed in decreasing order of preference on insects and crustaceans, mollusks, detritus and plankton. *Clarias gariepinus* has been observed to possess proteases similar to carnivorous species, starch digestive capabilities similar to those of specialized herbivore and lysozome and alkaline phosphatase as detrivores. *C. gariepinus* is physiologically equipped to cope with frequent and irregular meals as its digestive enzymes respond faster than those of eel (*Anguilla anguilla*) or carp (*Cyprinus carpio*) to feeding (Yalcin *et al.,* 2001; Adeyemi *et al.,* 2009).

The most frequent food component in this study was the phytoplankton (family Cyanophyceae, Chlorophyceae and Euglenophyceae). This result agreed with the observation of Yalcin *et al.* (2001) and Adeyemi *et al.* (2009) for *C. gariepinus* diets in Asi River and Gbedikere Lake. The food and feeding habit of *C. gariepinus* from Olupanna Reservoir was studied and the diet was found to comprise mostly of phytoplankton in fingerling, juvenile and adults stages (Ayinla, 1988).

Food is the main source of energy and plays an important role in determining the rate of growth and condition of fishes. Data on different food items consumed by fish may eventually result in identification of stable food preference and in creation of trophic models as a tool to understand complex ecosystems (Lopez-Peralta and Arcila, 2002; Bachok *et al.,*

2004). Studies of species food and feeding/ resource requirements can be used in understanding factors controlling the distribution and abundance of organisms in an ecosystem. Food and feeding habits of fishes have a great significance in aquaculture practice. It helps in selection of such species of fishes which will utilize all the available potential food resources of the water bodies, with less competition with one another (Begum *et al.,* 2008).

It is important to emphasize that the effect of seasonality should always be considered in the studies on natural feeding of fish, because the temporal changes of biotic and abiotic factors alters the structure of the food web along the year and as a consequence, the fish often shows seasonal diet shifts (Wotton, 1992). In conclusion, the feeding habit of *C. gariepinus* based on stomach content analysis revealed the fish as primary consumer within the food web of Egbe reservoir. This is not surprising, since phytoplankton is known to thrive well in the reservoir. Since *C. gariepinus* is a culturable fish species, information on its stomach content analysis will provide basic information needed in the formulation of artificial fish feed for its culture. The information gathered from this present study is inconclusive, as there is need to carry out the analysis to cover various seasons, and many more years. However, this finding will serve as a guideline to further research on the reservoir.

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