The Food Habits of *Ctenopoma pethereci,* Gunther (Pisces: Anabantidae) in River Oluwa, Ondo State, Nigeria

I. T. Omoniyi, A. O. Agbon* and Y. Akegbejo-Samsons
Department of Aquaculture and Fisheries Management, University of Agriculture, Abeokuta, Nigeria
*Corresponding *author; E-mail: oseremehis@yahoo.co.uk*

Abstract

The natural foods of *Ctenopoma pethereci* from River Oluwa in Ondo State, South-west Nigeria, were investigated by frequency of occurrence and points methods of analysis. The quantity of food in the full stomach constituted 0.83% of the body weight while food in the intestine formed 1.54%, thus, giving the quantity of food in the entire gut as 2.37% of the body weight. There was little or no qualitative difference in the food items found in the stomachs and intestines. The food items encountered in the gut covered a wide spectrum, and the species is shown to utilize a wider variety of plant materials than animals. The dominant plant source included diatoms, blue-green algae, green algae and higher plants, while the range of animals included rotifers, copepods and insects. Organic detritus also formed a substantial portion of its food which amounted to 98.94%. The study revealed that *C. pethereci* is an omnivore with herbivorous tendency in River Oluwa.

Introduction

Ctenopoma pethereci Gunther (belonging to the family Anabantidae) is one of the non-cichlid fishes occurring in West African rivers. Amevenku & Quarcoopome (2006) and Quarcoopome *et al*. (2007) reported the presence of *C. pethereci* in Libga reservoir in Savelugu-Nanton District of Northern Ghana. It also occurs in India where it was reported to have been found alive at the tops of palm trees probably dropped there by fish-eating birds (Holden & Reed, 1978). The species can breathe atmospheric oxygen through accessory respiratory organ. In South East Asian countries, where the group is referred to as Gouramis, it is important in traditional farming practice despite the less attention given to it by fisheries scientists (Pillay, 1990).

In Nigeria, the occurrence *C. pethereci* was reported by Reed *et al*. (1967) in a small stream entering a swamp near Shagunu in the northern part. Although, *C. pethereci* does not frequently feature in the fish markets in Ondo State, a study revealed that it formed a major subsistence activity of the River Oluwa fishing communities (Akegbejo-Samsons & Omoniyi, 1998). The abundance of this species in Oluwa river became a subject of interest, and, in order to gain an insight into its biology for rational exploitation and probably culture practice, a detailed study was carried out. This study reports on the food habits of *C. pethereci* in river Oluwa, the first report in this area to provide in-depth information on the natural diets of the species.

Materials and methods

River Oluwa (Fig. 1) is one of the large rivers in Ondo State, Nigeria, stretching from Lat 7º 2' 00" N down to the coast at Lat 6º 1' 00" N, meandering through many villages and towns in Ilaje/Ese Odo areas between Long 4º 31' 30" and 5º 2' 00" E, before linking with Lekki lagoon in the coastal belt. The features of the river have been adequately described by Akegbejo-Samsons (2005) who reported that the river is seasonally flooded every year

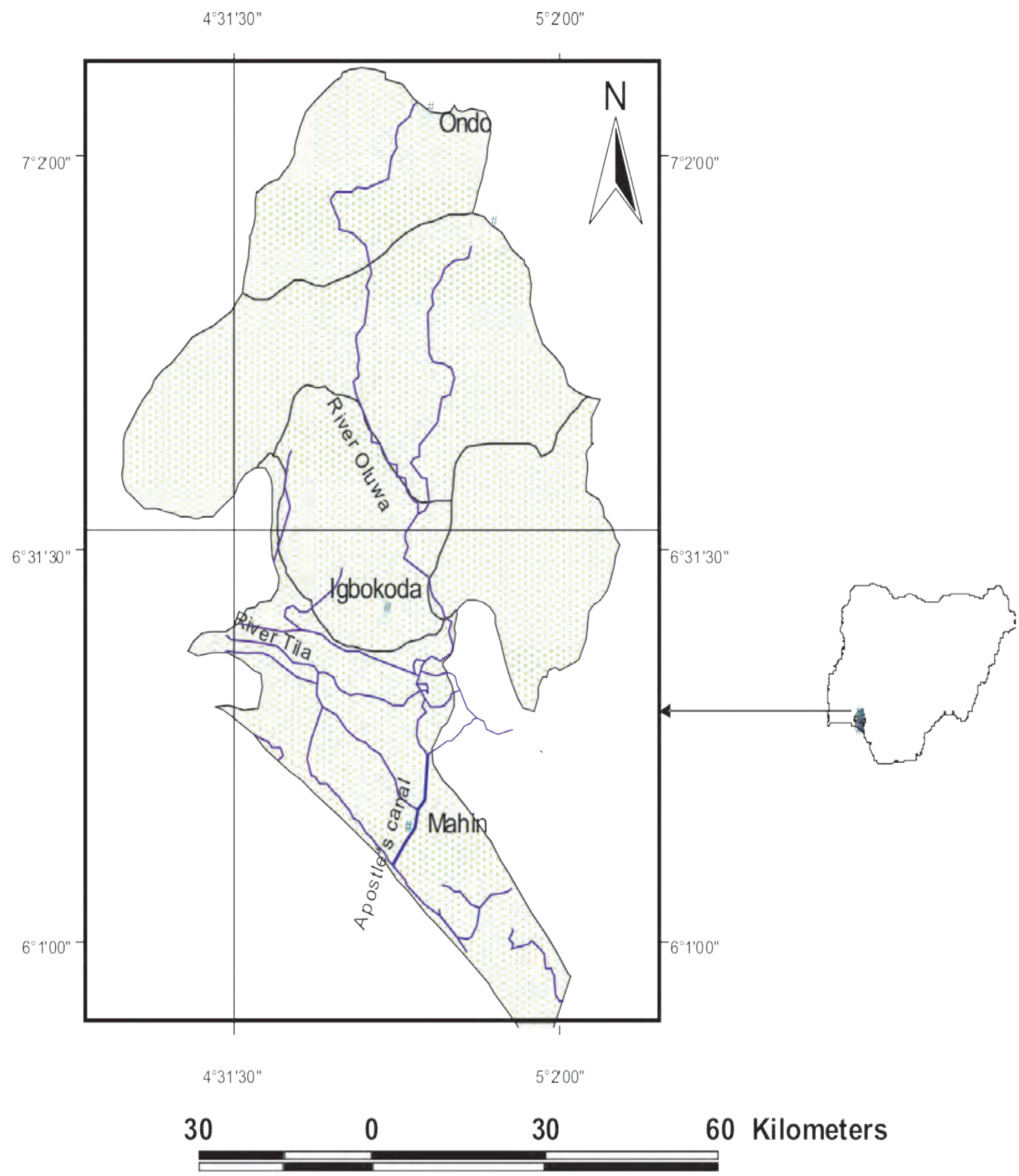

Fig 1. Map showing Oluwa River

between July and October. Fish specimens were collected monthly between January and December 2004 with the help of artisanal fishermen using no return-valve traps and set gill-nets of 50 mm and 75 mm mesh sizes. The sampling was done once a month lasting for a period of 24 h during which the no-return-traps set the previous day were inspected and catches, if any, retrieved. The set gill-nets on the other hand were inspected between 10-12 h after setting to prevent captured fish from spoilage.

Sampling was always done between 06.00 h and 11.00 h. On each occasion, fish weights were measured to nearest 0.1 g and standard lengths (SL) to nearest 0.1 cm. Thereafter, they were tagged before kept chilled, to reduce posthumous digestion, for transportation to the laboratory. At the laboratory, the fish specimens were transferred into a deep freezer prior to examination of the gut content. Specimens were thawed, entire gut excised and put into a petri-dish following which the stomach was separated from the intestine. Stomachs containing food were size-classified using the Table by Olatunde (1978).

The content of each stomach was weighed after being placed on a pile of filter papers that soaked away most of the moisture content. This was done to ensure that water ingested with the food items by the fish was not computed as part of the weight of ingested food. The contents of stomachs were either examined immediately or stored in 4% neutral formalin for later analysis. Fractions of food content placed on glass slides were observed under varying magnifications of the microscope, sometimes with an oil immersion lens. In this way, a lot of food items were identified and in some cases up to generic levels.

Ugwumba & Ugwumba (2007) recommended that when large numbers of specimen are sampled, at least a combination of two methods should be used for stomach content analysis for accuracy. Frequency of occurrence and points methods were used for the analysis of the dietary items. For the frequency of occurrence, the number of times a particular food item occurred in the stomach is counted and expressed as a percentage of the total number of stomachs with food (empty stomachs excluded). This is expressed as:

Percentage occurrence of a food item

$$= \frac{\text{Total number of stomachs with the particular food item}}{\text{Total number of stomach with food}} \times 100$$

This method presents the food spectrum of the species. Hence the importance of the food items relative to the population of the species could probably be guessed.

The point method involves scoring points to different food items depending on their numbers and sizes; one large organism being equivalent to many small organisms. All the points accumulated by each food item were summed-up and expressed as a percentage of the total number of points accumulated by all the food items as follows:

Percentage points of a food item

$$= \frac{\text{Number of points of the particular food item}}{\text{Total number of points of all food items}} \times 100$$

Results

A total of 944 specimens whose sizes ranged from 10.9 to 16.8 cm (total length) and from 8.7 to 13.6 cm (standard length) were examined. The body weight varied from 26.5 to 96.8 g with a mean of 52.4 $\pm$ 11.7 g. While food occurred fully in almost all the intestines, the condition of food in the stomachs varied from ¼ to $^{4}/_{4}$. Only 12.5% of the specimens had empty stomachs. The number of specimens with empty stomachs varied monthly with seasonality as shown in Table 1. The incidence of occurrence of empty stomachs ranged in percentages from 10 to 23% in the months of March, April and May, as well as from October to December. The month of March, which is the peak of dry season, recorded the highest incidence, with 23.6% of the specimens having empty stomachs. The table also shows that feeding was intensive in February, July, August and September, when the percentage of fish with empty stomachs were less than 10%.

The month of July, which is the peak of the rainy season, recorded the least incidence of specimens (5.4%) with empty stomachs. The months of January and June could be tagged as transitional in feeding intensity. In specimens whose standard length were below 11.0 cm, the food items in their stomachs constituted 0.64–1.17% (mean value 0.96%) of the body weight and the weight of food items in the intestines varied between 1.03 and 1.98% (mean 1.32%) of the body weight. Comparative values for specimens whose lengths were over 11.0 cm had between 0.31 and 0.66% (mean 0.47%) in stomach and 1.25–2.48% (mean 1.67%) in the intestines. However, pooled quantitative assessment of the food found in full stomach of the species constituted 0.31–1.17% (mean 0.83%) and in the intestines, the food formed between 1.03 and 2.48% (mean 1.54%). Thus, the weight of food in the entire gut constituted an average of 2.37% of the body weight.

The summary of food items found in the stomach of *C. pethereci* is shown in Table 2. The food items in the intestines were essentially similar to those found in the stomachs except a conspicuous absence of some rotifera members from all parts of the intestine. The table shows further that food from microscopic aquatic plant sources

TABLE 1
Monthly changes in the number of empty stomachs in Ctenopoma pethereci i*n River Oluwa, Nigeria (January – December 2004)*

Months	*No. of specimens examined*	*No. of specimens with empty stomach*	*Percent empty stomachs*
January	76	6	7.9
February	136	8	5.9
March	144	34	23.6
April	84	18	21.4
May	68	12	17.6
June	46	4	8.7
July	74	4	5.4
August	102	6	5.9
September	68	4	5.9
October	38	4	10.5
November	46	8	17.4
December	62	10	16.1
	944	118	12.5

TABLE 2

The percentage occurrence and the points of various dietary items in the stomach of Ctenopoma pethereci *in River Oluwa (January–December 2004)*

Dietary items	*Frequency of occurrence method*	*Frequency %*	*Total points method (%)*
PHYTOPLANKTON			
Green algae			
Eudorina	412	43.64	2.5
Spirogyra	718	76.05	5.4
Chlorella	128	13.56	0.7
Volvox	158	16.74	1.1
Blue-green algae			
Anabaena	822	87.08	10.7
Nostoc	264	27.97	2.2
Oscillatoria	516	54.66	4.9
Scenedesmus	546	57.84	5.1
Agmenellum	152	16.10	0.6
Diatoms			
Cosinodiscus	890	94.28	12.5
Navicula	818	86.65	6.1
Melosira	702	74.36	5.5
Synedra	648	68.64	4.1
Cyclotella	722	76.48	5.4
Pinnularia	694	73.52	3.5
Desmids			
Closteridium	460	48.73	2.1
Cosmarium	596	63.14	3.2
ZOOPLANKTON			
Rotifera			
Brachionus	234	24.79	1.1
Moina (Cladocera)	156 / 74	16.53 / 7.84	0.6
Unidentified rotifers	46	4.87	0.2
Copepoda			
Copepod parts	62	6.57	0.8
Nauplius larvae	26	2.75	-
Insect parts	28	3.39	0.3
Higher plants parts including seeds	738	78.18	6.2
Organic debris (Detritus including sand grains pebbles)	934	98.94	14.6

constituted 75.6% of the dietary items of the species. Among these, the diatoms comprised 37.1% while the blue-green algae constituted 23.5%. The green algae and desmids represented by *Spirogyra* and *Cosmarium,* respectively, contributed 9.7 and 5.3% of the food items respectively. Higher plants in the form of leaves, stems and seeds constituted 6.2% portion of the food. The zooplanktonic source of food comprising rotifers, copepods and insect parts contributed only 3.6% of the dietary component of *C. pethereci*. Intermixed with this assortment of plant and animal materials were unidentified organic matter in the form of detritus, sand grains and pebbles which had a frequency of occurrence of 98.94% in the stomach and intestine of specimens examined.

Discussion

The study of food habit of a species is of practical importance especially in its culture programme (Ofori-Danson & Kumi, 2006). The food items in the stomach of *C. pethereci* imply that it is an omnivorous feeder as its diets covered a wide spectrum of aquatic microscopic plant and animal materials. It was observed that an average of 87.5% of the specimens had food in the stomach all year round suggesting that food was available and the species took to continuous feeding in the habitat. It has been reported that the availability of food determines the quantity of food consumed (Moriarty & Moriarty, 1973). Monthly variation in feeding habits based on the degree of stomach emptiness showed a decrease during rainy season and an increase in the dry season.

As shown in Table 1, high percentage of empty stomachs were observed in November, December and also from March to May, which corresponded with the start of the dry and rainy seasons, respectively. During these months, the percentage of empty stomachs was higher than 10%. This could be explained by a steady dwindling of food resources in the river that is continuously decreasing in volume with the onset of the dry season. During the dry season, the river becomes shallow and the abundance and variety of food decrease (Akegbejo-Samsons, 2005). Correspondingly, the rainy season presents a wide variety and abundance of food resources due to high nutrient composition of the run-off from land promoting aquatic plant growth. Olojo *et al.* (2003) made a similar observation on *Synodontis nigrita* in Osun river, SW Nigeria, while Fagade (1979) also reported similar findings in the tilapias of Lagos lagoon.

The observation that the weight of food in the entire gut constitutes an average of 2.37% of the body weight is of practical value in that full meal by the species forms less than 3% of the body weight. This information is useful when supplementary food is to be economically provided for *C. pethereci* in a culture programme. The study has revealed the preference of this species for phytoplankton which is probably due to the seasonal predominance of these dietary items in the habitat. Ugwumba & Adebisi (1992) reported a similar finding in their study of *S. melanotheron.* The fish fed on little quantity of zooplankton such as rotifers, cladoceran, copepods and insect parts.

Holden & Reed (1978) reported *C. pethereci* as feeding on insects from a grassy swampy habitat as its primary food.

Unidentified organic matter in the form of detritus and debris were also ingested from substratum of the river. Ofori-Danson & Kumi (2006) reported the presence of similar structureless organic matter in the gut of *S. melanotheron.* The inclusion of detritus in the diet of *C. pethereci* seemed to be of survival value in addition to the fact that it is a substratum feeder. This was because these materials which were derived from the surrounding terrestrial habitat were abundant in the river throughout the seasons.

The unspecialized flexible dietary habit of *C. pethereci* is an optimal strategy for survival in the river where food sources are subject to fluctuation. The prominence of the species in River Oluwa is associated with wide choice of suitable food available to it. As an omnivore with herbivorous tendency, *C. pethereci* stands as a good candidate for commercial culture since only minimal inclusion of expensive animal protein would be required in its feed.

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