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A Comparative Study of the Food and Feeding Habits of *Chrysichthys nigrodigitatus* and *Brycinus nurse* in a Tropical River

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Abstract. A comparative study of food and feeding habits of two fish species, *Chrysichthys nigrodigitatus* (Lacepede) and *Brycinus nurse* (Ruppel) was carried out in the Ethiope, a tropical river. Fish species were procured from fishermen, using cast-nets, fish traps, hooks and lines for fish catch. Specimens were chilled with ice-blocks in a heat-insulated cooler and transported to the laboratory at the University of Benin for analysis. One hundred fish specimens were examined and their stomach contents analysed. Two methods were applied for the analysis, namely, the frequency of occurrence method and the volumetric method. The result of the analysis showed that *C. nigrodigitatus* was an omnivorous detritivore, while *B. nurse* was a herbivore. Thus, they occupied different ecological niches and hence were found in abundance in the same water body.

Keywords: food/feeding habits, fish species, tropical river, *Chrysichthys nigrodigitatus*, *Brycinus nurse*, Ethiope river

Introduction

Studies on the food and feeding habits of fish species is a subject of continuing research, since it constitutes the basis for the development of a successful fisheries management programme on fish capture and culture. The published work from Africa shows that intensive investigations on the fish species started when Boulenger (1916) produced a catalogue of the freshwater fishes of Africa. Later, Robert (1975) reported the geographical distribution of African freshwater fishes and Welcomme (1979) reviewed food and feeding habits of fish species in the African flood plain rivers. Durr and Gonzalez (2002) studied the feeding habits of *Beryx splendens* and *B. decadactylus* (Berycidae) off the Canary Islands. The effects of metazoan parasites on the feeding behaviour of some fish species in the North Sea were investigated by Klimpel *et al.* (2003). A comparative study on the feeding habits of co-occurring sprat (*Sprattus sprattus*) and cod (*Gadus morhua*) larvae in the Baltic Sea was carried out by Voss *et al.* (2003). The sediment grain size, with regards to the feeding, and assemblage structure of ground fish in the Northeastern continental shelf were studied by Methratta and Link (2004). In respect of Nigeria, Reed *et al.* (1967) had produced a comprehensive record of fish and fisheries of Northern Nigeria, while Fagade and Olaniyan (1973) studied the food and feeding relationships of fishes of the Lagos Lagoon in Western Nigeria. Other investigators who worked on the fishes of Nigeria include, Olatunde (1979) in the upper Ogun River, Adebisi (1981) in Lagos and Lekki Lagoons, Tetsola (1988) in the Niger Delta area and the Warri River, Ikomi and Sikoki (2001) at the River Jamieson, and Oboh *et al.* (2003) also at the Jamieson River.

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The Ethiope River is very important for commercial fisheries and the production of palm-wine from the numerous raffia palms (*Raphia hookerii*) growing luxuriantly along its bank. The only published work reported on the river is on the distribution of the fish species by Odum (1995). Thus, this study aims to continue research on the fishes of this river providing a more detailed comparative investigation into the food and feeding habits of the two fish species, *C. nigrodigitatus* and *B. nurse*, which were most abundant in the river. The two fish species selected for this study are also of very high commercial and economic value.

Materials and Methods

Study area. The Ethiope River is located between latitude 5° 57'-5° 45/N and longitude 5° 00'-6° 05/E. It has its source at Umuaja Hills (Fig. 1). From its origin it moves westwards to Sapele where it empties into the Benin River, covering a distance of 88 km. The river traverses an area having the tropical rain forest climate. The rainy season lasts from April to November, while the dry season lasts from December to March.

Procedure of sampling. The sampling zone for this study extended from Umeghe through Jerhe to the Ethiope-Jamieson Rivers Confluence at Sapele. Fish specimens were collected with the help of fishermen hired from Umeghe, using cast-net, fish traps, hooks and lines. The study was carried out from June to October 1999. A total of 100 fish specimens, collected through the fishermen, were chilled with ice-blocks in a heat-insulated cooler and transported to the laboratory at the University of Benin, Nigeria for analysis. Fish identification was done, using the published works and identification

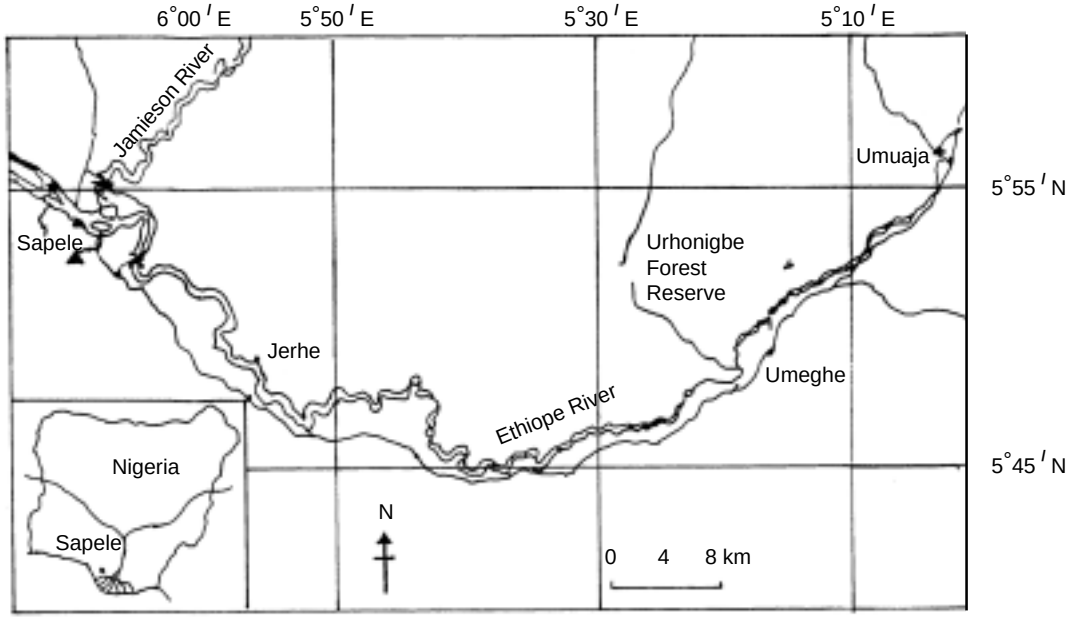

Fig. 1. Map showing the course of Ethiope River and the sampling zones.

guides of Odum (1995), Robert (1975), Holden and Reed (1972), Reed *et al.* (1967) and Boulenger (1916). Each fish specimen was weighed on a top loading balance (Mettler E200) after mopping off excess water with a filter paper. Standard and total lengths of each fish were measured to an accuracy of 1 mm (Lagler, 1964). Standard length was measured from the tip of the snout to the end of the caudal peduncle, while total length was measured from the tip of the snout to the end of the caudal fin. The stomach, from the oesophagus to the pylorus, of each fish was removed and preserved in 5% formalin by dissecting the fish, mid-ventrally from the throat to the anal pore. In order to establish the diet of the fish, each stomach was then slit open and its contents emptied into a petri-dish for analysis. Two methods were employed in the analysis, namely, the frequency of occurrence method and volumetric method.

Frequency of occurrence method. The number of stomachs of each fish species, having different types of food items was recorded. These observations were expressed as the percentage of the total number of stomachs of the species examined and the proportion of the fish population of that species that fed on a particular food item (Hynes, 1950). The percentage frequency of occurrence was then tabulated against each type of food item. This method has also been used by Oboh *et al.* (2003) and Ugwumba and Mbu-Oben *et al.* (1990).

Volumetric method. The volume of the stomach and its food contents for each fish species was determined by the application of Archimedes principle (displacement of water) using a measuring cylinder. The volume of the stomach contents of each fish was then expressed as percentage (%) of the volume of the stomach. Only those stomach samples were used for volume determination that had food contents.

Results and Discussion

The stomach content analysis, using the frequency of occurrence method, is given in Table 1. *Chrysichthys nigrodigitatus* was observed to be clearly a detritivore, having 68% frequency of detritus materials, whereas *Brycinus nurse* had only 24% of this category of food. On the other hand, *B. nurse* was observed to be a herbivore with 70% frequency of plant materials. The breakdown of different kinds of food items eaten by the two fish species is also shown in Table 1. It was most significantly noted that chironomid larvae and threads were absent in *B. nurse*, while fish scales were absent in *C. nigrodigitatus*. The frequency of 28% filamentons algae in the stomachs of *B. nurse*, which was only 2% in the stomachs of *C. nigrodigitatus*, clearly indicates further the herbivorous feeding habit of *B. nurse*. However, the appreciably high percentage frequencies of plant materials, insect parts and fish remains in the stomachs of *C. nigrodigitatus* suggest that this fish species is an omnivorous detritovore.

The stomach contents as analysed by the volumetric method are shown in Table 2. In the case of *C. nigrodigitatus,* 21 fish samples had 87-96%, followed by 1 sample with 75-77%, 6 samples with 50-55%, and 10 samples with 25-27% volume of stomachs filled with food samples. These values respec-

Table 1. Stomach contents analysis of *Chrysichthys nigrodigitatus* and *Brycinus nurse* using frequency of occurrence method

Food items	*C. nigrodigitatus*	*B. nurse*
	Frequency occurrence (%)	Frequency occurrence (%)
Detritus materials	68	24
Filamentous algae	2	28
Plant materials	36	70
Insect parts	34	22
Fish remains	26	20
Chironomid larvae	12	0
Sand grains	42	14
Threads	2	0
Seeds	8	22
Fish scales	0	20
Shrimps	6	8
Unidentified materials	18	16

Table 2. Stomach contents analysis of *Chrysichthys nigrodigitatus* and *Brycinus nurse* as done by the volumetric method*

Fish stomach category by volume	*C. nigrodigitatus*		*B. nurse*	
	Volume of stomach content (as % of the total)	Number of stomachs	Volume of stomach content (as % of the total)	Number of stomachs
¼-Full stomach	25 - 27	10	25 - 27	5
½-Full stomach	50 - 55	6	50 - 55	9
¾-Full stomach	75 - 77	1	75 - 78	3
Full stomach	87 - 96	21	88 - 97	26

*81 stomachs out of 100 were found with food contents, while 19 were found empty

tively corresponded to: full stomach, ¾-full stomach, ½-full stomach, and ¼-full stomach in the ratio of 21:1:6:10 fish samples. The trend for *B. nurse* on the basis of the stomach volume-fil was 26:3:9:5 stomach samples, respectively, for full, ¾-full, ½-full, and ¼-full stomach of this fish species.

The food and feeding habits of *B. nurse* and *C. nigrodigitatus* in the Ethiope River as reported in the present study is in agreement with earlier reports for these fish species found in some other water bodies. For instance, Ikusemiju and Olaniyan (1977) noted that *C. nigrodigitatus* fed on gastropods, ostracods, detritus and plant materials in the Lekki Lagoon. Brown (1985) further reported that this fish species fed mainly on detritus, insects and plant materials in Ikpoba River. In the case of *B. nurse*, Reed *et al.* (1967) recorded that the fish species feed on insects, snails and plant materials in Northern Nigeria. Ikomi and Sikoki (2001) also observed that the presence of tiny unicuspid teeth in the mouth of the fish suggest that this fish species feeds on plants, leaf buds and seeds of water lilies, and is thus a herbivorous feeder.

Conclusion

The comparative study on the food and feeding habit of *C. nigrodigitatus* and *B. nurse* from the Ethiope River has revealed that the former is an omnivorous detritivore, whereas the latter is a herbivore. These two fish species thus occupy different ecological niches, which explains their presence in abundance within the same water-body. Also, *C. nigrodigitatus* is known to be a bottom dweller, while *B. nurse* is a mid-water swimmer, which confirms the observation that they occupy different ecological niches within the same river.

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