

BIOMETRIC EVALUATION AND FOREGUT FOOD ANALYSIS OF *Lates niloticus* FROM SHIRORO LAKE, NIGERIA

Ayanwale, A. V.; I. K. Olayemi and M. Ibrahim

Department of Biological Sciences, Federal University of Technology, Minna, Nigeria.

ABSTRACT

The prospects of successful large-scale commercial culturing of the highly prized fish-species *Lates niloticus* was the reason for this study which, elucidated the biometric and feeding habits of the species in Shiroro Lake, Nigeria. Representative samples of the species were randomly collected from the lake between August and October 2008, using gill and cast nets. The specimens were evaluated biometrically and the stomach contents dissected out to identify component food items, using standard procedures. The result showed that all the biometric parameters evaluated varied significantly ($P < 0.05$) among the specimens. While, the mean total length of the fishes was 21.12 ± 5.05 cm, the mean standard length was 17.43 ± 3.79 cm. Total body mass and foregut mass of the specimens ranged from 42.50 - 45.91g (mean = 144.97 ± 104.03 g) and 2.00 - 2.83g (mean = 7.73 ± 5.99 g), respectively. On the whole, 10 kinds of food items were encountered in the foregut of the specimens dissected, with the principal components been copepods (20.80%); fingerlings, juvenile fishes and water fleas, each with a relative proportional distribution of 8.30%. The importance of these results in achieving successful culturing of *L. niloticus* was discussed. It was concluded that the biometric and feeding habits attributes of the species stand it in good stead as a viable fish specimen for artificial culturing. Efforts must, therefore, be harnessed to encourage Nigerian fish farmers to go in to large scale production of *L. niloticus* in captivity.

INTRODUCTION

The importance of fish in the economy and ecology of inland waters has generated a lot of interests over the years. Aquaculture has gained a rapid interest due to the importance of fish as a cheap source of animal protein, since beef is beyond the reach of the average Nigerian citizen. Fish, like other animals, require adequate nutrition to grow and survive. Bake and Sadiku (2004), reported that in the wild, nature offers a great diversity of food including nutrients in solution and a host of different plant and animal materials. However, in ponds, natural foods are not sufficient to sustain fish culturing especially in habitats that are densely stocked with fish. Consequently, effective aquaculture will require adequate and sustained nutritional strategies, which can only be achieved through a good understanding of the food and feeding habits of the fish to be cultured.

Lates niloticus, of the family Latidae, is widely distributed in Nigerian freshwater systems. The genus *Lates* consists of a large number of species exhibiting an array of body forms with well developed jaws, terminal and protrusible mouth, strong stomach, serpentine nature and strong body for carnivorous diets (Ogari, 1984; Balogun, 2004). *Lates niloticus* constitutes an important component of Nigeria's inland fishery due to its high level of acceptability. Under suitable environmental conditions and proper feeding, *Lates niloticus* gives reasonably high yield of about 200kg (Fish Base, 2004).

Shiroro lake, Niger state Nigeria is home to several commercially culturable fish species including *Lates niloticus* (Kolo, 1996). Unpublished reports

of dwindling productivity from fishermen around the area abound. Sustainable improved fishery productivity of artificial lakes have been achieved through deliberate stocking density and feeding (Ovie and Madu, 2008). However, the success of this strategy depends largely on a good understanding of the biology and feeding habits of the fish species. This information is presently lacking; thus, creating the obvious need for this study to be carried out, to elucidate the feeding ecology of *L. niloticus* in Shiroro lake and to relate such feeding habits to body size, age of the fish species with a view to identifying probable temporal shifts in its diet.

MATERIALS AND METHODS

Shiroro, one of the major towns in Niger state, Nigeria, hosts the 2nd largest hydro-electric power station (Shiroro Dam) in the country since 1986. The area is located within Longitude 6° 57'E and Latitude 9°58N and is about 60km from Minna, the state capital. The area has a tropical climate with mean annual temperature, relative humidity and rainfall of 30.20°C, 61.00% and 1,334.00mm, respectively (The Nigerian Congress, 2007). Shiroro presents a tropical eco-climatic region referred to as Guinea Savanna with distinct dry and rainy seasons between November - April and May - October, respectively. The area is drained principally by Kaduna river and Dinya river. The residents are essentially agrarian with a number of them dependent on Shiroro Lake for subsistence fishing (Kolo, 1996).

Specimens of *L. niloticus* were collected from Shiroro lake between August and October 2008, using gill and cast nets. Specimen collection was

done at 3 sampling stations randomly selected to represent the general eco-types of the lake. The fishes were killed, by breaking the spinal cord, immediately after collection to forestall regurgitation, feeding under duress and digestion of food post-capture. The specimens were then transported to the laboratory in ice chest, to minimize post-mortal changes (Bake and Sadiku, 2004).

Further analysis of the specimens of *L. niloticus* collected was carried out in the laboratory of the Department of Biological Sciences of the Federal University of Technology Minna, Nigeria, where each specimen was evaluated in terms of body length (cm) and weight (g) while, date and time of collection were noted for each specimen according to the techniques of Stephen and John (1978) and Sagua (1978). The stomach contents of the specimens were analyzed following standard procedures i.e., numerical, dominance, point and frequency of occurrence methods (Windell, 1968; Wareen and Davis, 1971; Stephen and John, 1978; Balogun, 2004). Identification of components of the stomach contents was done with the aid of a light microscope, using x40 objective lens.

Differences in biometric parameters among the specimens were compared using ANOVA at $P < 0.05$ level of significance (Steel and Torrie, 1980). The frequency of occurrence of the different food items in the stomach contents was computed and used in calculating the percentage distribution of the food items using simple proportions. Also mean biometric parameters, and deviations from such means were calculated.

RESULTS

Table 1 shows biometric attributes of *L. niloticus* from Shiroro lake, Nigeria. The total length (TL) of the specimens varied significantly ($P < 0.05$), ranging from 15.50cm to 28.00cm (mean = 21.13 ± 5.01 cm). The standard length (SL) of the fishes equally varied widely, ranging from 13.00cm to 22.50cm; (mean = 17.43 ± 3.79 cm), and was significantly ($P < 0.05$) less than the total length. The total body mass (TBM) and foregut mass (FM) of the specimens also varied significantly ($P < 0.05$), with mean values of 144.97 ± 104.03 g and 7.73 ± 5.99 g, respectively. The length of the foregut ranged from 3.30 to 6.70cm (mean = 4.93 ± 1.45 cm), values varying significantly ($P < 0.05$).

The frequency of occurrence of the array of food items encountered in the fore-gut of the *Lates niloticus* specimens examined is presented in Table 2. On the whole, a total of 10 kinds of food items, including both plant and animal materials, were encountered in the stomach of the *L. niloticus* fishes. Chyme (33.30%) was the most frequent

item in the diet of the fishes, distantly followed by copepods (20.80%). Fingerlings, juvenile fishes and water fleas occupied the third position each with a relative proportional distribution of 8.30%. The other food items namely, pond skaters, *Chironomus*, *Spirogyra* and plant fibres had very low frequencies of occurrence (i.e., 4.20% each). For the purpose of this study, copepods, smaller fishes, water fleas were regarded as the primary food items on which *L. niloticus* feeds in Shiroro lake since, chyme though with the highest frequency of occurrence (33.30%), is a processed form of any one or combinations of the other food items.

Table 1: Mean of biometric parameters of *Lates niloticus* from Shiroro Lake, Niger state, Nigeria.

Biometric parameters	Mean \pm SD
Total length (cm)	21.13 ± 5.01
Standard length (cm)	17.43 ± 3.79
Length of spine (m)	3.82 ± 0.54
Length of fin (cm)	7.33 ± 1.76
Total body mass (g)	144.972 ± 104.03
Gut mass (g)	7.73 ± 5.99
Length of foregut (cm)	4.93 ± 1.46

Values are average of 23 specimens

Table 2: Frequency of occurrence of food items in the foregut of *L. niloticus* from Shiroro Lake, Minna Niger state.

Food items	Freq.	%	Valid %	Cumulative %
Fish juvenile	2	8.3	8.30	8.3
Feather	1	4.2	4.20	12.5
Fish (fingerling)	2	8.3	8.30	20.8
Copepods	5	20.8	20.8	41.7
Pond skates	1	4.2	4.20	45.8
Chironomus	1	4.2	4.20	50.8
Water flea	2	8.3	8.30	58.3
Chyme	8	33.3	33.30	91.7
Spirogyra	1	4.2	4.2	95.8
Plant fibre	1	4.2	4.2	100
Total	24	100	100	

DISCUSSION

The wide variations in the biometric parameters of the species may indicate that many generations of *Lates niloticus* probably existed in the lake during the study period. This finding suggests that the individuals of the population of *L. niloticus* in Shiroro Lake during the study period were, perhaps, of different ages and so do not grow at the same rate. According to Acere (1984), *L. niloticus* grows very fast in its first year but growth rate decreases in subsequent years. In the past, such variations in biometric indices of collected fish samples have been attributed to the kind of gear used for specimen collection; the heterogeneous mesh size of cast and gill nets often results in a

collection of fish samples of different sizes during specimen collection (Meye and Ikomi, 2008).

The result of this study revealed that *Lates niloticus* in Shiroro lake is predominantly carnivorous with copepods (crustacean) been the most favoured food item. Though this finding agrees with the well known feeding habit of the species (Okedi 1970; Ogari 1984), certain differences were observed. Elsewhere, *L. niloticus* fed preferentially on smaller fishes (Gee 1969; Okedi 1970). The predominance of copepod in the diet of *L. niloticus* in Shiroro lake reflects the abundance of this crustacean in the lake and, perhaps, the scarcity of juvenile fishes. This observation may explain the presence of plant material in the stomach of *L. niloticus* specimens dissected. Some of the fish specimens encountered in the stomach of the dissected specimens were young stages of *L. niloticus* thus, confirming the cannibalistic tendency of the species during periods of dearth of alternative food sources (Hopson, 1972).

The findings of this study, regarding the gut content of *L. niloticus* in Shiroro lake, suggest that successful large-scale commercial production of the species must be preceded by a detailed systematic investigation of the foods and feeding behaviour of the species, with a view to elucidating the cost-effective diets, as well as, eliminating its cannibalistic behavior while in captivity.

CONCLUSION

The population of *L. niloticus* in Shiroro Lake is heterogeneous, indicating the co-existence of different generations despite the cannibalistic tendency of the species. *L. niloticus* in the lake though, carnivorous, as similar populations elsewhere but unlike such populations, fed preferentially on copepods, with feeble attempts at feeding on plant material. These attributes suggest that the large scale commercial production of *L. niloticus* is feasible though systematic investigations of its feeding ecology is necessary, to develop cost-effective rearing techniques, that will guarantee survival on artificial feeds and eliminate cannibalism.

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