ACTA ICHTHYOLOGICA ET PISCATORIA
Vol. XXXIII, Fasc. 1 2003

STUDIES ON THE ECOLOGY OF THE AFRICAN LONGFIN TETRA, *BRYCINUS LONGIPINNIS* GÜNTHER, 1864 IN THE JAMIESON RIVER (NIGER DELTA, NIGERIA)

Robert B. *IKOMI* [1*], F.D. *SIKOKI* [2]

[1] *Department of Zoology, Delta State University, Abraka, Nigeria*
[2] *Department of Zoology, University of Port-Harcourt, Port-Harcourt, Nigeria*

Ikomi R.B., Sikoki F.D., 2003. Studies on the ecology of the African longfin tetra, *Brycinus longipinnis* Günther, 1864 in the Jamieson River (Niger Delta, Nigeria). Acta Ichthyol. Piscat. 33 (1): 17–36.

Background. African longfin tetra, *Brycinus longipinnis* Günther, 1864, an ornamental fish, commonly occurs in a number of African rivers. The aim of the present paper was to describe elements of ecology of this fish, not hitherto studied in the Niger River delta.
Material and methods. The fish were sampled monthly in the Jamieson River (tributary of the Benin River, the Niger delta) during dry and wet season at four stations (1994–1995). Length, weight, sex, fecundity, and food records were collected. Methods (parameters and coefficients) used (calculated) in data processing include: Kolmogorov–Smirnov test, Fulton condition factor, gonadosomatic index.
Results. *B. longipinnis* was a dominant characid (49.0%) in the Jamieson River. It occurred in all stretches of the river throughout the year with peak abundance during the rainy season. The length frequency distribution pattern was leptokurtotic and the growth pattern was allometric for the males and isometric for the females and immature specimens. Condition factor fluctuated with season and increased with individual length of fish irrespective of sex. K-values were significantly higher in males. *B. longipinnis* was a mesopredator and fed mainly on insects. Fecundity estimates ranged between 160 and 1130 and about 2.26% of its body weight was utilized in egg production. Breeding activities occurred throughout the year.
Conclusion. The present study contributes important data on ecology of *Brycinus longipinnis* living in the particular habitat of the Jamieson River, Nigeria.

Key words: fish, longfin tetra, *Brycinus longipinnis,* freshwater, distribution, abundance, growth patterns, food and feeding habits

INTRODUCTION

The family Characidae is one of the dominant fish groups in African freshwater rivers. Characids have large scales and 3–5 branchiostegals. Their teeth are usually

---

[*] Correspondence: Dr Robert B. Ikomi, Department of Zoology, Delta State University, Abraka, Nigeria;
e-mail: *robkomi@yahoo.co.uk*

strong and multi-cuspoid. Dorsal fin, usually without spine but an adipose fin is always present. In Nigeria, 7 genera and 17 species have been found and this includes the African longfin tetra, *Brycinus longipinnis* (cf. Olaosebikan and Raji 1998). *Brycinus longipinnis* is found in freshwater rivers of West Africa but extended in distribution from the mouth of Guinea-Bissau to the mouth of the Congo/Zaire Rivers (Daget and Iltis 1965, Paugy 1986). *B. longipinnis* is a beautiful species currently finding its way into fish hobbyists' collections world wide. Along with other characids, this species flourishes in the Jamieson River, Nigeria. Many studies have been conducted on this fish. The most extensive being on its systematics (Boulenger 1901–1916, Daget and Iltis 1965, Géry 1977, Géry and Mahnert 1977, Paugy 1982, Lévâque et al. 1990, Teugels et al. 1992). Others are on its distribution and growth pattern (Thys Van der Audenaerde 1967, Loiselle 1972, Sydenham 1977, Paugy 1982, 1986), food and feeding habits (Planquette and Lemasson 1975, Victor and Brown 1990). Despite the abundant literature on this species, the bulk of studies conducted were in water bodies outside Nigeria. In Nigeria no such studies have been carried out in the Niger River delta.

Accordingly, the aim of the present study is to provide some basic but important comparative ecological data of the species with a view to fill gaps in current knowledge on the fish.

STUDY AREA

The Jamieson River (5°40'–6°00'E, 5°52'–6°08'N) (Fig. 1) is a tributary of the Benin River located in the Mid-Western Niger Delta area of Nigeria. It is an oligotrophic freshwater river with its origin from a watershed at Ugboko-niro. It flows from about 30 km in the westerly direction through Ekure, Owe-Ugbakele, and Palmol camp before emptying into the Benin River. The Benin River in turn discharges into the Atlantic Ocean at the Bight of Benin. The Jamieson River at its lower reaches (Sapele to Sakpoba stretch) are subjected to inundation by tidal waters from the Benin River while the upper reaches are non tidal.

In this study area, two climatic seasons prevail, namely the wet season (May–October) and the dry season (November–April). Some key physico-chemical variables of the river during the rainy and wet seasons are: water temperature (22–27°C), dissolved oxygen (5.0–12.0 mg · dm^{-3}), conductivity (9.0–24.2 µS · cm^{-1} at 25°C), and transparency (0.57–15.0 m). The study area was demarcated into four sampling stations namely: station I (upstream), station II (channel), station III (midstream), and station IV (downstream) (Fig. 1).

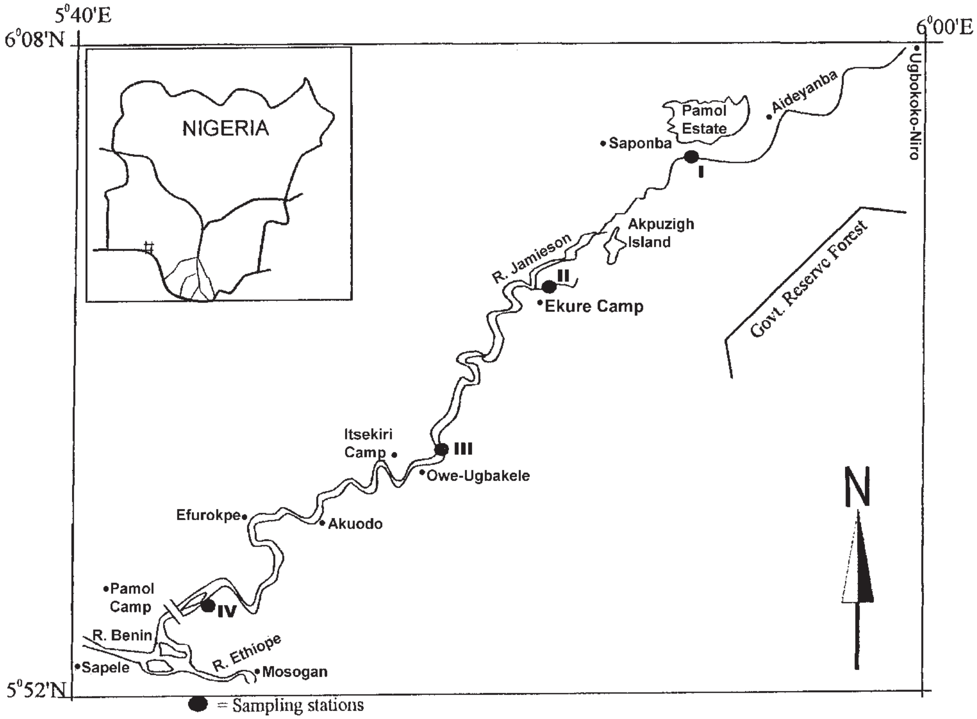

Fig. 1. Map showing the location of the Jamieson River in Nigeria (inset) and a map of the Jamieson River showing sampling stations

Station I was located at the Palmol Estate, 5 km from its origin. It is in the non-tidal zone of the river with average river width and depth of 7.5 m and 12 m, respectively. Dominant riparian vegetation are *Cyperus* and *Diplaxium* spp. and a few trees such as *Pandamus candelabrum*, *Symphonia*, and *Bambusia* spp. The river bed consists of fine sand mixed with gravels with submerged vegetations predominated by *Scirpus jacobi* and *Pycreus lanceolatus*.

Station II was located in the tidal zone about 5 km from station I. This station is about 5 m wide and 4 m deep and fairly exposed at ebb tide. It is heavily shaded and bordered by marginal vegetations such as *Anthostoma aubryanum* and *Oxystigma manii*. The substratum was mainly muddy with a large collection of allochthonous materials derived principally from the fallen leaves.

Station III was established at Owe-Ugbakele, 10 km downstream from station II. Average width and depth measured 35 and 14 m, respectively. The river bed was composed mainly of fine sand mixed with clay. The marginal vegetation was dominated by *A. aubryanum*, *P. candelabrum*, *Cocos nucifera*, and *Symphonia* spp.

Station IV was located at the Palmol Camp area, about 10 km downstream of station III. The river is widest here with average width and depth of 60 and 16 m, respectively. The substratum consists principally of clayey sand. The fringing vegetations were principally shrubs dominated by *Eupatorium odoratum* and *Impereta cylindrica*. Trees such as *Elaeis guinnensis*, *Symphonia* spp., and *Bambusia* spp. were common.

Relevant human activities in the river are fishing, commercial sand dredging, lumbering, and discharge of domestic and industrial effluents.

MATERIAL AND METHODS

Monthly fish sampling was conducted during the dry and wet seasons from the Jamieson River at the four stations from January 1994 to December 1995. Sampling was conducted during both day (0730–1200 hours) and night (2300–0500 hours) using set gill nets (22–70 mm stretched mesh size), drag net (10 mm stretched mesh size), and a hand net of 0.5 mm. *B. longipinnis* were captured and preserved in 10% formalin prior to laboratory examination. In the laboratory, data obtained from each fish included length, weight, sex, and food records. Standard length (SL) and total length (TL) were measured to the nearest 0.1 cm and weighed to the nearest 0.1 g. Stomachs were removed and their contents identified under a binocular microscope (10–100×) to the lowest convenient taxonomic level. Analysis of the stomach contents were by the frequency of occurrence and point methods (Hynes 1950, Hyslop 1980).

Stomach fullness was assessed on a 0–10 point scale in which 0, 2.5, 5.0, 7.5, and 10 are empty stomach, one quarter full, half full, three quarter full, and full stomach, respectively.

The spatial distribution of fish was assessed by the Kolmogorov–Smirnov goodness of fit test (D) (Zar 1984). The length-weight relationship of fish was described by the equation:

$$W = aL^b$$

where: W, weight (g),
L, standard length (cm),
a, b, regression constants.

The parameter a, b were estimated by linear regression logarithmically transformed weight and length data. It gave the equation:

$$\text{Log } W = \log a + b \log L$$

The Fulton condition factor (K) for each specimen was calculated from the equation:

$$K = \frac{100 \cdot W}{L^3}$$

where: K, condition factor,
L, standard length (cm),
W, weight (g).

The fish sex was determined by visual and microscopic examination of the gonads. The unsexed small fishes were regarded as immature. Fecundity estimates were made from ripe ovaries by the gravimetric method (Lagler 1978). The relationship between fecundity and fish length was described by the equation:

$$F = aX^b$$

where: F, fecundity,
X, standard length (cm),
a, intercept,
b, slope.

Through a logarithmic transformation, the equation becomes:

$$\text{Log } F = \log a + b \log X$$

The gonadosomatic index (GSI) was calculated for each gonad from the equation:

$$\text{GSI} = \frac{\text{Gonad weight (g)}}{\text{Fish weight (g)} - \text{Gonad weight (g)}} \times 100$$

(g)

The gonad maturity stages were recorded using the Kesteven (1960) criteria in which six gonadal maturity stages were recognized as follows: immature (I), maturing (II), ripe (III), ripe running (IV), partly spent (V) and spent (VI).

RESULTS

Distribution and abundance

B. longipinnis was found at all seasons of the year and in all stretches of the river. They were spatially unevenly distributed as indicated by the Kolmogorov–Smirnov goodness of fit D test (Table 1). Higher number and biomass occurred in stations I and III and were not significantly different ($P > 0.05$). Relatively lower number and biomass of *B. longipinnis* occurred in stations II and IV and differed significantly ($P < 0.001$).

Field observation and their occurrence in the nets on capture indicates that *B. longipinnis* moved in schools constituted by an almost homogenous size group which included both male and female specimens. The young fish (< 4.5 cm) along with a small growing characid *Rhabdalestes smykalai* (Poll, 1967) occurs mainly in shallow areas around the bank of the river while the adults ($\geqslant$ 4.5 cm) preferred the main channel of the river. This group usually make lateral movements to the bank mainly to feed.

Table 1

Distribution and relative abundance of *Brycinus longipinnis* in the four sampling stations; *D*, Kolmogorov–Smirnov goodness of fit statistics

Stations	Upstream	Channel	Midstream	Downstream	*D*	*P*
Abundance $n = 2849$	997	342	1054	456	0.0153	< 0.001
Biomass (g) 9358	3388	936	3443	1591	0.0194	< 0.001

The characids captured during sampling numbered 5787. The samples consisted of *Brycinus longipinnis* (49.0%), *Brycinus nurse* (Rüppel, 1832) (19.8%), *Brycinus macrolepidotus* Valenciennes, 1850 (0.2%), *Rhabdalestes smykalai* (17.2%), and *Arnoldichthys spilopterus* (Boulenger, 1909) (13.8%). Evidently, *B. longipinnis* was the most abundant characid in the river.

Data on the monthly variation in abundance and biomass of *B. longipinnis* (Fig. 2a) indicate that *B. longipinnis* flourished in all months of the year. Peak abundance was biphasic and occurred in all stations in the rainy months of May–September/October and in the dry months of December–February. Abundance in the wet season months was significantly more ($P < 0.001$) than in the dry season months. The monthly fluctuation in biomass in all the stations are reflection of the variations in number in these stations (Fig. 2b).

B. longipinnis from the Jamieson River measured between 3.0 to 10 cm SL (4.5–11.6 cm TL). The maximum length obtained for a male specimen was 10 cm and 9.4 cm for a female. The plot on the pooled length frequency distribution (Fig. 3) indicates that the population consists of one size group (3.0–10 cm) with a modal length between 7.4 and 7.9 cm for the female and 7.9 and 8.4 cm for the male. The distribution pattern was leptokurtotic for both sexes.

The immature fishes (3.0–4.5 cm) were captured in most months of the study period with peak abundance in June to September and December to February. The adult specimens ($\geqslant$ 4.5 cm) were captured in all months but were relatively fewer in the dry season months of March and April. The 6.5–8.0 cm size class constituted the bulk of the adult population and also formed a substantial part of the reproductive class which occurred in all months of the year.

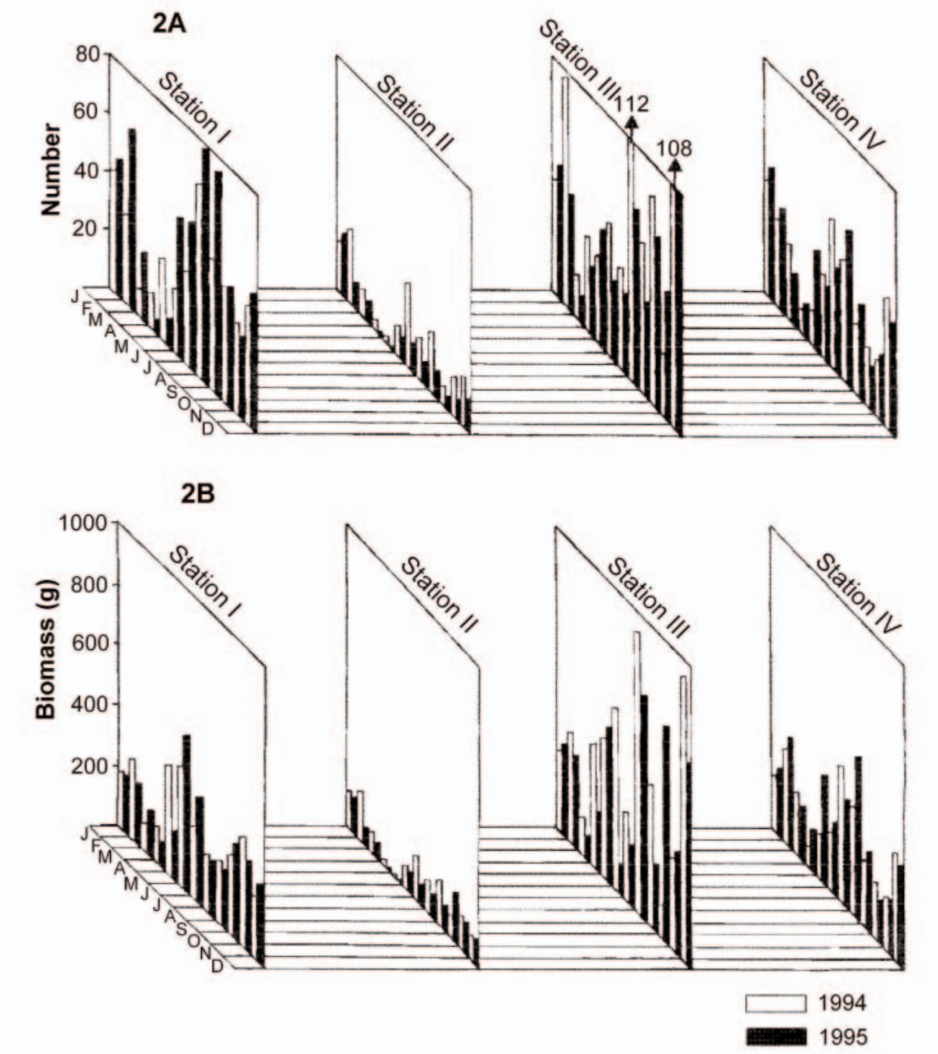

Fig. 2. Monthly and longitudinal variations in abundance (A) and biomass (B) of *B. longipinnis* from the Jamieson River

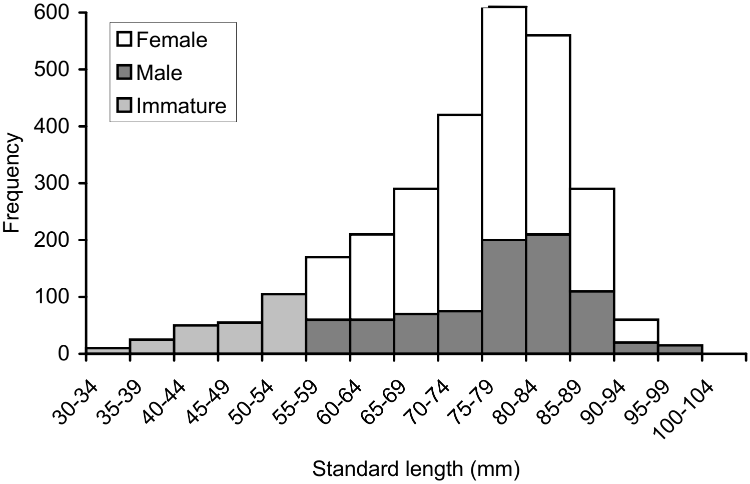

Fig. 3. Overall length frequency distribution of *B. longipinnis* from the Jamieson River

Length–weight relationship

Monthly variations in fish length are shown in Fig. 4

The weight of sampled *B. longipinnis* ranged from 1.06–26.0 g. The least squares common fit analysis of the transformed data for each sex and the combined sexes provides the linear regression equation in Table 2.

Table 2

Length–weight relationship of *B. longipinnis* in the Jamieson River; *n*, paired number; *r*, correlation coefficient; *t*, Student parameter to compared calculated slope to 3

Individual	Size group (cm)	Length–weight relation	*n*	*r*	*t*
Immature	3.0–4.5	Log W = log-1.596 + 3.074 log L	443	0.986	0.060
Male	4.6–10.0	Log W = log-1.940 + 3.484 log L	793	0.934	2.982
Female	4.6–9.4	Log W = log-1.618 + 3.035 log L	1613	0.904	1.466
Combined sexes	3.0–10.0	Log W = log-1.678 + 3.284 log L	2849	0.915	2.312

The regression coefficient b-values were significantly different ($P < 0.001$) among sexes with the male growing allometrically ($b > 3$) and the female and immature approximately isometric ($b = 3$). The growth in length and gain in weight of the fishes were well correlated.

Condition factor

The condition factor of *B. longipinnis* ranged between 1.94 and 2.80. The monthly fluctuation in K-values showed bimodal phases (Fig. 5).

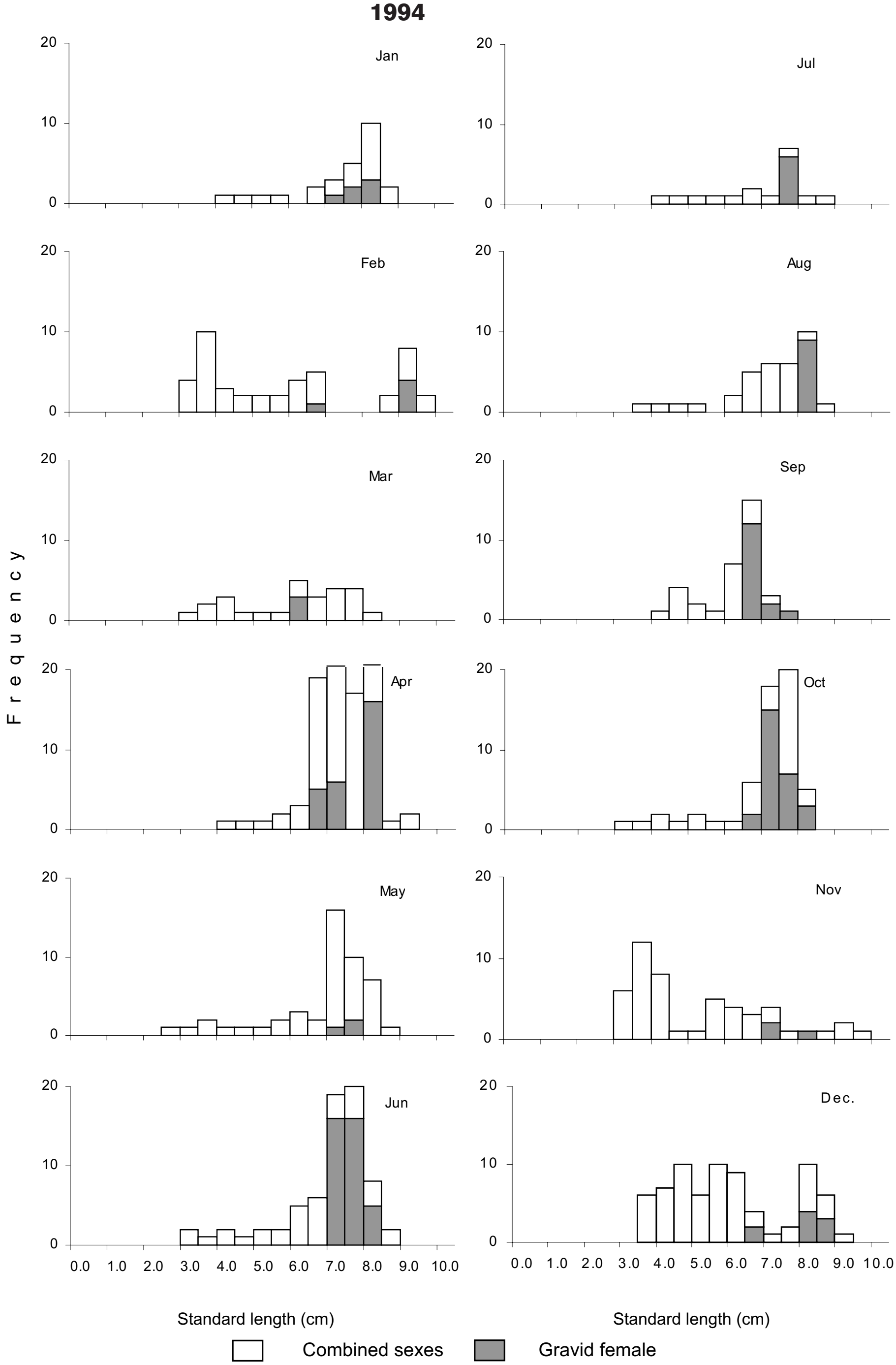

Fig. 4. Monthly variations in the length frequency distribution of of *B. longipinnis* from the Jamieson River (continines on page 26)

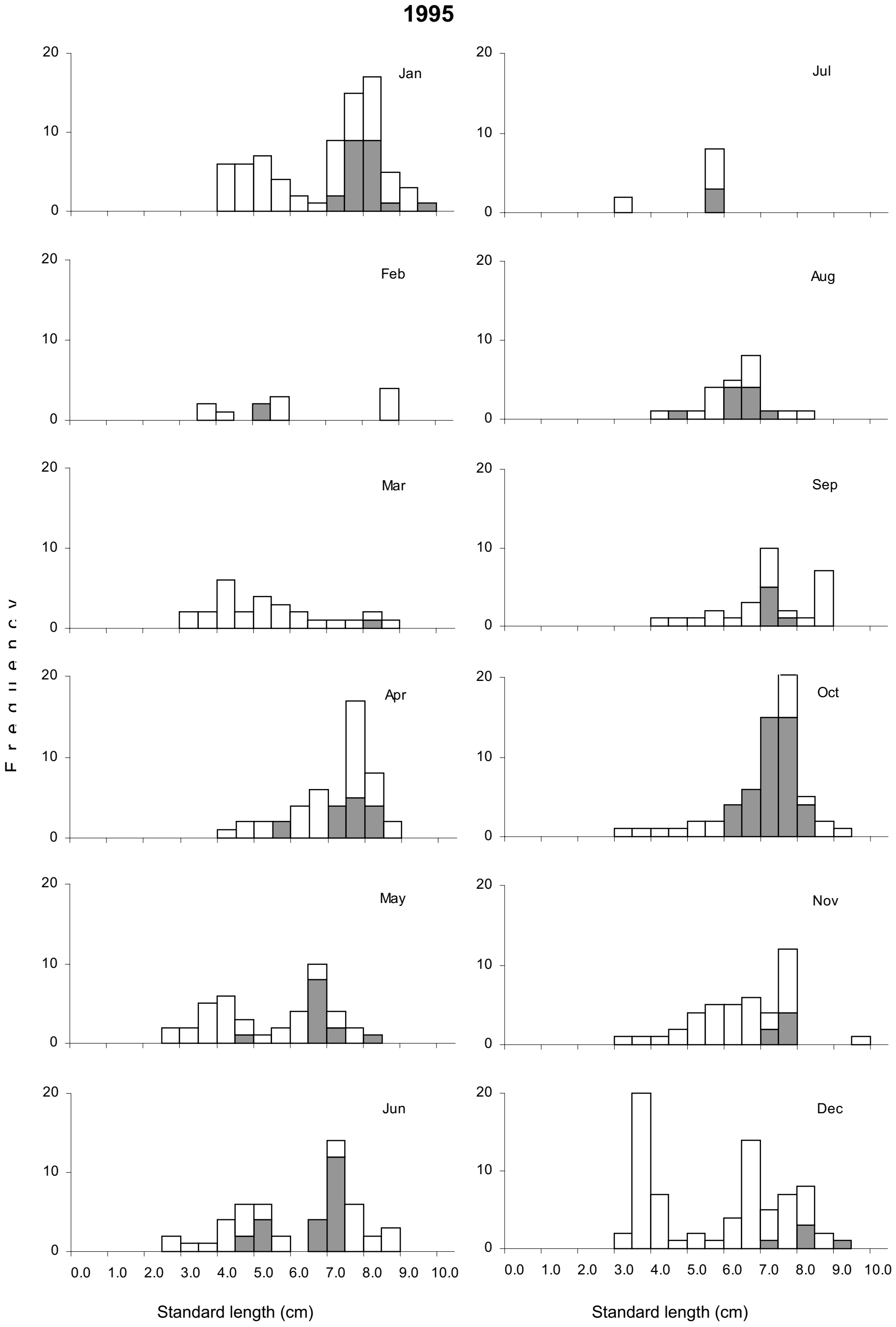

Fig. 4. (cont.) Monthly variations in the length frequency distribution of of *B. longipinnis* from the Jamieson River

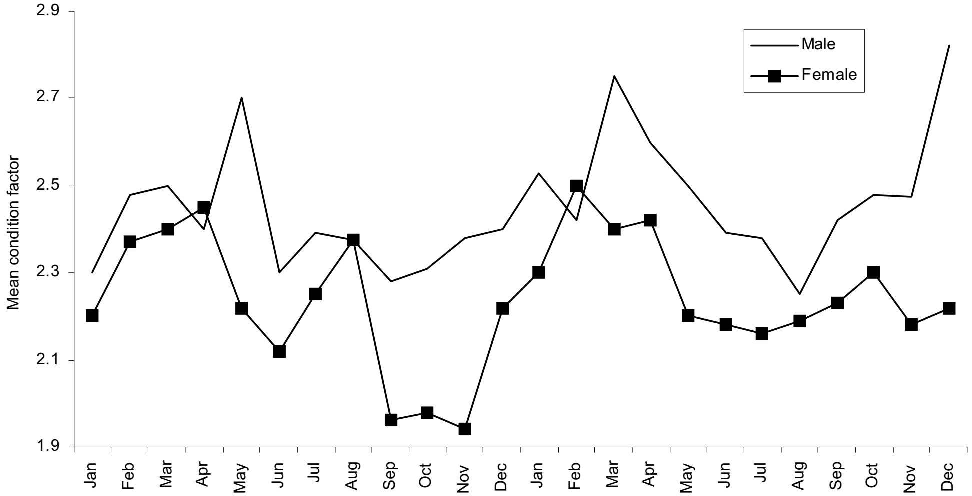

Fig. 5. Variations in the mean monthly condition factor of *B. longipinnis* from the Jamieson River

In the first phase, there was a gradual raise in *K*-values between January and April and dropped between May and July. The second phase commenced in August and October and peaked in between November and December. Condition factor values also varied with size and sexes of fish. *K*-values were inversely related to increase in fish size among the 3.0–4.5 cm size group but thereafter, *K*-values increased with increase in individual size of fish irrespective of sex. *K*-values were significantly higher ($P < 0.001$) in the males than in the females (Fig. 6).

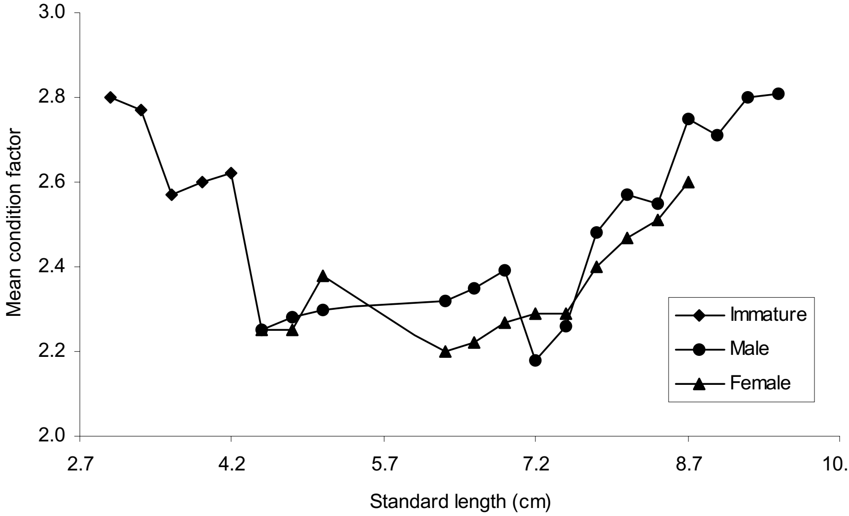

Fig. 6. Variations in the relative condition factor in the different length classes of *B. longipinnis* from the Jamieson River

Food and feeding habits

Three hundred each of day and night time captured specimens of B. *longipinnis* (3.0–10.0 cm) were examined for stomach fullness and content. 72% of the day specimens scored ⩾ 5 points in a 0–10 point scale of stomach fullness while in the night time specimens, 28% scored ⩾5 points. The number of day feeding *B. longipinnis* were significantly higher than the night ones ($\chi^2 = 19.4$; $P < 0.001$).

A summary of food items present in the stomachs of the fish is given in Table 3. The table demonstrates that *B. longipinnis* fed on allochthonus food items on the water surface and the substratum and that the primary food items consumed by the species were insects mainly Hymenoptera (tailor ants) and Coleoptera. Each taxon accounted for over 10% of the food consumed using the occurrence and point methods. Hymenoptera and Coleoptera contributed significantly to the insect remains found in he stomachs of the fish. Other insects, immature aquatic insects, aquatic macrophytes, algae, and detritus were supplementary diets and accounted for less than 10% of the species diet.

Table 3

Summary of food items of *B. longipinnis* in the Jamieson River
(January 1994–December 1995)

Food Items	Methods			
	Occurrence		Points	
	Frequency	Percent	Point	Percent
INSECTA				
Insect remains	248	41.3	554	16.0
Alate insects				
Hymenoptera	280	46.7	889	25.7
Coleoptera	156	26.0	588	17.0
Orthoptera	46	10.7	222	6.4
Isoptera	34	5.7	60	1.7
Other alate insects	54	9.0	78	2.3
Aquatic immature insects				
Dipteran larvae	72	12.0	158	4.6
Ephemeropteran nymph	12	2.0	20	0.6
Odonata nymph	28	4.7	98	2.8
MACROPHYTA				
Plant remains	128	21.3	232	6.0
Plant seeds	40	6.7	104	3.0
ALGAE	36	6.0	40	1.2
SAND	136	22.7	178	5.1
ARACHNIDA				
Hydracarina	8	1.3	26	0.7

No. of fish examined : 600
No. of empty stomachs : 21

Fig. 7 shows the monthly variations in the dietary habits of *B. longipinnis*. The categories of food items consumed in the wet season months ranged between 4 and 6 while the range was between 6 and 7 in the dry season months. Qualitatively, *B. longipinnis* fed basically on almost all categories of food items during the dry and rainy seasons. However, quantitatively, variable percentage points were scored by the different food categories. Alate insects were the primary diets in all months of the year except in December where dipteran larvae (chironomid) was also consumed in large quantities. The fish were particularly able to take advantage of seasonal emergence of adult insect which are sometimes distinguished. For example, Isoptera (alate *Macrotermes*) emerged in the wet months of June and July and constituted important food items of the species during the period. Hymenoptera though important in all months of the year were most preponderant between August and October. Aquatic macrophytes were taken in ten months of the year with higher intensity in January, September, and October. Immature aquatic insects constituted only a small quantity of the diet in all months of the year except in December.

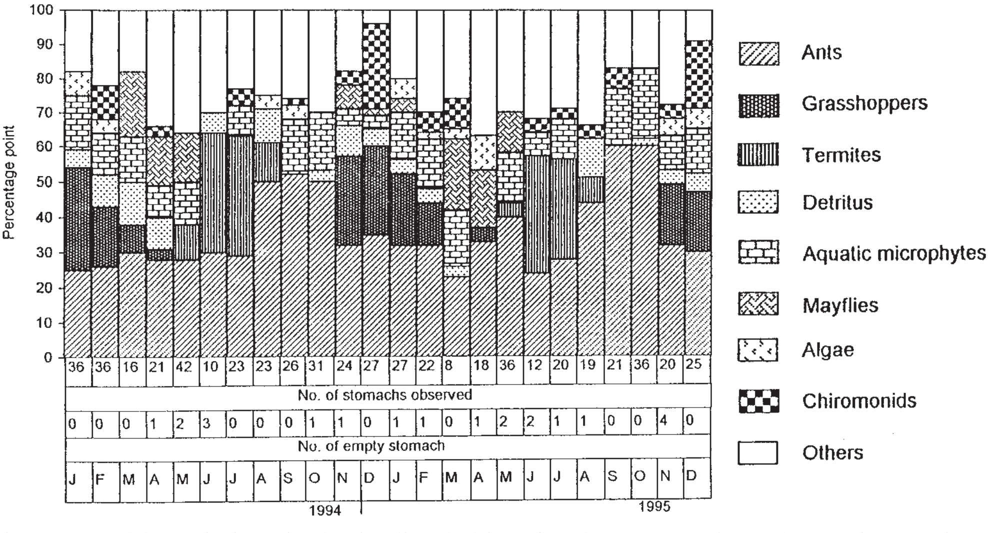

Fig. 7. Monthly variations in the feeding habits of *B. longipinnis* from the Jamieson River

Data on the food habits with respect to fish size (Fig. 8) shows that all size classes of *B. longipinnis* fed on insects constituted mainly of Hymenoptera, Coleoptera, Odonata, and Ephemeroptera.

The relative importance of these items in the diet of the fish varied with the length classes. For example, with increase in individual fish length, there appears to be an increase in the utilisation of alate insects and aquatic macrophytes. Algae and immature aquatic insects were the most important food items for the 3.0–5.0 cm length classes.

The diel variations in food items consumed by *B. longipinnis* was assessed using all the day and night time specimens. Items of fifteen food types were consumed during the day time while twelve types were taken at night (Table 4).

Odonata nymph, algae and hydracarina were consumed only in the daytime. The occurrence of all items except sand was significantly higher ($P < 0.001$) in the day catches than in the night ones. Sand occurred significantly more in the night-time specimens. By the point method, the trend was the same as in the occurrence methods (Table 4).

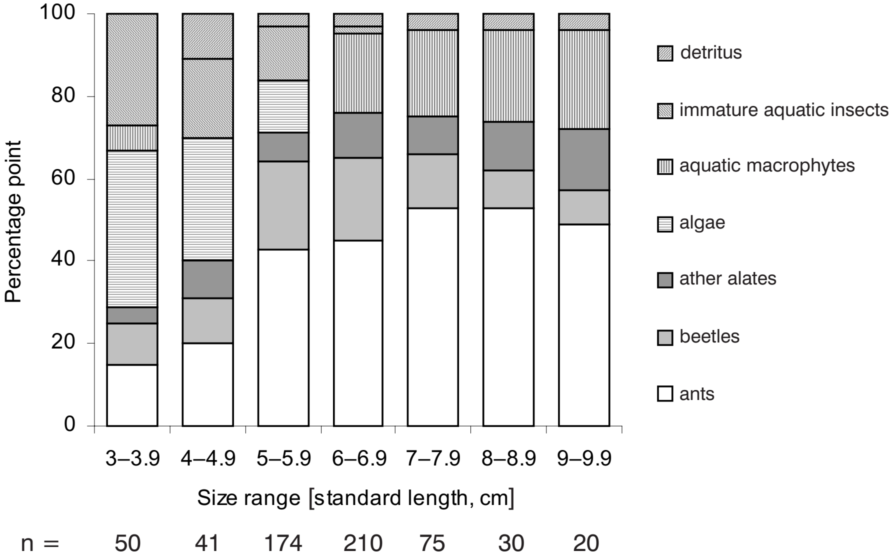

Fig. 8. Variations in the feeding habits in the different length classes of *B. longipinnis* from the Jamieson River

Table 4

Diel variations in the food habits of *B. longipinnis* in River Jamieson. The day and night values are actual frequencies and points gained

Food Items	Methods							
	Occurrence				Points			
	Day	Night	χ^2	P	Day	Night	χ^2	P
INSECTA								
Insect remains	273	60	139.6	< 0.001	400	150	113.6	< 0.001
Alate insects								
Hymenoptera	210	111	179.2	< 0.001	540	195	161.9	< 0.001
Coleoptera	45	66	3.97	< 0.001	60	99	9.6	> 0.001
Orthoptera	30	3	22.1	< 0.001	33	9	13.7	< 0.001
Isoptera	84	39	16.5	< 0.001	168	78	32.9	< 0.001
Other alate insects	33	9	13.7	< 0.001	90	51	10.8	< 0.001
Immature aquatic insects								
Dipteran larvae	21	6	8.3	> 0.001	12	3	5.4	< 0.001
Ephemeroptera nymph	15	6	4.5	> 0.001	9	2	4.5	> 0.001
Odonata nymph	6	—	—	—	1	—	—	—
MACROPHYTA								
Plant remains	120	39	41.2	< 0.001	288	129	60.6	< 0.001
Plant seeds	15	6	4.5	< 0.001	33	15	6.75	< 0.001
ALGAE	3	—	—	—	1	—	—	—
SAND	90	135	9.0	< 0.001	60	180	6.7	< 0.001

DETRITUS	84	30	25.6	< 0.001	252	60	110.9	< 0.001
ARACHNIDA								
Hydracarina	3	—	—	—	4	—	—	—
No. of fish examined	300	300						

Reproduction

Sex ratio. Table 5 shows the monthly variations in the sex ratio. In all months except April, more females than males were captured. In April, the males were significantly more frequent than the females ($P > 0.001$). The overall male : female sex ratio was 1 : 2.03. This was significantly different from the expected 1 male : 1 female ratio ($P < 0.001$).

Fecundity and gonadosomatic index. The number of eggs in sexually matured *B. longipinnis* ranged from 160 (in females measuring 6.6 cm SL and weighing 9.0 g) to 1130 eggs (in a 9.0 cm SL fish that weighed 18.0 g). Fecundity varied widely among fish of the same size length and generally the relationship between body length and egg number was poor (Fig. 9).

The linear regression equation derived from the logarithmic transformed data of the length (L) and fecundity (F) is as shown below:

$$\text{Log } F = \log 0.6852 + 2.1752 \log L$$

r (correlation coefficient) = 0. 4725, $n = 65$, $P = 0.001$.

Rewritten thus:

$$F = 4.844\ L^{2.1725}$$

Indicating that fecundity approximate the square of the body length.

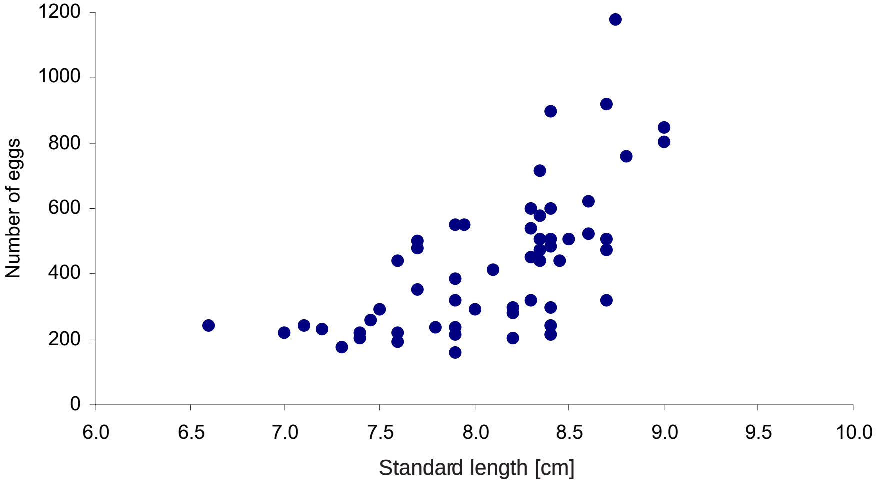

Fig. 9. Variations in the fecundity values in the different length classes of *B. longipinnis* from the Jamieson River

Table 5

Mean monthly variation in the sex ratio, percent gravid female, and gonadosomatic index (GSI) of *B. longipinnis*

Months	No. of Male	No. of Female	Ratio Male : Female	χ^2	*P*	% gravid female	GSI (%)
January	50	115	1 : 2.33	2.56	< 0.001	25	1.95
February	91	154	1 : 1.69	16.2	< 0.001	25	1.96
March	25	48	1 : 1.92	7.25	< 0.001	27	2.43
April	97	70	1 : 0.72	4.37	< 0.001	29	2.66
May	79	217	1 : 2.74	64.3	< 0.001	55	3.51
June	30	56	1 : 1.86	7.86	< 0.001	65	3.65
July	34	70	1 : 2.06	12.5	< 0.001	11	1.56
August	68	147	1 : 2.16	29.0	< 0.001	12	1.56
September	79	147	1 : 1.91	20.5	< 0.001	35	2.32
October	55	174	1 : 3.16	61.8	< 0.001	51	3.42
November	88	223	1 : 2.55	58.6	< 0.001	30	1.74
December	97	192	1 : 1.98	31.2	< 0.001	24	1.90
Overall	793	1613	1 : 2.03	279.4	< 0.001		

The mean GSI values ranged from 1.56 to 3.65 (Table 5) with an average of 2.26. Peak GSI values (> 3.0) were obtained in May, June and October. It dropped to ⩽ 2.0 in July and November and therefore started rising again in December through February.

Reproduction pattern. The frequency of gravid females in relation to the total female catch is also shown in Table 5. Gravid females were obtained throughout the year. The highest number of gravid females was recorded during the months of May, June, and October of each study year. Over 50% of matured females were gravid during these periods. In most other months, values < 30% were obtained. The right and left ovaries were similar in size but the eggs in matured ovaries were at different stages of development. The egg diameter ranged between 0.45 and 0.88 mm with a mean of 0.77 mm. The ripe eggs were orange coloured. Breeding takes place in all months of the year as indicated by the recruitment pattern (Fig. 4). However, the peak period was June and November / December.

DISCUSSION

B. longipinnis is evidently the dominant characid species in the River Jamieson. The flourishing of this species in other clear forested acid freshwater stream and rivers in Africa have been reported by Reed et al. (1967), Thys Van der Audenaerde (1967), Paugy (1986), Victor and Brown (1990), among others. Its scanty population in the white water Ase River and its absence in the dark water upper Warri River, Nigeria, was reported by Idodo-Umeh (1987) and Tetsola (1988), respectively. Peak abundance of *B. longipinnis* was in the rainy / flood season. This period can be credited with abundant food, wider feeding and reproductive niche and shelter for the juveniles and consequently enhancing high reproductive success (personal observation).

B. longipinnis was ubiquitous in all stretches of the river but spatial distribution pattern showed relative abundance in the upstream sections. Among other factors, this observation was diet related as these sections provided a thriving place for insects which formed the main food of *B. longipinnis*. The observed habitat preference of the immature size group for the shallow river banks is probably an ecological adaptation to avoid predation by the Kafue pike, *Hepsetus odoe* (Bloch, 1794) which is common in mid waters. *H. odoe* is a predatory fish in whose stomach, I have found a number of *B. longipinnis* as food item. It has elongated jaws with only conical teeth and each lower jaw has a triangular fold. The fish attains a maximum length of 45.0 cm (Olaosebikan and Raji 1998).

The maximum length of *B. longipinnis* in the river was 10 cm. The maximum standard length of the specimen from other African Rivers are: River Niger 7.5 cm (Daget 1952), Ikpoba River, Nigeria, 9.0.cm (Victor and Brown 1990), Bandama and Cavally Rivers, Cote d'Ivoire 7.4 cm and 9.3 cm, respectively (Paugy 1982). The comparatively relative large size obtained by the fish in this study may be attributed to poor exploitation by the riparian communities.

The regression coefficient values obtained in this study indicate that the immature and female specimens grew isometrically and the male allometrically. This variation was as a result of sexual dimorphism of the species and thus confirms an earlier report on this parameter in species from rivers in Cote d'Ivoire by Paugy (1982). The range of the condition factor in the present study falls within the range of the species in the Ikpoba River (Victor and Brown 1990) but is lower than the values 6.82–4.03 obtained in the Niger River (Daget 1952). The observed monthly fluctuations in the condition factor could be attributable to the influence of the breeding cycle and food availability. Higher *K*-values obtained between May and June may have resulted from accumulated fats and ripe gonads carried by the mature adult females. These values fell between July and August probably as a result of spawning activities. However, due to the preponderance of fish food during this period (personal observation), the species was able to feed intensively with the accompanying rise in *K*-values into November–April.

B. longipinnis in the Jamieson River was basically a mesopredator whose important food items were allochthonous surface insects mainly Hymenoptera (*Oecophylla* spp. and *Dorylus* spp.) and beetles. Algae, aquatic macrophytes, and others were minor diets. This dietary observation conforms to that of Planquette and Lemasson (1975) on the species in rivers in Cote d'Ivoire but differs from the dietary observations of the species in the Ikpoba Stream, Nigeria (Victor and Brown 1990). In the Ikpoba Stream, a variety of algal inclusions, constituted the primary diet of the species. Apparent dietary variation of this nature indicates the eurytrophic status of the species and hence its ability to utilise available food items. *B. longipinnis* in this study was essentially a day feeding fish, feeding mostly on the water surface. In the perturbed Ikpoba Stream, it fed mainly on substratum (Victor and Brown 1990).

Data on the monthly variations in the feeding habits of the fish demonstrates no significant qualitative variation in the dietary habit. However, quantitatively, food items consumed scored varying points (Fig. 8). *B. longipinnis* was particularly able to utilise emerging food items quickly and then turned to other food items. Daget (1952) observed changes in the diet of *B. longipinnis* from insects and seeds of higher plants during the rainy season to feeding on phytoplankton during the dry season.

Dietary habits in relation to fish size showed only quantitative variation. This variation was a product of gape size of the fish as the smaller fishes ($\leqslant$ 4.9 cm) fed predominantly on minute sized food items e.g. immature aquatic insect larvae. On the other hand, the reverse was the case for the > 5.0 cm size classes with a relatively larger gape size.

Breeding activities of *B. longipinnis* in the Jamieson River occurred throughout the year. The ovaries were in all stages of development at any one particular time. This is an attribute of multiple spawners. The number of ripe eggs in the ovaries varied between 268 and 1113. In the Cavally and Bandama Rivers of Cote d'Ivoire, the ranges were 560–2450 and 420–2800 eggs, respectively (Paugy 1982). Fecundity of *B. longipinnis* in the present study was comparatively low. According to Gerking (1978), fecundity of a fish depend on the fertility of the river and rivers rich in nutrients produce more fecund fishes. Jamieson River being oligotrophic, expectedly produced fish of lower fecundity.

ACKNOWLEDGMENT

The authors are grateful to the Delta State University, Abraka for the technical support in this research and to Mr. Okoro for the assistance in the field.

REFERENCES

Boulenger G.A., 1901–1916. Catalogue of the freshwater fishes of Africa in the British Museum (Natural History), 4 Volumes, British Museum, Natural History, London.

Daget J., 1952. Mémoire sur la biologie des poissons du moyen Niger. I. Biologie et croissance des poissons du genre *Alestes*. Bulletin de l'Institut Français d'Afrique Noire **14**: 191–225.

Daget J., Iltis A., 1965. Poissons de Côte d'Ivoire (eaux douces et saumâtres). Memoires de l`Institut Français d'Afrique Noire **74**: 1–385.

Gerking S.D. (ed.)**,** 1978. Ecology of freshwater fish production. Blackwell Scientific Publications, Oxford.

Géry J., 1977. Characoids of the world. T.F.H. Publications Inc., Neptune City – New Jersey.

Géry. J. Mahnert V., 1977. Description d'une espèce et d'une sous-espèce nouvelles d'Afrique occidentale du genre *Brycinus* (Pisces, Cypriniformes, Characoidei), avec une revue de sa super-espèce *Brycinus longipinnis* (Günther, 1864). Revue Suisse de Zoologie **84**: 617–643.

Hynes H.B.N., 1950. The food of freshwater stickleback, *Gasterosteus aculeatus* and *Pygosteus pungitius* with a review of methods used in studies of the food of fishes. Journal of Animal Ecology **19**: 36–58.

Hyslop E.P., 1980. Stomach content analysis: a review of methods and their applications. Journal of Fish Biology **17**: 411–429.

Idodo-Umeh G.J., 1987. Studies on the fish community of River Ase, Bendel State with special emphasis on the food and feeding habits of Citharinidae, Bagridae, Schilbidae and Mochokidae. Ph.D. Thesis, University of Benin, Benin City, Nigeria.

Kesteven G.L., 1960. Manual of field methods in fishery biology. FAO Manual in fish science No. 1.

Lagler K.F., 1978. Capture, sampling and examination of fishes. pp. 7–47. *In*: Bagenal T.B. (ed.) Methods of assessment of fish production in freshwater. Blackwell Scientific Publications, Oxford.

Lévâque C., Paugy D., Teugels G.G., (eds.) 1990. Faunes des poissons d'eaux douces et saumâtres d'Afrique de l'Ouest, vol. 1, Coll. Faune Tropicale N° 28. Musée Royal de l'Afrique Centrale, Tervuren, Belgique et O.R.S.T.O.M., Paris, France.

Loiselle P.V., 1972. The African longfin tetra, *Alestes longipinnis*. African Aquarist **77**: 13–15.

Olaosebikan B.D., Raji A., 1998. Field guide to Nigeria freshwater fishes. Federal College of Freshwater Fisheries Technology, New Bussa, Nigeria.

Planquette P., Lemasson J., 1975. Le peuplement de poissons du Bandama Blanc en pays Baoulé. Annales de l'Université d'Abidjan E 8 (1):77-121.

Paugy D., 1982. Mise en Synonmye D' *Alestes chaperi* (Sauvage, 1882). avec *A. longipinnis* (Günther, 1864) (Piscies, Characidae). Cybium **6**: 75–90.

Paugy D., 1986. Revision systematique des *Alestes* et *Brycinus* Africans (Pisces, Characidae) ORSTOM. Etudes et thesis, Paris.

Reed W., Burchard J., Hopson A.J., Jenness J., Yaro Y., 1967: Fish and fisheries of Northern Nigeria. Ministry of Agriculture, Northern Nigeria, Zaria.

Sydenham D.H.J., 1977. The qualitative composition and longitudinal zoneation of the fish fauna of River Ogun, Western Nigeria. Revue de Zoologie Africaine **91**: 974–996.

Tetsola E.A., 1988: Distribution and feeding relationships of the fishes in Warri River, Nigeria. Ph.D Thesis, University of Benin, Benin City, Nigeria, 240 pp.

Teugels G.G., Reid G. McG., King R.P., 1992. Fishes of the Cross River basin (Cameroon–Nigeria) taxonomy, zoogeography, ecology and conservation. Annales Sciences Zoologiques, Tervuren Belgique 266: 1–124

Thys Van der Audenaerde D.F.E. 1967. The freshwater fishes of Fernando Po. Paleis der Academien, Brussels.

Victor R., Brown C.A., 1990.The food and feeding habits of two species of characid fish in a perturbed West African River. Journal of African Zoology 140: 97–108.

Zar J.H., 1984. Biostatistical analysis, Prentice-Hall, Englewood Cliffs, NJ.

Received: 16 September 2002
Accepted: 7 April 2003