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OBSERVATIONS ON THE DWARF CICHLID *PELVICACHROMIS TAENIATUS* (BOULENGER, 1901) IN RIVER ETHIOPE (NIGER DELTA, NIGERIA)

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ABSTRACT

Some aspects of the biology of the dwarf cichlid *Pelvicachromis taeniatus* (Boulenger) were studied in the Ethiope River, Niger Delta, Nigeria. *P. taeniatus* is ubiquitous in the river and occurs in it throughout the year. It attains a maximum standard length of 6.5cm and weight of 8.1g. Its growth pattern is allometric. The condition factor (K) ranges from 2.81. to 3.37 and generally increases with individual size of fish irrespective or sex. K-values are slightly higher during the dry season. Fecundity estimates range between 16 and 215 eggs per matured female and are highly related to fish weight. Algal inclusions constitute its major diet and there occur distinct differences in the feeding habit in relation to size and season.

KEY WORDS: Freshwater, distribution, growth, food habits, fecundity, *Pelvicachromis taeniatus*, Nigeria.

INTRODUCTION

The dwarf cichlid *Pelvicachromis taeniatus* occurs abundantly in River Ethiope - a clear fluviatile acid river in the Delta area of Nigeria. This species has recently become commercially important as an aquarium fish because of its colourful appearance and suitable size (< 10cm total length).

Studies carried out on it are sparse. Available information to this author are on the taxonomy (REED *et al.*, 1967; THYS VAN DEN AUDENAERDE, 1968), breeding potential in the laboratory (MOOR, 1971 a & b) and behaviour (WICKLER, 1966). NWADIARO (1984) made observations on the distribution and food habits of the genus *Pelvicachromis* in River Sombreiro, Nigeria with emphasis on *P. pulcher*.

The work of FRYER & ILES (1972) appears to be the only source of information on the biology of *P. taeniatus*. Accordingly, this paper examines its distribution, growth pattern, fecundity and diet.

STUDY AREA

River Ethiope (Fig. 1) is one of the tributaries of River Benin, the other being the River Jamieson. They are both located in the Mid-Western region of Nigeria. River Ethiope took its source at Umuaja, approximately 5°55′N, 6°16′E and flows westwards for about 100km where it discharges into River Benin at Sapele. River Benin is bordered by the Atlantic Ocean.

The Ethiope River flows all round the year with the highest level and discharge during the flood period (July-November). The river is clear, oligoionic and partially tidal influenced at the Sapele to Aghalokpe end. It is about 1.5 to 90m broad with an average depth of 2-7m, 20m, in deepest part. Some other physico-chemical characteristics of the river are charted in Table 1.

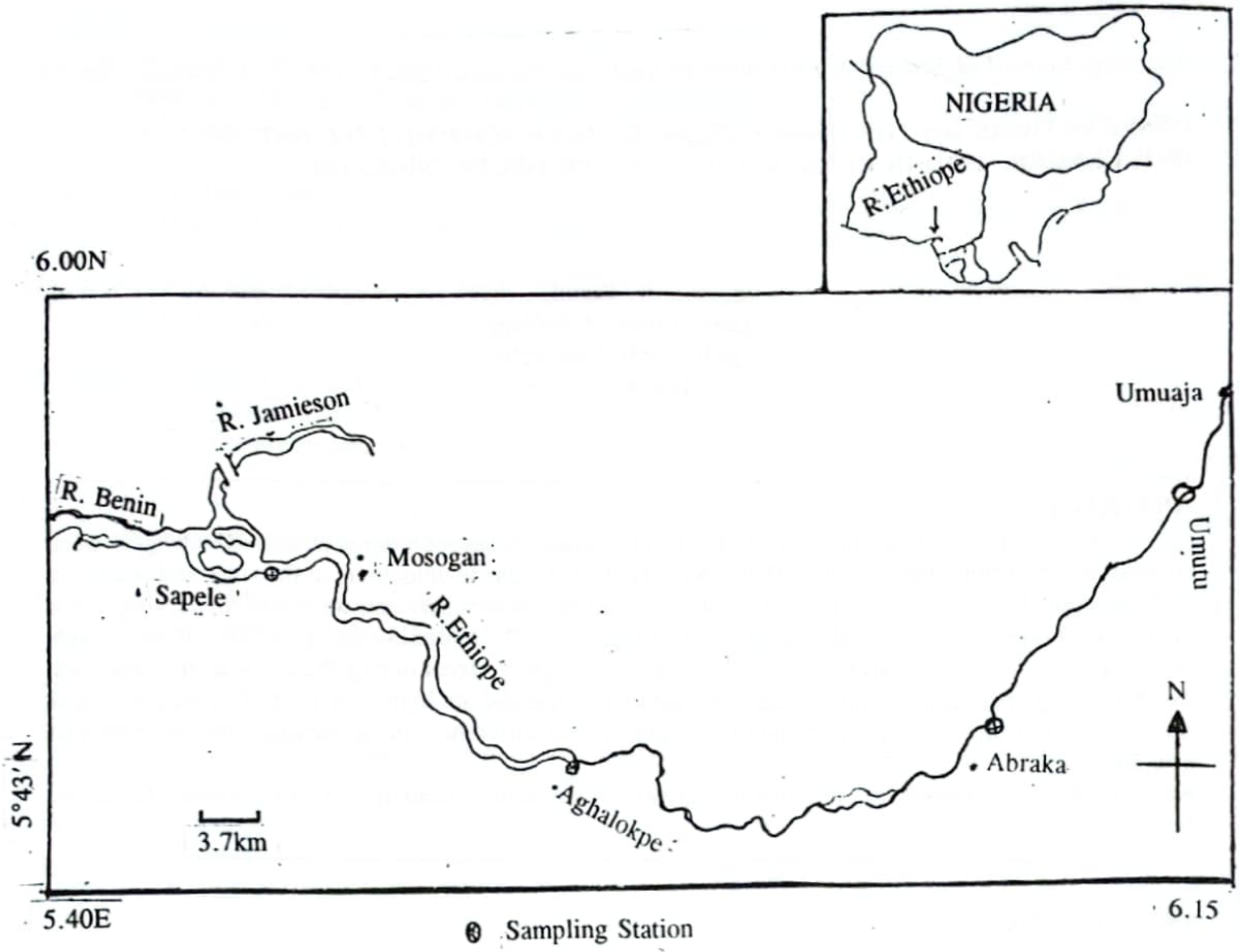

Fig. 1: Location of the River Ethiope in Nigeria (Inset) with a map showing the study area.

The River Ethiope is in the deltaic swamp forest zone. Consequently, its vegetations consist principally of floating higher plants such as *Nymphaea lotus* Linn., *Azolla afrucaba* Desv. and *Pistia stratiotes* Linn. Plants partly or totally submerged include *Scirpus jacobi* Fisher, *Salvinia nymphellula* Desv. *Hydrolea glabra* Schum and Thuin, *Ludwigia* spp., *Vossia cuspidata* Griff and *Pycreus lanceolatus* Poir.

The relevant human activities in the river are commercial sand dredging, lumbering, fermenting of cassava tubers for food and washing of melon. The level of pollution is relatively low except in the Sapele area where industrial and domestic wastes are frequently dumped into the river.

MATERIALS AND METHODS

Monthly samples of *P. taeniatus* were collected from River Ethiope between August 1993 and July 1994 using drag and set nets of small mesh size (1.2-2.0cm) during the day. Specimens were preserved in 10% formalin solution prior to laboratory examination. In the laboratory, data obtained for each specimen included length, total weight, sex and food records. Standard length (SL) was measured to the nearest 0.1 centimetre and weight to the nearest 0.1 gramme.

Sex determination was by examination of the gonad under a binocular microscope. The fecundity estimate was by direct count. The length-weight relationship of the fish is described by the equation:

$$w = al^b$$

where w = weight (g), l = standard length (cm) and a & b are regression constants. The transformed logarithmic data of the linear regression equation is expressed as:

$$\log w = \log a + b \log l.$$

Data obtained from the length and weight measurements were used to calculate the condition factor using the formula:

$$K = \frac{w \times 100}{l^3}$$

where w = weight (g), l = standard length (cm).

The relationship between fecundity and fish length is described by the equation;

$$F = al^b$$

where F = fecundity, l = standard length (cm), b = slope, a = intercept. Through a logarithmic transformation, the equation becomes:

$$\log F = \log a + b \log l.$$

Food and feeding habits were assessed by analysis of the stomach content using the frequency of occurrence and point methods (HYNES, 1950; HYSLOP, 1980). In the frequency of occurrence method, the number of stomachs in which different food items occurred were counted and expressed as percentage of the total stomachs examined.

In the point method, the food items in the stomachs were awarded points according to the volume they were judged to have occupied in relation to the total volume of flood in the stomach. The points scored by individual food items in each fish were summed and expressed as a percentage of the grand total point gained by all the food items during the entire period of study.

RESULTS AND DISCUSSION

Distribution:

The species composition of the cichlids found in River Ethiope consisted of *Tilapia mariae* Boulenger 1899, *Tilapia guineensis* Bleekes 1863, *Chromidotilapia quentheri* Sauvage 1882, *Hemichromis elongatus* Guichenot 1861, *Hemichromis bimaculatus* Gill 1862, *Pelvicachromis taeniatus* Boulenger 1901, and *Pelvicachromis pulcher* Boulenger 1901. *P. taeniatus* which constituted about 6.1% of the total cichlid catch is ubiquitous in all stretches of the river and occurs in it throughout the year. The species have preference of shallow water (<2m deep) with abundant emergent vegetation and are relatively preponderant in those areas of the river with low pH (Umutu and Abraka; Fig. 2) These sections are also low in conductivity (Table 1). The observation on pH conforms with that of NWADIARO (1984) who reported the flourishing of the species only in acid water rivers in the deltaic forest zone of Nigeria.

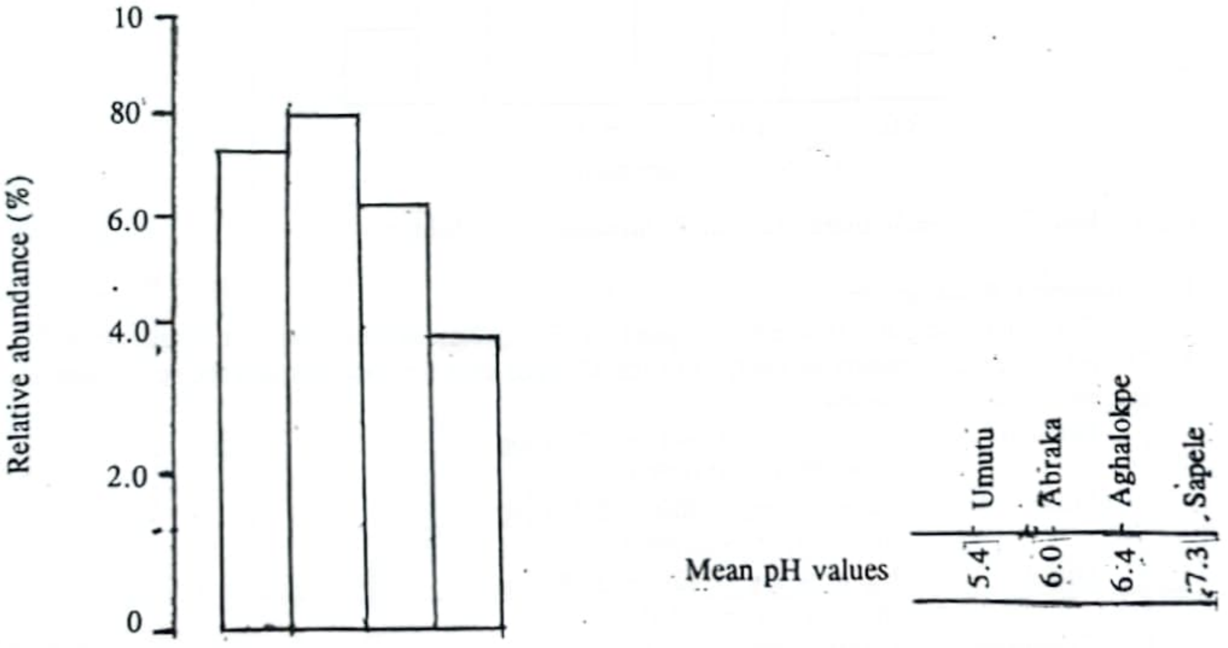

Fig 2: Histogram showing the abundance of *P. taeniatus* in relation to the total cichlid catch and mean pH value of the different locations in R. Ethiope.

The length frequency histogram of all the examined specimens of *P. taeniatus* is shown in Fig. 3. The standard length ranges from 3.0cm to 6.5cm. The figure shows that the length frequency distribution pattern of the species in the river is approximately normal consisting of one length class with its mode at 5.0cm. The maximum length obtained by this species in the river was 6.5cm (8.3cm, total length). This value is just a bit higher than the 8cm obtained by REED *et al.* (1967).

Table 1 Mean values of some physico-chemical characteristics of the River Ethiope

Parameters	Umutu	Abraka	Aghalokpe	Sapele
Flow rate (MS^{-1})	0.85	0.63	0.32	0.20
Temperature (°C)	25.0	25.0	26.5	26.5
pH	5.4	6.0	6.4	7.3
Dissolved Oxygen ($Mgdm^{-3}$)	5.6	5.6	6.1	6.3
Conductivity (μs)	14.6	16.1	39.8	53.7

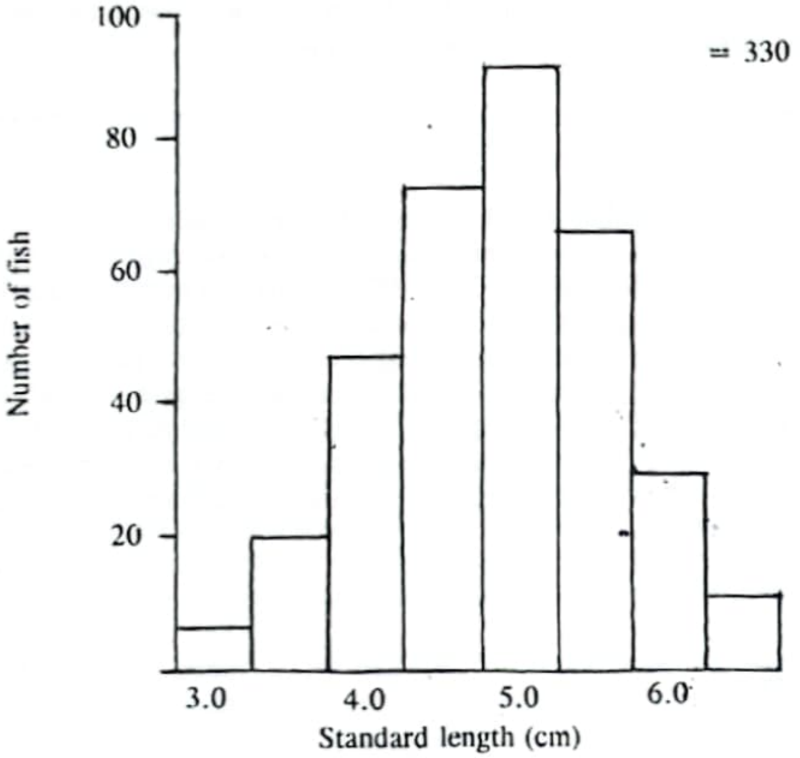

Fig 3: Length frequency distribution of *P. taeniatus* in R. Ethiope.

Length-weight Relationship:

The length-weight relationship is based on 330 specimens whose weight ranges from 2.0. to 8.1 g. The least squares common fit analysis of transformed data for each sex and the sexes combined gave, the regression equations below:

Immature: $\log w = \log -1.543 + 2.783 \log l$
$(n = 45; r = 0.6750)$

Male: $\log w = \log -1.560 + 2.845 \log l$
$(n = 110; r = 0.8960)$

Female: $\log w = \log -1.426 + 2.763 \log l$
$(n = 175. r = 0.7630)$

Combined: $\log w = \log -1.4374 + 2.860 \log l$

(n = 330; r = 0.8820)

The regression coefficient 'b' value obtained is less than 3, thus indicating an allometric growth pattern for the species (BAGENAL & TESCH, 1978). The correlation values also indicate a high correlation between increase in length of fish and weight gained.

Condition Factor:

Condition factor (k) organised by size and sex are presented in Table 2. K-values were noticeably different in the different length groups. For example, in the 3 cm group of males, the K-value was highest (3.372). Thereafter, irrespective of sex, the K-values increased with an increase in individual fish length. The same pattern was also obtained with the combined sexes. Generally, in each length group, the males were found to have a slightly higher condition factor than the females.

Table 2: Condition factor in relation to size in *P. taeniatus*.

Standard length (cm)	Male		Females		Combined sex	
	Number	Mean K-value	Number	Mean K-value	Number	Mean K-value
3	6	3.372	8	-	6	3.372
4	16	2.470	20	2.451	36	2.463
5	47	2.880	65	2.770	112	2.810
6	50	3.050	111	3.020	161	3.001
7	15	3.140	-	-	15	3.140

The monthly changes in condition factor is shown in Fig. 4. The values ranged between 2.61 and 3.35. The K-values of the fish increased steadily between August 1993 to May 1994 except in January 1994; after which it dropped suddenly in June and July 1994. This sudden drop may be connected with peak spawning activities of the fish as a large number of spent gonads were observed in the months of August and September.

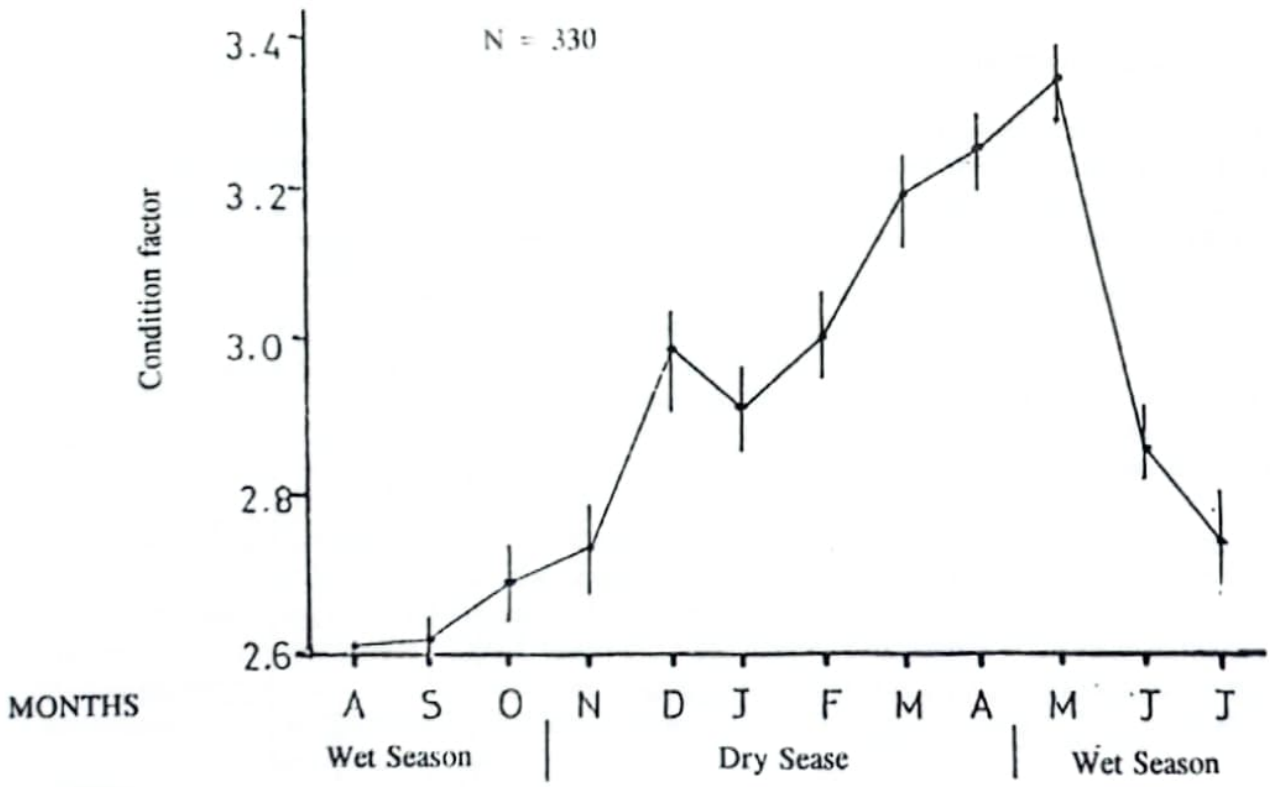

Fig 4: Mean monthly condition factor of *P. taeniatus* in R. Ethiope between August 1993 to July 1994.

Fecundity:

The fecundity of *P. taeniatus* ranged from 16 eggs in a female measuring 4.4cm to 215 eggs in a 6.4cm fish with a mean of 165 eggs. A wide variation in fecundity was observed among fishes of the same size. Also examination of the ovaries shows that the eggs were of different sizes and at different stages of maturation. The matured eggs diameter ranged between 0.9mm - 1.7mm with a mean of 1.4mm. The ripe eggs were orange yellows in colour. The occurrence of the eggs at various stages of maturation and of varying diameter is probably an indication of multiple spawning by the fish. The observed minimum standard length of female with ripe eggs was 4.3cm and the largest 6.4cm.

The relationship between fecundity and fish length (Fig. 5) was computed from 45 specimens. The regression equation obtained was:

$$\log F = \log 0.5732 + 1.7147 \log l$$
$$(r = 0.3760;\ p = 0.001)$$

The equation can be rewritten thus:

$$F = 3.742\ l^{1.7147}$$

The 'b' value shows that fecundity is more related to fish weight than to fish length (BAGENAL & BRAUM, 1978) and that fecundity approximates the square of the body

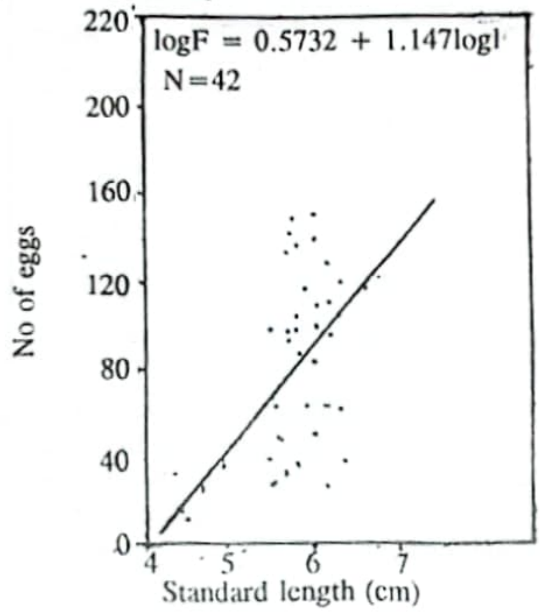

Fig 5: Changes in egg production potential in different sizes of *P. taeniatus*

length. *P. taeniatus* though a substrate spawner/mouth brooder, the 'b' value obtained here is closely related to some strictly mouth brooding cichlids like *Oreochromis leucosticta, Sarotherodom melanotheron* and *Sarotherodon gaililaeus* as reported by WELCOMME (1967), FAGADE (1979) and FAGADE *et al.* (1984) respectively.

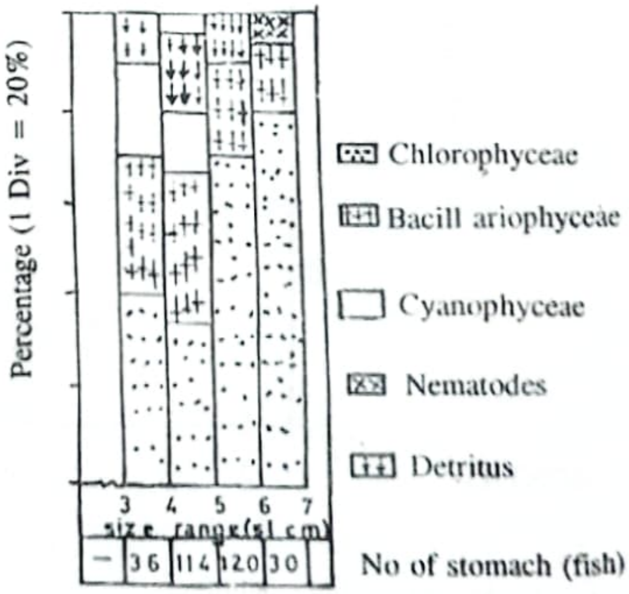

Fig 6: Feeding habit in different length classes of *P. taeniatus* in R. Ethiope

Food and Feeding Habits:

A total of 330 *P. taeniatus* were examined, of which 300 had food in their stomach and 30 had empty stomachs. A summary of food items taken by the species is given in Table 3.

P. taeniatus in River Ethiope can be described as an algivore as evidenced by the preponderance of a variety of algae in its diet. Using the occurrence method, its main food items were filamentous Chlorophyceae (37.2%), unicellular Chlorophyceae (20.0%) and Bacillariophyceae (54.7%). Cyanophyceae and detritus accounted for 8.0% respectively. The other food items ranged from 1.3 - 5.3%. Using the point method, the major food items - filamentous Chlorophyceae, Bacillariophyceae and Cyanophyceae accounted for 40.7%, 21.0% and 10.3% respectively

Table 3: Gross tropic spectrum and seasonal variations in the percentage occurrence (%0) and percentage points (%p) of the diet of *P. taeniatus* in Ethiope River. Also shown are number of food on categories taken, mean stomach fullness on point scale and percentage of empty stomachs.

Food Items	Gross Composition		Dry Season		Wet Season	
	%0	%P	%0	%P	%0	%P
ALGAE						
Chlorophyceae-Filamentous	37.2	40.7	65.1	36.8	75.1	64.8
Chlorophyceae-Unicellular	20.0	10.3	10.3	8.6	-	
Bacillariophyceae	54.7	21.0	53.1	29.1	45.3	22.8
Cyanophyceae	8.0	8.3	10.1	15.9	-	-
DETRITUS	8.0	8.2	8.5	3.5	6.9	10.9
SAND GRAINS	1.3	0.9	7.3	0.2	25.1	1.5
NEMATODA	4.0	3.5	7.4	7.1	-	-
Number of Categories taken	7		7		4	
Mean Stomach fullness (points)	6.5		4.9		6.5	
% Empty stomachs	10		14.6		6.5	
No. of Fish Exam.	330		149		181	

while the other food items range between 0.9 and 8.2%. The diatoms, green and blue green algae eaten by the species were digested to a large extent as a lot of empty diatom frustules and distorted algal filaments occurred in the recta of the specimens examined.

Generally it appears that the diet of the species is restricted to only algal inclusions. This restriction in diet composition may likely constitute constraints in sustaining the population of a species in an oligotrophic river, according to ODUM (1992), tend to show opportunistic elements in their feeding habit.

The seasonal variation in the feeding habit of *P. taeniatus* is also shown in Table 3. Qualitatively, the species fed on all the categories of food item listed in Table 3 during the dry season while in the wet season it fed on 4 categories. The wet season diet exclude unicellular Chlorophyceae, Cyanophyceae and nematodes. That is to say more categories of food items were taken in the dry season than in the wet season. The increase in the categories of food items fed upon by the species during the dry season may be a response to availability of food resources which, according to WELCOMME (1975), 1979), are usually scarce during the dry season in the topics. This is perhaps the reason why the fish utilized other available food items in addition to the major food items. Quantitatively, *P. taeniatus* fed more on the filamentous Chylorophyceae during the wet season than in the dry season. Other food items were variably consumed. The data on the mean stomach fullness show higher values during the wet season (6.5) than during the dry season (4.9) (Table 3). Wilcoxon signed-rank statistics also confirmed, significance in the %O(W = 17, $p < 0.01$) and % P(W = 11, $p < 0.01$) of the diet during the dry and wet season.

Fig. 6 presents the feeding habits of *P. taeniatus* in relation to different length groups. The small size fishes fed on all categories of food items, but with a higher intensity on Chlorophyceae and Bacillariophyceae. With increasing fish length, the species became more selective in its food habit. For example, the 5-7cm length groups fed almost exclusively on Chlorophyceae and Bacillariophyceae. Generally, Chlorophyceae and Bacillariophyceae were important diet to all the length classes of fish. it is well known that fish change their feeding habit with increase in size (WELCOMME, 1979). The gape which limits the particle size of food consumed is critical only in the early life stages of fish and after a certain size the gape is usually large enough to include the entire range of food size in he environment (ZARET, 1980). The variation is size-related feeding habits observed here is probably due to changes in feeding behaviour and food preferences.

The present work has examined aspects of the biology of *P. taeniatus* in a river system. The study reveals that the species was ubiquitous in the entire river stretch but with preference for the acid portions. Its diet, which consists mainly of algae, change in size and season affected the growth pattern. Among other factors, the restriction of its diet to mainly algal inclusions in an oligotrophic river of this nature may have been principally responsible for the relative paucity in number observed when compared with the other cichlids in the river. It is hoped that this work complements the existing knowledge on the biology of the species which has been very scanty.

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