GROWTH, REPRODUCTION AND FEEDING BIOLOGY OF *MALAPTERURUS ELECTRICUS* (GMELIN,1789) IN LOWER BENUE RIVER, NIGERIA

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Abstract
The reproductive biology, food and feeding habit and growth pattern of *Malapterurus electricus* (Gmelin) were investigated using a sample of 50 males and 67 females collected from the River Benue in Makurdi. The mean standard lengths of males and females were 18.9 ± 1.49cm and 17.8 ± 0.43 cm respectively, while the mean total weights were 195.7 ± 50.4g for males and 130.1 ± 21.7g for females. The mean condition factors were 2.32 ± 0.02 (males) and 2.09 ± 0.01 (females). *Malapterurus electricus* in River Benue exhibited isometric growth and their main food items were fish and arthropod. The species attained sexual maturity at a mean standard length of 16.7 ± 2.3cm in males and 17.4 ± 3.2cm in females. The mean fecundity was 2331 ± 970.2 eggs. The results were discussed in relation to the need for a full understanding of the basic biology of this important ornamental fish.

Keywords: Fecundity, diet, growth, *Malapetrurus electricus*.

Introduction

Malapterurus electricus (Gmelin) (common eletric fish) of family Malapteruridae, the only species of this family. Boulenga (1909) reported the distribution of this nocturnal, benthopelagic and potamodromous fish species in Tropical Africa and Nile and their low abundance. *Malapterurus electricus* lives mostly in swamps and occasionally in rivers around the reed beds flanking the flowing water (Alwyne, 1975, Sagua, 1975). Belbenoit *et al.* (1979) related the function of the electric organ of *M. electricus* to defensive and offensive predatory behaviour, while Sagua (1979) observed their low abundance in freshwaters of Africa despite their few natural predators. Documented information on the reproductive biology, feeding and the growth pattern of a fish species is basic to the understanding of the nature of stock and its availability (Lagler, 1962), especially of a rare ornamental and game fish species like *M. Electricus*. The present investigation was therefore an attempt to add to the scanty data on the reproductive biology, feeding and growth pattern of *M. electricus* in the Lower Benue River system.

Materials and Methods

The fish used for the study were caught from the Lower Benue River system with the use of standard mesh sizes of cast, gill and drag nets and assorted sizes of hooks, line and traps.

Fish specimens were sampled every two weeks from fishers for one year from January to December 2005) and from fish mongers in the three major fish markets (Wadata, Wurukum and North Bank). The samples were transported to the laboratory in a cool-box containing ice pellets in order to reduce posthumous digestion. The total and standard lengths were measured to the nearest millimeter using millimetric ruler while total weight and gonad weights were recorded using electronic top loading weighing balance. The relationship between the standard length and weight was determined using the formula: $W = al^b$ (Le Cren, 1951)

Where: W =weight (g), l = standard length (cm), a = constant and b = exponent. The condition factor for both sexes were computed using the formula ($K=W100/L^3$) of Worthington and Richardo (1930), where K= condition Factor, W = weight (g), L = standard length (cm).

The reproductive organs were dissected out and the sex and maturity stages of the gonad determined using Nikolsky's (1963) scale. The gonads were preserved in Gilson fluid for fecundity estimation using the sub-sampling dry method of Simpson (1959). The stomach was dissected out into petri-dishes and the contents identified under medium power of the compound microscope, then analyzed quantitatively and qualitatively using the point (Hynes, 1950) and frequency of occurrence (Allen, 1942) methods.

Results

Seasonal Abundance And Size Distribution

One hundred and seventeen specimens of *M. electricus* were investigated from January to December the mean weight standard and total length of the sample used in the study are given in Table 1:

TABLE 1: Mean Weight, Standard Length And Total Length Of Male And Female *Malapterurus electricus*

Physical Parameter	Sex	No. of Fish Examined	Range	Mean ± S.E.
Total Length (cm)	Male	50	11.7 37.4	22.2 ± 1.71
	Female	67	12.1 29.4	19.9 ± 1.02
Standard Length (cm)	Male	50	10.2 34.9	18.9 ± 1.49
	Female	67	10.9 26.8	17.8 ±0.43
Weight (g)	Male	50	24.0 804.6	195.7 ±50.4
	Female	67	28.9 442.0	130.1 ±21.7

The mean standard length of the males was 18.9cm ± 10.5cm (range = 10.2cm 34.9cm) while that of the females was 17.8cm ± 3.5cm and ranged from 10.9cm 26.8cm (Table 1)

The males had a mean weight of 195.70 ± 50.4g and ranged between 24.0g and 804.6g. The corresponding values for females were 130.1g ± 59.2g and 28.9g 442g respectively.

Growth Pattern and Condition Factor

The predictive equations relating standard lengths of given total weights of *M. electricus* were: Log W = 3.04 LogL log 1.69 for females, and Log W = 2.86 LogL log 1.47 for males, and Log W = 2.95 LogL log 1.57 for both males and females combined. The exponent 'b' in all the groups were very close to 3, indicating that this species grew isometrically.

The monthly mean condition factor for males and females is presented on Fig 2 (a & b). The males had higher condition factor (2.30) than the females (2.28). Table 2 shows that 'K' value did not change with standard length.

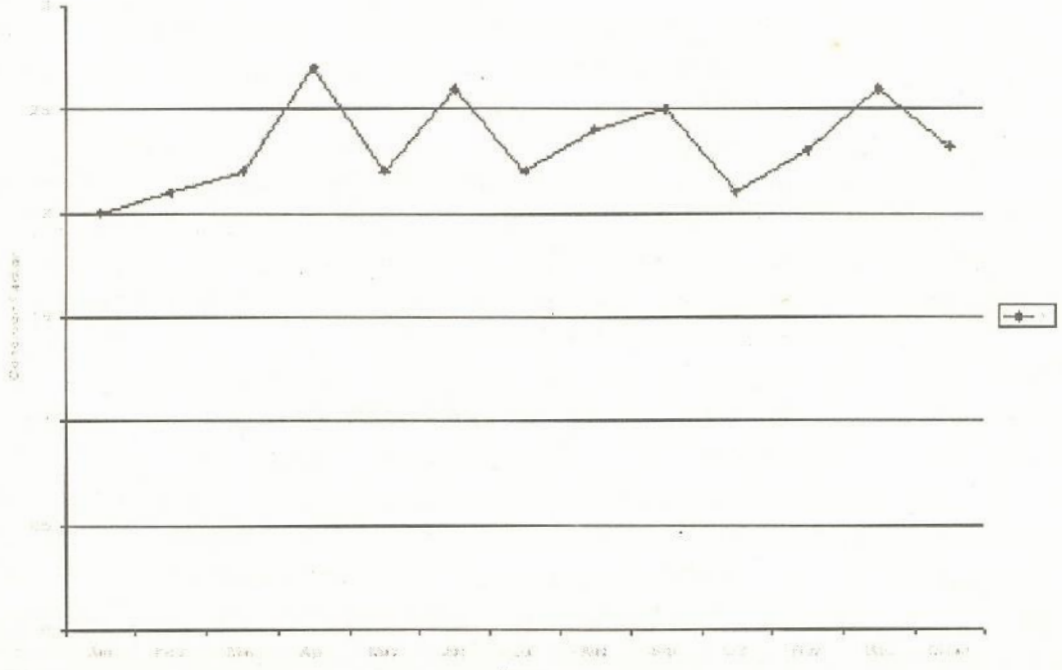

Fig 2a: Monthly Mean Condition Factor of male *Malapterurus electricus*.

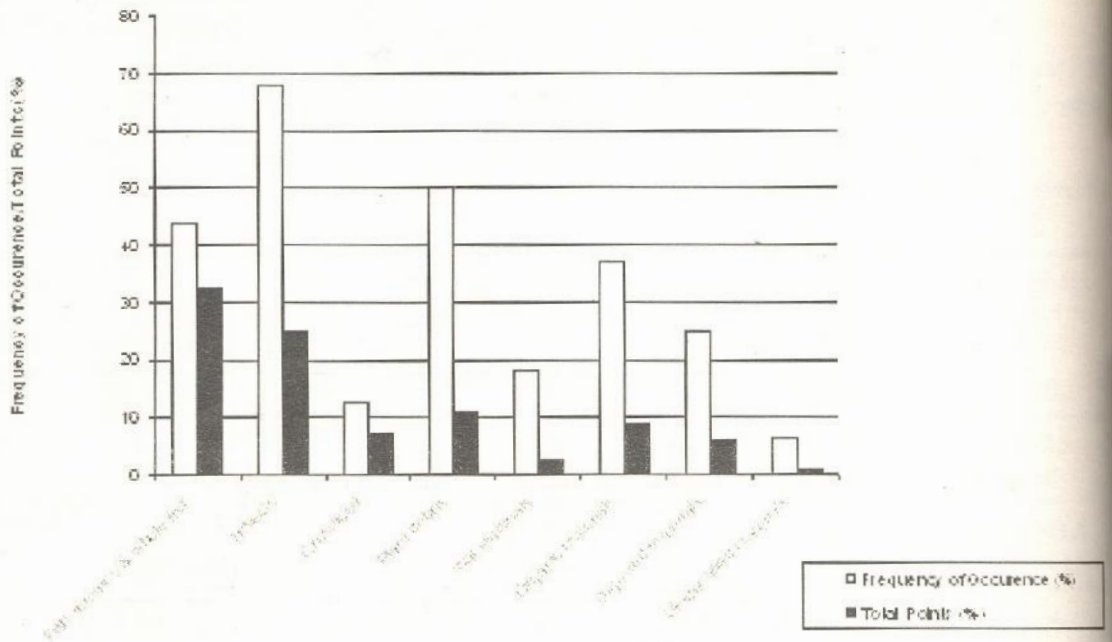

FIG 3:Relative Importance and Frequency of occurrence of dietary items in the stomach of *Malapterurus electricus*.

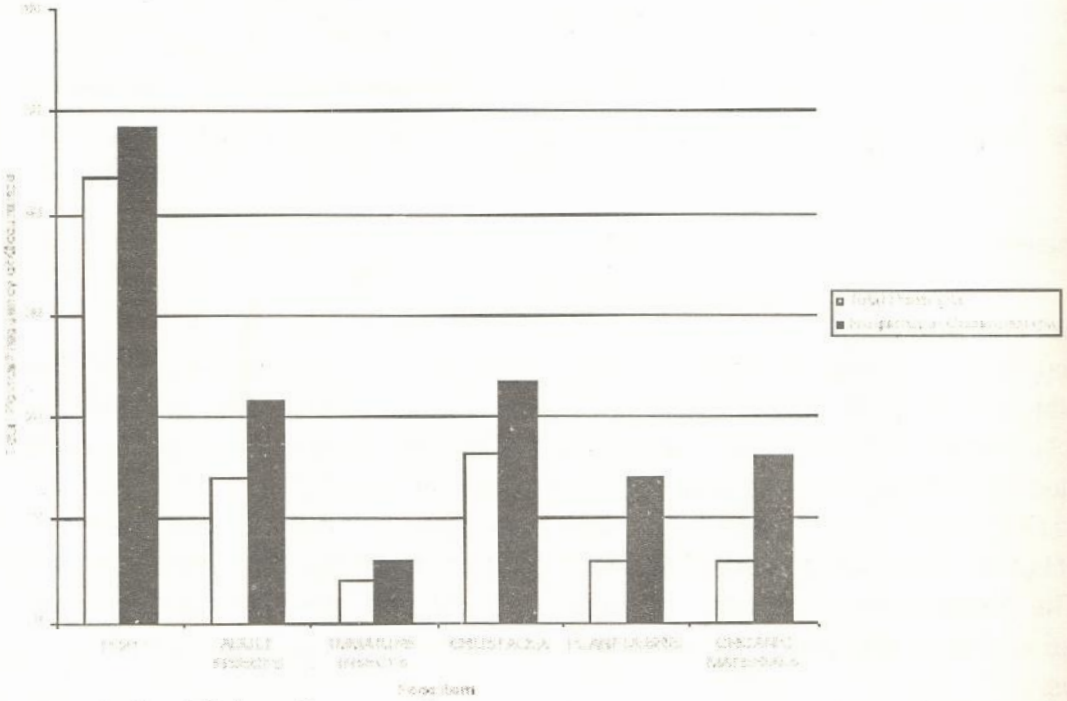

FIG 4a: Changes in the Dietary Composition with Standard Length of *Malapterurus electricus* (26cm - 40cm).

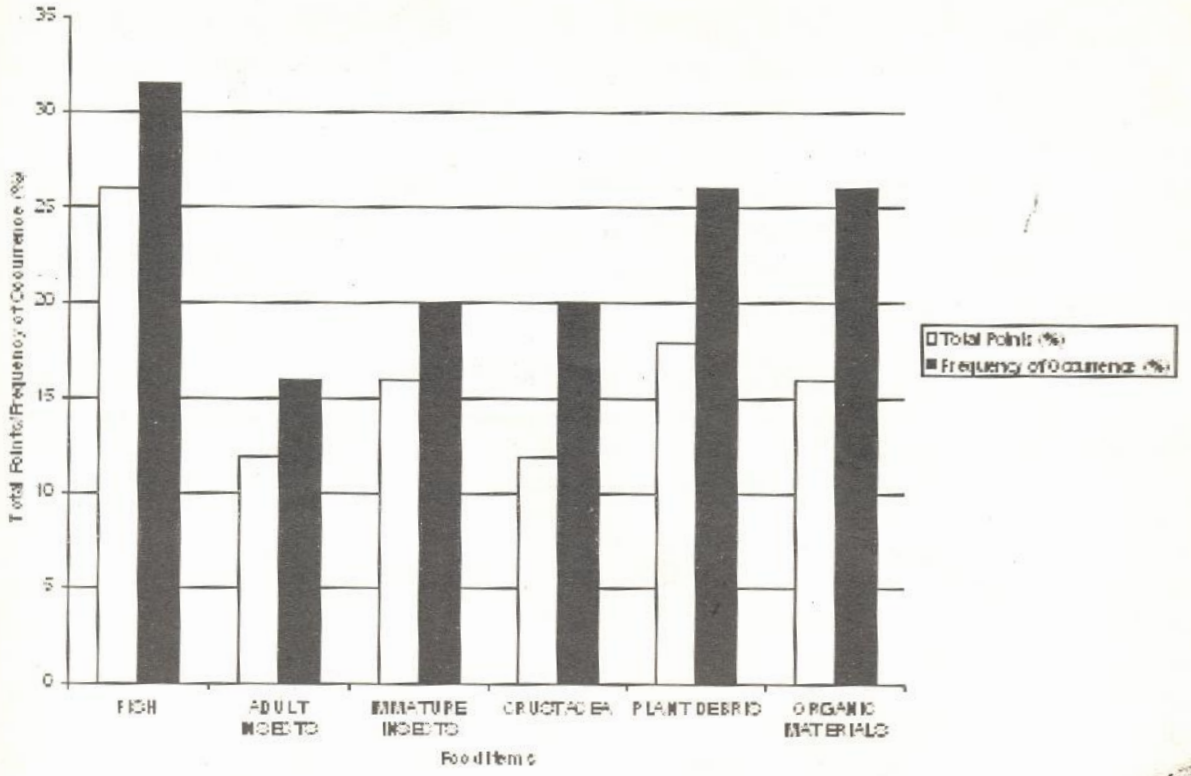

FIG 4b: Changes in the Dietary Composition with Standard Length of *Malapterurus electricus* (16cm - 25cm).

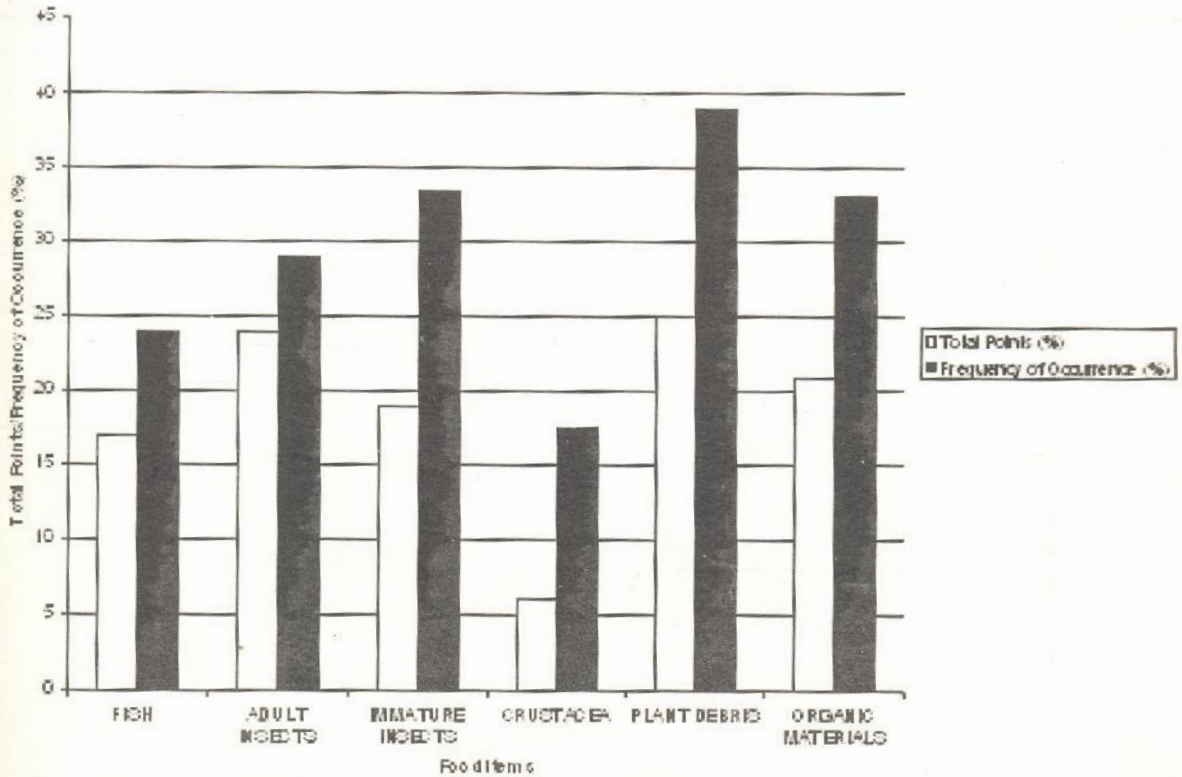

FIG4c: Changes in the Dietary Composition with Standard Length of *Malapterurus electricus* (10cm - 15cm)

Sex Ratio

Monthly variation in sex ratio of *M. electricus* are presented in Table 3. When all the samples were pooled, a ratio of 1 to 1.38 females was obtained on a monthly basis, and except for January and February, the ratio did not differ significantly from the expected 1:1 ratio.

Size Of Maturity

Males bred at a mean standard length of 16.7cm ± 2.3cm with a range of 15.6cm 23.0cm while the females bred at the mean standard length of 17.4 ± 3.2cm and ranged form 16.1cm to 24.1cm (Fig 5). All the stages of gonad maturity using Nikolsky's (1963) scale were established for the males and females except the spawning stage V.

TABLE 3: MONTHLY VARIATION IN SEX RATIO OF *Malapterurus electricus*

MONTH	MALES	FEMALES	TOTAL	SEX RATIO
JAN	1	3	4	1:3
FEB	2	6	8	1:3
MAR	6	10	16	1:1.6 (1:2)
APR	2	5	7	1:2.5 (1:3)
MAY	6	12	18	1:2
JUN	2	4	6	1:2
JUL	2	3	5	1:1.5 (1:2)
AUG	12	12	24	1:1
SEP	3	3	6	1:1
OCT	1	0	1	1:0
NOV	8	6	14	1.33:1 (1:1)
DEC	5	3	8	1.67:1 (2:1)
TOTAL	50	67	117	1.138 (1:1)

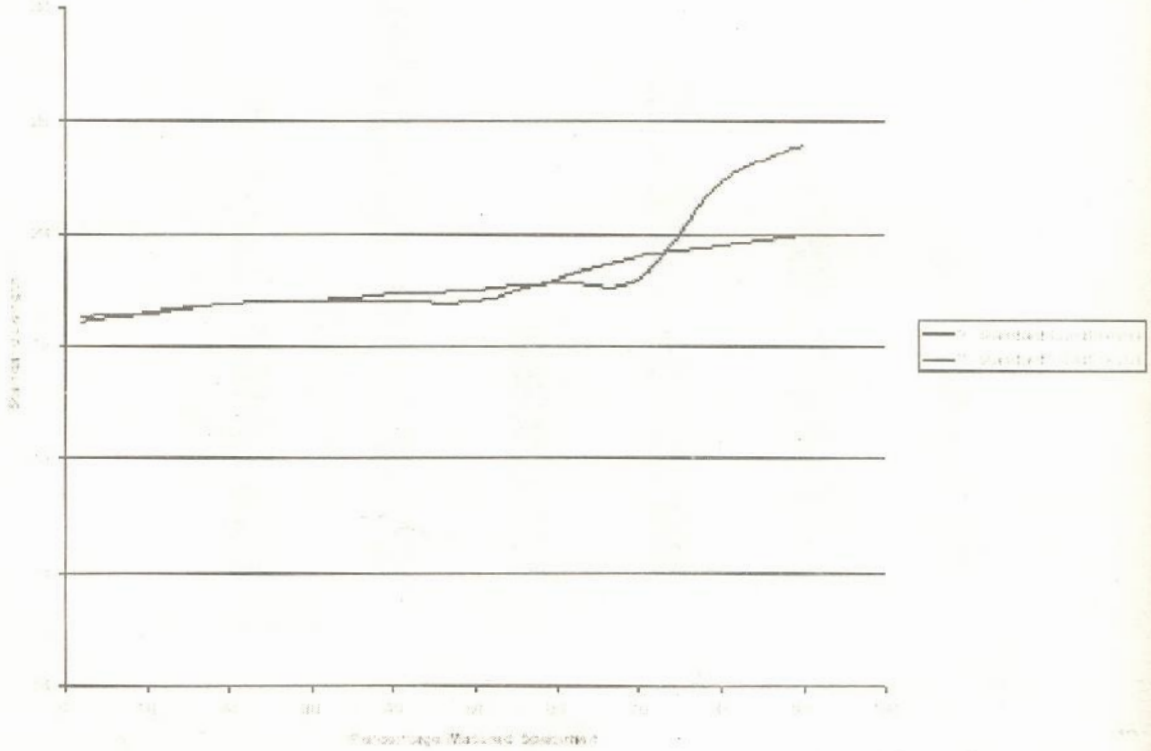

FIG 5: Relationship between percentage matured (Stage iv) male and female *Malapterurus electricus* and Standard Length

Monthly Changes in Frequency of Gonadal Stages

The variations in the proportion of different gonad stages are illustrated in Fig. 7 (a, b, c, d, e).

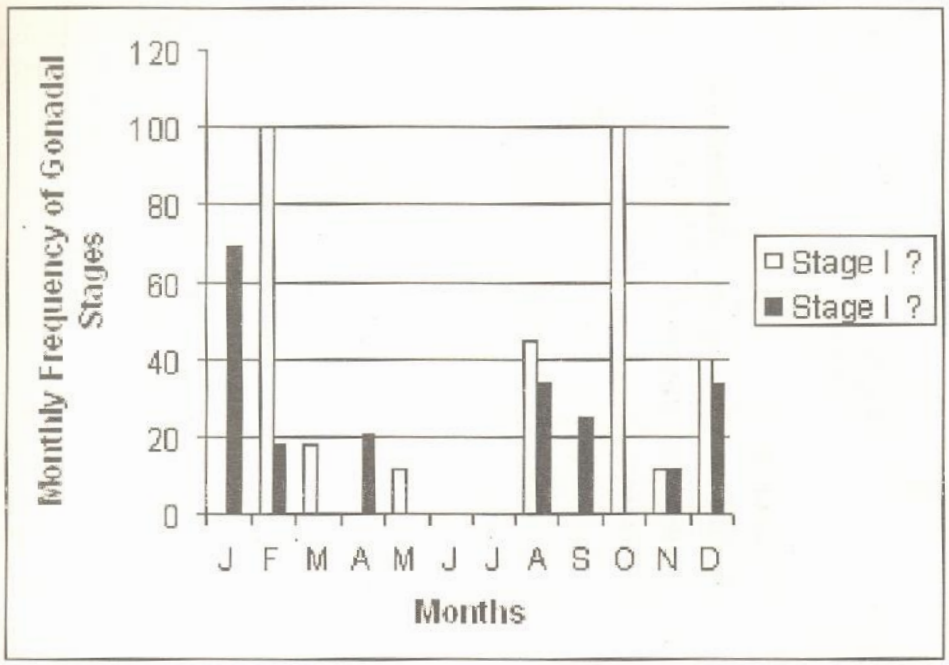

FIG 6a: Monthly Frequency of Gonadal Stages in *Malapterurus electricus* (Stage I, Male & Female)

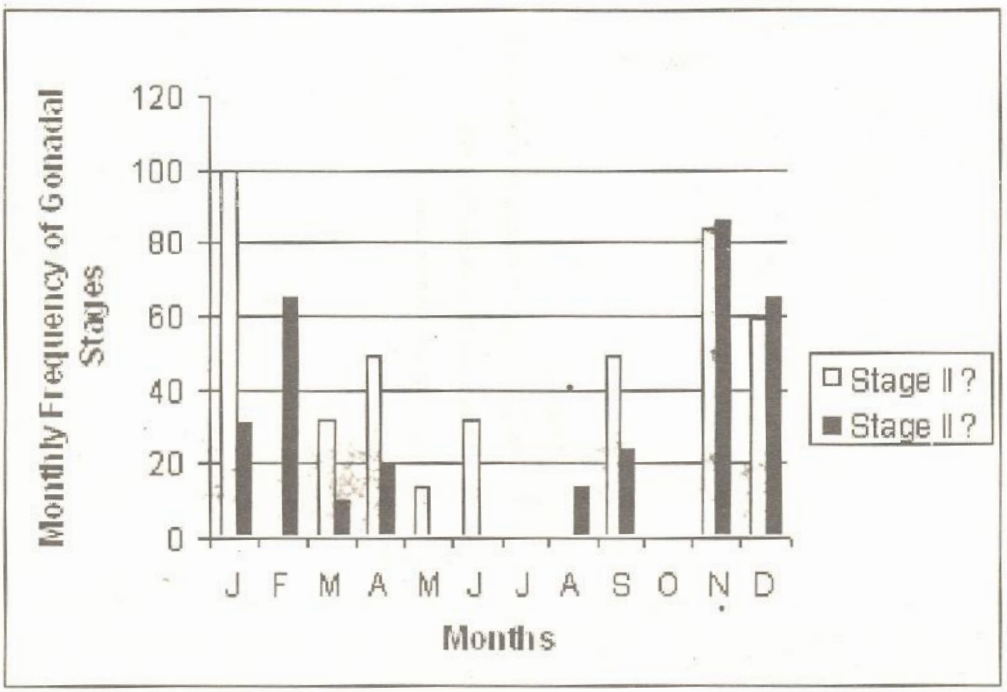

FIG 6b: Monthly Frequency of Gonadal Stages in *Malapterurus electricus* (Stage II, Male & Female).

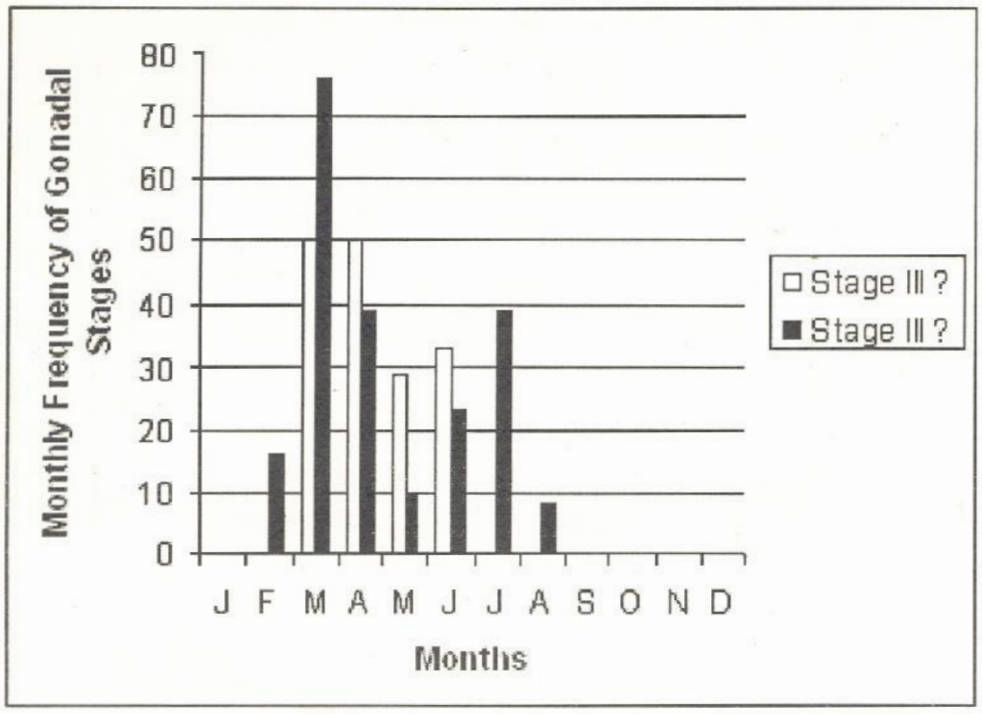

FIG 6c: Monthly Frequency of Gonadal Stages in *Malapterurus electricus* (Stage III, Male & Female).

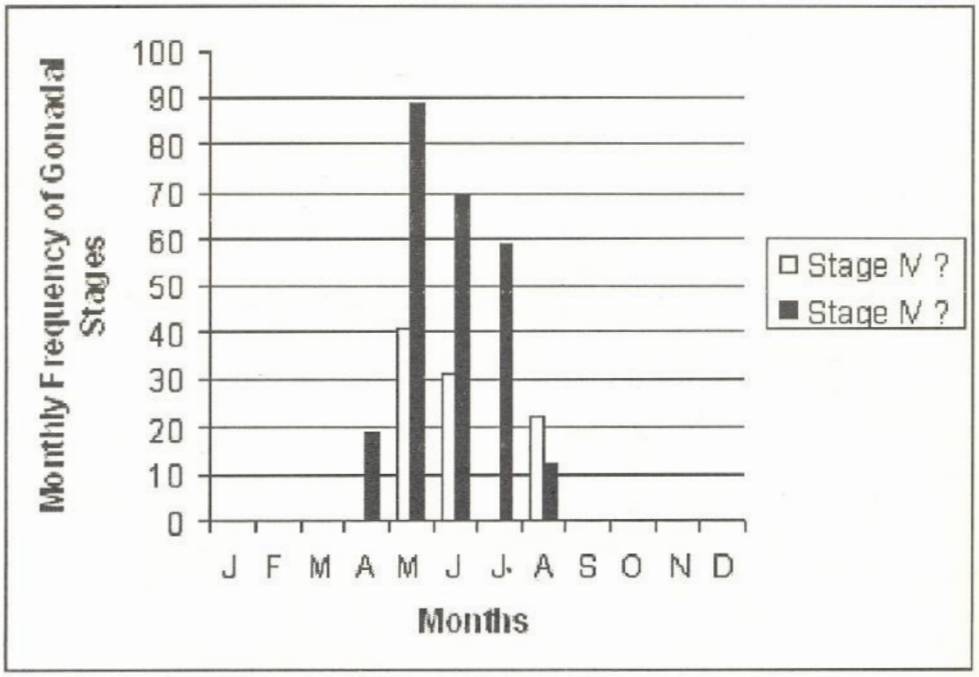

FIG 6d: Monthly Frequency of Gonadal Stages in *Malapterurus electricus* (Stage IV, Male & Female)

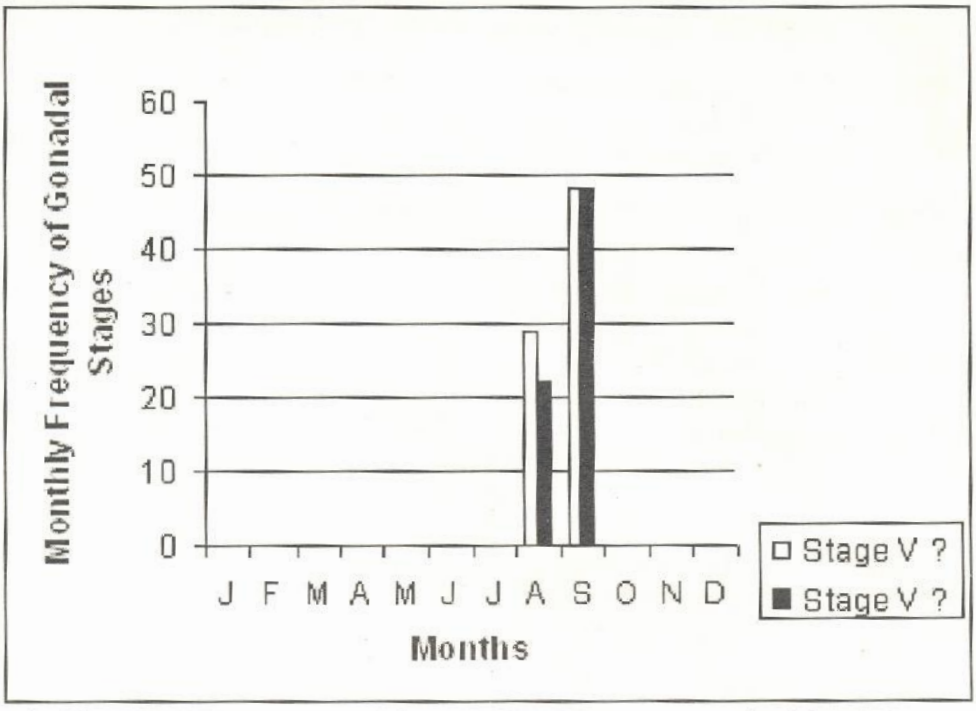

FIG 7e: Monthly Frequency of Gonadal Stages in *Malapterurus electricus* (Stage V, Male & Female)

Fort Males, Stages 1, II and III were found throughout the year but without a definite pattern. Matured gonad stage IV was seen in May, June and August while spent gonads occurred in August and September. For females, Immature and maturing gonads (stages I, II and III respectively) were noticed throughout the year except in October. Samples of fully matured gonads were seen from April to August while spent gonads were seen between August and September.

Fecundity

The mean number of eggs produced by the female *M. electricus* at the mean standard length of 13.3cm ± 2.76cm (range: 16.1cm - 24.1cm) and mean weight of 183.7g ± 90.5g (range, 125.9g 369.5g) and fecundity was 2331 ± 1037 (range, 902 4003). The relationship between fecundity and standard length and between gonadosmatic index and standard length were not significant. Table 4 shows the relationship between the mean gonado somatic index (GSI) and different stages of gonad development. There was a progressive increase in the mean GSI from gonad maturity stage I to stage IV, then a drastic decreasein stage V.

TABLE 4: MEAN GONADO-SOMATIC INDEX (GSI) AND VARIOUS STAGES OF GONAD DEVELOPMENT OF *Malapterurus electricus* IN RIVER BENUE

STANDARD LENGTH	FISH WEIGHT	GONADO-SOMATIC INDEX	TOTAL DRIED EGG WEIGHT	FECUNDITY
16.1	108.2	13.13	2.914	1,548
17.3	125.9	0.55	1.288	2,148
17.8	138.3	11.95	1.922	2,135
17.9	132.6	12.14	2.43	2,100
18.9	141.0	0.32	1.25	902
19.7	184.9	9.19	2.533	2,101
22.7	269.0	10.12	7.843	4,003
24.1	369.5	6.9	6.769	3,710
No. of Fish = 8	8	8	8	8
Range 16.1	108.2	0.55 13.13	1.25 7.843	902 4,003
24.1	369.5			
Mean = 19.3	183.68	8.04	3.370	2,331
S. E. = 0.98	32.0	2.07	0.889	970.2

Discussion

Malapterurus electricus was never found in great numbers in River Benue throughout the study period, confirming Sagua's (1975) observed scarcity of this species in Kainji Lake. All the specimens appeared to belong to the same cohort as illustrated by uni-modal size distribution which indicates a strong year class (Le Cren, 1951). The sample may not reflect the exact wild population as it might probably be influenced by the fishing gear, season of the year and time of the day of capture, structural and physiological adaptations which make a particular size more vulnerable to capture and the tendency for the fishers to select a preferred size (Olatunde, 1983).

M. electricus exhibited isometric growth with no apparent difference between the sizes of males and females as reported for *Bagrus sp.* (Qasim and Quayyum 1964), *Eutropius sp.* (Greonewald, 1964) and Schilbeids (Olatunde, 1978).

The fish is an omnivore with fish and arthroped as the main food items. The small fishes fed more on insects and fish while the large ones had preference for fish. The small fishes were more of opportunistic feeders showing some significant allochthonous materials like terrestrial insects and plant debris contributing to the food. According to Fagade (1983), size of river could affect impact of allochthonous production. The larger fish were more selective with preference for larger prey (fish) and in some cases crustaceans. This consideration shows that *M. electricus* from Lower Benue River are not exactly as has been recorded for Kainji Lake species by Sagua (1979) as voracious piscivore Coates and Atz (1962) reported that their food consisted of algae and fish. The results however, agree with Fagade (1983) who reported fish and insects as the main food of *M. electricus* from the lower Benue River.

M. electricus bred during the rainy season (May September) with females reaching sexual maturity at a size larger than the males. Majority of the West African fresh water fishes have been reported to breed during the local rains. Reynolds (1974) reported this trend in all the three families of small pelagic fishes he studied in Volta Lake and all the members of the family Schilbeidae in Lake Kainji (Olatunde, 1978). Other workers with similar reports are Imevbore and Bakare (1974), Blake (1977), Imevbore (1970) and Motwani and Kanwai (1970). In the view of Imevbore and Bakare (1974), fish breed during the local rains to take advantage of the increased food and protection for the young during this period while, Blake (1977) and Motwani and Kanwai (1970) related it to enough spawning ground.

Bhath (1971) and Olatunde (1978) reported that male schilbeids matured at a size smaller than females. The reason for the disparity in growth was given by Reynolds (1974) as a reflection of sexual differences in growth rate.

However, Matthes (1964) observed no such size differences in pellenuline clupeids of lake Tunter. The mean fecundity estimate of 2,331 eggs obtained for a specimens of *M. electricus*, mean standard length 19.3cm and mean weight of 183.7g in River Benue is much lower than the value of 23,000 eggs for 2 specimens of *M.electricus* of mean total length of 68.5cm and mean weight of 14,850g recorded in Kainji Lake (Sagua 1975). The variation in the value might be due to the sample size involved as well as the size of the fish. When compared with the fecundity of some species of fish from elsewhere, the value obtained for *M. electricus* is not low. For instance, Olatunde (1978) recorded fecundity range of 1,249 1,655 eggs for *Siluronacon auritus* of standard length range 9.0cm 11.6cm and a corresponding value of 1,204 3913 and 6.2cm 11.6cm respectively for *Physiala pellucida* in Lake Kainji. Otobo (1978) recorded the mean fecundities of 871 eggs and 311 eggs for *Pellonula afzeliusi* and *Sierrathrisia leonensis* respectively standard length range = 2.8cm 6.5cm and 1.8cm 2.8cm respectively.

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