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The Reproductive Biology of *Brycinus nurse* (Paugy 1986), Pisces: - Characidae in Asa Reservoir, Ilorin, Nigeria.

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Abstract

A total of 980 specimens of *Brycinus nurse* caught in Asa reservoir from November 1991 to October 1993 were examined for reproductive attributes. Female dominance was observed within the population, with a sex ratio of 1.0 male to 1.78 females. The fish spawns during the rainy season from March to August, with peak spawning in March, June and July, months coinciding with the onset of the rains and flooding. The Gonadosomatic Index (G.S.I) of the population of *B.nurse* in Asa reservoir ranged between 0.02-29.25% with a mean of 6.43 varying with season, size of fish, sex and stage of gonadal maturity. The absolute fecundity ranged between 1,720 - 68,700 eggs with a mean of 18,281 eggs while relative fecundity ranged from 19,933 to 849,453 eggs /kg with a mean of 345,000 eggs /kg of body weight. The fecundity increased with gonad weight, but showed no significant relationship with body size. Egg diameter ranged from 0.49 to 0.82 mm with a mean of 0.63 mm. The River Asa population of *B.nurse* had lower mean values of G.S.I, egg diameter, and relative fecundity but higher estimates of absolute fecundity than other populations, previously studied. These differences were thought to have emanated from differences in geographical location.

Key Words: *Brycinus nurse*, Characidae, Reproductive biology, Nigeria.

Introduction

Earlier reports of investigations into aspects of the reproductive biology of *B. nurse* include estimates of fecundity (Daget, 1952; Paugy, 1980; Albaret, 1980 and Omotosho, 1990), determination of spawning period (Daget, 1957; Blache, 1964; Reizer *et al*., 1972; Roest, 1974; Planquette and Lemasson, 1975; Paugy, 1980), sex ratio, size and age at sexual maturity (Blache, 1964; Roest, 1974; Paugy, 1980).

Female dominance in *B. nurse* has been reported amongst the population of four basins of Ivory Coast (Paugy, 1980). The species has also been known to carry out migratory movements, prior to spawning and such phenomenon has been documented by Whitehead (1959) and Reynolds (1973) in Lake Victoria and Volta respectively. *B. nurse* spawns during the peak of the floods with the specific months varying with the locality, July and October in Chad (Blache, 1964), July and September in Ivory Coast, (Paugy, 1980), June and July in River Asa and Galma, Nigeria (Omotosho, 1990).

Characids are usually highly fecund, producing small sized eggs and showing low or non-existing parental care. Estimates of absolute fecundities of 15,500 (Albaret, 1980) and 16,720 (Paugy, 1980) have been made while a relative fecundity of 368,000 eggs /kg of body weight was recorded for the species (Paugy, 1980). Mean egg size of 0.88 mm and Gonadosomatic Index of 20% were obtained in Ivory Coast (Paugy, 1980).

This study was carried out to determine, the sex ratio, Gonadosomatic Index, egg size and absolute and relative fecundity of *B. nurse* in Asa reservoir which is located approximately 4 kilometres south of Ilorin Township. It is located between latitudes 80°28' and 80°52'N and longitudes 40°35' and 40°45'E. Asa reservoir has a surface area of 302 ha (Ita *et al*., 1985), with a maximum length of 18 kilometres and a maximum depth of about 14 metres at the dam site. It can hold 45.44 million litres of water.

Materials and Methods

Specimens of *B. nurse* (n=980) ranging from 12.20 to 22.60cm (TL) and 17.96 - 134.51 g were examined for reproductive attributes. They were collected biweekly from November 1991 to October 1993, from Asa reservoir in the morning, using surface set nylon gill nets of stretched mesh sizes 3.80 to 5.00 cm.

The sex of each fish was determined externally using the shape of the anal fin (Reed *et al*., 1967).

The gonads were removed and the stages identified using the scale of Kesteven (1960).

Wet weight of the gonads were taken to the nearest millgram, using a top loading

Metler balance (model P 1200N). The Gonadosomatic Index (G.S.I) was calculated as:-

$$G.S.I = \frac{\text{Weight of Gonad}}{\text{(Total body weight of fish weight of Gonad)}} x100$$

The gonads in stages IV - VI were used in estimating the fecundity of the species.

The absolute fecundity (AF) of 169 specimens (13.20-21.50 cm,TL) and (29.04 -99.28 g) was determined as the number of ripe eggs (oocytes) in the female prior to spawning using the gravimetric method of Simpson (1951). Relative fecundity (F/kg) was also calculated for the same specimen.

Regression analysis was used to determine the relationship between fecundity and the length, weight and also gonad weight of the fish. The diameter of 40 eggs randomly selected from each female fish was measured.

Male and female mean K-values were subjected to T-test, to find out if significant difference existed between the sexes.

Results

Female dominance was observed in the species, as the sex ratio obtained over the entire study was 1.0 male to 1.78 female. Similarly females were more numerous than males in all the months of sampling, except November 1991, December 1991, May 1992 and April 1993 (Table 1).

The G.S.I of both male and female *B. nurse* ranged from 0.02 -29.25% with a mean value of 6.43 ± 0.39, (Table 2). G.S.I values were higher in the wet season, ($P<0.001$, Table 3) G.S.I increased with size of fish, ($P<0.05$, Figure 1), sex, ($P<0.01$, Table 2) and maturity of gonads, ($P<0.05$) as shown in Table 4. The seasonal cycle of the Gonadosomatic Index (Figure 2) indicated that *B. nurse* spawned between the months of March to August, with peak spawning in March, June and July.

The absolute fecundity estimate ranged from 1,720 to 68,700 eggs with a mean of 18,281 eggs while the relative fecundity estimates ranged from 19,933 to 849,453 eggs /kg of body weight, with a mean of 345,000 eggs/kg of body weight as shown in Figure 3.

Table 1. Monthly change in the sex ratio of *Brycinus nurse* in Asa reservoir, IIorin, Nigeria.

Month	Sex Ratio		
	Male	Female	Male : Female
November 91	12	03	1 : 0.25
December	24	09	1 : 0.40
January 92	16	18	1 :1.13
February	14	33	1 : 2.36
March	21	33	1 : 1.57
April	21	22	1 : 1.05
May	16	16	1 : 1.00
June	10	22	1 : 2.20
July	09	38	1 : 4.22
August	04	37	1 : 9.25
September	15	46	1 : 3.07
October	26	36	1 : 1.38
November	04	24	1 : 6.00
December	12	24	1 : 2.00
January 93	07	24	1 : 3.43
February	09	13	1 : 1.44
March	25	36	1 : 1.44
April	34	02	1 : 0.06
May	12	24	1 : 2.00
June	19	41	1 : 2.16
July	08	21	1 : 2.63
August	05	55	1 : 11.00
September	14	31	1 : 2.21
October	15	20	1 : 1.33
TOTAL	352	628	1 : 1.78

Table 2. G.S.I. for male and female *B. nurse* in Asa reservoir, IIorin, Nigeria.

	MALES				FEMALES			
	n	Range of G.S.I. Values	Mean G.S.I Values	Sem	n	Range of G.S.I. Values	Mean G.S.I Values	Sem
Nov.91- Oct. 92	63	0.05 – 1.01	0.32^{b}	0.03	146	0.02 – 24.93	5.12^{a}	0.60
Nov.92 –Oct. 93	27	0.17 - 3.04	2.03^{b}	0.14	122	0.13 - 29.25	12.13^{a}	0.56
Nov.91 - Oct. 93	90	0.05 - 3.04	0.83***	0.09	268	0.02 - 29.25	8.31	0.46

Means with the same letter are not significantly different ($P > 0.05$).
Significantly different at *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$
(T-Test comparing male and female means).

Table 3. Seasonal variation in mean G.S.I values of *Brycinus nurse* in Asa reservoir, IIorin, Nigeria.

Periods	Wet Season (April - October)				Dry Season (November - March)			
	n	Range of G.S.I. Values	Mean G.S.I Values	Sem	n	Range of G.S.I. Values	Mean G.S.I Values	Sem
Nov.91- Oct. 92	126	0.07 – 24.93	5.87***	0.67	83	0.02 – 2.00	0.33	0.03
Nov.92 – Oct.93	95	1.64 - 29.25	11.24*	0.66	54	0.13 - 24.68	8.64	0.97
Nov.91- Oct.93	221	0.07-29.25	8.18***	0.51	137	0.02 - 24.68	3.60	0.52

Means with the same letter are not significantly different ($P> 0.05$).
Significantly different at *$P < 0.05$, **$P < 0.01$, ***$P< 0.001$
(T-Test comparing wet and dry season means).

Table 4. Variation in mean G.S.I. of different stages of gonad development in *Brycinus nurse* in Asa reservoir, llorin, Nigeria.

	NOV. 91 - OCT. 92				NOV. 92 - OCT. 93				NOV. 91 - OCT. 93			
	N	Range Of G.S.I. Values	Mean G.S.I Values	Sem	N	Range Of G.S.I. Values	Mean G.S.I Values	Sem	N	Range Of G.S.I. Values	Mean G.S.I Values	Sem
Stage 1	68	0.05 - 0.70	0.25^{d}	0.02	07	0.13 - 0.21	0.17^{c}	0.01	75	0.05 - 0.70	0.25^{d}	0.02
Stage 2	67	0.02 - 1.19	0.33^{d}	0.02	03	0.26 - 0.29	0.27^{c}	0.01	70	0.02 - 0.29	0.32^{d}	0.02
Stage 3	13	0.16-1.01	0.53^{d}	0.07	07	1.16-4.41	2.19^{c}	0.42	20	0.16-4.41	1.11^{d}	0.25
Stage 4	19	0.54-9.99	5.17^{c}	0.60	11	1.12-12.57	6.11^{b}	1.13	30	0.54-12.57	5.51^{c}	0.87
Stage 5	21	0.63-19.53	10.64^{b}	1.11	18	1.60-17.54	6.33^{b}	1.04	39	0.63-19.53	8.65^{b}	1.08
Stage 6	21	11.18-24.93	19.03^{a}	0.81	103	1.64-29.25	12.97^{a}	0.59	124	1.64-29.25	13.99^{a}	0.70
Stage 7	60	-	-	-	-	-	-	-	-	-	-	-

Means with the same letter are not significantly different (P > 0.05).

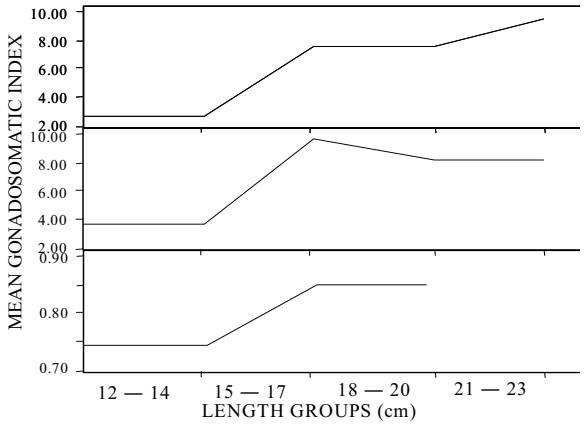

Figure 1. Variation in G.S.I. in relation to size of *B. nurse* in Asa reservoir, Ilorin, Nigeria.

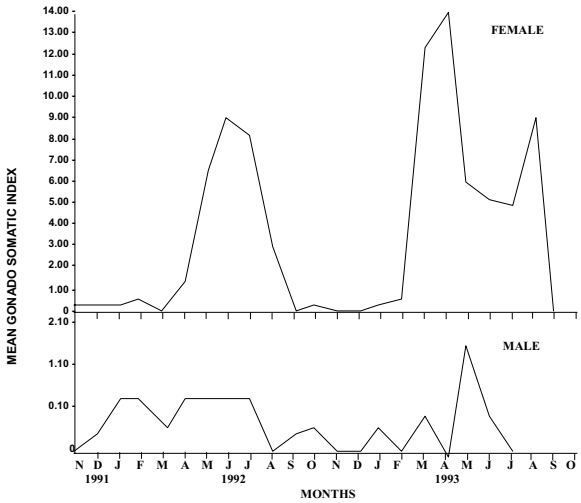

Figure 2. Monthly variation in mean gonadosomatic index in *B. nurse* in Asa reservoir, Ilorin, Nigeria.

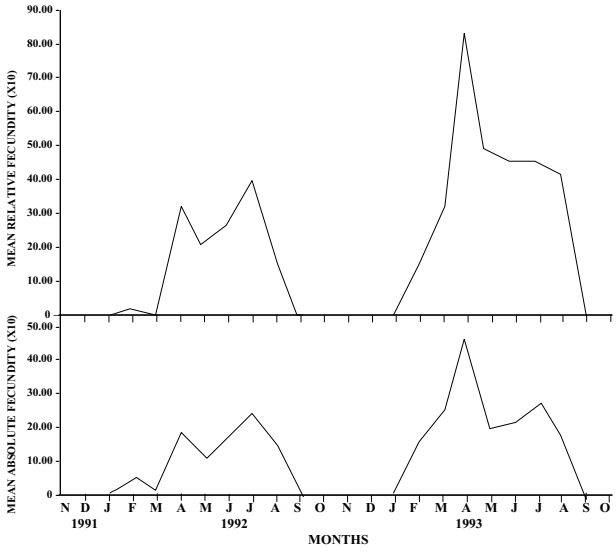

Figure 3. Monthly variation in mean fecundity estimate of *B. nurse* in Asa reservoir, Ilorin, Nigeria.

There is no significant relationship between fecundity and total length and fecundity and body weight as shown by equations l and 2 respectively.

(1). Y = 1831.65 +197.41x, (r=0.002, P>0.05).
(2). Y = 1813.11 + 61.77x, (r = 0.02, P >0.05).

However, the fecundity was positively related to gonad weight as shown by equation 3 (Figure 4)

(3). Y = 696.83 + 2237.99x, (r = 0.83, P <0.05)

The egg diameter ranged from 0.49 - 0.82mm, with a mean of 0.63±0.06. The monthly variation in egg diameter is as shown in Figure 5.

Mean G.S.I values, egg diameter and relative fecundity estimates of *B. nurse* in Asa reservoir were lower than those previously reported for the same species in Ivory Coast by Paugy (1980). However the mean absolute fecundity estimates were higher in the *B. nurse* population of Asa reservoir, than those studied by Albaret (1980) and Paugy (1980). These variations are as a result of differences in the geographical location of the populations. Since different set of environmental factors would operate within the different habitats.

The preponderance of the female specimens over the male as observed in Asa reservoir has similarly been observed by Paugy (1980) in populations of the species from four basins in Ivory Coast. Ham (1981) attributed these disparities to differential survival over certain environmental conditions while Fagade etal (1984) explained the phenomenon as a mechanism for population regulation. However the preponderance of females in Asa can be attributed to the fact that male *B. nurse* has been known to carry out migratory movements prior to spawning and such a phenomenon has been documented by Whitehead (1959) and Reynolds (1973)

The low G.S.I values obtained for *B. nurse* in Asa reservoir could be as a result of the frequency of spawning. *B. nurse* spawned between the months of March and August with peak spawning in March, June, and July (Figure 2). Imevbore (1970) observed that an increase in the frequency of spawning in fish is usually accompanied by a fall in G.S.I

The months of peak spawning corresponded with the on set of the rains and the floods. Breeding of tropical species at the beginning of the rainy season has been observed by Greenwood (1955) and Vanderwaals (1974). Harding (1966) stated that most tropical fishes are adapted to breed on the rising flood thus allowing the juveniles to take full advantage of the flooded banks for feeding while protected from predation. The choice of a particular season in fishes for breeding is influenced by various factors among which is food supply, changes in water quality or level, interspecific interactions, availability of spawning sites (Lowe Mc Connell, 1969; Baylis, 1974; McKaye, 1977; Kramer, 1978; Zaret, 1980; Ward and Samarakoon, 1981).

Adebisi (1987) reported that Characids, Cyprinids, Schilbeids, and Mochokids produce comparatively small sized planktonic eggs because they are highly fecund and show little or no parental care. This accounted for the low mean value of egg size obtained in Asa reservoir. However there was no seasonal variation in size of the eggs since the species spawned only in the rainy season.

The high absolute fecundity recorded by *B. nurse* in Asa reservoir is typical of pelagic fishes. For the Asa reservoir population of *B. nurse*, the small

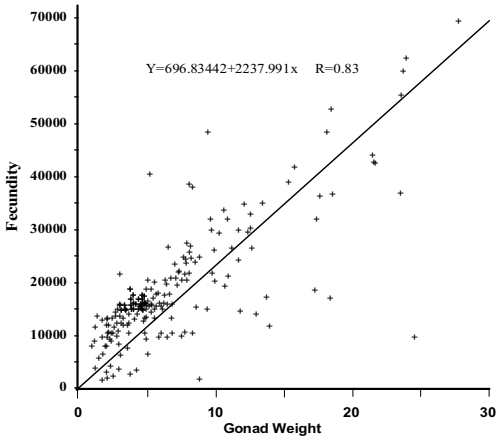

Figure 4. Relationship between fecundity and gonad weight of *B. Nurse* in Asa reservoir, Ilorin, Nigeria.

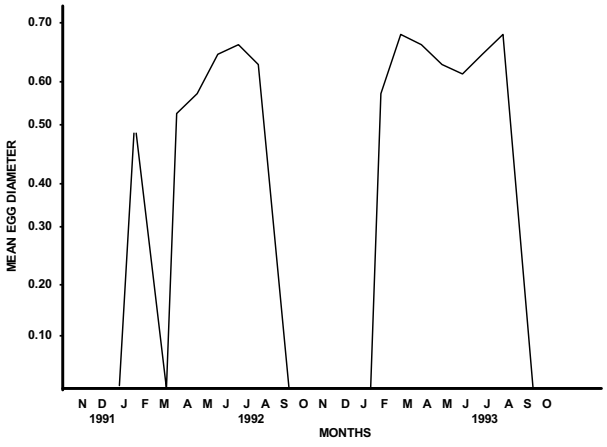

Figure 5. Monthly variation in egg diameter of *B. nurse* in Asa reservoir, Ilorin, Nigeria.

egg size, lack of parental care within the species and availability of food were factors implicated for its high fecundity.

As a conclusion from this study, it has been established that:-

- There is a preponderance of females over males within the population of *B. nurse* in Asa reservoir.
- Spawning occurred in the species during the rainy season between the months of March to August with peak spawning occurring in March, June, July, months corresponding to on set of the rains and the floods.
- The River Asa population of *B. nurse* had lower mean values of G.S.I, egg diameter and relative fecundity but higher absolute fecundity estimates than other population previously studied. These differences were thought to be purely geographical.

It is recommended that other aspects of the reproductive studies of the species within Asa reservoir, such as the migratory phenomenon amongst the males and size at sexual maturity of the species would be investigated.

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