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SOME ASPECT OF THE BIOLOGY OF *Brycinus nurse* (Alestidae, Ruppell, 1832) FROM THE LOWER RIVER BENUE RIVER NIGERIA

BY

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Abstract

The feeding habits and reproduction of Brycinus nurse was studied for 12 month period, from September, 2021 to August, 2022. A total number of 241 specimens were obtained from fishermen at the biggest commercial fish landing sites along the bank of River Benue, (Wurukum and Wadata) Makurdi and taken to the laboratory for morphometric measurements, stomach content examination, and fecundity estimation. Out of 241 specimens obtained, 110 (45.61%) were males, while 131 (54.32%) were females with the male to female sex ratio of 1:1.2. The standard length and total weight ranges of males were 7.0-17.0cm with a mean of 10.76±0.218 and 6.26-104.77g with a mean of 30.094±1.969 respectively, Females were 7.0- 17.2cm with a mean of 11.09±0.192 and 6.47-103.48g with the mean of 32.602±1.747 respectively. The mean condition factor (K) ranged from 1.760 to 2.426 in males and 1.844 to 2.903 in females, while the highest K of 2.903 was observed in the females. Out of 241 stomachs examined in the laboratory, 41 (37.27%) and 43 (32.82%) were empty in males and females respectively, while 69 (62.73%) in males and 88 (67.18%) in females had varied quantities of food. The species was found to be omnivorous feeding on food items that comprised of plant materials, algae, insects, molluscs, crustaceans, fish scales, protozoa, rotifers, detritus, sand, and unidentified food items. The gonado-somatic index (GSI) of the female specimens revealed that the species spawn only one time in a year, from May to August, with peak in May, June, and July. The species had high absolute fecundity ranging from 3,247-28,388 eggs and egg diameter range of 0.5-1.0mm with a mean of 0.7±0.2.

Keywords: *Brycinus nurse, Lower Benue River, Food, Fecundity*

1. Introduction

Food availability is one of the critical factors that influenced the survival of fish (Oribohabor *et al*., 2019). Fish diet has been found to be an important factor governing fish growth, condition factor, fecundity, and migration patterns (Adeyemi *et al*., 2009). Fish digestive system varies with their feeding habits which include; carnivorous, omnivorous, and herbivorous.

The study of some of the biology of some fish species with preference to their diet composition is an important aspect in fish biology (Abdul *et al*., 2016). The analysis of stomach contents in fish is a common method in investigating the diet of fish and does describing food chains and webs shared by different species. Such studies also reveal interactions among species (Kenneth *et al*., 2004). Information on their diet provides further support on practices of aquatic management, especially agriculture, aquaculture and conservation (Saikia, 2015).

Knowledge about fecundity of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery (Musa and Bhuiyan, 2007). Fecundity of an individual female varies according to many factors, such as age, size, species, food availability, water temperature and season (Akombo, 2013). Fishes that do not care for their eggs lay large numbers of eggs. Those that make elaborate and provide parental care to their young have their eggs ranging from 30 – 100, while those that bear their young alive and accord an extreme care like external incubation, have a usual brood of less than two dozen (Lagler *et al*., 1977).

The freshwater fish *Brycinus nurse* (Order: Characiformes; Family: Alestidae), is a bony fish and an important fish in the ecology of tropical waters as well as in the resources of aquatic systems of the subtropical region (Uneke and Nwani, 2013). This species is a native to freshwater systems in Africa, thriving well in both lacustrine and riverine conditions (Saliu, 2002). In the Lower River Benue, they are abundantly found when there is reduction in water level.

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Although a study on reproduction of *B. nurse* from Asa Reservoir has been carried out by Saliu and Fagade (2003) and, Uneke and Nwani (2013) in a tropical flood river system, there is still paucity of knowledge on the reproduction of this species. Since reproductive patterns of fish differ when considering the habitat, geographical zone and species (Paugy, 2002), this research will therefore provide base-line data on feeding habits and reproduction of *B. nurse* from the Lower River Benue.

2. Materials and Methods

2.1. Description of Study Area

The study area is the Lower Benue River, Makurdi. It is one of the major rivers in Nigeria (Aho *et al*., 2014). The Lower River Benue originates from the Adamawa mountains of Cameroon, some 500km bounding the Nigerian frontier (Ogbe and Ataguba, 2010), and flows westward for about 1,400km until it meets the Niger River about 450km above the delta, near the city of Lokoja, Kogi State, Nigeria (Ashley, 2010). The flood plains of the river are characterized by extensive swamps and ponds which have potential for dry season irrigated farming (Abah and Petja, 2017). The highest water levels occur in August and September and the lowest from March to April. The water temperatures range between 22 and 26°C for most of the year (Okayi, 2002).

2.2. Sampling Method

Fish samples were obtained from fishermen at the biggest commercial fish landing sites (Wurukum and Wadata) along the bank of River Benue, Makurdi. The fishes were procured twice in a month for one year. They were transported to the Zoology Laboratory, Benue State University for measurements. Keys of Reed *et al*., (1967) and Holden and Reed (1972) were used for identification of the species.

2.3. Length-Weight Measurements

The (SL) of each specimen were measured in centimeter using a measuring board. The SL was measured from the anterior extremity of the fish to the hidden base of the midian tail rays. The total body weight (BWT) was measured to the nearest 0.1 grammes using a digital electronic weighing balance (ADAM AFP 4l00L).

2.4. Sex Determination

The sexes of the fish were determined after observing the shape of the anal fin (concave or straight in female and convex in male, Reed *et al*., 1967) and after dissecting of the fish to inspect the gonads. In matured females, gonads were gray in colour with blood vessels running over the eggs which were readily discernable in the ovaries. The female gonads were classified using the scale of Brown-Peterson *et al*. (2011) in which five gonadal maturity stages were observed as follows: Stage I, immature; Stage II, developing; Stage III, spawning; Stage IV, regressing and Stage V, regenerating. The weights of the gonads were taken using the aforementioned weighing balance. The gonads in stages II-IV were then preserved in Gilson fluid to harden and release the eggs from the ovarian tissue for 8-12 weeks.

2.5. Food and Feeding Habits

The stomachs of the dissected fishes were removed and preserved in 4% formalin for subsequent examination of the food items. Each stomach sample was then opened and the content emptied in a Petri dish. Some of the food items were identified macroscopically. Slides preparations were made and examined under a light microscope (Olympus Camera Microscope M-CX31RTSF) using x 10 and x 40 objectives. The stomach contents were analysed using:

i. Frequency of occurrence method

Frequency of occurrence (FO) of food items were calculated using the formula:

$$\%\ of\ food\ sample = \frac{No\ of\ stomchs\ with\ food\ item}{Total\ No\ of\ non-empty\ stomchs} X\ \frac{100}{1}$$

ii. Numerical method

Different types of items in the stomach content of the fish species were calculated under numerical method (NM) using the formula:

$$NM = \frac{Food\ item}{Total\ No\ of\ different\ food\ items} X\ \frac{100}{1}$$

2.6. Fecundity Estimation

Gonads in the Gilson's fluid were vigorously shaken at intervals until all the eggs were liberated from the ovarian tissues. The ovarian tissues were removed by vigorously shaking the eggs in water then, decanting the water. The clean eggs were pour on a labeled filter paper to hand pick the remaining ovarian tissues. The washed eggs were dried in an oven at 25°C for 48 hours. Dried eggs in a 0.1 gram three subsamples were counted. The mean number of eggs in the three subsamples gave the number of eggs per 0.1 gram weight. Fecundity was determined using the formula:

$$f = \frac{Wt\ of\ eggs}{Wt\ of\ sub-Sample} X\ \frac{No.\ of\ eggs\ in\ sub-Sample}{1}$$

f= Fecundity

Wt=Weight

The diameter of 100 eggs randomly selected per female fish was measured to determine its size. An eyepiece graticule which was calibrated using a stage micrometer was inserted in the eyepiece of a binocular microscope and used for measurement of egg diameter.

2.7. Gonado-somatic Index (GSI)

The gonado-somatic index (GSI) was calculated based on the formula suggested by Lagler*et al.,* (1977) which was expressed as

$$GSI = \frac{Gonad\ weight}{Total\ body\ weight} X\ \frac{100}{1}$$

2.8. Condition Factor (K)

The Fulton's condition factor (K) was determined for each specimen using the equation:

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

Where W = the observed weight for each fish

L = the observed standard length for each fish, and

K'= the condition factor.

3. Results

Table 1 below shows the sex ratio of *Brycinus nurse* obtained from the study. The species had more females than males in all the months except in January, 2022, (N=21), April, 2022

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(N=13) and May, 2022 (N=6). In August, 2022 and March, 2022, no male and female were obtained respectively. The species was not found in the month of February, 2022.

Table 1.*Monthly Sex Ratio of Brycinus nurse From the Lower Benue River, Nigeria (September, 2021- August, 2022).*

Month	Male(M)	Female(F)	Total	Sex RatioM: F
Sept.,2021	8	15	23	1:1.9
Oct.,2021	20	29	49	1:1.5
Nov.,2021	15	25	40	1:1.7
Dec., 2021	13	22	35	1:1.7
Jan.,2022	21	13	34	1.6:1
Feb., 2022	-	-	-	-
Mar., 2022	7	-	7	7:0
April,2022	13	1	14	13:1
May,2022	6	4	10	1.5:1
June,2022	4	12	16	1:3
July,2022	3	5	8	1:1.7
Aug.,2022	-	5	5	0:5
Total	110	131	241	1:1.2

Table 2.*Morphometric Parameters and Condition Factor of Brycinus nurse From the Lower Benue River, Nigeria (September, 2021 August, 2022).*

Month	Sex	SL(cm)	Mean SL(cm)±SE	WT(g)	Mean WT (g)±SE	K
September,2021	M	8.0-13.6	11.41±0.866	10.36-61.03	38.968±7.872	2.279
	F	8.5-15.7	11.95±0.688	14.12-80.50	44.511±6.359	2.325
October,2021	M	7.2-15.5	11.29±0.527	9.22-82.34	35.570±4.587	2.229
	F	7.0-13.8	9.97±0.347	6.47-88.49	25.908±3.133	2.903
November,2021	M	9.4-17.0	13.64±0.572	15.51-104.77	57.987±6.550	2.102
	F	9.0-17.2	12.62±0.518	14.16-103.48	45.962±5.191	2.039
December,2021	M	8.7-11.6	13.64±0.572	17.57-30.09	23.349±1.048	1.877
	F	7.6-14.0	12.62±0.518	9.95-47.50	23.851±1.639	1.954
January,2022	M	7.0-11.2	8.48±0.233	7.12-37.96	13.587±1.593	2.079
	F	7.6-10.5	9.04±0.222	9.05-26.67	16.743±1.325	2.212
February,2022	M	-		-	-	-
	F	-		-	-	-
March,2022	M	10.5-11.2	10.13±0.084	19.13-25.33	21.746±0.894	2.086
	F	-	-	-	-	-
April,2022	M	7.3-13.6	9.99±0.469	6.26-50.84	22.609±3.788	1.904
	F	10.2-10.2	10.20±0.000	20.79-20.79	20.79±0.000	1.959
May,2022	M	11.5-13.7	12.48±0.378	30.80-51.60	40.867±3.696	2.073
	F	10.0-13.3	11.88±0.759	20.43-55.74	38.058±8.507	2.142
June,2022	M	8.2-11.2	9.53±0.692	11.25-28.67	19.213±3.620	2.175
	F	10.6-14.9	12.29±0.342	24.84-62.65	40.856±3.559	2.148
July,2022	M	9.9-11.2	10.40±0.404	17.18-28.67	20.130±3.223	1.760
	F	10.2-14.5	11.90±0.719	20.62-59.83	34.294±6.784	1.944
August,2022	M	-		-	-	-
	F	9.1-11.4	10.66±0.411	16.38-32.09	25.122±2.532	2.058

The result of the morphometric parameters of the fish revealed that the highest standard length (SL) was 17.2cm in female and 17.0cm in male while the highest body weight (WT) was 104.77g and 103.48g in male and female respectively. The lowest SL obtained was 7.0cm in both sexes while the lowest weight was 6.26g and 6.47g in male and female respectively (Table 2).

3.1. Condition Factor

The relative mean monthly condition factor of the species from September, 2021 to August, 2022 was observed to be higher in the wet season (Fig.1). In males, the lowest K (1.760) was observed in July, 2022 while the highest K

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(2.279) was obtained in September, 2021. In females, the lowest K (1.944) was observed in July, 2022 while the highest K (2.903) was obtained in October, 2021.

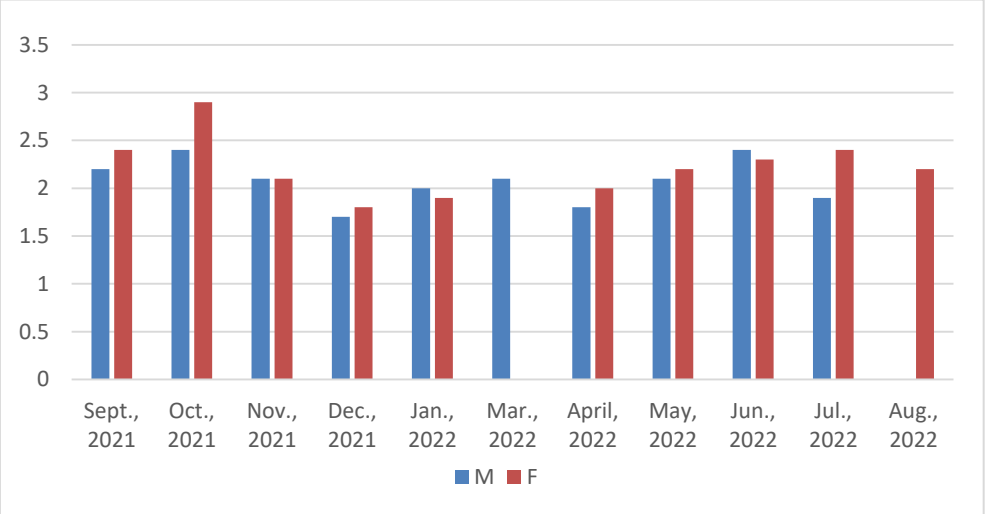

Fig. 1.*Mean Monthly condition factor of B. nurse from Lower Benue River.*

3.2. Food and Feeding of B. nurse

The results of the stomach content analysis of *B. nurse* examined from September, 2013 to August, 2014 revealed that the species were omnivorous with diets comprising of different food items. The prominent food items were plant remains artificial meal, unidentified seeds, algae, detritus and insect parts while the less prominent food items were bivalves, fish scales, amoebae, sand particles and rotifers parts (Table 3 and 4).

Table 3.*Stomach Content of Brycinus nurse from the LowerBenue River, Nigeria Using Frequency of Occurrence Method (September, 2021-August, 2022).*

Food item	Sept.,2021	Oct.,2021	Nov.,2021	Dec.,2021	Jan.,2022	Feb.,2022
PLANT						
Plant remains	5.06	18.35	12.66	8.23	12.03	-
Unidentified seeds	3.16	4.43	4.43	0.63	0.63	-
Artificial meal	6.96	12.66	11.39	9.49	-	-
ALGAE						
Surface water algae	3.79	12.03	4.43	3.16	5.69	-
Filamentous algae	1.27	3.79	1.27	-	1.27	-
Pigmented algae	0.63	0.63	1.27	1.27	0.63	-
Diatoms	-	12.66	3.16	3.79	0.63	-
INSECTS						
Insects parts	1.27	5.69	1.89	2.53	1.27	-
Insect larvae	-	0.63	0.63	-	-	-
MOLLUSCS						
Bivalves	-	0.63	-	-	-	-
CRUSTACEANS						
Crustacean parts	-	1.89	0.63	2.53	0.63	-
FISH						
Fish scales	-	-	0.63	-	-	-
PROTOZOA						

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Amoebae	-	-	-	0.63	-	-
ROTIFERS						
Rotifer parts	-	-	-	-	2.53	-
Detritus	2.53	7.59	8.86	6.33	5.06	-
Sand particles	-	-	-	-	1.89	-
Unidentified items	7.59	12.03	3.16	5.06	4.43	-

Table 3.*Stomach Content of Brycinus nurse from the LowerBenue River, Nigeria Using Frequency of Occurrence Method (September, 2021-August, 2022)*

Food item	**Mar.,2022**	**Apr.,2022**	**May,2022**	**Jun.,2022**	**Jul.,2022**	**Aug.,2022**
PLANT						
Plant remains	0.63	5.06	-	5.69	4.43	0.63
Unidentified seeds	3.16	-	-	-	1.27	0.63
Artificial meal	1.89	-	1.27	0.53	0.63	-
ALGAE						
Surface water algae	1.27	3.79	-	1.27	1.89	-
Filamentous algae	-	1.89	-	1.89	1.27	-
Pigmented algae	-	0.63	-	-	-	1.89
Diatoms	0.63	1.89	0.63	0.63	2.53	-
INSECTS						
Insects parts	2.53	0.63	-	0.63	1.89	-
Insect larvae	-	-	-	-	-	-
MOLLUSCS						
Bivalves	-	-	-	-	-	-
CRUSTACEANS						
Crustacean parts	-	-	-	-	-	-
FISH						
Fish scales	-	-	-	0.63	-	-
PROTOZOA						
Amoebae	-	-	-	-	-	-
ROTIFERS						
Rotifer parts	-	0.63	-	0.63	-	-
Detritus	-	3.79	-	2.53	0.63	1.27
Sand particles	-	0.63	-	-	-	-
Unidentified items	-	3.16	0.63	3.16	2.53	-

Table 4.*Stomach Content of Brycinus nurse from Lower Benue River, Nigeria Using Numerical Method (September, 2021-August, 2022).*

Food item	**Sept.,2021**	**Oct.,2021**	**Nov.,2021**	**Dec.,2021**	**Jan.,2022**	**Feb.,2022**
PLANT						
Plant remains	***	*	*	*	*	-

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Unidentified seeds	2.12	2.65	2.38	0.53	0.53	-
Artificial meal	*	*	*	*	-	-
ALGAE						
Surface water algae	2.91	6.08	2.65	2.38	3.70	-
Filamentous algae	0.53	1.85	0.53	-	0.53	-
Pigmented algae	0.26	0.26	0.53	0.53	0.26	-
Diatoms	-	6.61	1.32	2.12	0.26	-
INSECTS						
Insects parts	0.79	2.91	1.59	1.85	1.27	-
Insects larvae	-	0.26	0.53	-	-	-
MOLLUSCS						
Bivalves	-	0.26	-	-	-	-
CRUSTACEANS						
Crustacean parts	-	*	*	*	*	-
FISH						
Fish scales	-	-	0.26	-	-	-
PROTOZOA						
Amoebae	-	-	-	0.26	-	-
ROTIFERS						
Rotifer parts	-	-	-	-	1.06	-
Detritus	*	*	*	*	*	-
Sand particles	-	-	-	-	*	-
Unidentified items	3.97	5.56	2.65	5.06	4.43	-

Table 4.*Continued.*

Food item	**Mar.,2022**	**Apr.,2022**	**May,2022**	**Jun.,2022**	**Jul.,2022**	**Aug.,2022**
PLANT						
Plant remains	*	*	_	*	*	*
Unidentified seeds	1.59	-	-	-	0.53	0.26
Artificial meal	*	-	*	*	*	-
ALGAE						
Surface water algae	1.06	2.65	-	0.79	0.79	-
Filamentous algae	-	0.79	-	1.32	0.53	0.79
Pigmented algae	-	0.26	-	-	-	-
Diatoms	0.26	0.79	0.26	0.26	1.85	-
INSECTS						
Insects parts	1.06	0.26	-	0.26	0.79	-
Insects larvae	-	-	-	-	-	-
MOLLUSCS						

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Bivalves	-	-	-	-	-	-
CRUSTACEANS						
Crustacean parts	-	-	-	-	-	-
FISH						
Fish scales	-	-	-	0.26	-	-
PROTOZOA						
Amoebae	-	-	-	-	-	-
ROTIFERS						
Rotifer parts	-	0.26	-	0.53	-	-
Detritus	-	*	-	*	*	*
Sand particles	-	*	-	*	-	-
Unidentified items	-	2.12	0.79	2.91	1.06	-

* Undeterminable using this method

3.3. Fecundity and Gonado Somatic Index of Brycinus nurse

The lowest number of eggs was found in a fish with SL of 11.8cm, WT of 33.20g, gonad weight of 0.49g, egg size range of 0.6 – 1.0mm and fecundity of 3,247 eggs, while the highest was observed in a specimen with SL of 13.3cm, WT of 55.74g, gonad weight of 3.85g, egg size range of 0.6 – 0.7mm and fecundity of 28, 388 eggs. The mean gonado-somatic index ranged between 0.470±0.000-5.085±1.825.

Table 5.*Fecundity and Gonado-somatic Index of Brycinus nurse from the Lower Benue River, Makurdi (September, 2021 – August, 2022).*

Month	Standard length (cm)	BodyWeight (g)	Gonad weight(g)	Egg sizeRange (mm)	Fecundity	GSI	Mean GSI
May, 2022	12.9	49.10	1.60	0.6-0.9	10, 128.00	3.26	5.085±1.825
	13.3	55.74	3.85	0.6-0.7	28, 388.00	6.91	
June, 2022	11.8	33.20	0.49	0.6-1.0	3,247.00	1.33	2.137±0.684
	14.9	62.65	0.31	-	-	0.49	
	13.3	53.62	0.27	-	-	0.50	
	12.6	38.37	2.74	0.9-1.0	19,709.00	7.14	
	12.0	31.24	0.31	-	-	0.99	
	12.0	41.83	0.98	0.5-0.9	6,135.00	2.34	
	12.4	45.01	0.56	0.5-0.6	3,437.00	1.24	
	11.5	33.57	0.91	0.5-0.8	6,049.00	2.71	
	11.0	24.84	0.62	0.6-0.9	3,970.00	2.49	
July, 2019	14.5	59.83	1.64	0.5-0.9	12,770.00	2.74	2.358±0.604
	11.2	25.64	1.00	0.5-0.7	6,667.00	3.90	
	10.2	20.62	0.30	-	-	1.45	
	12.1	33.53	0.45	-	-	1.34	
Aug., 2014	10.6	26.04	0.15	-	-	0.47	0.47±0.000

4. Discussion

On the whole, the number of female *B. nurse* exceeded that of the male with the ratio of 1:1.2 during the study period (Table 1). Uneke and Nwani (2013) observed that *B. nurse* had more females than males with the male to female sex ratio of 1:1.5 for *B. nurse* in a tropical flood river system, Cross River State. Abdulkarim *et al* (2017) reported a sex ratio of 1:1.17 for *B.*

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nurse in Gudi Dam, Bauchi State. Ham (1981) attributed these disparities of differential survival over certain environmental conditions while Fagade *et al*., (1984) explained the phenomenon as mechanism for regulation. Saliu and Fagade (2003) explained that the males of *B. nurse* have been known to carry out migratory movements prior to spawning. Nieto-Nevarro *et al*., (2010) explained that the differences in observations could be due to seasonal variability of the environment, food availability, sampling size and length interval within different areas or habitat suitability. According to Khallaf and Authman (2010), sex ratio in fishes varied from one species to another.

The lower and the higher values of mean condition factor (k) recorded for *B. nurse* ranging from 1.760 – 2.279 in males and 1.944 – 2.903 in females (Table 2 and fig. 1) implies that they could survive better even when biotic and abiotic factors are less favorable. Ogbe *et al*., (2008) obtained a peak condition in December for *A. nurse* in River Benue. Uneke (2014) observed the condition factors ranging from 1.0 – 3.4 for *B. nurse* in a tropical flood river basin. Ahmed *et al*., (2011) recorded a K value range of 0.506 and 3.415 for six fish species in Atbara River and Khashm el-girba reservoir, Sudan. In Ologe Lagoon, Lagos, Kumolu-Johnson and Ndimele (2010) reported the condition factors of 0.12 – 16.29 for 21 fish species. Kumolu-Johnson and Ndimele (2011) stated that the condition factors of the nine fish species ranged between 0.91 – 8.46 and that 56% of the nine fish species had their K-values outside the range of 2.9 – 4.8 recommended as suitable for mature fresh water fish by Bagenal and Tesch (1978). The condition factor range of 1.760-2.903 obtained for this study was not far from the 2.88 obtained by Ogbe *et al.,* (2008) for *A. nurse* in River Benue and 1.94-2.80 reported by Ikomi and Sikoki (2003) for *B. longipinnis* in Jameison River, Niger Delta, Nigeria.

The relative mean monthly condition factors of the species was higher in the rainy season than the dry season, indicating that the fish was in better condition in the wet than the dry season (Fig.1). This could be due to availability of more food during this period. However, the decrease in July could be attributed to spawning activity. Lizama and Ambrosio (2002) who worked on nine species of fish of the characidae explained that during the reproductive period the fish often does not feed, but uses lipid reserves necessary for spawning and the condition factor and the quantity of accumulated fat follow the rhythm of reproductive process.

A sum total of 241 stomachs of *B. nurse* were examined for food content analysis. Out of the number of stomachs examined, 41 (37.27%) and 43 (32.82%) had empty stomachs in males and females respectively, while 69 (62.72%) in males and 88 (67.17%) in females contained varied quantities of food items.

The stomach content analysis results (Tables 3 and 4) shows that *B. nurse* examined during the study period were omnivores with their diets comprising of plant remains, algae, diatoms, insect larvae, insect parts, artificial meal (probably used by fishermen as baits), crustaceans, fish scales and detritus. Uneke (2014) reported that B. nurse in the Cross River basin was basically an omnivore and consequently fed on a broad spectrum of food items ranging from various types of plankton to invertebrates and plants. Ogbe *et al* (2008) showed that *A. nurse* in River Benue was omnivorous where fish materials (formed the major food item); invertebrates such as prawns, insects (ephemeropteran larvae and chironomid larvae, diptera, hemiptera and plecoptera), worms and plant materials were present in the fish stomachs. Abdulkarim *et al* (2017) reported that the diet of *B. nurse* from Gubi Dam was composed of animal and plant materials, zooplanktons, algae, detritus and stone particles. Oronsaye and Nakpodia (2005) observed that *B. nurse* in a tropical river was herbivorous. The presence of plant remains, seeds, artificial meal and surface water algae in the stomachs of the fish species indicates that they are surface feeders (pelagic).

The size at maturity of this fish ranged from 10.2 – 14.9cm standard length. Abdulkarim *et al* (2017) obtained 12 – 17cm total length for *B. nurse* in Gubi Dam, Bauchi State while Uneke and Nwani (2013), reported 10. 2cm TL for the smallest sexually mature female and 12.32cm TL as the median size at maturity for female *B. nurse* from Cross River Basin, Nigeria. The influence of varying environmental conditions on maturity and reproductive traits of fishes in the West African aquatic systems have been reported by Duponchelle and Legendre (2001), Panfili *et al*., (2004), Laléyé *et al*., (2006) and Shinkafi *et al*., (2011). According to Wooten (1979), a fish should reproduce at that time of the year that will tend to maximize its life time production of offspring. The larval fish must hatch into a world that can provide appropriate food, protection and benign abiotic conditions.

The absolute fecundity of *B. nurse* in this study was high ranging from 3,247 – 28,388 eggs (Table 5). Abdulkarim *et al* (2017) obtained absolute fecundity of 334 – 2,879 eggs for *B. nurse* in Gubi Dam, Bauchi State, Nigeria. Ajiboye *et al* (2019) reported absolute fecundity of 5,838 to 39,208 eggs for B. macrolepeidotus in Akomoje water reservoir, Abeokuta, Nigeria. The number of eggs obtained in this study fell within the range of 1,720 – 68,700 eggs reported by Saliu and Fagade (2003) for *B. nurse* in Asa Reservoir, Ilorin, Nigeria. The variations are as a result of the differences in the geographical location of the populations, since different set of environmental factors would operate within the different habitats (Shafi, 2012). Difference could also be attributed to the size (length-weight), species and food availability of the species (Ajiboye *et al*, 2019).

The egg diameter of the studied fish ranged from 0.5 – 1.0mm with a mean of 0.7 ±0.2 (Table5). These results are similar with the findings of Saliu and Fagade (2003) who reported the egg diameter of 0.49 – 0.82mm with a mean of 0.63 ± 0.06 for *B. nurse* from Asa Reservoir, Ilorin. Other results obtained from different fish species include 0.60 – 2.50mm (mean 1.31±0.33mm) for *Auchenoglanis occidentalis* by Shinkafi and Ipinjolu, (2012), 0.4 – 0.9mm (mean 0.3 ± 0.2 – 0.9± 0.1mm) for *Synodontis* species from River Benue (Akombo, 2013). The differences in the egg diameter could be as a result

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of different gonadal maturity stages, nutritional status or well being of the fish and species genetics.

The gonado-somatic (GSI) indices of the female were higher (6.91) in May than the rest of the months. Uneke and Nwani, (2013) obtained a GSI of 2.68 ± 0.19 and 5.71±1.28 for males for females *B. nurse* respectively, with a range between 0.1-15.9 in Cross River Basin. Ikomi and Sikoki, (2003) stated a mean range of 1.56 – 3.65 with an average of 2.26 for *B. longipinnis* at Jamieson River, Niger Delta. Ogbe and Ataguba, (2010) reported the highest mean GSI of 1.48±0.76 and 2.71±1.38 for males and females *H. bebeoccidentalis* respectively in River Benue, Makurdi. They also reported the highest mean GSI of 1.29±0.69 and 2.34±0.1 for males and females *Mormyrops anguilloides* respectively in River Benue, Makurdi.

The result of this study indicated that *B. nurse* spawn once in the annual breeding season from May to August with the peak in May, June and July. In Asa Reservoir, Niger Delta, Saliu and Fagade (2003) reported March to August with peak spawning in March, June and July for *B. nurse*. Breeding activities of *B. longipinnis* in the Jamieson River, Niger Delta occur throughout the year and were also observed to be multiple spawners (Ikomi and Sikoki, 2003). Uneke and Nwani, (2013) reported that March – August maybe the spawning period for *B. nurse* in the Cross River Basin. Ogbe and Ataguba (2010) stated that spawning began from June and ended in September in *M. anguilloides* with principal spawning taking place in August while *H. bebeoccidentalis* spawn between May and October in River Benue, Makurdi. The differences in the observations of spawning period could be explained on the different localities and climatic conditions of the habitats and the species. According to Shinkafi and Deneji (2011), flood among other things provided expanded habitat and abundant food and most fishes spawned during this period so as to ensure the survival of the huge number of the young fish produced, provide reproductive niche and shelter for the juveniles, and consequently ensuring reproductive success.

5. Conclusion

Some aspects of biology of *Brycinus nurse* studied revealed that this fish species was omnivorous with good condition factor as well as high absolute fecundity from the Lower Benue River, Nigeria.

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References

1. Brown-Peterson N. J., Wyanski D. M., Saborido-Rey F., Maccewicz B. J. and Lowerre-Barbieri S. K. (2011). A standardized terminology for describing reproductive development in fishes, marine and coastal fisheries, 3:1, 52-70.
2. Oribhabor B. J., Akpan A. E. and David G. S. (2019). The food and feeding habits of fishes of a coastal Nigeria River. *Scientific Research Journal, vol.* vii(ix):43-63.
3. Saikia S. K. (2015). Food and feeding of fishes. What do we need to know? *Transylv. Rev. Syst. Ecol. Res*., 17(1):71-84.
4. Abdul W. O., Omoniyi I. T., Agbon A. O., Adeosun F. I., Olowe O. S. and Adekoya E. O. (2016). Food and feeding habits of some fish species in Ogun State Coastal Estuary, Ogun State, Nigeria. *J. Agric. Sci. and Env*., 16(1):61-74.
5. Adeyemi S. O., Bankole N. O. and Adikwu A. I. (2009). Food and feeding habits of *Protopterus annectens* (Owen) in Gbedikere Lake , Bassa, Kogi State, Nigeria. *Cont. J. Biol. Sci.* 2:7-11.
6. Shinkafi B. A., Ipinjolu J. k. and Hassan W. A. (2011). Gonad maturation stages of *Auchenoglanis occidentalis* (Valenciennes, 1840) in River Rima, North-western Nigeria. *J. Fish. Aquat. Sci*., 6(3):236-246.
7. Ajiboye E. O., Adeosun F. I. and Oghenochuko M. T. O. (2019). Assessment of fecundity of *Brycinus macrolepidotus* in Akomoji Water Reservoir, Abeokuta, South West, Nigeria. Egyptian journal of aquatic Biology and Fisheries, vol. 23(1):245-252.
8. Shafi S. (2012). Study on fecundity and GSI of *Carassius carassius* (Linneaus, 17580) introduced from Dal Lake Kashmir. *Journal of biology, Agriculture and Healthcare*, 2(3)68-75).
9. Aho I. M., Utsev J.T. and Isikwue M. O. (3014). Trend analysis of raw water parameters in River Benue at the reach of Makurdi, Nigeria. *Global Journal of Engineering Research*, vol. 13, 1-9.
10. Ashley B. (2010). Freshwater eco-regions of the world. The natural conservancy WWF/TNC p.28.
11. Abah R. C. and Petja B. (2017). Increased stream flow dynamics and implications for flooding in the Lower River Benue Basin. *African Journal of Environmental Science* and technology vol. 11(10):544-555.
12. Abdulkarim M., Yusuf C. D. and Suleiman S. B. (2017). Preliminary studies on the potentialities of *Brycinus nurse* (Ruppell, 1832) for aquaculture in Nigeria. *Nigerian Journal of Fisheries and Aquaculture* 5(1):30-36.
13. Uneke B. I. and Nwani C. D. (2013). Stock assessment of *Brycinus nurse* (Characiformes: Alestidae) in a Tropical Flood River System. *Continental J. Fisheries and Aquatic Science* 7(3):22-23.
14. Ahmed E.O., Ali M.E. and Aziz A.A. (2011). Length –weight relationships and condition factors of six fish species in Atbara River and Khashm el-girba Reservoir, Sudan. *International Journal of Agriculture Sciences.* 3(1):65–70.
15. Akombo P.M. (2013). Population dynamics of the Catfish (*Synodontis*, Cuvier, 18116) in the Lower Benue River. Ph.D. Thesis, Benue State University, Makurdi (Unpublished).

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16. Bagenal T.B. and Tesch F.W. (1978). Methods for assessment of fish production I freshwaters.I.B.P. Handbook No. 33rdedn. *Oxford Blackwell Publications*, 365.
17. Duponchelle F. and Legendre M. (2001). Rapid phenotypic changes of reproductive traits in response to experimental modifications of spatial structure in Nile tilapia (*Oliochromisniloticus*). *Aquatic Living Resources,* 14: 145-152.
18. Fagade S.O., Adebisi A.A. and Atanda A.N. (1984). In: Saliu J.K. and Fagade S.O. (2003). The reproductive biology of *Brycinus nurse* (Paugy 1986), Pisces- Characidae in Asa Reservoir, Ilorin, Nigeria. *Turkish Journal of Fisheries and Aquatic Studies*, 3:5-9.
19. Ham R. (1981).The ecology of six native and two introduced fish species in Enoggera creek system, south east, queens land. Bsc. (Hons) thesis, Griffith University, Brisbane, 157.
20. Holden M. and Reed W. (1972). West African Freshwater Fish. *Longman Group Ltd*., 46 -49.
21. Ikomi R.B. and Sikoki F.D. (2003). Studies on the ecology of the African longfin tetra, *Brycinuslongipinnis* Gunther 1864 in the Jamieson River (Niger Delta, Nigeria). *ActaIchthyol. Piscat*. 33(1):17–36.
22. Khallaf E.A. and Authman M.N. (2010). Some biological aspects of the Nile Mormirid fish (*Mormyruskannume*, Forsskal, 1775) from Bahr Shebeen Nilotic canal, Egypt. *World J. Fish Mar. Sci.*, 2: 357-375.
23. Kumolu-Johnson C.A. and Ndimele P.E. (2010). Length-weight relationships and condition factors of twenty-one fish species in Ologe Lagoon, Lagos, Nigeria. *Asian Journal of Agricultural Science,* 2 (4): 174-179.
24. Kumolu-Johnson C.A. and Ndimele P.E. (2011). Length-weight relationships of nine fish species from Ologe Lagoon, Lagos, Nigeria.*African Journal of Biotechnology*, 10 (2): 241 – 243. http://www.academicjournals.org/AJB.
25. Lagler K.F., Bardach J.E., Miller R.R. and Passino D.R.M. (1977). Ichthyology (Second Edition). *John Wiley and Sons Inc*. Canada, 130-506.
26. Lalèyè P., Chikou A., Gnohssou P., Vandewalle J. C. P. and Teugels G. (2006). Studies on the Biology of two species of catfish *Synodontis schall* and *Synodontisnigrita* (Ostariphysi: Mochokidae) from the Ouémé River, Bénin. *Belg. J. Zool*., 136 (2): 193-201.
27. Lizama M. De Los A. P. And Ambrosio A. M. (2002). Condition factor in nine fish species of the caracidae family in the Upper Parana River Floodplain, Brazil. Braz. J. Biol. vol. 62 no.1.
28. Musa A.S.M. and Bhuiyan A.S. (2007). Fecundity on *Mystusbleekeri* (Day, 1877) from the River Padma, near Kajshahi city. *Turkish Journal of Fisheries and Aquatic Sciences,* 7: 161-162.
29. Nieto-Navarro J.T., Zetina-RejonArreguin-Sanchez Arcros-Huitron N.E. and Petria-Mesina (2010). Length-weight relationships of dermersal fish from the eastern coast of California. *Journal of fisheries and Aquatic Sciences,* 5 (6): 494-502.
30. Ogbe F.G. and Ataguba G.A. (2010). Reproductive cycle of *Mormyropsanguilloides* and *Hypersopisusbebeoccidentalis* in River Benue, Makurdi. *Nigerian Journal of fisheries* Vol. 7 (1&2): 1-7.
31. Ogbe F.G., Ataguba G.A. and Okosuwe E.H. (2008). Feeding habits and growth parameters of *Hydrocynusforskalii* and *Alestes nurse* in River Benue, Nigeria. *Journal of Applied Biosciences*, vol. 11:576–583.
32. Okayi R.G. (2002). Effects of effluent discharges on water quality, distribution and abundance of plankton and fish species of River Benue. Ph.D. Thesis, University of Ibadan (Unpublished).
33. Oransaye, C.G. &Nakpodia, F.A. (2005). A comperative study of the food and feeding Habits of Chrysichthysnigrodigitatus and Brycinus nurse in a tropical river. Park. J. ind Res. 48 (2): 118-121.
34. Panfili J., Mbow A., Durand J. D., Diop K., Doiuf K., Thior D., Ndaye P. and Lae R. (2004). Influence on the life-history traits of the West African black-chinned *Tilapia* (*Sarotherodon melanoptheron*): Comparison between the Gambia and Soloun estuaries. *Aquatic Living Resources,* 17: 65-74.
35. Paugy D. (2002). Reproductive strategies of fishes in a tropical temporary stream of the upper Senegal basin: Baoule River in Mali. *Aquat. Living Resour*. 15:25–35.
36. Reed W., Burchard J., Hopson A.J., Jenness J. and Yaro I. (1967). Fish and fishes of northern Nigeria. *Gaskiya Corporation, Zaria, Northern Nigeira*, 37–41.
37. Saliu J.K. (2002). Size, sex and seasonal dynamics in the dietary composition of *Brycinus nurse* (Pisces: Characidae), from Asa Reservoir, Ilorin, Nigeria. *Rev. Biol. Trop.* 50(1):233-238.
38. Saliu J.K. and Fagade S.O. (2003). The reproductive biology of *Brycinus nurse* (Paugy 1986), Pisces-Characidae in Asa Reservoir, Ilorin, Nigeria. *Turkish Journal of Fisheries and Aquatic Studies*, 3:5-9.
39. Shinkafi B.A. and Daneji A.I. (2011). Morphology of the gonads of *Synodontiseupterus* (Boulenger) from River Rima, north – western Nigeria. *International Journal of Zoological Research*, 7:382–392.
40. Wooten R.J. (1979). Energy cost of egg production and environmental determinants of fecundity in teleost fishes. *Symp. Zool. Soc. London*, 44: 133-159.

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