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Studies on the aspect of the biology of Mochokidae in the lower Cross River, Akwa Ibom State, Nigeria

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Research Paper

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Some aspects of the biology of Mochokidae in the artisanal fishers' landings in the lower Cross River, Nigeria were studied between May and December, 2014. A total of 360 specimens comprising 3 genera and 14 species with 6-29.50 cm total length (mean: 12.80 cm TL) and 0.16-268.21 g total weight (mean: 30.65 g TW) were examined. The largest sample size was recorded in *Synodontis schall* (61 specimens; 16.94%) while *Mochokus niloticus* and *S. clarias* with one specimen (0.28%) were the least. The degree of effective contribution expressed as index of preponderance revealed that *S. schall* (33.63%) made the most significant contribution while *S. waterlofti* (0.06%) made the least contribution. Length-weight relationship showed that the growth pattern of the fishes were negatively allometric with the slope, b values' ranges of 1.36 and 2.02 for *Synodontis omias* and *S. waterlofti* ($P<0.05$). Gut contents revealed that 11 food items were ingested (sediments, detritus, insect, algae, macrophytes, crustaceans, annelids, molluscs, nematodes and unidentified food); hence they were euryphagus. The present study revealed that Mochokidae is an omnivore-detritivore with highest body condition factor of (1.46) for *S. obesus* and lowest (0.96) for *C. batesii*; with mean K value of 1.23. This implies that could thrive better even when environmental factors are less favorable; hence, they are recommended for aquaculture.

Key words: Biology, body condition, gut contents, length-weight relationship, lower Cross River and Mochokidae.

INTRODUCTION

Mochokidae is represented mainly by the genus *Synodontis*, *Chiloglanis* and *Mochokus* commonly known as catfish which support the thriving commercial fishes in many West African countries (Ofori-Danson, 1992; Ofori-Danson et al., 2002). *Synodontis* species are currently restricted to freshwaters of Africa, occurring mostly in Central and West Africa (Koblmüller et al., 2006) and throughout Africa except in the southern-most parts (Friel and Vigliotta, 2006). They are the most widely distributed mochokid genus, occurring throughout most of the rivers of sub-Saharan Africa and Nile River systems (Friel and Vigliotta, 2009), with over 23 species in Nigerian rivers (Idodo-Umeh, 2003). The author noted that of all these species, some such as *Synodontis membranaceus*, *Synodontis omias* and *S. schall* command higher market prices than other species for sustainable management and conservation.

Mochokids are beautiful ornamental fish species with strong powerful spines on the dorsal and pectoral fins with bony head structure extending towards the posterior on the dorsum. Depending on the species, the number and branching patterns of the barbels together with the blotches make them very unique. They are short stumpy (Lalèyè et al*.,* 2006) and stout-like fish. Apart from their utilization as a food fish, they are important economic and commercial species as they occur in both subsistence and artisanal fisheries landings.

Length-weight relationship studies have been done in different water bodies and on different fish in Africa (Obasohan et al. 2012). It is used to estimate the average weight of fish. The decline in the abundance of freshwater fish resources is always an issue in the fishing industries in Nigeria (Etim, 1993; Etim and Akpan, 1993; Akpan 1994; Akegbejo- Samsons, 1995). The declining trend is thought to prevail due to either over-exploitation of the fish resources with bad fishing methods like explosives and poisoning or factors relating to availability of food in the area (Ita et al. 1985; Moses, 1995). Therefore, there is need for the study of species abundance as it describes key elements of biodiversity and indicates how common or rare, a species is, relative to other species in a given location or community (Baran, 2002).

The condition factor compares the wellbeing of a fish and is based on the prediction that heavier fish of a given length are in better condition (Bagenal and Tesch, 1978). Condition factor has also been used as an index of growth and feeding intensity which tends to decreases with increase in length (Abowei, 2010; Ogamba and Abowei, 2012; Ezekiel and Abowei, 2013; Ekpo et al. 2014) It also influences the reproductive cycle in fish (Luis et al., 2010). According to Abowei, (2009), the condition factor (K) reflects through its variations in the information on the physiological state of the fish in relationship to its welfare and when comparing two populations living in certain feeding, density, climate, and other conditions.

The study of feeding habit of these species in their natural habitat has been shown to promote useful information on positioning of the fish in the food web (Shinkafi et al., 2010), provide information about the niche of the particular fish in its ecosystem and contributes a better understanding of the trophic dynamics and food webs which is essential for appropriate fisheries management (Offem et al., 2009). It also gives information on seasonal changes of fish because the type and magnitude of food available as well as season of occurrence plays an important role in the history of the fish (Akpan and Isangedighi, 2005). Therefore, the information about the feed habits of fishes is useful in defining predatory-prey relationship (Sa-a et al. 1997). Food and feeding habits based on stomach content analysis, is widely used in fish biology as an important means of investigating trophic relationship in the aquatic communities (Ekwu, 2006 and Arendt et al., 2001) and in the creation of trophic models as a tool to understanding complex ecosystem (Lopez-Peralta and Arcila, 2002).

Mochokid species have only been identified and listed in the lower Cross River (Moses, 1989; Ekpo and Udoh, 2013). There is dearth of information on biology of this important food, economic and commercial fish family. This paper, therefore aims to investigate the abundance, growth, condition, food and feeding habits of Mochokidae in the lower Cross River South-Eastern, Nigeria.

MATERIALS AND METHODS

Study area

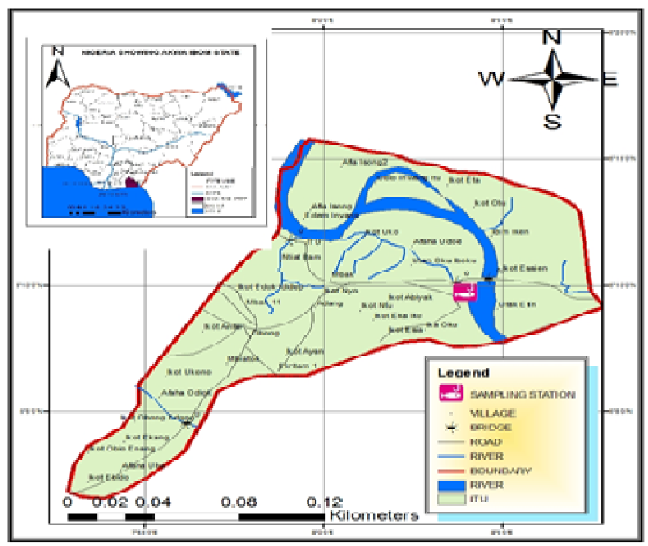

Figure 1. Map of southeastern Nigeria showing sampling station at Ayaedeghe in Itu L.G. A. in Akwa Ibom State (Insert: Map of Nigeria showing the location of Akwa Ibom State).

The lower Cross River at Ayaedeghe is located in Itu Local Government Area, Akwa Ibom State within the Niger Delta region, Nigeria (Figure 1). It lies between latitude 5º 10′N and longitude 8° 03′ E. It is bounded in the North by Cross River State, West by Ibiono Ibom Local Government Area, East by Uruan Local Government Area, and South by Uyo Local government Area. The lower Cross River has an area of 1500 km^2 of the tidal floodplains (Ekpo and Udoh, 2013) as it empties into the Atlantic Ocean. The main channel of the river has a total surface area of 70,000 km^2 of which 50,000 km^2 is at the lower reaches. The lower Cross River is approximately 7 m deep and inundates an area of approximately 800 km^2 (Offem et al., 2013). The floodplain contains numerous swamps, pools and lagoons which are often isolated from the main river, sometimes in dry season (Etim, 1993). It is subjected to seasonal flooding between July and October (Etim, 1992); with the wet (April – October) and dry (November – March) seasons.

Field and laboratory analysis

Sampling was done bimonthly for eight months from May 2014 to December 2014. Fish samples were randomly collected from selected artisanal fishers' landings whose fishing gear were mainly gillnet (22-76 mm), stretched seine net (10-34 mm stretched mesh size) and traps. Fish samples collected were preserved in 10% formalin prior to laboratory examination in well labeled containers to reduce microbial digestion to the minimum (Ekpo, 2013c). The preserved samples were neutralized in water a day before the analysis due to the hazardous nature of the formalin and excess fluid were drained out as they were placed on dissecting boards. Identification of fish samples was done using appropriate identification keys (Idodo-Umeh, 2003 and Olaosebikan and Raji, 1998).The total length were measured to the nearest 0.1 cm using the measuring board (Schneider, 1990) and weighing balance with model no (TDA: 6002A) to the nearest 0.1 g respectively following the procedure of King (1996) after blotting out water from the fish.

Data and statistical analysis

The statistical relationship between these parameters of fishes was established using the parabolic equation by Froese (2006):

$$W = aL^b \quad (1)$$

Where:
W = weight of fish (g)
L = Length of fish (cm)
a = intercept (constant)
b = an exponential expressing the relationship between length-weight.
The relationship ($W=aL^b$) when converted into the logarithmic form gives a straight line relationship graphically:

$$LogW = Log\ a + b\ LogL \quad (2)$$

Where:
b = slope of the linear graph = constant.
Relative abundance was estimated from the index of preponderance (%IP) that is which takes account of both number and weight (Watson and Balon, 1984a, b) thus:

$$IP = \frac{100(\%N.\ \%TW)}{\Sigma(\%N.\ \%TW)} \quad (3)$$

Where
%N = percentage of the species (by number)
%TW = percentage weight of all the species sampled during the study.
Fish with %IP values of less than 0.50 were regarded as being of relatively insignificant contribution while those with IP values greater than 0.50 were regarded as being of significant contribution (Moses, 1987).
Condition factor (K) which is the degree of fatness or well-being of a specimen was calculated using Fulton (1904):

$$K = \frac{100W}{L^3} \quad (4)$$

Where

K = Condition factor.
W = Observed total weight for each fish (g)
L = Observed standard length for each fish (cm)
Fish with condition factor values greater than one (≥ 1) were considered as high while those < 1 were low.

Stomach contents analysis

Specimens for diet studies were dissected and their guts removed and preserved in 4% formaldehyde solution and properly labeled for subsequent examination of the food items (King, 1996). Gut content analysis was later carried out and food items identified (Malami and Magawata, 2009). The stomachs were scored according to an arbitrary 0-20 scale using the point method (Hyslop, 1980), according to their fullness (Olatunde, 1978). Each stomach sample was opened and the content emptied into a petri dish. Some food items such as grains and insects parts were identified with the naked eyes while others were identified with the aid of a microscope (Hyslop, 1980). Slide preparation were made and examined under the light microscope, using the x^{10} and x^{40} objectives. Different methods were employed for the estimation of the fish diets:

Frequency of occurrence method

Frequency of occurrence method by Hynes, (1950) as follows:

$$\% \text{ food sample} = \frac{\text{No of Stomach with food sample}}{\text{Total No of stomachs with food}} \times 100 \quad (5)$$

Point method

$$\% \text{ Points} = \frac{\text{Points allotted to a food sample}}{\text{Total points allotted}} \times 100 \quad (6)$$

Gut repletion index (GRI)

The number of non-empty guts divided by the total number of guts multiplied by 100 which are mathematically expressed as:

$$\text{GRI} = \frac{\text{Number of non-empty gut of sampled specimens}}{\text{Total number of gut sampled}} \times 100 \quad (7)$$

The total points and frequency of occurrence of each food object were assessed and the Index of Food Dominance (IFD) estimated. The indices were employed in evaluating feeding intensity between size groups. The relative importance of food items were estimated, using the relative frequency method (King, 1988a, b), the frequency of the variety of items in the stomach was noted and these data were used to evaluate their relative frequency using the formula below:

$$Rf = \frac{F_i}{\Sigma F_i} \times 100 \quad (8)$$

Where
F_i = frequency of item i
ΣF_i = sum of all F_i

All RF values sum up to 100 and the integrated importance of each food item was then expressed as Index of Food Dominance (IFD) (king 1988a, b), using the formula below:

$$IFD = \frac{RF.PP}{\Sigma(RF.PP)} x100 \quad (9)$$

Where
RF = relative frequency of food item
PP = point percentage.

This index ranges from 0 to 100%. The use of Index of Dominance (IFD) to establish overall food preponderance is adequate as it incorporates the F and P data, thus minimizing the bias characteristic of cases in which results from different analytical methods are independently interpreted. Feeding intensity and food composition were also analyzed.

RESULTS

Species abundance

A total of 360 specimens of Mochokidae comprising 14 species and 3 genera were examined (Table 1). The largest sample size was recorded in *S. schall* (61 specimens; 16.94%) while *M. niloticus* and *S. clarias* with a single specimen (0.28%) were the least. The mean total length was 12.80cm, and mean total weight was 30.65 g. The degree of effective contribution based on index of Preponderance (%IP) showed that *S. schall* (33.63%) had the most significant contribution and was followed by *S. courteti* (19.89%) (Figure 2). Others such as *S. obesus, S. budgetti, S. nigrita, S. omias, S. gobroni, S. sorex, S. verniculatus* and *Chiloglanis batesii* also contributed significantly as depicted by their %IP values: 13.69%, 11.84%, 7.51%, 7.33%, 3.29%, 0.98%, 0.86% and 0.73% respectively. The remaining four species: *S. violaceus* (0.17%), *S. waterlofti* (0.06%), *S. clarias* (0.01%) and *M. niloticus* (0.01%) made insignificant contributions.

Condition factor

Highest well-being was obtained in *S. obesus* (1.46) but the least was found in *C. batesii* (0.96) as illustrated in (Table1). All the species generally, showed high body condition values except but one that is *C. batesii* which recorded 0.96.

Length –Weight relationship

The results of the measurements of the total lengths and total weights of 14 species of Mochokidae examined were presented in (Table 2). *S. schall* had the highest values with TL range of 6.50 - 29.50 cm and TW range of 0.16-228.21 g. *S. omias* was next with TL range of 6.00-26.50 cm while TW ranged from 2.92-255.32. Other species followed leaving *M. niloticus* as the least with TL range of 0.00 - 12.50 cm and TW range of 0.00 - 23.55 g. The 95% confidence interval values of the regression coefficients (a and b) and the correlation coefficient (r) were also presented in (Table 2). The intercept, a values of the fishes were 2.71 (*C. batesii*), 2.90 (*S. budgetti*), 2.54 (*S. courteti*), 2.51 (*S. gobroni*), 2.72 (*S. nigrita*), 2.64 (*S. obesus*), 2.48 (*S. omias*), 2.85 (*S. schall*), 2.55 (*S.

Table 1. Sample size, mean TL, mean TW, condition factor, %IP and %GRI of species of Mochokidae in the lower Cross River, Nigeria.

Mochokid species	N	%N	Mean		K	%IP	%GRI
			TL (cm)	TW (g)			
Chiloglanis batesii	8	2.22	17.97	63.02	0.96	0.73	37.50
Mochokus niloticus	1	0.28	12.50	24.53	1.26	0.01	12.50
Synodontis budgetti	43	11.94	12.38	31.04	1.41	11.84	44.68
S. clarias	1	0.28	13.00	23.55	1.07	0.01	12.50
S. courteti	54	15	12.99	33.05	1.29	19.89	53.79
S. gobroni	28	7.78	11.85	21.93	1.18	3.29	33.44
S. nigrita	39	10.83	11.88	23.95	1.31	7.51	41.96
S. obesus	47	13.06	12.26	30.04	1.46	13.69	58.87
S. omias	35	9.72	12.38	28.98	1.18	7.33	53.74
S. schall	61	16.94	13.89	44.54	1.31	33.63	64.74
S. sorex	14	3.9	11.29	24.24	1.16	0.98	32.96
S. verniculatus	18	5	12.58	32.72	1.23	0.86	36.01
S. violaceus	8	2.22	9.80	12.98	1.28	0.17	9.38
S. waterlofti	3	0.83	14.50	34.60	1.13	0.06	12.50
Total	360	100					

IP=index of preponderance, GRI =gut repletion index,TL= total length, TW=total weight.

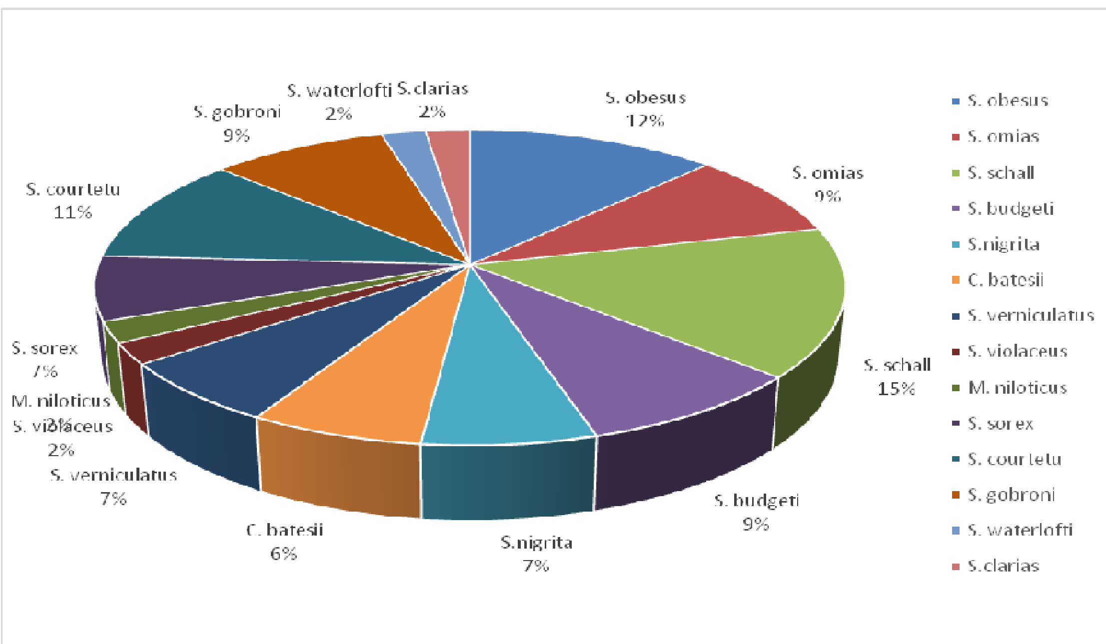

Figure 2. Relative abundance of species of Mochokidae in the lower Cross River, Nigeria.

sorex), 2.90 (*S. verniculatus*), 2.75 (*S. violaceus*), 3.07 (*S. waterlofti*). The corresponding exponent b values were 1.66, 1.76, 1.42, 1.42, 1.60, 1.45, 1.36, 1.83, 1.49, 1.81, 1.65, and 2.02 for *C. batesii, S. budgetti, S. cortetu, S. gobroni, S. nigrita, S. obesus, S. omias, S. schall, S. sorex, S. verniculatus, S. violaceus* and *S. waterlofti* respectively. The exponent, b values of all the fishes was each less than 3 and indicated negative allometric growth pattern in all the fish species. The correlation coefficients (r) which values ranged from 0.7286 to 0.99 (Table 2) in all the fish species showed a high degree of positive correlation ($P<0.05$) between their TL and TW. Figure 3a

Table 2. Total length and total weight ranges and length-weight relationship parameters of Mochokidae in the lower Cross River, Nigeria.

Species	N	TL (cm) Min – Max	TW (g) Min – Max	a	b	r	r²
C. batesii	8	11.5 - 25.50	17.30 - 143.95	2.70	1.66	0.97	0.94
M. niloticus	1	12.50	23.55	-	-	-	-
S. budgetti	43	7.00 - 21.50	5.63 - 191.00	2.90	1.76	0.96	0.92
S. clarias	1	13.00	24.53	-	-	-	-
S. courteti	54	6.00 - 24.50	2.82 - 115.27	2.54	1.42	0.93	0.86
S. gobroni	28	7.90 - 19.40	6.07 - 62.57	2.51	1.42	0.98	0.97
igrita	39	8.00 - 22.20	7.44 - 106.10	2.7	1.60	0.94	0.89
S. obesus	47	7.00 - 20.00	5.64 - 84.58	2.64	1.45	0.97	0.94
S. omias	35	6.00 - 26.50	2.92 - 255.32	2.48	1.36	0.96	0.95
S. schall	61	6.50 - 29.50	0.16 - 268.21	2.85	1.83	0.73	0.53
S. sorex	14	6.70 - 25.00	3.51 - 132.58	2.55	1.49	0.99	0.99
S. verniculatus	18	7.50 - 23.00	5.90 - 104.26	2.90	1.81	0.99	0.97
S. violaceus	8	8.00 - 14.00	6.70 - 31.72	2.75	1.65	0.99	0.99
S. waterlofti	3	14.0 -15.00	31.99 - 39.57	3.07	2.02	0.88	0.77

and b showed the regression graphs of the 12 species of fish. The regression graphs gave straight line relationships which implied that as the length increased, the weight also increased.

Feeding intensity

Of the 360 fish samples examined, 74 (20.56%) had empty stomachs, 64 (17.78%) quarter-full stomachs, 51(14.67%) half-full stomachs, 67 (18.61%) had three-quarter full stomachs and 102 (28.89%) had full stomachs as shown in (Table 3). The percentage of specimens with food was highest in *S. schall* (61; 64.74%) and lowest in *S. violaceus* (8; 9.38%) (Table 3).

Fish diet composition

The trophic spectra of the 14 fish species were illustrated in (Figure 4). Eleven major dietary compositions were identified. The highest relative frequency was observed in sediments, (34.67%) while the lowest occurred in nematodes (0.09%) although, there was no significant difference (P<0.05) between the dietary compositions of these species. These dietaries were of sediments (mud and sand grains), detritus (Fine Particulate Organic Matter - FPOM and Coarse Particulate Organic Matter - CPOM),phytoplankton,(Chlorophyceae,Bacillariophycea, Phaeophyceae and Cyanobacteria), Insecta (chiromid larvae, insect remains and Coleoptera), crustaceans (shrimp remains, daphnia and copepods), Mollusca (bivalves and gastropods), macrophytes (plant roots, plant seeds and palm fruit fibres), chilopods, nematodes, annelids and unidentified food items (Table 4).

Seasonal variation in food composition

The composite diet data for the two seasons (Figure 5) shows that the wet season dietary composition was more than that of the dry season. The qualitative food compositions portrayed high dissimilarity in proportions between the seasons. For instance, detritus showed significant difference (P<0.05) between the wet and the dry season.

DISCUSSION

This study revealed that *S. schall* (61; 16.94%) was the most abundant while *M. niloticus* and *S. clarias* (1; 0.28%) were the least. This agrees with Lalèyè et al. (2006) who reported that *S. schall* was more abundant than *S. nigrita* in the Oueme River, Benin. Bishai and Gideiri (1967) also reported that *S. schall* was among the commonest species of *Synodontis* in the Nile River. Ofori-Danson (1992) revealed that *S. schall* contributed about 50% of the biomass of the five Synodontis species found in Kpong Reservoir, Ghana. Araoye, (2004) indicated that *S. schall* was caught abundantly in Ase Lake, Nigeria which is in consonance with the present findings. *S. schall* seems to be a ubiquitous species, being found in all aquatic habitats including headwaters of tributaries, pools in dry sandy river beds, as well as in rivers and marshes. The high occurrence of *S. schall* in this study can be attributed to its diverse feeding habits.

The species condition factor (range: 0.96-1.46) for *C. batesii* and *S. obesus* were high. In fishery science body wellbeing ≥ 1.0 is considered as good. The highest value of mean condition factor recorded for *S. obesus* among others implies that it could survive better even when

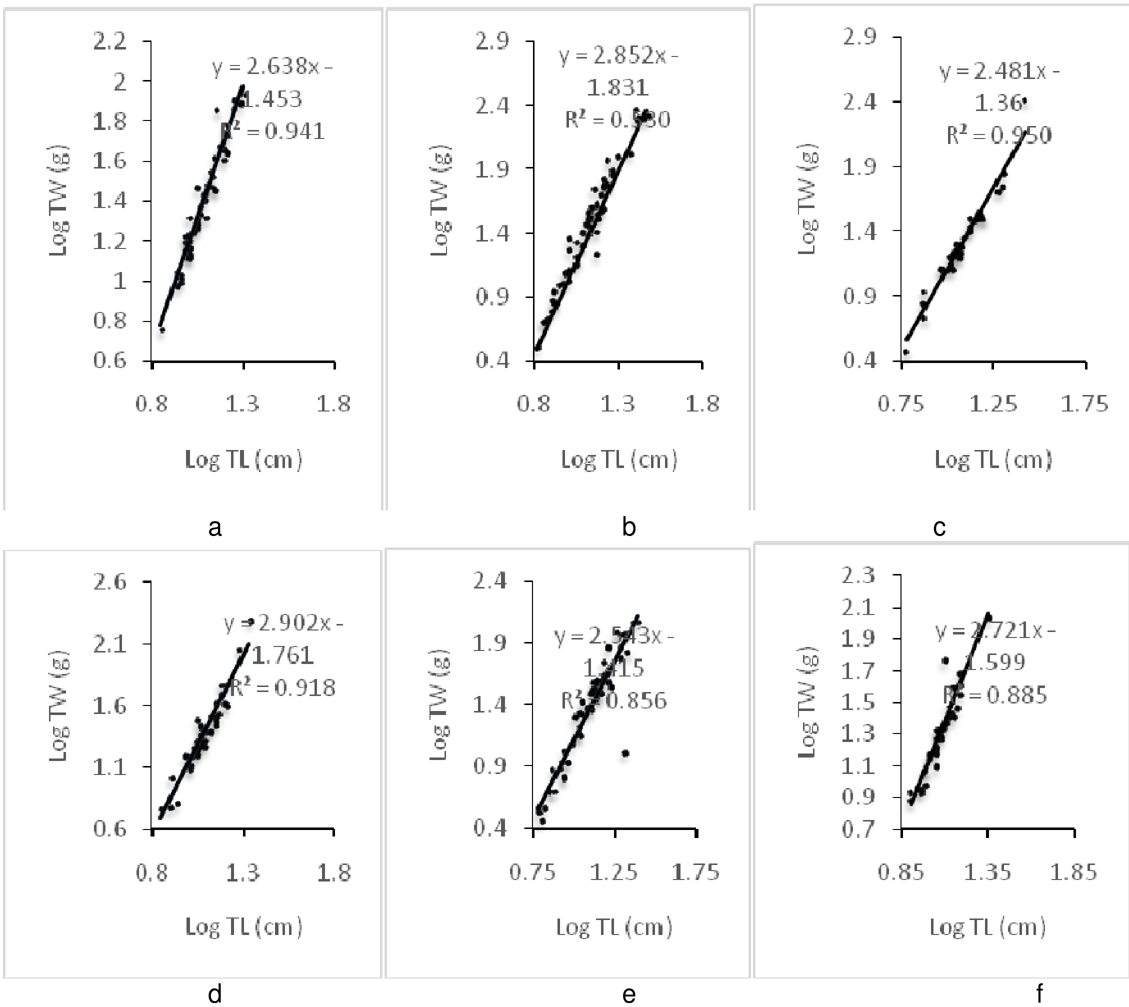

Figure 3a. Length-Weight relationships of the Mochokidae (a - *S. obesus*; b - *S. schall;* c - *S. budgetti; d - S. omias*; e - *S. courteti* and f - *S. nigrita*) in the lower Cross River, Nigeria.

Table 3. Stomach fullness of various species of Mochokidae in the lower Cross River, Nigeria.

Species	0 (empty)	5 (¼)	10 (½)	15 (¾)	20 (full)	Total
C. batesii	3	1	0	2	2	8
M. niloticus	0	0	0	1	0	1
S. budgetti	8	11	6	7	11	43
S. clarias	0	0	0	1	0	1
S. courteti	9	10	7	10	18	54
S. gobroni	3	7	4	5	9	28
S. nigrita	8	7	8	5	11	39
S. obesus	13	7	5	7	15	47
S. omias	4	7	6	11	7	35
S. schall	15	7	10	13	16	61
S. sorex	4	3	2	1	4	14
S. verniculatus	5	3	1	3	6	18
S. violaceus	2	1	2	0	3	8
S. waterlofti	0	0	0	1	2	3
Total	74	64	51	67	104	360

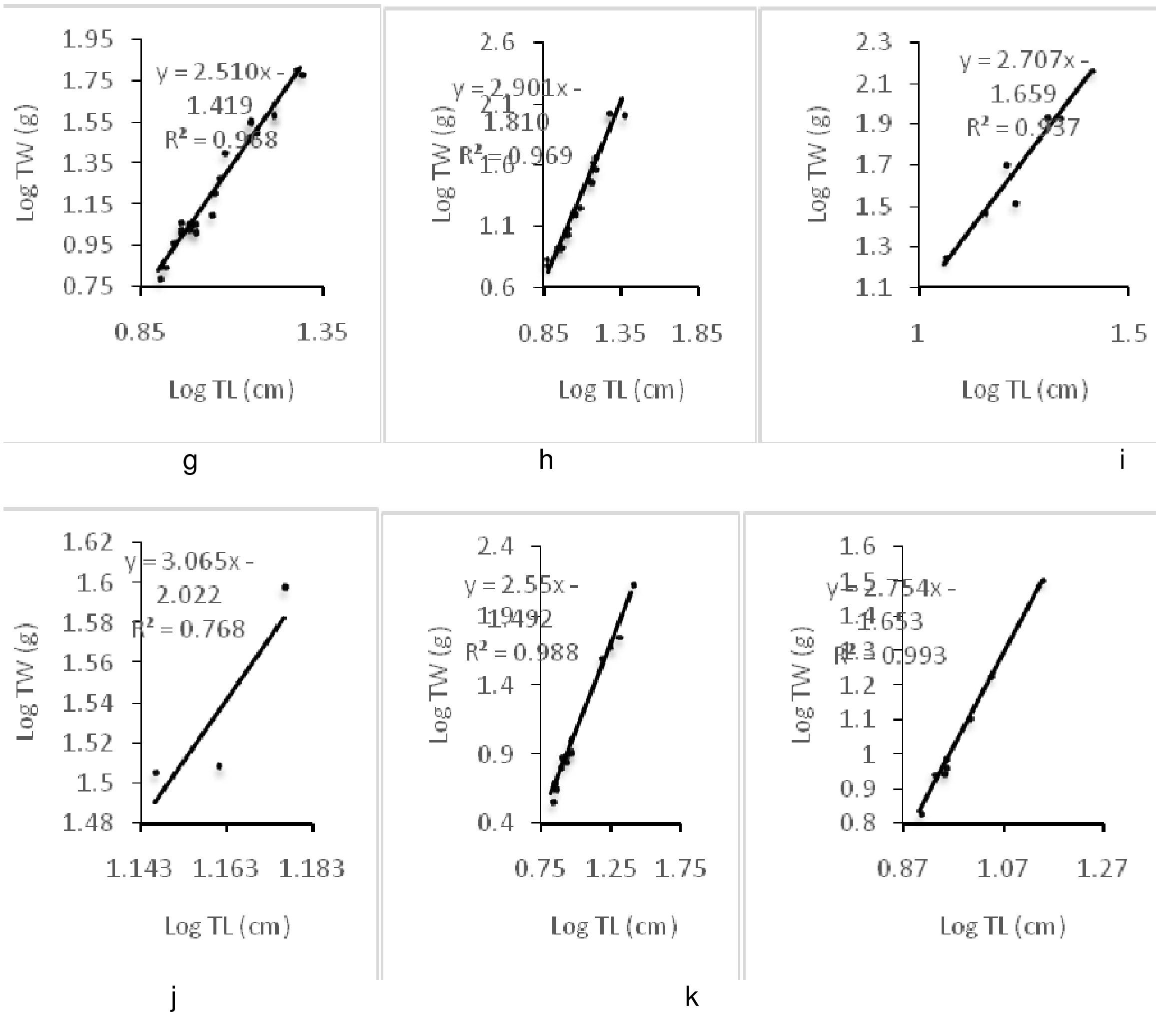

Figure 3b. Length-Weight relationships of the Mochokidae: *g - S. gobroni;* h – *S. verniculatus;l - C. batesii*; j - *S. waterlofti;* k - *S. sorex* and *S. violaceus*) in the lower Cross River, Nigeria.

biotic and abiotic factors are less favourable. Explanation for this high k-value could activities and population changes. However,the presentk-values are comparatively in line with those documented by Adeyemi, (2011) for Synodontis robbianis which ranged from 1.57 to 3.83 in River Niger, Kogi State. These are also similar with those (range 0.5 – 1.5) reported by Abowei, (2009) The different values of mean K obtained in this study could therefore be as a result of differences in increase or decrease in feeding activities and population alteration, possibly due to modification of food resources. Lalèyè et al. (2006) reported that Mochokidae are characterized by short stumpy body. The sizes of *S. schall* and *S. omias* examined were larger than other species with the least being *M. niloticus* judging from their higher total lengths and body weights. The fish ranged between 6.00-29.50 cm for total length and 0.61-268.21 g which is slightly different from that obtained by Akombo et al. (2011) who reported the total length and total weight ranges for the species of *Synodontis* in Benue River, to be 0.9-26.2 cm and 11.01-485.85 g. The larger sizes of *S. schall* and *S. omias* could be attributed to their faster growth rates and intense feeding habits; as also observed by Idodo-Umeh, (2003) and Abowei and Hart (2009). Oni et al. (1983) earlier opined that feeding and reproductive phenomena were the main factors responsible for the size of the fish. It is conceivable that the bigger sized *S. schall* and *S. omias* were adults, probably with full-laden stomachs. The slope of the graph, b values in length-weight relationships determine the growth pattern of the fish species. When b is equal to 3 or close to 3, growth in the fish is said to be isometric that is, fish becomes more

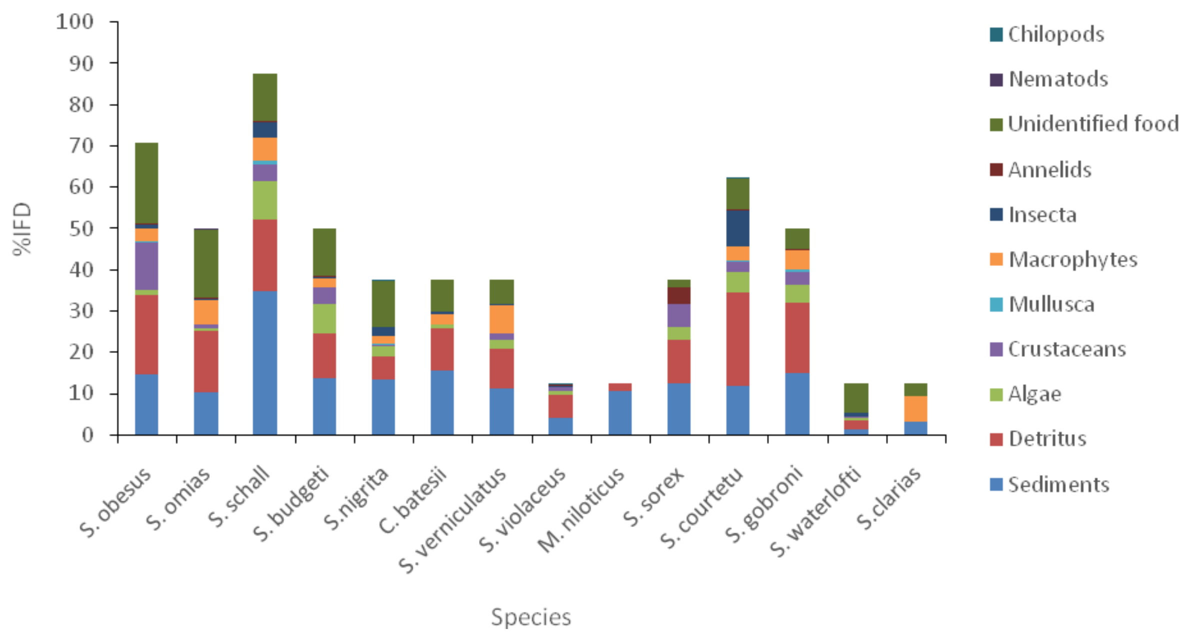

Figure 4. Index of Food Dominance of dietary composition of species of Mochokidae in the lower Cross River, Nigeria.

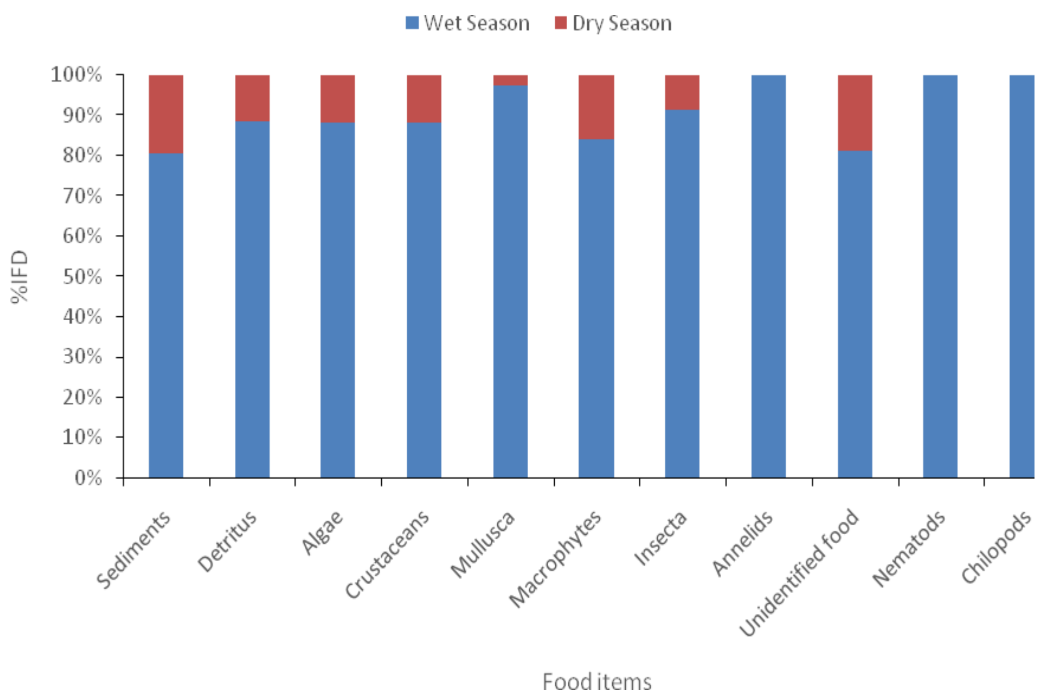

Figure 5. Seasonal variations in the food composition of Mochokidae in the lower Cross River, Nigeria.

Table 4. Index of Food Dominance of Mochokidae in the lower Cross River, Nigeria.

Food items	*S. obesus*	*S. omias*	*S. schall*	*S. budgetti*	*S. nigrita*	*C. batesii*	*S. verniculatus*	*S. violaceus*	*M. niloticus*	*S. sorex*	*S. courteti*	*S. gobroni*	*S. waterlofti*	*S. clarias*
SEDIMENTS														
Sandgrains	10.72	14.36	28.51	18.94	23.82	19.43	15.38	19.92	23.93	22.59	9.74	16.18	5.19	10.00
Mud	8.63	9.42	11.10	11.31	17.35	33.28	19.45	11.81	59.80	10.56	13.87	13.58	3.89	15.00
DETRITUS														
Fpom	17.42	16.14	9.62	13.81	7.37	6.16	12.27	38.73	11.96	4.38	24.17	21.51	17.54	-
Cpom	13.31	14.01	16.43	15.89	7.98	23.22	13.54	6.64	4.31	24.84	16.89	12.83	1.30	-
INSECTA														
Coleoptera	-	-	-	-	-	-	1.34	-	-	-	-	0.65	-	-
Insect remains	1.61	2.16	2.13	2.15	5.66	4.66	-	0.74	-	-	22.81	1.05	7.79	-
Chiromid larva	6.26	0.19	7.46	0.64	-	-	1.30	-	-	-	0.88	0.18	-	-
ALGAE														
Chlorophyceae	3.76	0.96	2.64	26.49	5.15	6.98	8.89	-	-	3.33	0.58	14.15	-	-
Phaeophyseae	-	-	10.00	-	-	-	-	-	-	-	-	-	-	-
Cyanobacteria	-	2.82	4.95	4.28	0.81	-	-	7.75	-	23.89	10.12	7.06	5.20	-
Bacillariophyceae	14.69	-	-	-	-	-	-	-	-	-	3.70	-	-	-
Chilopod	-	-	-	-	0.21	-	-	1.11	-	-	2.30	-	-	-
MACROPHYTE														
Plant seeds	-	-	-	-	8.05	-	-	-	-	-	-	-	-	-
Plant roots	5.17	10.40	15.32	6.83	2.61	20.00	0.59	3.00	-	-	1.73	12.66	-	50.00
Palm fruit fibres	1.72	7.96	0.33	2.12	1.62	-	1.62	-	-	-	7.96	-	-	-
CRUSTACEAN														
Shrimp remains	10.042	3.43	15.81	4.32	2.99	-	1.19	5.17	-	9.52	12.15	6.64	0.65	-
Daphnia	-	-	-	-	1.05	-	6.08	-	-	-	-	0.69	-	-
Copepods	3.15	-	0.57	20.00	0.20	-	1.11	0.74	-	33.33	-	1.26	-	-
ANNELIDA	0.03	1.38	1.70	0.64	-	-	-	0.74	-	0.00	2.88	0.72	-	-
MOLLUSCA														
Bivalves	0.10	-	6.25	-	-	-	-	-	-	-	-	-	-	-
Gastropods	3.39	-			0.43						0.30	4.07		
NEMATODES	-	0.73	-	-	-	-	-	-	-	-	-	-	-	-
UNIDENTIFIED FOOD	-	16.05	22.95	30.60	30.21	20.77	17.25	3.65	-	13.97	15.24	9.69	58.44	25.00
Grand total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

robust with increasing length (Bagenal and Tesch, 1978). Similarly, when b is far less or greater than 3, growth in the fish is allometric that is, the fish becomes thinner with increase in length (King, 1996). The result of the present study revealed that all the fishes investigated exhibited negative allometric growth pattern with regression analysis exponent (b) values less than 3 which ranged from 1.36 to 2.02. This was similar with the observation of Olatunde (1989) for *S. schall*. Adedeji and Araoye (2005) also reported negative allometric growth in *S. schall* in the lower Benue River. Lalèyè et al. (2006) reported that *S. schall* and *S. nigrita* showed negative allometric growth in the Oueme River. According to Adeyemi et al. (2009), negative allometric growth in fish implies that the weight increases at a lesser rate than the cube of the body lengths. King (1996) reported similar negative allometric growth pattern in many fishes in the Nigerian freshwaters. This implies that the body weights of the fishes increased with increase in body length, but the rate of increase in weight is less than the rate of increase in length. The correlation coefficient of the fishes which ranged between 0.73 and 0.99 indicated high degree of positive correlation between their total lengths and body weights. The high positive correlation in the LWR agrees with many researchers: Ayuba (1997) on *Synodontis* species in River Benue, and Abubakar and Edward (2002) in upper Benue River basin. Many factors such as sex, age, state of maturity, size, state of stomach fullness,sampling methods,sample size and environmental conditions affect condition and LWR parameters in fish (Ama-Abasi, 2007 and Adeyemi et al. 2009). Differences in regression coefficient, r could be influenced by sex, maturity, season and time of the day as a result of stomach contents. The regression graphs gave straight line relationships which implied that as the length increased, the weight also increased.

The food items in the stomachs of Mochokidae suggest that they are euryphagous, feeding on a wide range of organisms. They can be further classified as omnivores, feeding on all types of phytoplanktons, detritus, crustaceans, molluscs, macrophytes, annelids, nematodes, chilopods and insects that are typical of bottom fauna species. Owolabi, (2008) revealed that *S. membranaceus* fed on plant materials, plant seeds, insects, copepods, detritus, gastropods, *Spirogyra*, etc.According to the author, the insects clearly originated from both the bottom (with organic sediment and pieces of wood often present) and from periphyton of flooded trees, grasses and other aquatic plants. This is in agreement with the findings of Olatunde, (1989) who considers this family as eclectic. Olojo et al., (2003) observed the same food habits in *S. nigrita* from the Osun River. A clear morphological explanation for their feeding versatility may be due to the ventral location of the mouth which can also be a further indication of bottom feeding, while the simple horny structures around the mouth enable the species to adopt to filter feeding at the bottom and at the same time. Thus, enabling the species to gnaw at any hard plant tissues or insect parts which form part of its rich diet (Welcomme, 1979). This encourages a detritivorous mode of feeding.

In this study, the most frequent food items in the stomachs were the sediments and the unidentified food items. The species of Mochokidae showed preference for sediments and detritus, among others. Some of the sand grains ingested with the detritus may be coated with microbes and nutrients which are also good sources of food for the fishes. The observed results contradict the findings of Araoye, (2004) in Ase Lake, Lalèyè et al., (2006) in Ouémé River and Akombo et al., (2010) in lower Benue River, where the most frequent food items in the stomachs of *S. nigrita* and *S. schall* were macrophytes and algae. Some categories of food items present in the stomachs of these species varied, suggesting that their habitats are not rigorously the same. The presence of sand grains and mud in the stomachs indicates that these species browse on benthic deposits. The presence of nematodes in stomach *S. omias* could explain some diseased and parasitized specimens observed during the study. The high diversity of the food composition in the stomachs indicates a wide range of adaptability to the habitat in which they live.They can use any food material available in their habitats. This is an important strategy for survival and advantage over the fish species competing for a specific food items (Lalèyè et al., 2006). The seasonal variation of food items in this family showed significant difference ($P<0.05$) between the wet and dry seasons in the food items, as detritus showed significant difference between the seasons in all the species.

This high number of empty stomachs may be attributed to inadequate food in the river, post-harvest digestion, the method of catching or the duration the catches remained in the gear after being caught. The presence of artificial corn meal in the diet is an indication that the fishermen were using corn meal as baits.

CONCLUSION

The weight of Mochokids in the lower Cross River increased at a lesser rate than the cube of the body; implying a negative allometric growth. The body condition of the Mochokids was high as a result of abundance of food items ingested. The species abundance and fair distribution of *S. schall* throughout the sampling period could be attributed to its successful adaptation within its environment due to low predation and its diverse feeding habits. The feeding versatility of Mochokidae enables this family to overcome perturbations, natural or human induced. This diversity in food items found in the stomachs of the family showed that Mochokidae is widely adaptable to the habitats in which they live. Life-history of species is influenced by varying ecological conditions and highly tolerant species, such as the catfishes, which are promising candidates for commercial exploitations. More qualitative investigations should be carried out in areas of reproduction in relation to water quality to update this benchmark information.

AUTHORS` DECLARATION AND APPROVAL

We declare that this research is an original design by our research team published in Direct Research Journal of Agriculture and Food Science (DRJAFS) and approved by us as not being considered elsewhere.

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