SOME ASPECTS OF BIOLOGY OF *Synodontis schall* IN OYAN LAKE, SOUTH WESTERN NIGERIA

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ABSTRACT
This study was carried out on natural diets and morphometric characteristics of *Synodontis schall* from Oyan Lake, Ogun State, Nigeria. A total of 150 fresh specimens of *S. schall* comprising 111 males and 39 females were collected on a monthly basis between February and August, 2017. The samples were preserved in ice-chest and transported to the laboratory where morphometric and meristic features were examined. Determination of sex and gut content analyses were also carried out. Frequency of occurrence and numerical method were used for gut content analysis. Descriptive statistics and correlations were employed to depict the results. Length-weight relationship was analyzed using regression analysis. Results revealed that the condition factor of male, female and combined sexes of *S. schall* were 1.010, 1.000 and 1.000 respectively. The study revealed that male specimens of *S. schall* exhibited negative allometric growth pattern with "b" value = 2.83. While, female and combined sexes (3.00 and 2.90 respectively) exhibited isometric growth pattern with regression values not significantly different ($p>0.05$) from 3. The highest positive correlation (0.99) was detected in standard length/fork length while, the least positive correlation (1.19) was detected in snout length/depth of caudal peduncle. A total of 68 organisms were identified as food items consumed by this species. Frequency of occurrence showed that *Closterium* (54.00%) was most consumed organism while numerically it was *Nitzschia* (6.95%). This species exhibited omnivorous feeding habit. The ratio of male to female was (2.9:1) respectively. It was concluded that Oyan Lake supported the thriving fisheries of the species where it showed a preponderance due to availability of a wider variety of dietary items. There should be reduction of fishing intensity during the peak spawning period of the fish stock.
Keywords: Gut content, growth, stomach, condition factor, organisms

INTRODUCTION

Nigeria is blessed with adequate fisheries resources, which have contributed immensely to the growth and development of the country (Odulate, 2015). According to Ekpo and Essien-Ibok (2012), the inland water bodies in Nigeria are estimated to be over 14 million hectares that are being fished predominantly by artisanal fishermen. Akombo *et al.,* (2013) studied length-weight relationship, condition factors and feeding habits of *Synodontis schall* in Benue River. Morphomeristic/Morphometric and meristic characters are important in identifying fish species and their habitat as well as ecological criteria in any stream, lake or sea (Akombo *et al.,* 2011). The food and feeding habits of fish will continue to be studied because it forms the basis of a good aquaculture management system (Orosanya and Nakpodia, 2005). The feeding habits of many fish in different water bodies have been investigated and documented as dietary composition may be due to availability of food, season, age and size (even sex) (Adeosun *et al.,* 2015). Feeding habits of fish provide essential information on bionomics of single species (Abdul *et al.,* 2016).

Mochokidae is represented mainly by the genus *Synodontis*, *Chiloglanis* and *Mochokus* and are commonly known as catfish which supports the thriving commercial fisheries in many West African countries (Ofori-Danson *et al.,* 2002). *Synodontis* is the most widely distributed mochokid genus, occurring throughout most of the rivers of sub-Saharan Africa and Nile River systems (Friel and Vigliotta, 2009). The Mochokidae is a family of catfishes (order Siluriformes) that are known as the squeakers and upside-down catfish (although not all species swim upside-down). There are nine genera and about 200 species of mochokids (Froese *et al.,* 2011). *Synodontis schall* is the most tolerant species of the genus to adverse environmental conditions and it has the widest distribution in Africa (Lowe-McConnell, 1987).

Laleye *et al*., (2006) described it as a highly valued food-fish in Benin contributing an unquantified but significant proportion to the fishery of the rivers. Therefore, this study was carried out to examine the natural diets, predator – prey relationship and morphometric characteristics of *Synodontis schall* from Oyan Lake, Ogun State, Nigeria

MATERIALS AND METHODS

Description of study area

Oyan Lake (man- made lake) is located at coordinates 7°14'N and 3°13'E near Abeokuta, Ogun State, Nigeria. The Lake was established in 1984 lying adjacent, two resettlement communities named Abule-Titun and Ibaro. The dam has an embankment crest length of 1044m, a height of 30.4m, four spillway gates (each 15m wide and 7m high), and three outlet valves (each 1.8 metres). The Lake has a surface area of 40 km^2, a gross storage capacity of 270 million m^3, and a dead storage capacity of 16 million m^3. It covers 4,000 hectares and has a catchment area of 9,000 km^2 (Ofoezie and Asaolu, 1997). It was constructed and designed to supply raw water to Lagos and Abeokuta, and to support the 3,000 hectares Lower Ogun Irrigation Project (Ikenweiwe *et al.,* 2007). Oyan Lake is relatively rich in fish and other wildlife, and has potential for ecotourism (Ikenweiwe *et al.,* 2007).

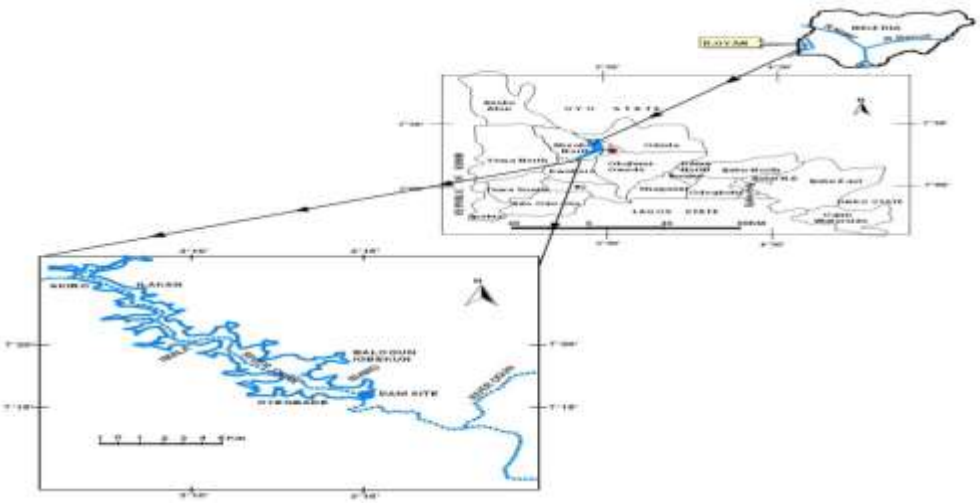

Figure 1: Map of the study area

Collection of fish specimens

Fresh specimens of *S. schall* were collected from Oyan Lake, Abeokuta, Nigeria on a monthly basis between February and August, 2017. Fish samples were collected in Ibaro, Apojola and Abule titun landing sites between the 7: 00 am and 12:00 noon. A total of 150 fish samples comprising 111 males and 39 females were obtained directly from local fishermen at landing sites using cast net with mesh sizes ranging from 50 and 75 mm and traps with wooden canoes. They were transported to the laboratory in an ice chest where measurement started immediately to avoid shrinkage. Each specimen was labeled appropriately using permanent marker and paper cello tape. The morphometric features measured were total length (TL), standard length (SL), body depth (BD) to the nearest 0.1 cm using a wooden measuring board, while the body weight (WT) was determined to the nearest 0.01g using a Kerro electronic compact scale (model BL3000 1E). The other measured morphometric characters were body width (BW), snout length (SNL), eye diameter (EYD), head length (HL), length of base of dorsal fin (LBDF), length of pectoral spine (LPCS), length of pelvic fin (LPF), length of anal fin base (LAB), length of base of adipose fin (LBAF), pre-dorsal length (PDL), length of caudal peduncle (LCP), length of dorsal spine (LDS) were done using Vernier Caliper to the nearest 0.01 millimeter. The meristic characters enumerated were dorsal rays (DR), dorsal spine (DS), pectoral rays (PCR), pectoral spines (PCS), and anal rays (AR). Each fish was dissected using scalpel and a pair of scissors from a dissecting kit by cutting the fish up ventrally from the anal opening to the head. The gut tip of oesophagus to the end of the rectum was carefully removed by use of forceps. The stomach was removed with care so that its contents remain intact and the state of fullness of each stomach was recorded and expressed as; empty stomach (0), one- quarter full (1), half full (2), three quarter full (3), and full stomach (4). Each stomach was weighed with an electronic scale (Camry – model: EHA251) to the nearest 0.1g, and then preserved in a

specimen bottle containing 4% neutral formalin and labeled accordingly with the tag number on each fish specimen. The preservation of the stomach in 4% formalin enhances coagulation of the diet component for ease of identification (Job, 2006).

Gut content analysis
The analysis of gut content was carried out using numerical and frequency of occurrence methods as described by (Hyslop, 1980).

Numerical method
This method involved counting the number of each food item present in the stomach of a fish and summing up these numbers to obtain the grand total number of all the food items in the stomach. Each stomach content was poured into a petri dish and examined under a binocular microscope. Each of the dietary items was identified to taxonomic categories using checklists. The number of each food item was expressed as a percentage of grand total number of all food items. It was usually expressed as (Ugwumba and Ugwumba, 2007);

$$\text{Numerical Method} = \frac{\textit{Total number of the particular food item}}{\textit{Total number of all food items}} \; x \; 100 \qquad \text{(1)}$$

Frequency of Occurrence Method
This involved counting the number of times a particular food item occurs in the stomach and expressing it as a percentage of the total number of stomachs with food (empty stomach excluded). This was usually expressed as (Ugwumba and Ugwumba, 2007);

$$\text{Frequency of Occurrence} = \frac{\textit{Total number of stomachs with particular food item}}{\textit{Total number of stomachs with food}} \; x \; 100 \qquad \text{(2)}$$

Statistical Analysis
Statistical analyses were carried out using Statistical Package for Social Sciences (SPSS software, version 20). Descriptive and correlation statistics were used to depict the results. Total length/weight relationship was expressed by the equation $W = aL^b$. Linear transformation was made using natural logarithm as proposed by Zar (1984): $\log Wt = a + b \log TL$; where Wt = weight of the fish (g), a = constant, b = slope and TL= total length (cm). Regression coefficient (slope = b) from the linear regression analysis was tested for significance from 3 (allometric) using student's T-test at 95% confidence limit. Discriminate analysis (DA) (stepwise method) was used to distinguish male and female populations using morphometric characters.

RESULTS
Table 1 shows the phenotypic characteristics of male and female *S. schall*. There was no significant difference (p>0.05) between the means of the morphometric characters of male and female *S. schall* except for weight (WT), head length (HL) and length of base of dorsal fin (LBDF) where the mean values for females were significantly higher (p<0.05) than that of male. Also, no significant difference (p>0.05) was observed in the condition factor between the sexes. Table 2, shows the correlation matrix of morphometric characters. Very high positive correlation was observed in fork length/standard length (0.99), total length/standard length (0.97) and total length/fork length (0.97) while the least relationship was observed in depth of caudal peduncle/snout length (0.19).

Table 1: Morphometric characteristics of male and female *Synodontis schall* from Oyan Lake, Ogun State, Nigeria

	MALE			FEMALE		
	Min	Max	Mean± SE	Min	Max	Mean± SE
WT*	16	187	47.51±2.77	9.0	250	67.51±10.29
SL	9.0	20.0	12.61±0.21	7.0	21.0	13.33±0.52
FL	9.6	22.0	13.91±0.23	8.0	23.0	14.80±0.58
TL	11.4	26.0	16.30±0.29	9.0	29.0	17.60±0.76
BD	1.4	4.5	2.63±0.06	1.1	5.2	2.84±0.15
BWD	12.81	37.88	21.01±0.47	9.30	53.81	23.26±1.51
SNL	5.87	14.91	8.32±0.16	5.64	13.40	8.69±0.31
EYD	5.41	16.89	7.44±0.15	5.20	12.01	7.56±0.26

HL*	14.28	52.48	30.83±0.66	18.41	59.14	34.32±1.47
LBDF	10.01	29.62	18.03±0.37	9.46	35.95	19.45±0.94
LPCS	13.77	53.87	29.98±0.68	18.00	54.78	32.30±1.33
LPF	11.62	34.59	19.28±0.44	12.00	39.56	20.78±0.95
LAB	9.80	25.55	12.81±0.27	7.42	24.77	13.40±0.56
LBAF*	13.72	71.28	39.43±0.82	20.14	77.67	43.23±1.96
DCP	3.86	45.96	12.90±0.44	7.36	20.05	12.94±0.52
LDS	19.36	51.36	32.60±0.69	11.20	59.18	34.59±1.73
PDL	35.41	73.35	47.87±0.76	20.14	82.86	51.33±2.12
NDR	6	7	(6 - 7)	6	7	(6 - 7)
NDS	1	1		1	1	
NPCR	6	8	(6 - 8)	6	8	(6 - 8)
NPCS	1	1		1	1	
NPR	6	8	(6 - 8)	7	7	
NAR	8	10	(8 - 10)	8	11	(8 - 11)
CF	0.59	1.63	1.01±0.02	0.73	1.31	0.99±0.02

*Mean values significantly different at $p<0.05$.

WT=Weight, SL= Standard Length, FL= Fork Length, TL=Total Length, BD=Body Depth, BWD=Body Width, SNL=Snout Length, EYD=Eye Diameter, HL=Head Length, LBDF=Length of Base of Dorsal fin, LPCS=Length of Pectoral spine, LPF=Length of Pelvic fin, LAB= Length of Anal Base, LBAF=Length of Base of Adipose, DCP=Depth of Caudal Peduncle, LDS= Length of Dorsal Spine, PDL=Pre-Dorsal Length, NDR=Number of Dorsal Rays, NDS=Number of Dorsal Spine, NPCS=Number of Pectoral Rays, NPCS=Number of Pectoral Spine, NPR=Number of Pectoral Rays, NAR=Number of Anal Rays, CF=Condition Factor.

Table 2: Correlation of morphometric characters of *Synodontis schall* from Oyan Lake, Ogun State, Nigeria

	WT	SL	FL	TL	BD	BWD	SNL	EYD	HL	LBDF	LPCS	LPF	LAB	LBAF	DCP	LDS	PDL
WT	1																
SL	0.92	1															
FL	0.92	0.99	1														
TL	0.93	0.97	0.97	1													
BD	0.89	0.89	0.89	0.90	1												
BWD	0.93	0.89	0.90	0.90	0.90	1											
SNL	0.36	0.40	0.39	0.33	0.41	0.40	1										
EYD	0.53	0.55	0.56	0.53	0.51	0.52	0.37	1									
HL	0.82	0.87	0.87	0.85	0.87	0.82	0.39	0.51	1								
LBDF	0.85	0.87	0.87	0.86	0.87	0.81	0.51	0.56	0.82	1							
LPCS	0.75	0.82	0.82	0.79	0.82	0.74	0.38	0.42	0.87	0.73	1						
LPF	0.81	0.88	0.88	0.88	0.83	0.78	0.43	0.48	0.81	0.84	0.81	1					
LAB	0.78	0.80	0.80	0.80	0.73	0.71	0.50	0.47	0.67	0.78	0.71	0.84	1				
LBAF	0.86	0.89	0.89	0.86	0.85	0.85	0.44	0.52	0.81	0.80	0.77	0.78	0.69	1			
DCP	0.46	0.47	0.48	0.48	0.52	0.46	0.19	0.34	0.45	0.54	0.45	0.46	0.40	0.35	1		
LDS	0.71	0.81	0.81	0.80	0.74	0.70	0.26	0.43	0.71	0.71	0.77	0.71	0.58	0.73	0.48	1	
PDL	0.91	0.96	0.95	0.95	0.93	0.90	0.38	0.53	0.89	0.87	0.83	0.90	0.78	0.85	0.49	0..82	1

WT=Weight, SL= Standard Length, FL= Fork Length, TL=Total Length, BD=Body Depth, BWD=Body Width, SNL=Snout Length, EYD=Eye Diameter, HL=Head Length, LBDF=Length of Base of Dorsal fin, LPCS=Length of Pectoral spine, LPF=Length of Pelvic fin, LAB= Length of Anal Base, LBAF=Length of Base of Adipose, DCP=Depth of Caudal Peduncle, LDS= Length of Dorsal Spine, PDL=Pre-Dorsal Length, NDR=Number of Dorsal Rays, NDS=Number of Dorsal Spine, NPCS=Number of Pectoral Rays, NPCS=Number of Pectoral Spine, NPR=Number of Pectoral Rays, NAR=Number of Anal Rays, CF=Condition Factor.

Length-weight relationship (LWR) of this specimen for male, female and combined sexes are shown in Figures 2, 3, 4. The sex ratio of Male to female specimens of this study location is 2.9: 1. That is, (Male to female). The "b" value of male, female and combined sexes were 2.83, 3.00 and 2.90 while correlation (r) values were 0.94, 0.98 and 0.96 respectively. The study further revealed that male specimens of *S. schall* exhibited negative allometric growth pattern while, female and combined sexes exhibited isometric growth pattern with regression values not significantly different ($p>0.05$) from 3. Male fish specimen from Oyan Lake depicted highest condition factor in April (1.10) and least in the month of February (0.92). However, the female specimen had the highest condition factor also in the month of April (1.06), and lowest in July (0.88). For combined sexes, the condition factor was highest in the month of April (1.09) and lowest in February (0.92).

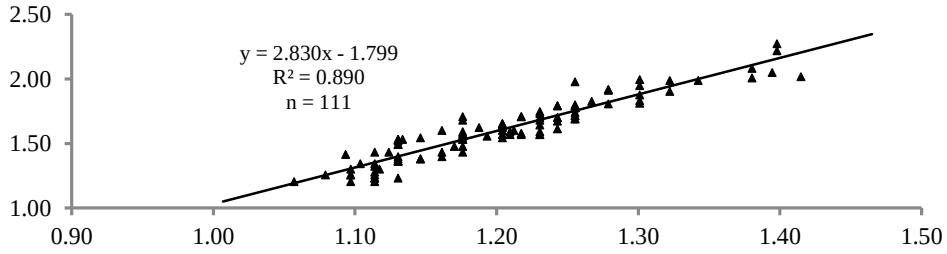

Figure 2: Length-weight relationship of male *Synodontis schall* from Oyan Lake, Abeokuta, Ogun State, Nigeria

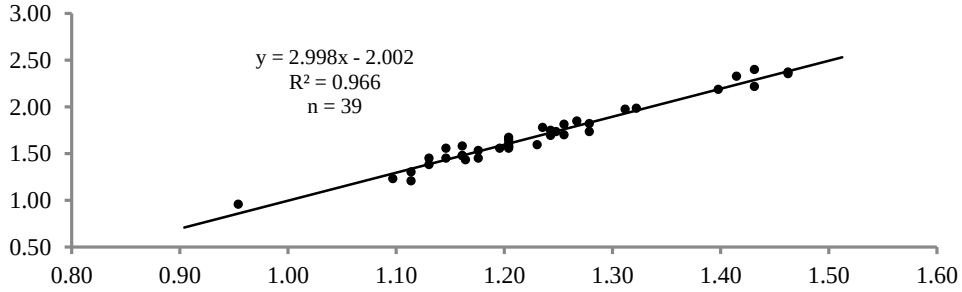

Figure 3: Length-weight relationship of female *Synodontis schall* from Oyan Lake, Abeokuta, Ogun State, Nigeria

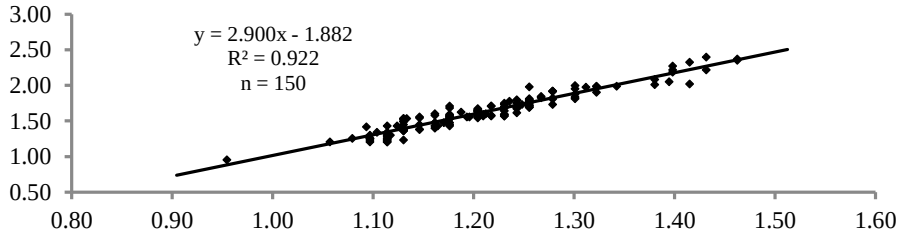

Figure 4: Length-weight relationship of *Synodontis schall* (combined) from Oyan Lake, Ogun State, Nigeria

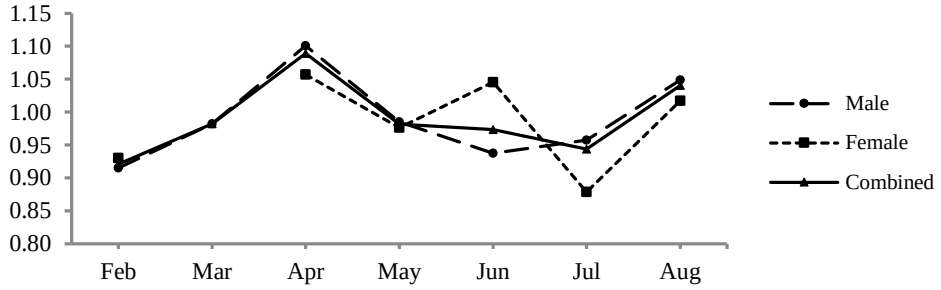

Figure 5: Monthly condition factor of *Synodontis schall* from Oyan Lake, Abeokuta, Ogun State, Nigeria

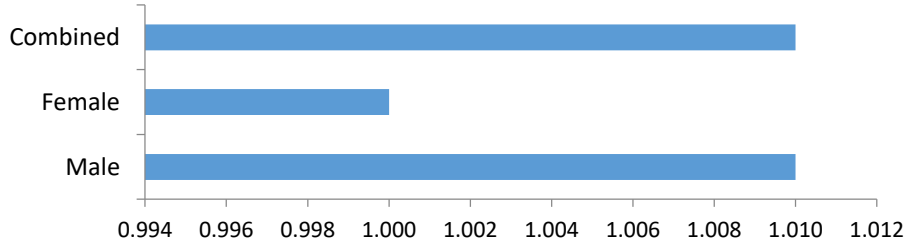

Figure 6: Overall Condition factors of *Synodontis schall* from Oyan Lake, Ogun State, Nigeria

Analyses of Stomach Content

A total of 150 specimens of *S. schall* were examined during the study period. Of all the 150 specimens of *S. schall* examined, majority of sampled specimens (33%) had three quarter full stomach (¾), followed by those with (4/4) with full stomach fullness (29%). Samples with half full stomach (½), and one-quarter stomach (¼), were 17% and 12% respectively and empty stomach (0) were (9%) as shown in (Figure 7). A total of 68 organisms were identified in the gut during the study period. Table 3 shows fifteen (15) natural diets of *Synodontis schall* in Oyan Lake. It is shown that Chlorophyta (30.88%) had the highest percentage by occurrence method, followed by Baccillariophyta (16.18%) and Ciliophora (10.29%). The least contributors to the natural diets of *Synodontis schall* were Annelida, Bryozoa, Cnidaria, Myzozoa, Nematoda, Rhodophyta and Rotifera; they all contributed less than 2%. Also, by frequency of occurrence method, *Closterium* constituted the most frequently consumed food item (59.56%), followed by *Gonatozygon* (57.35%), and *Nitzschia* (50.00%). While the highest relative percentage by numerical method was recorded in *Nitzschia* (6.95%), followed by *Closterium* and *Gonatozygon* with 5.13% and 3.78% respectively. Hence, the most abundant organisms in the stomach of *S. schall* from this study location using both methods were *Closterium*, *Gonatozygon* and *Nitzschia.* While the least consumed were *Alonella*, *Vaucheria* and *Stichococcus* using both methods.

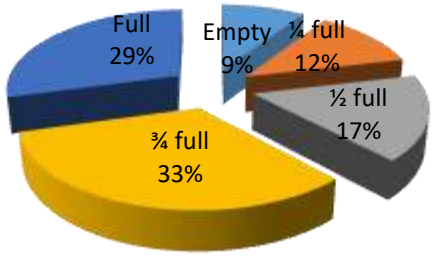

Figure 7: Stomach fullness of *Synodontis schall* from Oyan Lake, Abeokuta Ogun State, Nigeria

Table 3: Natural diets of *Synodontis shall* in Oyan Lake, Abeokuta, Ogun State, Nigeria

	Method		Relative percentage (%)	
Organism	Occurrence	Numerical	Occurrence	Numerical
Amoebozoa	**3**	**575**	**4.41**	**2.11**
Amoeba	18	219	13.24	0.81
Difflugia	16	216	11.76	0.79
Dictyostellium	24	140	17.65	0.51
Annelida	**1**	**172**	**0.74**	**0.63**
Tubifex	13	172	9.56	0.63
Arthropoda	**3**	**564**	**4.41**	**2.07**
Simocephalus	24	252	17.65	0.92
Cypridopsis	17	242	12.50	0.89
Alonella	6	70	4.41	0.26
Bacillariophyta	**11**	**5208**	**16.18**	**19.11**
Surirella	34	548	25.00	2.01
Cyclotela	45	621	33.09	2.28
Gyrosigma	30	365	22.06	1.34
Melosira	46	453	33.82	1.66
Synedra	45	505	33.09	1.85
Campylodiscus	36	694	26.47	2.55
Stephanodiscus	42	520	30.88	1.91
Navicula	28	425	20.59	1.56
Tabellaria	32	481	23.53	1.76
Meridion	25	330	18.38	1.21
Fragilaria	16	266	11.76	0.98
Bryozoa	**1**	**396**	**1.47**	**1.45**
Plumatella	31	396	22.79	1.45
Charophyta	**8**	**4334**	**11.76**	**15.89**
Gonatozygon	78	1030	57.35	3.78
Mougeotia	41	457	30.15	1.68
Mesotaenium	16	270	11.76	0.99
Micrasterias	16	222	11.76	0.81
Penium	27	330	19.85	1.21
Closterium	81	1400	59.56	5.13
Netrium	31	414	22.79	1.52
Chlorophyta	**21**	**10455**	**30.88**	**38.31**
Oedogonium	63	719	46.32	2.64
Zygnema	48	517	35.29	1.90
Nitzschia	68	1895	50.00	6.95
Ulothrix	63	912	46.32	3.34
Ankistrodesmus	37	337	27.21	1.24

Microspora	46	688	33.82	2.52
Cosmarium	54	679	39.71	2.49
Protococcus	56	833	41.18	3.05
Volvox	34	442	25.00	1.62
Bulbochaete	50	508	36.76	1.86
Pleurotaenium	32	444	23.53	1.63
Botryococcus	14	168	10.29	0.62
Spirogyra	19	222	13.97	0.81
Eudorina	34	503	25.00	1.84
Genicularia	17	303	12.50	1.11
Tetraspora	10	94	7.35	0.34
Cladophora	19	274	13.97	1.00
Chaetophora	17	238	12.50	0.87
Enteromorpha	19	244	13.97	0.89
Stigeoclonium	21	292	15.44	1.07
Stichococcus	10	143	7.35	0.52
Ciliophora	**7**	**3108**	**10.29**	**11.40**
Loxodes	39	597	28.68	2.19
Spirostomum	52	637	38.24	2.34
Paramecium	38	497	27.94	1.82
Frontonia	40	486	29.41	1.78
Prorodon	19	336	13.97	1.23
Vorticella	26	369	19.12	1.35
Colpoda	15	186	11.03	0.68
Cnidaria	**1**	**106**	**1.47**	**0.39**
Hydra	12	106	8.82	0.39
Cyanobacteria	**5**	**1093**	**7.35**	**4.01**
Microcystis	12	149	8.82	0.55
Myxophyceae	22	377	16.18	1.38
Rivularia	13	196	9.56	0.72
Gomphosphaeria	12	166	8.82	0.61
Anabaena	14	205	10.29	0.75
Myzozoa	**1**	**72**	**1.47**	**0.26**
Ceratium	6	72	4.41	0.26
Nematoda	**1**	**272**	**1.47**	**1.00**
Nematode worm	18	272	13.24	1.00
Onchrophyta	**3**	**494**	**4.41**	**1.81**
Vaucheria	10	91	7.35	0.33
Tribonema	15	183	11.03	0.67
Botrydium	18	220	13.24	0.81
Rhodophyta	**1**	**191**	**1.47**	**0.70**

Lemanea	17	191	12.50	0.70
Rotifera	**1**	**228**	**1.47**	**0.84**
Testudinella	19	228	13.97	0.84

DISCUSSION

The growth pattern of *Synodontis schall* of Oyan Lake reveal that males showed negative allometric growth while females and combined sexes showed isometric growth. The negative allometric growth pattern obtained for male specimen corroborated the work of Lalèyè *et al.,* (2006) who reported negative allometric growth pattern with regression coefficients of 2.8 for *S. schall* in Ouémé River, Bénin. King (1996) also reported similar negative allometric growth pattern in many fishes in the Nigerian freshwaters. 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. Fish weight is considered to be a function of length (Zafar *et al.,* 2003). Length-weight relationship reflects that an increase in weight led to a corresponding increase in length of *S. schall*. However, the negative allometric growth pattern observed in male specimen is in contrast with the work of Ahmed *et al.,* (2011) who reported positive allometric growth pattern for *S. schall* in El-Girba Reservoir, Sudan. According to Froese (1998), the expected range of the exponent "b" of the length-weight relationship is between 2.5 and 3.5. When the specific gravity and the shape of a fish remain the same during its lifetime, its growth pattern is isometric and the value of length exponent would be 3 (Wotton, 1998). Sadiku and Oladimeji (1991) observed isometric growth pattern for *S. Schall* obtained from Zaria Dam, Nigeria and that of another *Synodontis* species from Lake Kainji (Willoughby, 1974). This also corroborates the findings of Olurin and Aderibigbe (2006) that regression coefficients obtained from length-weight relationships, which are indicatives of isometric or allometric growths differs not only between species but at times also between stocks of the same species. Odebiyi *et al.,* (2007) also observed similar result of isometric growth pattern in River Osse. The differences in length-weight relationship in fishes could be as a result of prevailing ecological conditions of different water bodies, degree of stomach fullness, gonad maturity, sex, size range, growth phase and condition of fish (Tesch, 1971). The observed difference in the value of the result in the present study may be due to environmental differences with respect to different ecosystems (Pauly and Gayannillo, 1979).

The high correlation coefficients observed in the study corroborate the reports of Ayuba (1997) in River Benue and Abubakar and Edward (2002) in upper Benue basin on *Synodontis species.* Condition factor is a useful index for the monitoring of feeding intensity, age and growth rates in fish (Oni *et al.,* 1983). It is strongly influenced by both biotic and abiotic environmental conditions and can be used as an index to assess the status of the aquatic ecosystem in which fish live. The values recorded from general condition factor of *S. schall* from in this study for male, female, and combined sexes revealed that male *S. schall* has a better condition factor than female species. The empty stomach observed in some samples which could be as a result of sampling time is in accordance with the documentation of Shinkafi *et al.,* (2010) who reported empty stomach in fish samples of *Synodontis nigrita* in River Rima, Sokoto, Nigeria. Also, Shinkafi and Ipinloju (2001) found empty stomach in *Synodontis clarias* and Malami *et al.,* (2005) in *Synodontis eupterus* from River Rima, Sokoto.

The abundance of algae and macrophytes in the stomach of the specimen from this study conforms to the work of Olojo *et al.,* (2003) who observed the similar diets composition in *Synodontis nigrita* from Osun River, Nigeria. Ajah *et al.,* (2006) opined that *Synodontis nigrita* mainly feed on diatoms and crustaceans. Ajiboye *et al.,* (2013) documented that *S. nigrita* from Asejire Lake, Nigeria mainly subsist on insects. Shinkafi *et al.,* (2001) reported *Oedogonium* and Diatoma species as the most abundant phytoplankton fed upon by *S. nigrita* in River Rima, Sokoto. Furthermore, they noted that Chlorophyceae and Baccillariophyceae accounted for a large percentage of the food. The observed results supported the findings of 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, this implies that, this species feed on different varieties food. The presence of different food composition in the stomachs of *S. schall* is an indicative of a wide range of adaptability to the habitat in which they live. This is an important strategy for survival and advantage over the fish species competing for a specific food items (Lalèyè e*t al.,* 2006).

CONCLUSION

It can be concluded that population of *S. schall* in Oyan Lake are omnivore bottom feeders with wide

diversity of natural diets. There was no significant difference between the male and female species morphometrically. Though, male had better condition factor than female. The male specimen exhibited negative allometric growth pattern while female and combined sexes exhibited isometric growth pattern. There was preponderance of male *S. schall* than female in Oyan Lake. The most abundant organisms in the stomach of *S. schall* from Ogun River by both frequency of occurrence and numerical methods were *Cyclotella*, followed by *Melosira* and *Navicula.*

It is recommended that urgent step must be taken to assess the environmental variables of Oyan Lake to ensure sustainable fish production to support the teeming human population in the area. This is necessary in order to provide adequate environment for the fish species to thrive to enhance sustainable production of fish food for the populace. Also, the culture of *S. schall* should be experimented for domestication to add to the list of aquaculture fish species since it is relished for its taste.

AUTHORS CONTRIBUTION: ODO, AWO and AOY designed the study; AOY, ASO and OAI experimented and collected the data. ODO, ATO and ASO analyzed the data and wrote the draft of the manuscript. All authors approved the manuscript for submission.

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