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Research Article

Length-Weight Relationship, Condition Factor and Natural Diet of *Hyperopisus bebe occidentalis* and *Brycinus macrolepidotus* in Ikere Gorge, South-West, Nigeria

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ABSTRACT

This study was conducted to determine the Length-weight relationship, Condition factor and Feeding habit of two commercial fish species *Hyperopisus bebe occidentalis* and *Brycinus macrolepidotus* in Ikere Gorge. A total of 561 samples (276 *Hyperopisus bebe occidentalis* and 285 *Brycinus macrolepidotus*) were caught from experimental gill net between October 2015 to November 2016 across five fishing site. Sex ratio show significant different $p < 0.05$ across all location in favor of females in *Hyperopisus bebe occidentalis*. Male dominancy was recorded for *Brycinus macrolepidotus* in most fishing site with chi square value of 18.33. Growth pattern for *Hyperopisus bebe occidentalis* showed positive allometric in three of the sampling locations (Oyo junction, Apata and Spillway) with b value >3 and poor environmental condition less than 1 in all the locations. *Brycinus macrolepidotus* observed negative allometric growth pattern in all the sampling location with better ecological condition (K values >1). Stomach index expressed as percentage indicate that *Brycinus macrolepidotus* had the highest percentage of empty stomach (35.44%) while *Hyperopisus bebe occidentalis* recorded low value of empty stomach (0.36%). Size class food composition by *Brycinus macrolepidotus* and *Hyperopisus bebe occidentalis* showed a wide spectrum of items ingested at the various stages of life. Broad classification showed that Juveniles fed on Desmidiaceae as dominant item (34.91% and 32.03%), followed by Chlorophyceae (31.10% and 33.95%); Sub-adult fed on Chlorophyceae (28.38% and 39.80%), followed by Protozoans (18.96% and 19.68%), while Adult fed on Rotifers (28.91% and 13.17%) followed by Bacillarophyceae, (17.07% and 18.63%). The present of Sub adult and adult was notice in *Hyperopisus bebe occidentalis*, Green algae (19.96% and 17.92%) follow by Diatoms (17.50% and 24.37%); while in Adult Green algae (19.89% and 19.23%) follow by Diatoms (18.21% and 21.41%). This shows that as the fish species increases in size food item ingested also increase. Base on the identify food items in the stomach of both species *Brycinus macrolepidotus* is classified as Omnivore while *Hyperopisus bebe occidentalis* indicate Herbivore nature.

Keywords: Sex ratio; *Hyperopisus bebe occidentalis*; Ikere Gorge; Allometric; Food items; *Brycinus macrolepidotus*

INTRODUCTION

Successful management of aquatic ecosystem requires the use of biometric data for continuous sustainability of fisheries population. Length-Weight Relationships Knowledge (LWR) is an important tool for the adequate management of any fish species which have been applied in the assessment of fish stocks and populations [1]. Length-weight relationship (LWR) data of fishes are useful for biologists in fishery assessment and proper management of their population [2]. It has been widely used in fish biology with several purposes: to predict weight from length measurements for yield assessment, to calculate the standing crop biomass, to estimate weight at age, stock assessment, to evaluate index of well-being of fish population, to assess age structure and function of fish populations, growth studies, to assess fish population dynamics and growth, to make morphometric comparisons between species and populations and life history comparisons between regions [3-7]. LWR is used to obtain information about the condition of fishes in order to determine whether somatic growth is isometric or allometric [8,9]. Condition factor (K) is an important biological parameter, which indicates the suitability of a specific water body for growth of fish and an index of species average size [10]. The values of this factor depend on physiological features of fish especially maturity, spawning, life cycle, environmental factors

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and food availability in a water body [9,11]. Thus this parameter is of great importance in fishery assessments, more importantly for proper exploitation and management of fish population [5].

Food is a fundamental element in the life of all living organisms including fish, being the source of energy and nutrients for growth, reproduction, movement that are vital activities for survival in the aquatic environment. Qualitative and quantitative compositions of fish diets are important to the growth, maturity and fecundity changes in fish. Food study reveals the status of foraging, growth rate and seasonal life history changes in fish, which are useful for rational exploitation of the species [12]. However, these tools may provide important information concerning morphometric comparison between species and populations for life history comparisons within regions [13].

Hyperopisus bebe, of the family Mormyridae, was formerly under the genus *Mormyrops*. *Hyperopisus bebe occidentalis* are well distributed in swamps, lakes and rivers of most Nigerian fresh water bodies. They are far more abundant in Cross River basin than other Mormyrids and they are called Kuma, Egwayeko and Lere locally. *Hyperopisus. bebe occidentalis* could be referred to as omnivorous fishes, feeding on both plant and animal substances which include insect larvae, nymphs and plant seed [14].

Brycinus macrolepidotus which belongs to the family Characidae is one of the dominant fish groups in African freshwater. Characids have large scales and 3–5 branchiostegals. Their teeth are usually strong and multi-cuspoid. Dorsal fin, usually without spine but an adipose fin is always present [15]. This study is aimed to find out the present status of length-weight relationship, condition factor and feeding habit of *Hyperopisus bebe occidentalis* and *Brycinus macrolepidotus* in Ikere Gorge Nigeria.

MATERIALS AND METHODS

Description of study area

Ikere gorge is located in Iseyin, Iseyin Local Government area of Oyo State. The gorge is a man-made lake constructed on the River Ogun, eight kilometers East of Ikere village and thirty kilometers North East of Iseyin in Oyo State, Nigeria. The gorge covers all the land between longitude 8° 10[11] and 8° 20[11] E as well as latitude 3° 40[11] and 3° 50[11] N of the Greenwich meridian in the Rain Forest vegetation zone of Nigeria, with a total area of 300,000 km^2 (Figure 1). The dam part of Ikere Gorge was designed to supply water to Iseyin, Okeho Iganna and environs i.e., the Iseyin-Okeho water supply scheme of Oyo State, provide irrigation water for the 3,000 ha to middle ogun irrigation project and generate 6 megawatts of

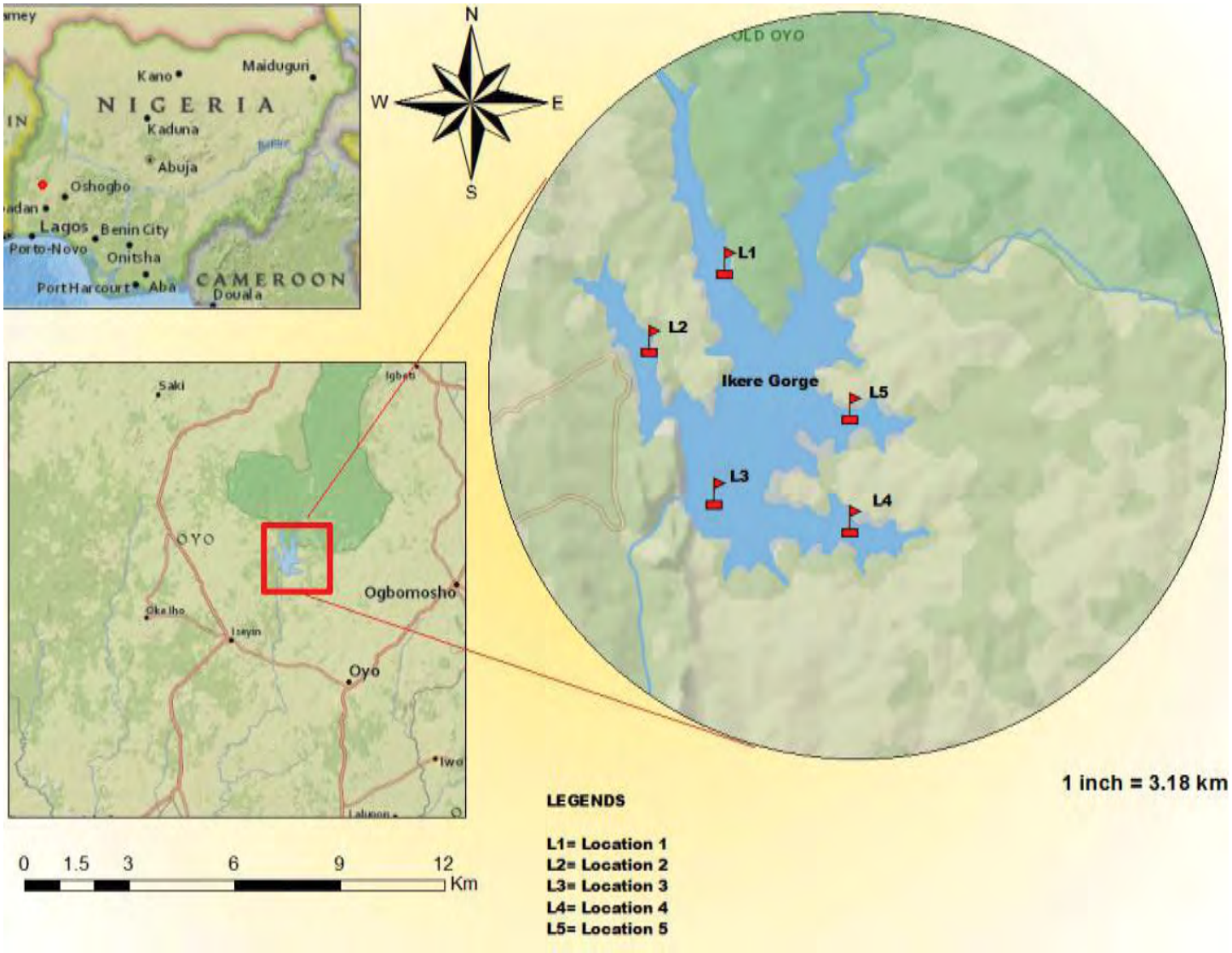

Figure 1: Map showing the study sites.

hydro- electricity. Climate condition of Ikere Gorge is influenced by the NE – SW movement of the wind of surface discontinuity (S.D.) between maritime (Atlantic) air masses and dry continental (Sahara) air masses. Regular movement of these air masses creates two distinct climatic seasons in the area. This includes a dry season from November to April and rainy season from May to October [16]. Vegetation of the study area is the forest savanna mosaic characteristic of a derived savannah zone. The character of the vegetation varies rapidly over short distances, with low forest, dense woodlands with open tree and grass savannah. Moist deciduous forests are found on hilly sides of the Gorge and well developed riparian forest in the valleys [17].

Sampling method

Fish samples of *Hyperopisus bebe occidentalis* and *Brycinus macrolepidotus*were collected from five randomly selected stations based on the intensity of fishing activities, namely Oyo junction, Apata, Spillway, Bendel and Dwellings camp sites. Sample taken covered eighteen consecutive months (October 2015 - November 2017) of dry and wet season of the year.

Biometric measurements

The total lengths of the selected fish species were measured with the aid of a measuring board and meter rule. This done by placing the fish on the board and the measurements were taking from the anterior end of the fish snout (mouth closed) to the posterior extremity of the caudal fin, to the nearest 0.1 cm. The standard length was measured from the anterior tip of the snout to the end of the caudal peduncle for every fish in centimetres (cm). The body weight of each fish was measured to the nearest 0.1 g using top loading weighing balance (Mettler balance Model 2000) in grams (g).

Sex ratios

The sexes of the samples were determined using Indian chalpark ink technique [17,18]. This was done by brushing the ink over the genital papilla of the samples to accentuate the contour and structure of the genitals. The papilla that presented a fissure parallel with the body axis identifies a female while the absence of the fissure indicated that the fish was a male.

Length-weight relationship and condition factor

LWR of fish can be express as $W = aL^b$ [17]. This expression could be transform into logarithm function as; Log W = Log a + bLog L

Where W = Weight in grams, L = Length in cm, a = Constant, b = Exponential or slope.

Fulton condition factor (K) was calculated in line with according [19] formulae:

$K = 100W/L^b$

K = Condition factor, W = Body weight in grams, L = Total length of fish in cm and b = Exponential.

Stomach analysis

Fish specimens were cut open for diet composition and degree of stomach fullness (full, half full, one quarter full and empty stomach). Stomach contents were emptied in sterile petri-dish and observed under the microscope. Large food items were easily recognized with the naked eyes, while microscopic ones were teased to disperse their aggregates, on a cleaned slide. All recognized food items were identified [20]. The stomach contents identified were analyzed using numerical method and frequency of occurrence methods [21].

Statistical analysis

Information on Total length in centimeters, Standard length in centimeters and Body Weight in grams (g) were used to estimate Length-Weight relationship and Condition Factor using linear regression model of FiSAT. LWRs values range from 2.5-2.99 indicate Negative allometric, values greater than 3 illustrate positive allometric while 3 means isometric. Condition factors of ≥1 indicate a good level of feeding and proper environmental conditions [22].

RESULTS

Location wise sex ratio distribution of *Hyperopisus bebe occidentalis* in Ikere Gorge

The sex ratio (Male:Female) for population distribution in the study area is showed in Table 1. Overall, there was significant departure from the expected 1:1 sex ratio during the study months, but females were significantly ($p < 0.05$) more numerous than males throughout the location. Apata has the lowest chi square values of 4.04 and the highest in Dwelling with 18.96.

Location wise sex ratio distribution of *Brycinus macrolepdotus* in Ikere George

Location wise distribution samples collected across the five sampling point (Table 2), indicate sex ratio which were in favour of males throughout the location 2.61:1, 2.07:1, 2.77:1, 2.52:1 and 2.2: 1 respectively for Oyo junction, Apata, Spillway, Bendel and Dwelling. The highest Male: Female value of 2.77:1 was obtained at Spillway with corresponding chi square 18.33. However significant difference ($p<0.05$) was observes across the five location.

Table 1: Sex ratio distribution of *Hyperopisus bebe occidentalis* at different sampling point in Ikere Gorge.

Location	Frequency	Male	Female	Sex ratio M:F	X^2
Oyo junction	46	11	35	0.31:1	12.52**
Apata	55	20	35	0.57:1	4.09**
Spillway	60	13	47	0.28:1	19.26**
Bendel	61	18	43	0.42:1	10.25**
Dwelling	54	11	43	0.26:1	18.96**

**Significant ($p<0.05$) , x^2 = Chi square

Table 2: Sex ratio Distribution of *Brycinus macrolepdotus* at different sampling point in Ikere Gorge.

Sex	Oyo junction	Apata	Spillway	Bendel	Dwelling
Male	60	56	61	53	55
Female	23	27	22	21	25
Frequency	83	83	83	74	80
Sex ratio M: F	2.61:1	2.07:1	2.77:1	2.52:1	2.2:1
Chi square	16.5[ab]	10.13[ab]	18.33[ab]	13.84[ab]	11.25[ab]

[ab]Significant ($p<0.05$)

Location-wise LWR of *Hyperopisus bebe occidentalis* in Ikere Gorge

Location-wise length- weight and condition factor parameters of *Hyperopisus bebe occidentalis* in Ikere gorge are shown in Table 3. The parameters were separated by fishing site. The 'b', 'r^2' and 'K' values in Oyo junction were 5.05, 0.30 and 0.74. In Apata, the respective values were 3.30, 0.78 and 0.74. Spillway values are 3.20, 0.66 and 0.84 respectively. However Bendel and Dwelling parameters analyses values are 2.70, 0.82, 0.72 and 2.98, 0.82, 0.92 respectively.

Location-wise LWR of *Brycinus microlepidotus* in Ikere Gorge

Length-weight relationship and condition factor of *Brycinus microlepidotus* were analyzed in Table 4 base on location in Ikere George. The overall total length of *Brycinus microlepidotus* ranged from 5.3 cm to 39.2 cm with mean of 10.80 ± 0.34 cm and weight ranged from 5.2 g to 322 g with mean of 25.52 ± 2.69. The values of the regression coefficients a', 'b' and 'r^2' and the condition factors obtained are presented in Table 4. The intercept (a) values of the fish with respect to location were 0.062 (Oyo junction), 0.071 (Apata), 0.062 (Spillway), 0.074 (Bendel) and 0.053 (Dwelling) respectively. The corresponding exponent b values were 2.31, 2.26, 2.30, 2.23 and 2.36 for Oyo junction, Apata, Spillway, Bendel and Dwelling respectively. The correlation coefficients which values ranged between 0.92 and 0.99 showed a high degree of positive correlation. Condition factor values were 1.23, 1.47, 1.40, 1.48 and 1.30 for the respective location.

Monthly Stomach Index of *Hyperopisus bebe occidentalis* in Ikere Gorge

Figure 2 shows the overall stomach index of *Hyperopisus bebe occidentalis* in the study area. In all, a total of 276 specimens with total length range of 17.3 – 50.5 cm and corresponding weights of 51.5 g – 607 g. The highest stomach fullness in term of percentage was observed in full stomach (58.99%) follow by three-quarter degree of fullness (30.58%) while empty and one-quarter full stomach had similar percentage of 0.36% respectively. December 2015 was observed to have the highest number of stomach examined with 22 specimens while February, April and June 2016 recorded the least number of stomach examined with 11 specimens respectively.

Length class group of stomach content of *Hyperopisus bebe occidentalis* in Ikere Gorge

Stomach content in relation to Length class size in the study area of *Hyperopisus bebe occidentalis* is illustrated in Table 5. Diatoms, Green algae, Desmids and Protozoans constitute the most consumed taxa fed in Sub adult group (17.50 and 24.37%, 19.96 and 17.92%, 15.80 and 12.20% and 13.00 and 11.29%) by numerical and occurrence method. Adult length class follow the same pattern with highest percentage of 18.21 and 21.41%, 19.89 and 19.23%, 15.48 and 11.31% and 13.71 and 12.48% in respective taxa Diatoms, Green algae, Desmids and Protozoans by numerical and occurrence method.

Monthly Stomach Index of *Brycinus macrolepidotus* in Ikere Gorge

Figure 3 shows the monthly stomach index of *Brycinus macrolepidotus* during the period of the study. In all, a total of 285 specimens with total length range of 5.3 – 34.9 cm and corresponding weights of 9.5 g to 362 g were sampled. Mean TL ranged from 9.62 ± 1.06 cm in stomach index of empty to 17.32 ± 2.11 cm in three-quarter degree of fullness June with corresponding mean weight of 72.54 ± 7.96 g and 84.04 ± 6.10 g. The highest stomach fullness in term of percentage was observed in empty stomach (35.44%) follow by one-quarter degree of fullness (25.57%) and lowest in three-quarter degree of fullness (9.62%). Samples analyzes was most abundant in February 2016 and least in January and November 2016 respectively.

Table 3: Location-wise LWR of *Hyperopisus bebe occidentalis*.

Parameters/Location	Number	b	r^2	K
Oyo Junction	46	5.04	0.30	0.74
Apata	55	3.3	0.78	0.73
Spillway	60	3.2	0.66	0.84
Bendel	61	2.7	0.82	0.72
Dwelling	54	2.98	0.82	0.92
Mean ± SE	276	3.44 ± 0.41	0.68 ± 0.10	0.79 ± 0.04

b=Growth pattern, r^2= Regression coefficient and K=Condition factor

Table 4: Location-wise LWR and CF of *Brycinus microlepidotus* in Ikere Gorge.

Location	Number	TL(cm)	BW(g)	a	b	r	K
		Mean ± SE	Mean ± SE				
Oyo Junction	83	9.61 ± 1.05	72.5 ± 7.96	0.062	2.31	0.99	1.23
Apata	83	4.26 ± 0.46	25.10 ± 2.70	0.071	2.26	0.94	1.47
Spillway	83	4.78 ± 0.52	34.5 ± 3.78	0.062	2.3	0.96	1.4
Bendel	74	6.65 ± 0.77	59.5 ± 6.91	0.074	2.22	0.92	1.48
Dwelling	80	7.14 ± 0.80	59.6 ± 6.65	0.053	2.36	0.98	1.3

TL=Total Length, BW=Body Weight, a= Intercept, b=Growth pattern, r=Correlation coefficient and K=Condition factor.

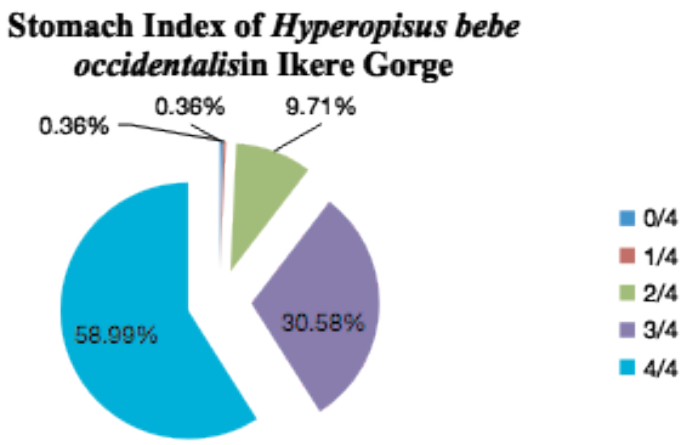

Figure 2: Stomach Index of *Hyperopisus bebe occidentalis* in Ikere gorge. (0/4=Empty stomach, ¼=One-quarter full stomach, 2/4=Half full stomach, ¾=Three-Quarter full stomach and 4/4=Full stomach).

Table 5: Length class group of stomach content of *Hyperopisus bebe occidentalis* in Ikere Gorge.

Taxa	(17.3-32.5 cm)		(33-50.5 cm)	
	NM	OM	NM	OM
	%	%	%	%
Blue Green Algae	13.60	11.29	12.33	13.67
Green Algae	19.96	17.92	19.89	19.23
Desmids	15.80	12.20	15.48	11.31
Diatoms	17.50	24.37	18.21	21.41
Protozoans	13.00	12.90	13.71	12.48
Rotifers	3.18	2.91	3.39	3.17
Crustaceans	9.59	12.20	9.83	11.63
Insect	6.43	5.15	6.32	6.03
Detritus	0.93	1.05	0.82	1.07

NM= Numerical Method and OM= Occurrence Method

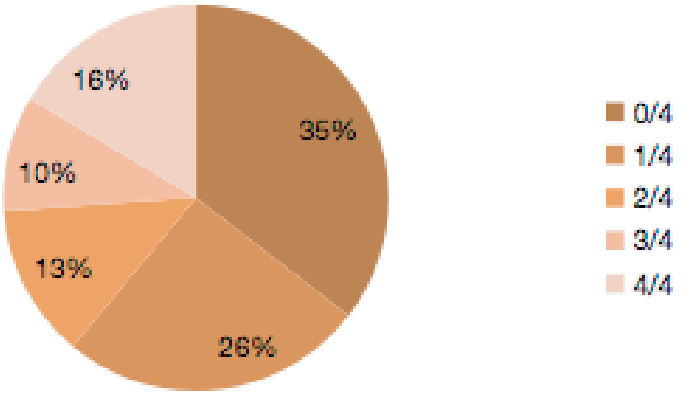

Figure 3: Overall Stomach Fullness of *Brycinus macrolepidotus* in Ikere gorge. (0/4=Empty stomach, ¼=One-quarter full stomach, 2/4=Half full stomach, ¾=Three-Quarter full stomach and 4/4=Full stomach).

Length class group of stomach content of *Brycinus macrolepidotus* in Ikere Gorge

Stomach content in relation to Length class size in the study area of *Brycinus macrolepidotus* is illustrated in Table 6. Desmidiaceae, Chlorophyceae Cyanophyceae and Bacillarophyceae constitute the most consumed taxa fed on Juveniles size group (34.91% and 32.03%, 31.10% and 33.95%, 16.01% and 18.86% and 6.74% and 3.44%) by numerical and occurrence method. Sub adult length class constitutes the most occurring taxa in Chlorophyceae, Protozoans, Rotifers and Desmidiaceae (28.38% and 39.80%, 18.96% and 19.68%, 17.84% and 13.31% and 12.69% and 12.98%). Adult length class follow the same pattern with highest percentage of 28.91% and 13.17%, 17.07% and 18.63%, 11.72% and 8.10% and 10.75% and 15.12% in respective taxa Rotifers, Bacillarophyceae, Annelids and Chlorophyceae by both method.

DISCUSSION

Sex determination in natural ecosystem is expected to have equal representation in fish population number [23]. However, this 1:1 ratio does not hold true in most fish population. The preponderance of females in fish population could be seen as adaptive mechanism used by the fish perpetuate itself in the environment, since more females implies more population through greater number of egg production. The assumption is that one male is capable of fertilizing eggs from several females. Thus, a population dominated by females has greater potential for growth [24]. The observed overall sex ratio of 2.42:1, in favour of males for *Brycinus macrolepidotus* population caught in Ikere George during the period of study was significantly different from the expected 1:1. This indicates that males were relatively higher in number than females. The present observation is similar to the work of Ekokotu et al. [25] for *Clarotes laiceps* in River Niger. However, *Hyperopisus bebe occidentalis* sex ratio does not agree with the outcome of male dominance in the same water body. Fapohunda et al. [26] reported more females than males in Owena Reservoir. Gómez-Márquez et al., [27] observed higher number of females in their studies. Balirwa et al. also observed that different habitats may favour one sex over the other. In the present study, the cause of skewed sex ratio in favour of either sex might be mainly due to genetic factors as the species shows differential growth between the sexes. This is supported by the observation of Fryer et al. [28] that, in African lakes, it is common any sex to for males to dominate because they generally exhibit faster growth than females.

Length-weight relationships of fish play a significant role in fishery management [5], which gives an estimate of average fish weight at a given body length, assess the well-being of fish population [29] and in assessing their maturity, growth and production. Length and weight are two fundamental components that can be used to know the growth, estimate average weight of fish at a given body length, assess the well-being, maturity and production of fish in the aquatic environment. Length-weight relationship predicts the growth pattern of fish. If the value is equal to 3 it is known as isometric growth and less than or greater than 3 are known as allometric growths. All the five locations (Oyo junction, Apata, Spillway, Bendel and Dwelling camp) had b-values of less than 3 indicating negative allometric growth patterns in *Brycinus macrolepidotus*. Growth model in fish according to Gulland et al. [30] generally follows the cube law, hence the use of Fulton's condition factor or the isometric factor. This is in line with the findings of Ikomi et al. [15] and Offem et al. [31] but contrary to the findings of Adeosun et al. [32] in lower Ogun River Akomoje Ogun State Nigeria. This could be due to location difference, period of sampling, sizes caught and number of samples used amongst other factors. Correlation coefficient value (r) of all species of *Brycinus macrolepidotus* shown positive correlation between the length and weight which indicate a homogenous population. However the growth pattern for *Hyperopisus bebe occidentalis* showed positive allometric in three of the sampling locations (Oyo junction, Apata and Spillway) with b

Table 6: Length class group of stomach content of *Brycinus macrolepidotus* in Ikere Gorge.

Taxa	(5-15 cm)		(16-26 cm)		(27-39 cm)	
	NM	OM	NM	OM	NM	OM
	%	%	%	%	%	%
Cyanophyceae	16.01	18.86	7.94	5.03	4.56	8.29
Cholorophyceae	31.10	33.95	28.38	39.80	10.75	15.12
Desmidiaceae	34.91	32.03	12.69	12.98	5.69	4.98
Bacillarophyceae	6.74	3.44	6.38	4.17	17.07	18.63
Protozoans	6.58	8.74	18.96	19.68	9.21	20.29
Rotifers	2.74	2.58	17.84	13.31	28.91	13.17
Molluscs	0.13	0.00	2.48	0.00	5.31	8.39
Annelids	0.00	0.00	2.06	0.96	11.72	8.10
Fish	1.80	0.40	2.60	3.50	3.64	0.78
Detritus	0.00	0.00	0.67	0.57	3.14	2.24

NM= Numerical Method and OM= Occurrence Method

value >3. Adeyemi et al. [14] and Usman et al. [33] observed similar result in *Hyperopisus bebe occidentalis* from tropical freshwater ecosystem Nigeria and Kontagora reservoir Niger state Nigeria. The study of Olele et al. [34] exhibited negative allometric growth having 'b' value lower than 3. The linear relationship from plots between total length and body weight can be predicted based on r-value. The regression coefficient (r^2-values) for Dwelling camp, Bendel and Apata sex were 0.82, 0.82 and 0.76, respectively. This shows that there was strong association between the total length and body weight of *Hyperopisus bebe occidentalis* during the period of study. Differences in 'b' values may be influenced by sex, maturity stages, seasonality and the time of day the food was consumed by the fish [35].

Condition factor (K) is very important because it shows the well-being of an organism in its immediate environment; whether it is conducive for survival or not. Oni et al.; Ekanem et al. [36]; Yem et al. [37] and Lawal et al. [38] reported K-value of 1 and above for most fresh water fishes. When K-value is equal to 1 and above it indicated that the fish is doing well in the water body. Ekpo et al. [39] explained the favorable condition of k value of 1.12 for *Alestes macrolepidotus* in Asejire reservoir; this shows that the environment is good for the survival of the species in the reservior. Nazeef and Abubakar et al. [40] reported the condition factor of fifteen fish species and stated that 9 out of the 15 species had K values less than 1.0, while the remaining six fish species had values greater than 1.0. According to Lagler et al., [41] K values are not constant for individual species or populations; it was subject to a wide variations in fish conditions. An ideal K-factor is equals to 1, while those less than or equal to 1, shows average conditions. Atobatele et al. [42] did report that low condition factor could be due to reduced availability of food and prey items. Moise et al. [43] also reported that low condition factor in *Hyperopisus bebe occidentalis* from River Galma Zaria Nigeria and relate it to poor environmental condition and spawning pressure on females. However variation in K value could be attributed to predation, breeding season, competition for food, pollution and size of fish amongst other factors.

Frequency of stomach fullness is a key that can be used to determine the feeding intensity of fish in the aquatic environment. The degree of stomach fullness determines the feeding category as well as feeding intensity of fish. *Hyperopisus bebe occidentalis* had overall results of the monthly stomach index fullness analyses revealed that 0.36% of stomach were empty, while varying quantities of food items were found in 58.99% and 30.55% of full and three quarter full stomach. Adeyemi et al. [14]; Olele et al. [34]; Malami et al. [44] observed similar result on the same species in Nigeria water bodies. The observance of higher non empty guts may have resulted from the immediate arrest of food digestion through the injection of formalin in the gut region of the fish before their conveyance to the laboratory for examination. The greater number of guts with food is generally attributed to a successful feeding strategy adopted by the specimens [45], and additionally benefitting from good food abundance during the sampling season. Higher percentage of stomach index with fullness has been attributed to omnivore's species, Tilapia guineensis and *Hyperopisus bebe occidentalis*. The percentage of empty stomachs was as high as 35.44% (140 specimens) for *Brycinus macrolepidotus* in the present investigation. Odum et al. [46] cited by Wells et al. [47] highlighted that the average retention time of food for mot fresh water fish are 4 – 5 hrs. Many fish are therefore likely to have digested their food while held in the nets. Also, some fish may have disgorged their food following capture. Consequently, the degree of fullness in stomachs of Alestes is likely to represent the intensity of feeding. On a general note, the results of the fullness method of stomach contents analysis revealed that there was high degree of empty feeding intensity due to the fact that percentage of empty stomach was more than that those with food. Adeosun et al. [32] did report contrary result on the ecological conditions governed by feeding intensity of food could affect the feeding habits, feeding intensity and diets of fish. Ogbeibu et al. [48] reported that even at species level, fish in the same genus sometimes has different feeding intensity or category. It is imperative to note that food availability and monthly stomach index did not have much effect on the feeding intensity of *Brycinus macrolepidotus* in this study.

Size class food composition by *Brycinus macrolepidotus* and *Hyperopisus bebe occidentalis* showed a wide spectrum of items ingested at the various stages of life. Broad classification showed that Juveniles fed on Desmidiaceae as dominant item (34.91% and 32.03%), followed by Chlorophyceae (31.10% and 33.95%); sub-adult fed on Chlorophyceae (28.38% and 39.80%), followed by Protozoans (18.96% and 19.68%), while adult fed on Rotifers (28.91% and 13.17%) followed by Bacillarophyceae, (17.07% and 18.63%). This shows that as the fish species increases in size food

item ingested also increase. Adeosun et al. [32] reported that *Brycinus macrolepidotus* consumed more fauna as it increased in size with decrease in flora. Ekanem et al. [49] did report that larger sizes of the species preferred fishes and shrimps, while smaller sizes had a wide range of items in the diet. This is agrees with the findings of this study. Annelids and Detritus was absent in juvenile size; mollusks is absent in sud adult stage. The present of Sub adult and adult was notice in *Hyperopisus bebe occidentalis*, Green algae (19.96% and 17.92%) follow by Diatoms (17.50% and 24.37%); while Adult algae (19.89% and 19.23%) follow by Diatoms (18.21% and 21.41%). This concise the findings of Ajah et al. [50] that adults of C. *nigrodigitatus* consumed more of diatoms (23%), Chlorophyceae and crustaceans (22%). The presence of detritus in the items ingested by the species in all the sized groups corroborates the findings of Idodo-Umeh [51], which showed that feeding was mainly done at the bottom of the lake.

CONCLUSION

Sex ratio of both species under study shows a skew variation of either male or female in the population. LWR of *Hyperopisus bebe occidentalis*, had positive allometric growth pattern with poor environmental condition. However, *Brycinus macrolepidotus* show negative allometric growth pattern and better ecological condition. The feeding habits of both species show a wide spectrum of food items at various stages. The presence of aquatic flora and fauna suggest that *Brycinus macrolepidotus* is an Omnivore species and *Hyperopisus bebe occidentalis* indicates Herbivore nature.

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