

## LENGTH WEIGHT RELATIONSHIP, FOOD AND FEEDING HABITS AND CONDITION FACTOR OF *Synodontis melanoptera* AND *Synodontis courtetti* FROM LOWER RIVER BENUE, BENUE STATE, NIGERIA

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### ABSTRACT

*Length weight relationship, food and feeding habit and condition factor of Synodontis melanoptera and Synodontis courtetti from Lower River were investigated. The results show that total length, weight and condition factor of S. melanoptera male ranged from 25.50-47.00cm, 100.00-955.00g and 0.39-1.82. Total length, weight and condition factor of S. melanoptera female ranged from 22.50-45.70cm, 103.00-963.00g and 0.55-2. Female S. melanoptera had higher mean total length (34.02±0.96cm), weight (518.20±42.58g) and condition factor (1.12±0.05) than the male with (33.15±1.21cm), 358.83±52.09g and 0.78±0.05 respectively. Contrastingly, the total length, weight and condition factor of S. courtetti male ranged from 21.48-44.40cm, 106.20-840.40g and 0.37-1.94. Total length, weight and condition factor of S. courtetti female ranged from 22.48-48.30cm, 106.20-946.10g and 0.34-1.76. Female S. courtetti had higher mean total length (33.40±0.85cm), weight (381.58±36.09g) and condition factor (0.89±0.40) than the male counterpart (32.30±0.87cm, 327.32±39.68g and 0.88±0.06 respectively. The 'b' values for male, female and combined sexes of S. melanoptera were 3.62, 3.32 and 3.45, with high correlation coefficients of 0.91, 0.92 and 0.90, respectively. Male S. melanoptera had better 'b' value (3.62) than the female (3.32). Also, the 'b' values for male, female and combined sexes of S. courtetti were 3.16, 3.10 and 3.12 with high correlation coefficients of 0.83, 0.85 and 0.84, respectively. Higher 'b' value (3.16) was recorded for male S. courtetti than the female (3.10). The most frequently food item consumed by S. melanoptera and S. courtetti were stones; while S. melanoptera consumed 61.64% of this food item, S. courtetti consumed 86.44% followed by worms. S. melanoptera consumed 45.21%, S. courtetti consumed 69.49% whereas, the least frequently consumed food item by S. melanoptera and S. courtetti were crayfish (4.11%) and unidentified food item (10.17%), respectively. Numerically, the highest food item consumed by S. melanoptera and S. courtetti were worms (Nematode); S. melanoptera accounted for 31.90% while S. courtetti accounted for 34.57%. Crayfish (3.33%) and unidentified food item (5.76%) were the least food items consumed by S. melanoptera and S. courtetti.*

**Key words:** Length-weight, food and feeding, condition factor *Synodontis melanoptera*, *Synodontis courtetti*

### 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 (Kobl Müller *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). 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 (Akegbejo- Samsons, 1995).

Condition factor has also been used as an index of growth and feeding intensity which tends to decrease 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 dietary habits of fishes based on stomach content analysis is widely used in fish biology and ecology to indicate the position of species within a food web and to provide information on the contribution of different prey items to the diet. The information about the food and feeding habits of fishes is useful in dieting predators-prey relationship, estimation of trophic level and in creation of trophic models as a tool to understanding complex ecosystems (Lopez Peralza and Acila 2002).

Mochokid species have only been identified and listed in the Lower River Benue but the identification and listing of this fish species are not enough for the purpose of their management. This work becomes imperative due to the dearth of information on the biology of this important food, economic and commercial fish family in the Lower River Benue, Makurdi, Nigeria.

## MATERIALS AND METHODS

### Field and laboratory analysis

Sampling was done monthly for four months from September 2015 to December 2015. Fish samples were randomly collected from selected artisanal fishers' landings whose fishing gear were mainly gillnet, stretched seine net 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 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 (Olaosebikan and Raji, 1998). The total length was measured to the nearest 0.1 cm using a measuring tape while the weight of the fish samples was taken using a weighing balance with model no (HC-D) to the nearest 0.1 g, respectively following the procedure of King (1996) after blotting out water from the fish.

### 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). Each stomach sample was opened and the content emptied into a petri dish. Some food items such as stones and insects parts were identified with the naked eyes while others were identified with the aid of a microscope. Different methods were employed for the estimation of the fish diets as follows:

#### Numerical method

The total number of each food item in each gut was summed up for all guts and expressed as a percentage of the total number of all food items (Inyang and Nwani, 2004).

$$\% NFI = \frac{SEFG}{TNAF} \times 100$$

Where:

% NFI = Percentage Numerical of food item

SEFG = Summation of each food item in each gut

TNAF = Total number of all food items

#### Frequency of occurrence method

Frequency of occurrence method was carried out as described by Hynes, (1950). The number of guts in which each food item occurred were listed and expressed as a percentage of the total number of guts examined. The fish population that fed on a particular food item was estimated (Inyang and Nwani, 2004).

$$FC = \frac{NSPT}{TNST} \times 100$$

Where:

FC = Frequency of occurrence

NSPT = Number of stomach with the particular food item

TNST = Total number of stomach with food

#### Condition factor of the fish samples

Condition factor (K) which is the degree of fatness or well-being of a specimen was calculated using Fulton (1904):

$$C.F = 100W/L^3$$

Where

K = Condition factor,

W = Observed total weight for each fish (g),

L = Observed Total length for each fish (cm)

### Data and statistical analysis

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

$$W = aL^b$$

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<sup>b</sup>) when converted into the logarithmic form gives a straight line relationship graphically:

$$\text{Log}W = \text{Log} a + b \text{Log}L$$

Where: b = slope of the linear graph = constant. Descriptive statistics of some of the measured morphometric characteristics were carried out using Social Science Software (SPSS Version 16).

## RESULTS

### Morphometric Parameters and Condition Factors of *S. Melanoptera* and *S. Courtetti* from Lower River Benue

Results of the minimum and maximum total length and weight, mean total length, mean weight and mean condition factor of *S. melanoptera* and *S. courtetti* from Lower River Benue are shown in Table 1. Total length, weight and condition factor of *S. melanoptera* male ranged from 25.50-47.00cm, 100.00-955.00g and 0.39-1.82 with the

corresponding mean total length, weight and condition factor of 33.15±1.21cm, 358.83±52.09g and 0.78±0.05, respectively while the total length, weight and condition factor of *S. melanoptera* female ranged from 22.50-45.70cm, 103.00-963.00g and 0.55-2.65 with the corresponding mean total length, weight and condition factor of 34.02±0.96cm, 518.20±42.58g and 1.12±0.05, respectively. Female *S. melanoptera* had higher mean total length (34.02±0.96cm), weight (518.20±42.58g) and condition factor (1.12±0.05) than the male (33.15±1.21cm), 358.83±52.09g and 0.78±0.05 for mean total length, weight and condition factor, respectively. However, there was no significant difference (p>0.05) in mean total length between the male and female *S. melanoptera* but significant differences (p<0.05) existed in mean weight and condition factor of male and female *S. melanoptera* from Lower River Benue.

Contrastingly, the total length, weight and condition factor of *S. courtetti* male ranged from 21.48-44.40cm, 106.20-840.40g and 0.37-1.94 with the corresponding mean total length, weight and condition factor of 32.30±0.87cm, 327.32±39.68g and 0.88±0.06, respectively while the total length, weight and condition factor of *S. courtetti* female ranged from 22.48-48.30cm, 106.20-946.10g and 0.34-1.76 with the corresponding mean total length, weight and condition factor of 33.40±0.85cm, 381.58±36.09g and 0.89±0.40, respectively.

Female *S. courtetti* had higher mean total length (33.40±0.85cm), weight (381.58±36.09g) and condition factor (0.89±0.40) than the male counterpart (32.30±0.87cm, 327.32±39.68g and 0.88±0.06), for mean total length, weight and condition factor, respectively. There was no significant difference (p>0.05) between the male and female *S. courtetti* in the parameters measured.

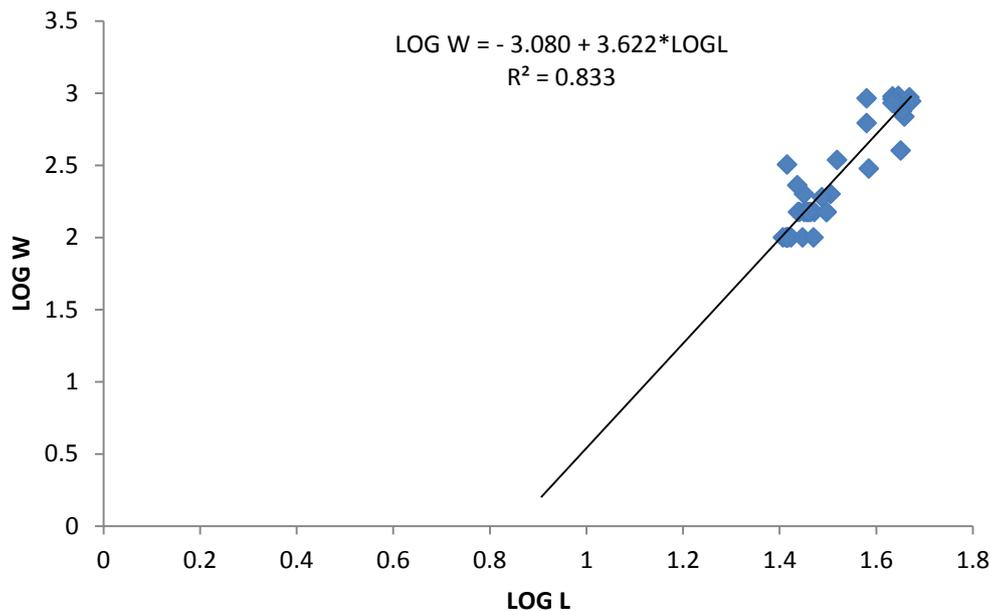
**Table 1.** Morphometric parameters and condition factors of *S. melanoptera* and *S. courtetti* from Lower River Benue

Parameters	Fish species					
	<i>S. melanoptera</i>			<i>S. courtetti</i>		
	Male	Female	P-value	Male	Female	P-value
TL Range	25.50-47.00	22.50-45.70	-	21.48-44.40	22.48-48.30	-
Mean TL	33.15±1.21	34.02±0.96	0.58 <sup>ns</sup>	32.30±0.87	33.40±0.85	0.40 <sup>ns</sup>
WT Range	100.00-955.00	103.00-963.00	-	106.20-840.40	106.20-946.10	-
Mean WT	358.83±52.09	518.20±42.58	0.02	327.32±39.68	381.58±36.09	0.34 <sup>ns</sup>
K Range	0.39-1.82	0.55-2.65	-	0.37-1.94	0.34-1.76	-
Mean K	0.78±0.05	1.12±0.05	0.00	0.88±0.06	0.89±0.40	0.91 <sup>ns</sup>

**NOTE:** TL = Total length, WT = Weight, K = Condition factor, Ns = No significant difference

Results of the length-weight relationship of male, female and combined sexes of *S. melanoptera* are shown in figures 1, 2, and 3 while the results of the length-weight relationship of male, female and combined sexes of *S. courtetti* are shown in figures 4, 5, and 6, respectively. The ‘b’ values for male, female and combined sexes of *S. melanoptera* were 3.62, 3.32 and 3.45, with high

correlation coefficients of 0.91, 0.92 and 0.90, respectively. Male *S. melanoptera* had better ‘b’ value (3.62) than the female (3.32). Also, the ‘b’ values for male, female and combined sexes of *S. courtetti* were 3.16, 3.10 and 3.12 with high correlation coefficients of 0.83, 0.85 and 0.84, respectively. Higher ‘b’ value (3.16) was recorded for male *S. courtetti* than the female (3.10).



**Fig. 1:** Length weight relation of male *S. melanoptera* from Lower River Benue

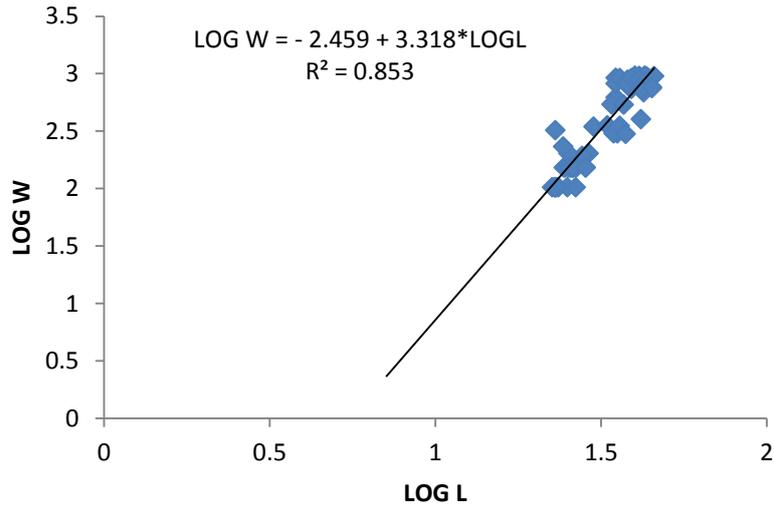


Fig. 2: Length weight relation of female *S. melanoptera* from Lower River Benue

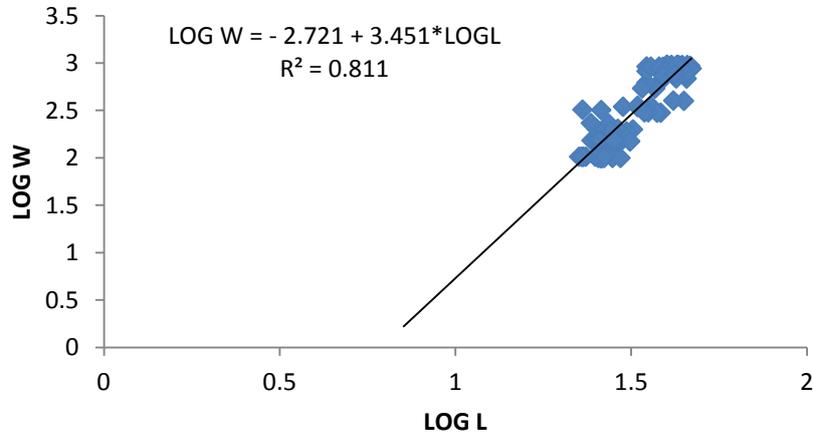


Fig. 3: Length weight relation of combined sexes of *S. melanoptera* from Lower River Benue

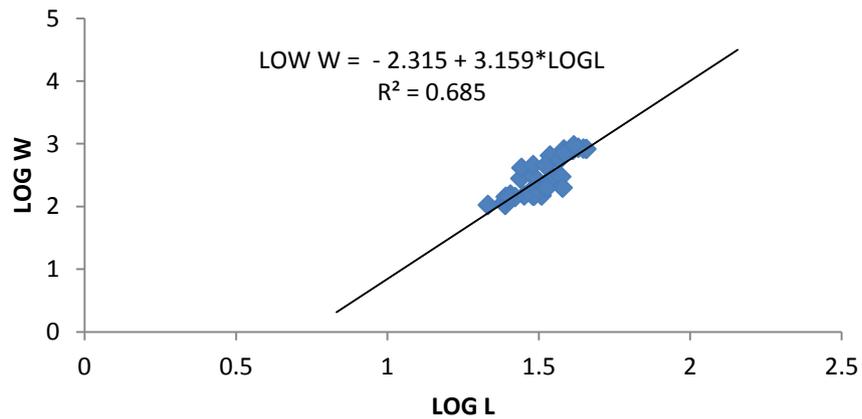


Fig. 4: Length weight relation of male *S. courtetti* from Lower River Benue

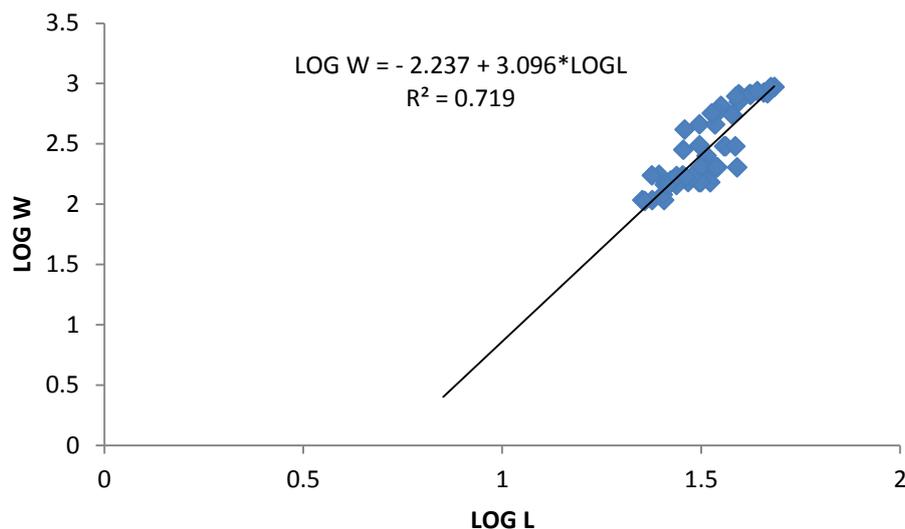


Fig. 5: Length weight relation of female *S. courtetti* from Lower River Benue

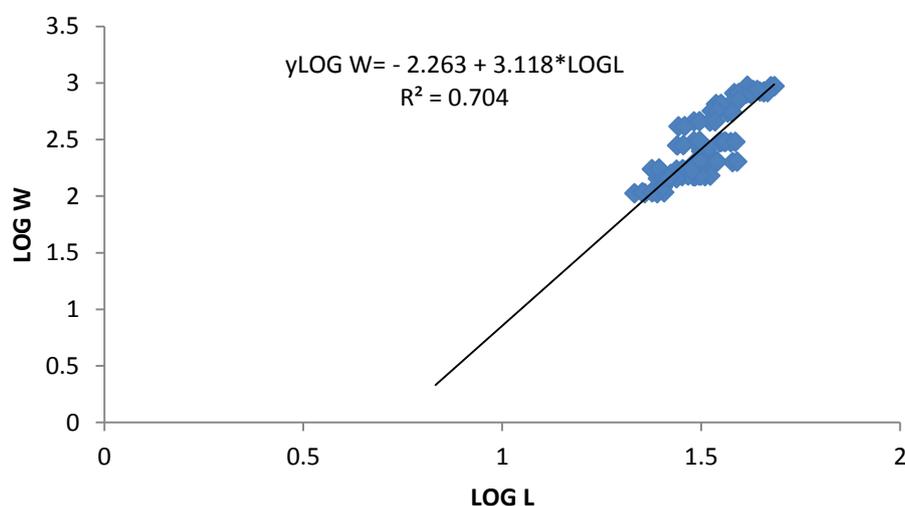


Fig. 6: Length weight relation of combined sexes of *S. courtetti* from Lower River Benue

**Diet composition in the Stomach of *S. Melanoptera* and *S. Courtetti* from Lower River Benue**

Of the 100 *S. melanoptera*, 27% had empty stomach, 17% had quarter-full stomach, 23 % had half-full stomach, 20 % three quarter full stomach while 13 % had full stomach whereas, of the 100 *S. courtetti*, 41% had empty stomach, 11% had quarter-full stomach, 20 % had half-full stomach, 21 % three quarter full stomach while 7 % had full stomach. Results of the diet composition of *S. melanoptera* and *S. courtetti* by frequency of occurrence and numerical methods from Lower River Benue are presented in Figures 7 and 8, respectively.

The most frequently food item consumed by *S. melanoptera* and *S. courtetti* were stones; while *S. melanoptera* consumed 61.64% of this food item, *S. courtetti* consumed 86.44% followed by worms; while *S. melanoptera* consumed 45.21%, *S. courtetti* consumed 69.49% whereas, the least frequently consumed food item by *S. melanoptera* and *S. courtetti* were crayfish (4.11%) and unidentified food item (10.17%), respectively. Numerically, the highest food item consumed by *S. melanoptera* and *S. courtetti* were worms (Nematode); *S. melanoptera* accounted for 31.90% while *S. courtetti* accounted for 34.57%. Crayfish (3.33%) and unidentified food item (5.76%) were the least food items consumed by *S. melanoptera* and *S. courtetti*.

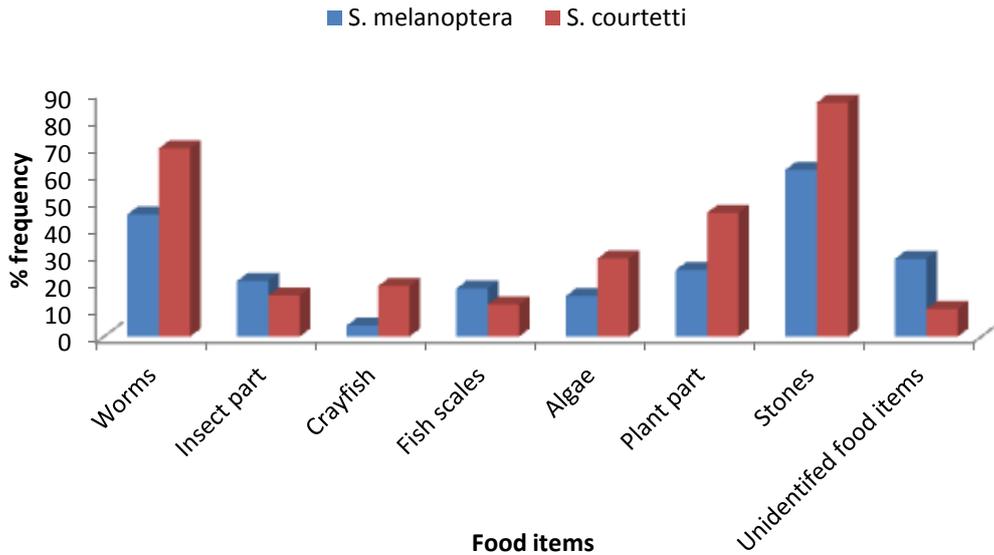


Fig. 7: Diet composition in the stomach of *S. melanoptera* and *S. courtetti* from Lower River Benue by frequency of occurrence method.

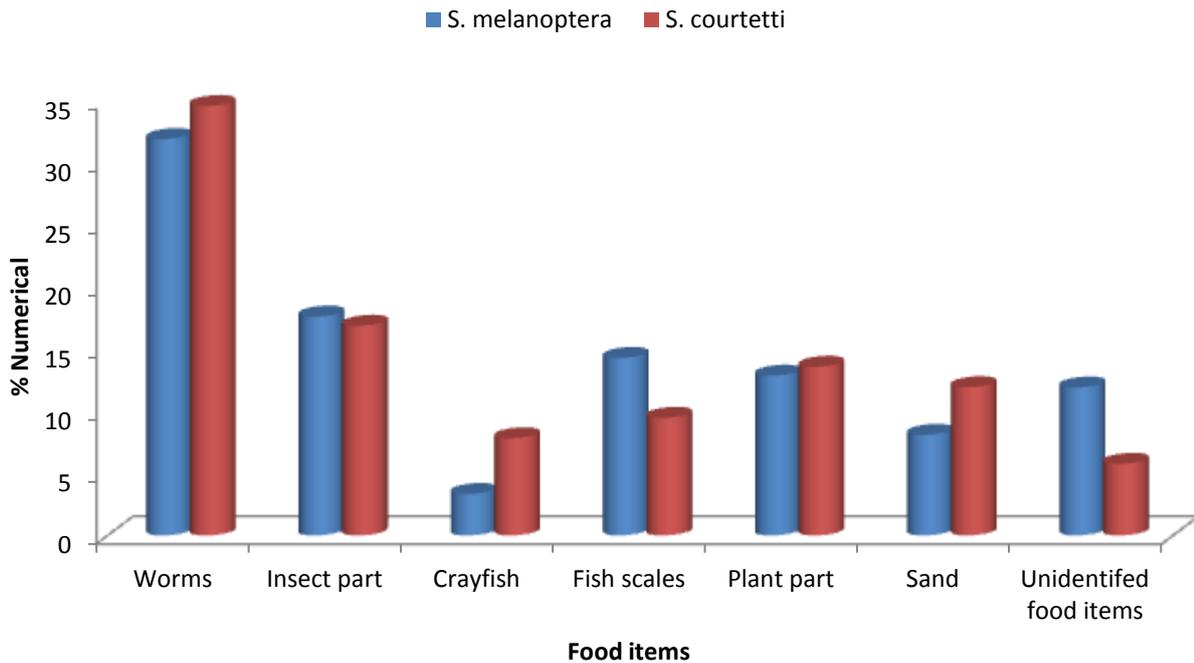


Figure 8: Diet composition of *S. melanoptera* and *S. courtetti* by Numerical method.

**DISCUSSION**

Length-weight relationship, food and feeding habit and condition factors of *S. melanoptera* and *S. courtetti* from Lower River Benue were determined. Positive allometric growth was exhibited by the fish samples used for this work. The high positive correlations exhibited by the male and female *S. melanoptera* and *S. courtetti*

from Lower River Benue suggested that as length of the fish increased, its body weight also increased and this could be attributed to the presence of quality and quantity of food and plankton yield from the water body where the fish samples inhabited. Similar observation had been made by Peeple and Ofor (2011). The ‘b’ values for male, female and combined sexes of the fish

samples obtained in this work are within the range of 'b' values reported by Bagenal and Tech (1978). According to Bagenal and Tech (1978), allometric coefficients may range from 2 to 4.

Different factors are known to affect Length-weight relationship parameters (a and b) of fish and among these factors are season, habitat, gonad maturity, sex, diet, stomach fullness, health, preservation techniques and annual differences in environmental conditions (Froese 2006). The little variation in 'b' values of the fish samples in this work could be due to one or a combination of most of the factors including differences in the number of specimens examined, area/seasonal effects and distinctions in the observed length ranges of the specimens caught, to which duration of sample collection can be added as well (Moutopoulos and Stergio, 2002).

Variation in the of K-values of the fish samples could be as result of food abundance, adaptation to the environment and gonad development of the fish samples. This is in line with the reported work of Soyinka and Adekoya (2011) who reported that variations of K may be indicative of food abundance, adaptation to the environment and egg/gonad development in fish. Understanding the relationship between body structures and fish diet is vital for predicting fish diet and their mechanisms of feeding. Hence the type of food found in an area influenced the distribution, abundance and rate of growth (size) of the fish (Oghenechuko, 2007).

The size frequency distribution of the specimens revealed different weight, age and size classes in

the population. Previous studies have shown that there exist varieties in food and feeding habits of fishes according to their weight, age and size, (Omorinkoba and Fatuiti 2009). The stomach of the fish samples in this work showed that the variety of food items comprised organisms of animal and plant materials as well as stones and food that could not be identified (unidentified food items), suggesting that the fish samples were omnivores. Olele, (2011) had made similar observation. Omnivorous nature of *S. membranaceus* had been reported by Owolabi (2008). The prominence of stones and worms in the diets of the fish samples could be an indication that *S. melanoptera* and *S. courtetti* are bottom-benthic feeders. This agrees with the reported work of Owolabi (2008) who reported *S. membranaceu* as a bottom-benthic feeder, feeding actively on bottom food items including falling organic debris.

The greater number of guts with food observed in this work could be attributed to good feeding strategy adopted by the fish samples and probably due to food abundance during the period of study (Nwani 2007). Also, the occurrence of higher non empty guts observed in the fish samples in this work may have resulted from the immediate arrest of food digestion through the injection of formalin into the gut region of the fish before its conveyance to the laboratory after capture. This observation is in line with the reported work of (Malami *et al.*, 2004).

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