

# Morphometric Characteristics and Feeding Habits of Five Commercial Fish Species of the Libga Reservoir in the Northern Region of Ghana

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## Research Article

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## Abstract

Knowledge of the growth size of fishes and what they feed provide basis for the choice of fish species for culture which is very essential for successful aquaculture. This study was conducted to assess the size and feeding habits of *Auchenoglanis occidentalis*, *Brycinus imberi*, *Sarotherodon galilaeus*, *Oreochromis niloticus* and *Marcusenius abadii* of the Libga reservoir. Samples were purchased from catches of local fishermen from the reservoir and assessed once every month from December 2015 to May 2016. Fish samples were preserved with ice and immediately transported to the laboratory for morphometric data and stomach content analysis. A total of 223 specimens were examined. The mean total length of the preferred fish species ranged 11.73 – 18.63 cm and mean weight ranged 26.75 – 79.21 g. *A. occidentalis* fed more on insects (35 %), *O. niloticus* fed more on algae (90 %), *S. galilaeus* showed more preference for algae (80 % composition). *B. imberi* preferred plant parts (50 % composition) and *M. abadii* fed on earthworms and insects with equal composition of 42.1 %. Some of the species also fed on sand namely *A. occidentalis* (20 %), *O. niloticus* (10 %) and *M. abadii* (10.5 %). The ability of the preferred fish species to feed on a wide range of food items makes them potential candidates for aquaculture.

**Keywords:** Diet; Feeding Habit; Fish Morphometry; Libga; Reservoir

## Introduction

Northern Ghana is endowed with numerous rivers and reservoirs of which Libga reservoir is one of them. This reservoir serves a number of functions including watering of livestock, irrigation of crops and as domestic water source to nearby communities. Fisheries resources are also provided by this reservoir which ensures enhanced nutritional health from fish protein and occupational fishing to both local and migrant fishermen from southern Ghana thus providing employment and income to local and migrant fishermen though this is not its intended use. Frequent assessment of the Libga reservoir fishery may be necessary because population size, structure, and distribution fluctuate in response to environmental variation [1].

Biological research of fish species is important for the assessment of probability of culture in water bodies. The morphometric analysis of fish is a vital key in the study of biology of fish. In most fishes, variations in the relative growth of the various body parts are known to occur at distinct stages of development and particularly at sexual maturity [2]. Growth of the body parts is proportional to the growth of the total length. So, morphometric measurement of fishes and the study of relationship among them are important for taxonomic study of a species [3]. The shape and structures are unique to the species and the variations in its feature are probably related to the habit and habitat among the variants of this species [4].

The food and feeding habitat of fish may be an important characteristic of the life-history strategy of a species to know the foremost necessary functional role of the fish inside their living ecosystems [5-8]. The study of the food and feeding habits of freshwater fish species is a subject of continuous research, because it plays a basic integral part in the development of a successful fisheries management programme on fish capture and culture [9,10]. Diet compositions are important in community ecology because the use of resources by organisms has a major influence on population interactions within a community according to Mequilla and Campos [11]. Knowledge on the natural food of fish in its habitat is important in order to be aware of its nutritional needs

and interaction with other organisms [12]. Again, the understanding of fish diet provides information on grouping of fish with respect to their food, method of feeding, determination of the population parameters of some species that cannot be determined by other methods and subsequent successful culture [13].

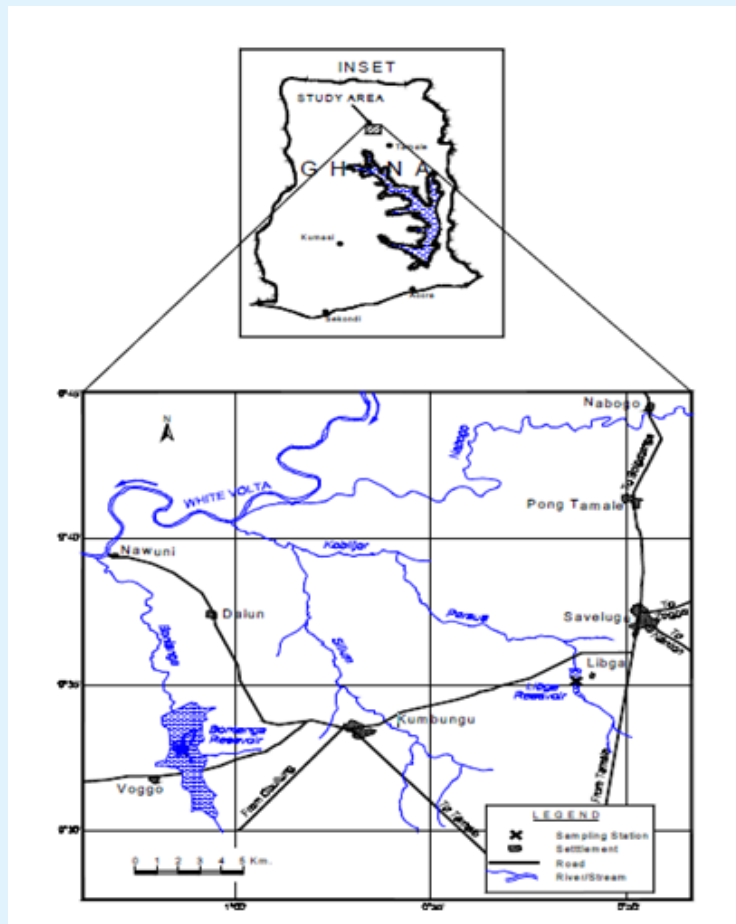
Reservoir fisheries cannot be overlooked as far as its nutritional and economic importance is concerned with regards to the riparian community and the nation as a whole. Despite the numerous importances of reservoirs (Libga) in terms of fisheries, catches are declining as human population is increasing while the demand for fish and fish resources is increasing [14]. According to Quacoopome T, et al. [15] dwindling catches have become a common problem for over 20 years with possible reasons for their decline being over exploitation of stocks, environmental degradation and low water levels.

To meet this demand for fish, there is a need for management of the stock and also alternative fish sources preferably aquaculture. Unfortunately there is inadequate data on preferred fish species in the Libga reservoir. Thus there is a need to know the food and feeding habits of the preferred fishes and also their morphometry since morphometric studies are not only essential to understand the taxonomy but also the health of a species (including reproduction) [4], in order to lay a foundation for the culture of these fishes since aquaculturists would first of all be interested in the food of these fishes.

## Materials and Methods

### Study Area

The Libga reservoir (9° 35' N, 0° 51' W) (Figure 1) located in the Savelugu District has a surface area of 48 ha at maximum height. It was impounded in 1970 but the wall collapsed in the same year, flooding the downstream areas and subsequent rehabilitation was completed in 1971. Although its main purpose of construction was irrigated agriculture, it is currently being used for a variety of domestic purposes. Besides these benefits, the Libga reservoir is of immense economic importance to the locals and migrants who have developed survival strategies based on access to both fishing and farming [15].



**Figure 1:** Map of Ghana showing Libga reservoir in northern Ghana, adopted from Quarcoopome T, et al. [15].

### Data Collection

Information on the preferred fish species was obtained with the use of semi-structured interviews. A total of seventeen randomly selected fishermen from the two major landing sites of the reservoir and five fish sellers were interviewed for response on the preferred fish species. Samples of the preferred fish species used for stomach content analysis were purchased from catches of local fishermen using hooks and lines, gill nets, and cast nets in the reservoir. Catches of local fishermen from the reservoir were assessed once every month from December 2015 to May 2016. All fish specimens were still alive as at the time of purchase. Fish samples were preserved with iced block and immediately transported to the laboratory for further analysis. Fish species of economic importance were identified using identification keys provided by Dankwah HR, et al. [16]

### Determination of Stomach Contents

Specimens were dissected and the guts removed, poured out into a petri dish for stomach content analysis. Contents which could not be easily identified using the naked eye or magnifying glass were taken with a dropper and placed on slides and viewed under an electronic microscope.

### Data Analysis

Stomach contents were analysed using the frequency of occurrence and 'points' method [17-19]. The frequency of occurrence method estimates the percentage of stomachs in a sample containing a given food item whereas the 'points' method gives the bulk contribution of each food item to the total food consumed. Points were awarded to each stomach according to its degree of fullness; 10 points for full stomach, 5 for half stomach and

2.5 for quarter filled stomach. Empty stomachs were excluded from the analysis. The total number of points awarded to each stomach was subdivided among the food items present according to their relative contribution to the total stomach content. The percentage composition of each of the food items was determined by summing up the points awarded to the item and dividing it by the total points awarded to all stomachs containing food, and the resulting value expressed as a percentage [20].

The Gut Repletion Index (GRI) was calculated using the formula: No. of non-empty guts/Total no. of specimens x 100 [21].

The data obtained on the stomach contents was analysed using Microsoft Excel and presented using

descriptive statistics such as tables and pie charts for easy comparison.

## Results and Discussion

### The Preferred Fish Species by Riparian Community

The result showed that *Auchenoglanis occidentalis* (Valenciennes, 1840), *Brycinus imberi* (Peters, 1852), *Sarotherodon galilaeus* (Günther, 1903), *Oreochromis niloticus* (Linnaeus, 1758) and *Marcusenius abadii* (Boulenger, 1901) were the preferred fish species and the reason for their choice was good taste, as such, these fish species are easily patronised for quick income to the fishermen (Figure 2).

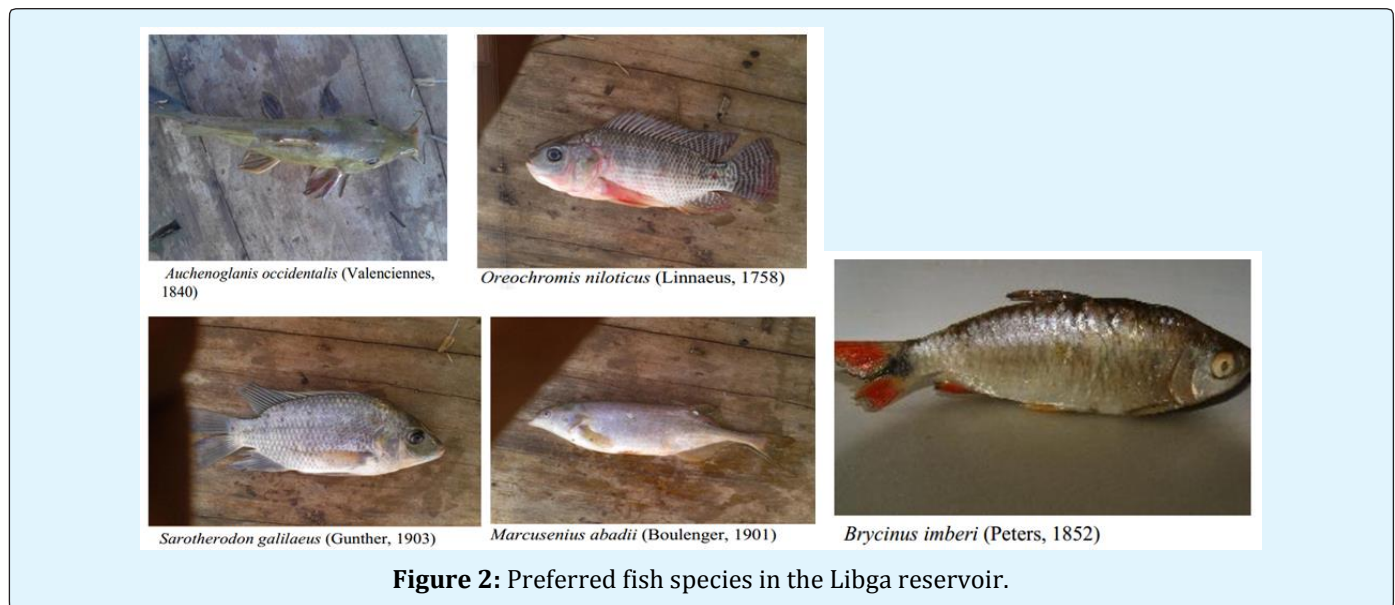


Figure 2: Preferred fish species in the Libga reservoir.

### Morphometry of the Preferred Fish Species

Out of a total of 223 specimens examined, 49 were *Auchenoglanis occidentalis*, 56 *Brycinus imberi*, 66 *Sarotherodon galilaeus*, 30 *Oreochromis niloticus* and 22 *Marcusenius abadii*. This showed that the samples were dominated by *Sarotherodon galilaeus* species with *Marcusenius abadii* being the least (Figure 3). *Auchenoglanis occidentalis* recorded the highest mean total length and weight of 18.6 cm and 79.2 g respectively and *Marcusenius abadii* recorded the least mean weight of 26.75g while *Sarotherodon galilaeus* recorded the least mean total length of 11.7cm with 80% of the species recording their highest mean total length in March (Table 1).

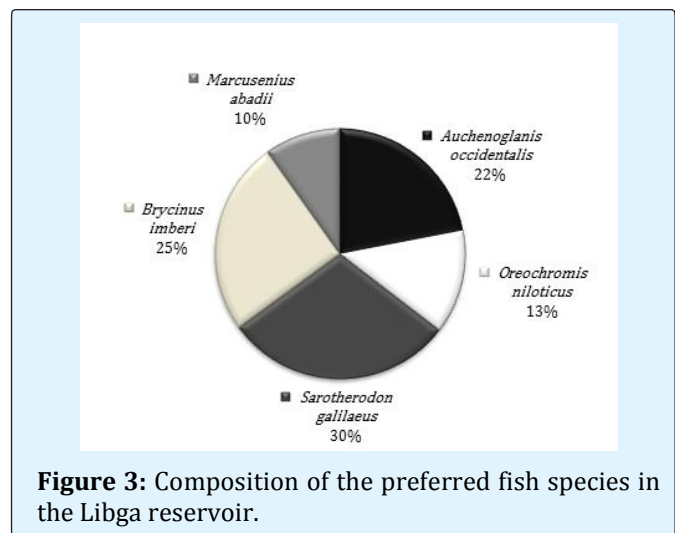


Figure 3: Composition of the preferred fish species in the Libga reservoir.

Species	N	Total Length, TL/cm			Weight/g			Month	
		Max	Min	Mean	Max	min	mean	Max	Min
<i>Auchenoglanis occidentalis</i>	49	28.2	13.5	18.6	259	26	79.2	Mar	Feb
<i>Oreochromis niloticus</i>	30	20	6.2	12	151.5	4.24	41.2	Mar	Dec
<i>Sarotherodon galilaeus</i>	66	16.5	6.5	11.7	82.7	5.2	37.5	Mar	Dec
<i>Brycinus imberi</i>	56	18.3	10	13	64	10.4	28.1	Mar	Jan
<i>Marcusenius abadii</i>	22	16.1	10	14.7	39	18	26.75	Dec	Feb

**Table 1:** Summary of weight and length distributions of the preferred fish species.

The maximum total length and maximum weight of *Auchenoglanis occidentalis* specimen was 28.2 cm and 259.01 g respectively (Table 1) compared to that recorded by Onimisi HU, et al. [22] (37.5 cm total length and 800 g maximum weight) in Zaria reservoir, Nigeria suggesting that the species caught from the Libga reservoir were small in size. The differences in the length and weight of the species may be due to the high level of exploitation. The minimum total length of fish (13.5 cm) maybe due to the selectivity of the mesh sizes of the nets used to capture the fish [23].

It was observed that the maximum weight of *Oreochromis niloticus* was 151.52 g (Table 1) from the Libga reservoir. This was in contrast to that recorded by Imam TS, et al. [24], who recorded a maximum weight of 50 g for *Oreochromis niloticus* in Wasai reservoir, Nigeria. However, the average weight of the fish during the study was 41.16 g which means that most of the fish captured were small sized with only few big ones. This might be due to the selectivity of the fishing gear used to capture the fish species.

The mean total length of *Sarotherodon galilaeus* was 11.73 cm (Table 1) compared to that recorded by Adedeji HA, et al. [25], (16.23±1.41 cm), showing that most of the fish were under size at the time of capture and it was the same for the mean body weight. The total length of *Brycinus imberi* ranged 10-18.3 cm (Table 1) compared to that of its close relative *Brycinus nurse* recorded by Abobi SM, et al. [26], (6.5-27.5cm) showed that the fish species captured in Libga reservoir were medium sized. The total length of *Marcusenius abadii* ranged 10-16 cm (Table 1) indicating that the fish were small sized which might be due to the selectivity of the mesh sizes of the nets and over-exploitation.

#### Food Items Consumed by the Preferred Fish Species

The Gut Repletion index of the preferred fish species ranged from 30% to 63.6% (Table 2). This showed that all the species are non-active feeders and have lower energy requirement to sustain this level of feeding intensity [27].

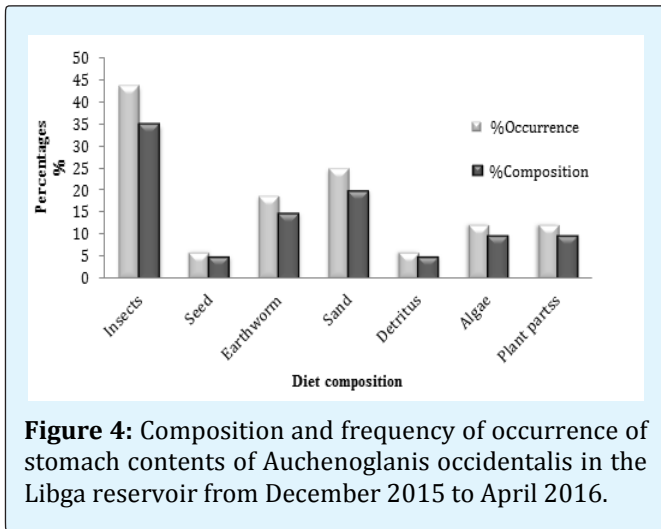
Species	% Occurrence					GRI (%)
	Empty	Quarter	Half	Three-quarter	Full	
<i>Auchenoglanis occidentalis</i>	68	6	10	4	12	32.7
<i>Oreochromis niloticus</i>	70	0	10	0	20	30
<i>Sarotherodon galilaeus</i>	71	12	6	5	6	30.3
<i>Brycinus imberi</i>	84	5	7	0	4	16.1
<i>Marcusenius abadii</i>	36	9	9	0	46	63.6

**Table 2:** Percentage distribution of stomach contents of the preferred fish species in the Libga reservoir.

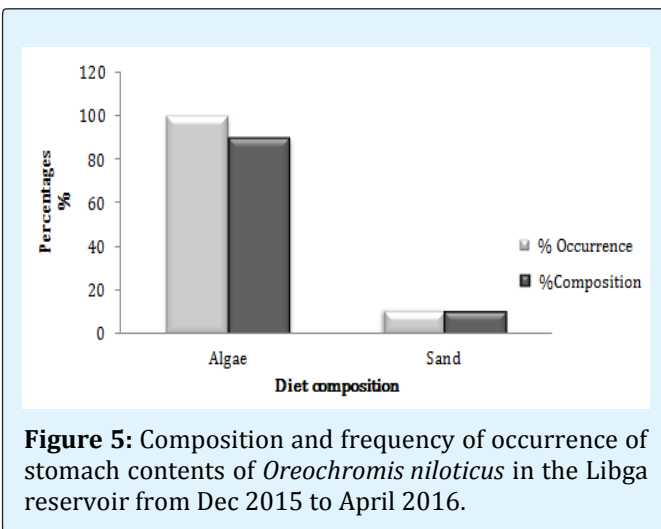
The results from this study showed that *Auchenoglanis occidentalis* consumed variety of food items ranging from insects, sand, earthworms, plant parts and algae (Figure 4). This was similar to Onimisi HU, et al. [28], who reported that *Auchenoglanis occidentalis* from Zara reservoir fed on a variety of food such as insect larvae and pupae and plant material including detritus making the fish omnivorous. This result also showed that

*Auchenoglanis occidentalis* was a bottom feeder. It was also observed in this study that the fish fed more on insects and earthworms than other food items and this preference could be due to the fact that these food items were dominant in the reservoir. The high percentages of empty stomachs encountered during the study maybe due to the fact that the foods eaten were soft and were easily digested. This might also be as a result of the fishes been

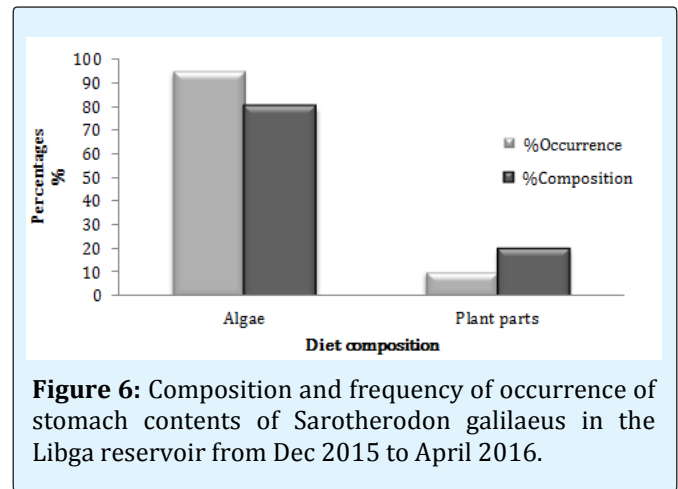
captured the evening before sampling hence long period of struggling making them expend more energy [29].



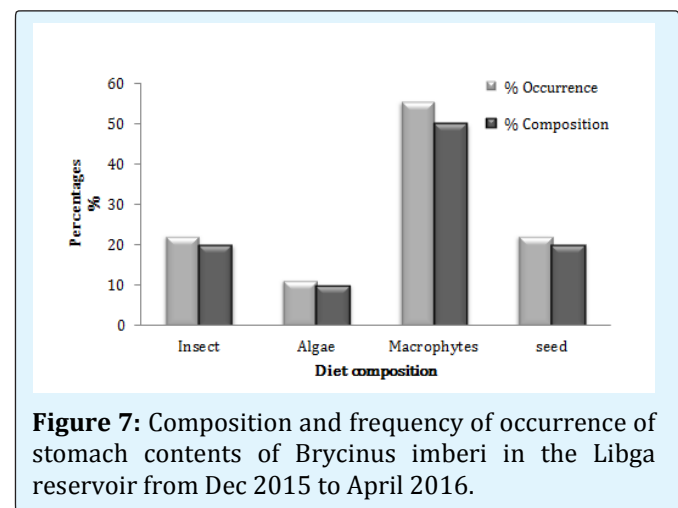
*Oreochromis niloticus* fed exclusively on green algae with only one of the fish feeding on sand (Figure 5). This was in contrast to Oso JA, et al. [9], who suggested that *Oreochromis niloticus* was omnivorous feeding on a wide range of macrophytes, green algae, detritus, sand grains, insect parts etc. and that of Abdulhakim, A et al. [30] who said that the major food items of *Oreochromis niloticus* in Lake Alau were mainly herbs, algae and fish remains. The contrasting feeding habits of the fish may be due to the differences in the abundance of the food items in the different locations. The feeding habits were also different from those reported by Fagade SO and Olaniyan [31] in the Lagos lagoon. However, Abdulhakim A, et al. [30] also discovered sand or mud in the gut of *Oreochromis niloticus* and this indicated that the fish is a bottom feeder.



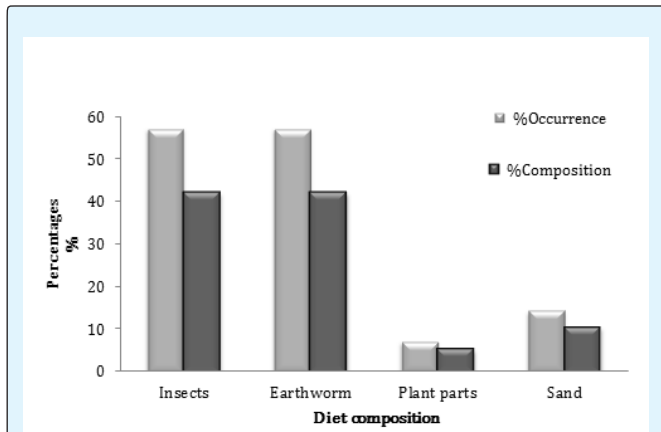
The result of the study showed that *Sarotherodon galilaeus* fed mainly on green algae and plant parts (Figure 6). This did not differ markedly from Oso JA, et al. [9], who suggested that *Sarotherodon galilaeus* was omnivorous feeding on a wide range of macrophytes, green algae, detritus, sand grains, insect parts etc. However, this was in contrast with Ajala O, et al. [32], who reported that *Sarotherodon galilaeus* had preference for food items of animal origin in both immature and matured stages.



The study showed that *Brycinus imberi* fed on algae, insects and plant parts being the dominant food item (Figure 7). This made the fish omnivorous feeding on a range of food items. This agreed with N'da AS, et al. [33] who said *Brycinus leuciscus* was omnivorous. This also was similar to that recorded in its close relative *Brycinus nurse* by Saliu JK [34]. The trophic status of the fish indicated that it was omnivorous and consequently it fed on a broad spectrum of food items, a feature that similarly occurred in its other close relatives.



*Marcusenius abadii* in Libga reservoir fed on a wide range of food items namely insects, plant parts, earthworms and sand with insects been the dominant food item (Figure 8). This indicated that the fish was an omnivore and a bottom feeder. This did not differ from the findings of Kouamelan EP, et al. [35] who asserted that *Marcusenius* species fed on chironomid larvae.



**Figure 8:** Composition and frequency of occurrence of stomach contents of *Marcusenius abadii* in the Libga reservoir from Dec 2015 to April 2016.

## Conclusion

The sizes of the preferred fish species sampled during the study were relatively small and this may be due to the type of fishing gear used and size-selectivity of the mesh of the nets used. The result indicated that the fishes fed on wide range of food items though most of their stomach at the time of study was empty which may probably be due to long hours of struggling after capture. Most of the species from the results were omnivores. The ability of the economic fish species to feed on a wide range of food items means there is less interspecific competition in the reservoir and probably makes them possess a high aquaculture potential. This is particularly important for the culture of these species, since it is possible to formulate artificial diets necessary for their mass production. The non-specific feeding habit of these fish species is what has accounted for their wide distribution and abundance in the Libga reservoir. It can be concluded that the preferred fish species in the Libga reservoir utilize more than one source of food.

It was recommended that studies should be done on other aspects of the fishes such as the reproduction of the species in order to aid their culture. Extended study of this research should be carried out on these species for a

year to bring into light possible inherent factors leading to this observation.

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