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SEASONAL CHANGES IN STOMACH CONTENT OF THREE FISH SPECIES, *OREOCHROMIS NILOTICUS, AUCHENOGLANIS OCCIDENTALIS* AND *MORMYRUS RUME* IN RIVER NIGER AXIS, ONITSHA, NIGERIA.

I.E. Iloghalu [a*], V N. Arazu [b], K. N. Ibemenuga [a], N. P. Udeh [c], C. U. Ezechi [d] and E. C. Nwanna [e]

[a] Department of Biological Sciences, Faculty of Natural Sciences, Chukwuemeka Odumegwu Ojukwu University, Uli campus, Anambra State, Nigeria.
[b] Department of Fisheries and Aquaculture, Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University, Igbariam campus, Anambra State, Nigeria.
[c] Department of Zoology, Faculty of Biosciences, Nnamdi Azikiwe University, Awka Nigeria.
[d] Anambra State Polytechnic, Mgbakwu, Anambra State, Nigeria.
[e] Department of Agricultural and Bioresources Engineering, Faculty of Engineering, Nnamdi Azikiwe University, Awka Nigeria.

Corresponding author: lizzyfine003@gmail.com

ABSTRACT

Food and feeding habits of fishes are feared to be affected by seasons, therefore the aim of this study is to ensure fish food security at all seasons. Objectives of this research is to determine stomach content of studied fish species. In the method fish samples were collected from sampling sites from March 2022 to November 2023, fortnightly, for 18 months. Fish samples were collected between 9.00- 11.00 am from artisanal fishermen operating along Onitsha (marine), Ogbaru and Nsugbe locations. Analysis was done in the Biological Science Laboratories of Chukwuemeka Odumegwu Ojukwu University, Uli. A total of 201 *Oreochromis niloticus*, 92 *Auchenoglanis occidentalis* and 168 *Mormyrus rume* were collected, dissected for examination and identification of the food contents using naked eyes, hand lens (magnifer), binocular microscope, identification keys and taxonomic work by Idodo (2002) and Haruna (2014). SPSS version 25 and Microsoft Excel sheet were used to analyze and managed data. In the result, fish stomach food items were significantly related to the seasons ($p<0.05$). In conclusion, fish food was higher in wet season than in dry season. This study has contributed to the knowledge by identifying the season fish eat less and may need help to achieve a bumper harvest.

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Keywords:
Oreochromis niloticus, *Auchenoglanis occidentalis*, *Mormyrus rume*, fish food security, fish species.

1. INTRODUCTION

Freshwater fish is a vital and indispensable source of high-quality, low-cost animal protein, essential for a balanced diet in marginal foods. Therefore, the importance of fish to human beings cannot be overemphasized, these include; provision of protein, recreation, sense of beauty as in ornamental fish, serve in religious symbols, economic value and so they are important trade commodities in many regions of the world. Globally, fish provides more than 3.3 billion people with 20 percent of their average per capita intake of animal proteins, with countries like Bangladesh, Cambodia, Gambia, Ghana, Indonesia, Sierra Leone, Sri Lanka and many other small island developing States reaching 50 percent or more (Food and Agricultural Organization (FAO, 2020). However, fish is cheap, affordable, accessible and available to everybody in the society, Mohanty *et al.* (2019). These qualities of fish therefore have made it to be cultured in many parts of the world in order to match the growing world population. Food and feeding habits of fish is necessary to understand the welfare and husbandry requirements in the wild and adopting same in captivity so as to make domestication of fish a success (Okomoda, 2017). As far as fisheries management is concerned, information on diet and feeding practices are very important when making decisions related to natural resource management. As far as fisheries management is concerned, information on diet and feeding practices are very important when making decisions related to natural resource management.

However, it is very pertinent to note that food and feeding habit of fishes may vary from season to season and that seasonal changes in temperature and water volume can influence the food availability and consumption as well as spawning in fish. The food availability and intake may determine population levels, rates of growth and health conditions of fish. There is a great diversity of organisms available as fish food in the wild and they are different in size and taxonomical groups (Okomoda, 2017). The natural food of most fish may be presumed to be bacteria, desmids, diatoms and other microscopic planktons. Nature offers great diversity of organisms used as food by the fishes and these differ in size and taxonomic group (Agropedia, 2012). It is virtually impossible to gather sufficient information on food and feeding habits of fish in their natural habitat without studying its gut contents (Khaing and Khaing, 2020). According to Mahesh (2018) fish nutrition represents an integration of many important ecological components, including behaviour, condition, habitat use, energy intake, inter and intra

- specific interactions, to mention a few. In his opinion, he mentioned that a valid description of fish food and feeding habits provides the basis for understanding trophic interactions in aquatic food webs. However, the food components of fish are often determined indirectly using stomach content analysis. This can also provide information on feeding habits apart from associated structural features of the food, for example gut analyses is a prerequisite for fish survival (Opadokun and Ajani, 2015). The knowledge of stomach content of fish helps to select species of fish for culture and ensure a maximum yield by using all the available possible food of the water bodies to avoid competition. Feeding is the dominant activity of the whole life cycle of fish. Therefore, the success on good scientific planning and management of fish species largely depends on the knowledge of their biological features; of which their feeding is very important. However, the study of food of freshwater fish species is a subject of continuous research because it constitutes the basis for the development of a successful fisheries management program, especially on capture and culture fishes. According to Keredin *et al.* (2021), information on marine fish gut contents is important to understand community ecology, structure and stability of food webs, trophodynamics, resource allocation, and functional role of different aquatic ecosystem and ecological energetics. Therefore, the purpose of this study is to provide information on seasonal changes in stomach content and of these three species of fish, *Mormyrus rume*, *Oreochromis niloticus* and *Auchenoglanis occidentalis* that have high market acceptability, mainly due to their affordability, delicious flesh, economy and nutritional values, along the River Niger axis, of Anambra State Nigeria, to guide the sustainable utilization of the fisheries resources.

2. LITRATURE REVIEW

2.1 Effect of Changing Seasons on Fish Food

Physical habitat disturbance and seasonal changes in habitat quality and quantity affect population dynamics and species interactions, Winemiller and Jepsen (2018). They opined that physical transport of nutrients, detritus, or food between habitats or larger landscape units, and the movement of animal between habitat sections or ecosystems, can profoundly affect productivity, material cycling, and predator–prey interactions. However, seasonality in hydrology is an important aspect of environmental condition in tropical freshwater habitats, which affects biota population, community and ecosystem processes. The functioning of large

river systems with adjacent floodplains is strongly influenced by the flood impulse (Raniere and Carlos, 2008). This phenomenon is the main structuring force for biota, including fish communities that use floodplain environment for spawning, feeding, nurturing and shelter. In floodplains and in the entire basin the amount of water controls internal current, during wet season, as the water rises, the river discharge acts as a natural barrier to the canals connecting floodplain lakes because water flows from river to the lakes. During the dry period, there is a reduction of discharge and water flow is reversed or stationary. With regards to fish diet and feeding behavior of individual, hydrological seasonality is generally reflected by seasonal changes in abundance, availability and accessibility of major food sources (Perga *et al.,* 2005). In aquatic habitat seasonal fluctuations in food resources availability are known to occur. Low densities of benthos and aquatic insect density were observed during the dry season in comparison with wet season (Kabré *et al.,* 2002). Higher abundances of zooplankton were observed during the wet season (Ouéda *et al.,* 2007). Besides, documenting seasonal patterns of diet breath and diet overlap, there were studies on how seasonal diet shifts could be accounted for by seasonal changes in the availability of major food resources. In particular, certain expectation can be observed in the following diet shifts from dry to wet season: reduction of piscivore and more consumption of zooplankton and benthos.

During high water level we could also expect omnivore to be higher as allochthonous and littoral carbon sources are more diversified.

Dasgupta (2015) stated that, the processes from gonad development to spawning are closely related to temperature and photoperiod variations. He also emphasized that controlling these two parameters allow egg production to be independent of season. However, the gonad development, fertility and spawning efficiency of fish species can be increased by improving the nutritional quality of the brood stock. The nutrition of brood fish has a decisive influence on the breeding success and is of crucial importance during the early larval stages, especially during the yolk feeding phase. He opined that fish oil grade need to be screened for an appropriate level and ratio which is essential for producing high quality eggs. In his opinion low vitamin C content in fish diet can adversely affect the quality of egg production and the rate of fertilization; however, it varies from species to species. Balanced dietary protein promotes vitellogenin synthesis and up take, resulting in high fertility and egg quality. Gonad development and the onset of maturation

can be manipulated by providing food just before or during spawning in fishes with short vitellogenic period (Izquierdo *et al*., 2000).

2.2 Natural fish food

There are varieties of natural fish food existing in water bodies and their abundance depends on the productivity of the water body.

Some examples of fish natural food include phytoplankton, zooplankton, annelids, worms, insects, insect larvae, mollusks, etc. These natural food ranges from microscopic to relatively large size. They may be living or dead (detritus) and available as a result of bacterial decomposition. In the pond they are generally present in various part of the pond like near the shore, floating, on the surface of or within the bottom (eg. worms, insect larvae and snail), covering the surface of submerged objects and swimming around like aquatic insects, frogs and fish (nektons) The natural foods provide a complete and balanced diet for fish. The demand of different type of food varies from species to species and between age group of individuals. For example, family Cichlidae is herbivorous and may prefer phytoplankton while cat fishes are carnivorous and may prefer zooplankton. At the same time, it is good to be aware that at a younger stage, fish may feed on plankton, because most fish rely on it for life after the yolk sac is absorbed. The larvae of the carps feed mainly on the zooplankton at the initial stages followed by other food types with the increase in age (Anton-Pardo and Adamek, 2015). Research has shown that natural feeds have high protein and fat content, which promote the growth of fish. Therefore, it is necessary to increase natural diet in the aquatic ecosystem to improve growth of fish.

2.3 Phytoplankton as fish food

Phytoplankton are autotrophs which indicate that they fix solar energy by the process of photosynthesis using carbon dioxide (CO_2), nutrients and water. Phytoplankton occupies the base of the food chain and produces the primary food material on which other organisms in the ecosystem sustain themselves. Phytoplankton provides many valuable phytonutrients and biologically active ingredients, especially fatty acids, amino acids, sterols, organic minerals, enzymes, carotenoids, chlorophyll, trace elements, and vitamins, which are directly available for the first larval/juvenile stages of fish or indirectly (through trophic chains) for the more mature forms (Agnieszka, 2017). Phytoplankton is grazed by zooplankton and small fish (Buraschi *et*

al., 2005). Zooplanktons which are part of the aquatic food web are nutritionally dependent on them. Phytoplankton usually gives green colour to the water due to the presence of chlorophyll within them. They are generally made up of mostly unicellular algae which are either solitary or colonial. They are carried about at the mercy of the wind and water movements.

2.4. Zooplankton

Zooplankton is microscopic planktons from animal origin. They are abundant in water bodies. Zooplankton forms an important group as it occupies an intermediate position in the food web, many of them feed on algae and bacteria and they are in turn fed upon by fishes. Their importance as food for young and adult fish is well known. Zooplankton generally occupy a central role in the aquatic food web, feeding mainly on algae and bacteria and in turn preyed upon by numerous invertebrates and fish predators (Arazu *et al*., 2017). In natural habitats, the zooplankton constitutes the bulk of the staple food of different fish species as revealed through the gut content analysis (Kar *et al*., 2017). Almost all major zooplankton groups are used as food sources in freshwater and marine aquaculture (Payne and Rippingale 2001; Raskoff *et al*., 2003). According to them, the survival of juvenile fish and crustaceans depends partly on food sources such as zooplankton. Species like *Moina micrura* and *Diaphanosoma birgei* are considered as highly valued food resources for the fish species, with high protein content (Sipaúba-Tavares and Bachion 2002; Ud Din and Altaff 2010). High numbers of zooplankton species were recorded in wet season (Adesalu *et al*., 2018).

2.5 Seasonal Influence on the Fish Stomach Contents

Changes in preferred food of a fish species mainly depend on the availability of preferred food items in a given environment and season. An abundance of favorite food items in the environment determines their predominance of such food items in the fish stomach (Palmeira and Monteiro-Neto, 2010; Gondal *et al*. 2020; Kim *et al*., 2021). Moreover, requirements of energy by fish in a particular stage of its life sometimes induce ontogenetic shifts in feeding mode and choice, (Cruz and Abitia, 2004). Therefore, analysis of stomach contents based on the seasons could help in establishing standard practices in fishery science as well as provide important scientific advice on sustainable fisheries management (Zacharia, 2004).

2.6 Food and feeding habit of *Oreochromis niloticus*

Oreochromis niloticus feeds on phytoplankton which is trapped in a plankton rich bolus with the help of mucus excreted from their gills (Rupinder *et al.*, 2014). It also consumes periphyton as well as aquatic plants. Its other food includes invertebrates, benthic fauna, and at times fish eggs (Food and Agricultural Organization (FAO), 2012). *Oreochromis niloticus* feeds in the day and shows-off suspension filtering feeding habit, as well as surface grazers (Lee *et al*., 2018). Agumassie and Mathewos (2018) earlier studies conducted by Pinka *et al.* (2014) showed that *Oreochromis niloticus* feeds on bottom deposits derived from the plankton rain and other sources, deriving its nutrient from organic particles and micro-organisms (Kumar and Gopa, 2015). Rupinder *et al.*, (2014) observed that *Oreochromis niloticus* feeds on plankton which is structured and usually driven by nutrient dynamics of the habitat. Tesfahun (2018) reported that the feeding habit of *Oreochromis niloticus* and stomach contents are dependent on availability and abundance of plankton in the habitat, which contribute to the fish growth rate. Temesgen *et al*., (2022) observed that *Oreochromis niloticus* in Lake Langeno are characterized by omnivorous feeding habits that showed a seasonal and length-based variation of food composition.

2.7 Food and feeding habit of *Auchenoglanis occidentalis*.

According to Abdel-Aziz and Gharib (2007) report, analysis of the stomach content of fish could provide information on better understanding of the transfer of energy from one trophic level to the next in the aquatic ecosystems. Therefore, identifying their food composition and feeding habits are absolutely necessary for sound fisheries management. *Auchenoglanis occidentalis* feeds on a variety of items ranging from insect larvae and pupae to plant material and detritus, Onisimi *et al.*, (2009). Ikongbeh *et al*., 2014 reported that the most important food items of *Auchenoglanis occidentalis* were insects, insect larvae, algae and fish scale. His result was an indication that *Auchenoglanis occidentalis* is an omnivore but had a tendency to predate more on insects.

2.8 Food and feeding habits of *Mormyrus rume*

Mormyrus rume feeds on detritus and plant parts, Fawole (2002). In his report plant parts and detritus are their main food. The fish species is always available, tasty and affordable in the market. The

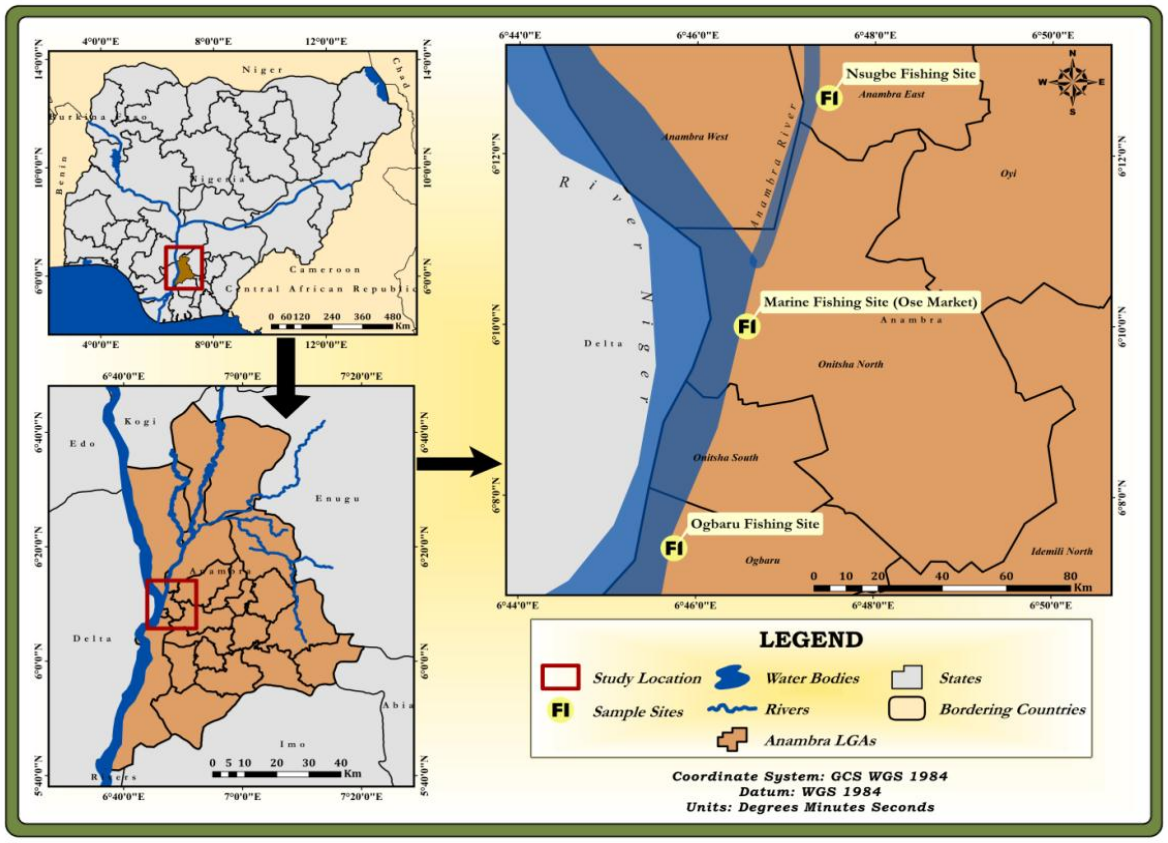
knowledge in some aspects of the biology of this fish will provide a basis for comparative studies and also for the proper management of the species in culture for maximum yield.

3. METHODOLOGY

3.1 Description of Study Area

River Niger at Onitsha is located in Anambra State in Eastern Nigeria and lies within latitudes 6° 46' 27'' E and 6^0 11'6" N and longitudes 6° 45'52" E and 6° 7'53" N. Onitsha in Anambra State, is found on the east bank of River Niger and covers an area of about 49,000 km^2. It is one of most important commercial centers in sub-Sahara African and it is a transit city in Nigeria. Anambra is rich in natural gas, crude oil, bauxite, and ceramic. It has an almost 100 percent arable soil. Anambra state has many other resources in terms of Agro-based activities such as fisheries and farming, as well as land cultivated for pasturing and animal husbandry. River Niger is a home to many rain forest rivers and its surroundings are hub of business activities such as buying and selling, fish and Agro produce landing, sand dredging and many other business activities. The two main seasons that are observed in Onitsha include dry season which begins in October and ends in March and the rainy season that starts from April to September.

Figure 1: Map of Anambra state showing River Niger at Onitsha, Ogbaru and Nsugbe.



3.2 Experimental Design

Fish samples (*Mormyrus rume, Oreochromis niloticus* and *Auchenoglanis occidantalis*) were collected fortnightly at each outing, Sampling of fishes was normally done in the morning between 9.00- 11.00 am for 18 months (March, 2022-Novembe ,2023). Fish specimens were obtained from artisanal fishermen operating along River Niger axis Onitsha. The fishermen use various types and sizes of fishing gears including hand nets, cast nets and gill nets of various standard mesh sizes (20.2, 25.4 and 30.5 mm). Canoe was used as fishing craft. The collection was done in three different sites, selected based on the location of less and more anthropogenic influence and other activities. Samples collected were examined fresh then preserved in ice blocks and 10% formalde before taken to the Laboratory of Biological Science Chukwuemeka Odumegwu Ojukwu University Uli, for studies of stomach content analysis.

3.3 Collection of the fish stomach content

In the laboratory, each specimen was dissected to carefully remove the gut. The entire stomach of the fishes was removed, emptied in petri dishes and graded according to fullness. The graded stomach of each specimen was dissected length wise and emptied into a petri-dish for examination and identification of the food contents. Small quantity of distilled water was added into the petri-dish to disperse the stomach content.

3.4 Identification of food items

The contents of the stomach which were emptied into petri dishes were examined using naked eyes and hand lens (magnifier). The observed food items were identified using identification keys and taxonomic work by Idodo (2002) and those that cannot be seen with naked eyes and hand lens were observed under a binocular microscope for identification of the food materials with the aid of identification key as in Haruna (2014).

3.5 Frequency of occurrence method:

This method was used to obtain frequency of occurrence for each food item in the fish stomach. Therefore, food items occurring in each of the stomach of the fish were examined and recorded. Frequency of occurrence is the number of times a particular

food item occurred in the stomach; this was counted and recorded as number of stomachs with food excluding empty stomachs. The number of guts in which each food item occurred were listed on a table and that without food were also listed. The proportion of the fish population that fed on a particular food item was estimated according to Odun and Auta (2001) as in Haruna (2014).

3.6 Data Analysis

Data obtained were presented on tables and graphs, use simple statistical tools analysis like, mean and standard deviation to ascertain the significance of the variables obtained. SPSS version 25 and Microsoft Excel sheet were used to analyze and managed the data.

4. RESULTS

Result of Stomach content Analysis of the fish species with varying seasons

The number of stomachs with food was highest in *Oreochromis niloticus* (6.63±1.996) at the wet and dry (9.75±5.6) in Onitsha site followed by *Mormyrus rume* (6.25±3.454) wet season and (4.38±1.996) dry season then *Auchenoglanis occidentalis* was least (Tab. 13). At Ogbaru site *O. niloticus* stomach was also recorded highest with food in their stomachs at both seasons followed by *M. rume* and then *A. occidentalis*. At Nsugbe, the result was obtained in the same order for both seasons.

Table 13: Showing the mean result of the three fish species stomach with food during wet and dry seasons.

Locations	**Season**	O.niloticus	A. occidentalis	M.rume	**Total**
Onitsha	Wet	6.63	5.75	6.25	6.21
		±1.996	±2.121	±3.454	±2.519
	Dry	9.75	2.38	4.38	5.5
		± 5.6	±1.408	±1.996	±4.634
Total		8.19	4.06	5.31	5.85
		±4.37	±2.462	±2.892	±3.707
Ogbaru	Wet	9.5	5	5.88	6.79
		± 4.629	±1.852	±3.482	±3.901

	Dry	10.13	2.63	3.88	5.54
		±3.98	±1.598	±1.727	±4.212
Total		9.81	3.81	4.88	6.17
		±4.183	±2.073	±2.849	±4.065
	Wet	6.38	5.38	5.5	5.75
		±1.768	±1.768	±2.777	±2.111
Nsugbe	Dry	9.38	2.5	4.5	5.46
		±4.069	±1.604	±2.268	±4.011
Total		7.88	3.94	5	5.6
		±3.403	±2.205	±2.503	±3.174
Total	Wet	7.5	5.38	5.88	6.25
		±3.284	±1.861	±3.125	±2.935
	Dry	9.75	2.5	4.25	5.5
		±4.416	±1.474	±1.939	±4.233
Total		8.63	3.94	5.06	5.88
		±4.014	±2.206	±2.701	±3.649

$P > 0.05$ at seasons and locations, $P<0.05$ by species.

There was no significant difference with the stomach content for both seasons and location but there was significant difference by species. (Appedx: xxxv)

Result of stomachs without food was recorded highest in *Mormyrus rume* (3.88±3.137) wet season and (2.13±0.991) dry, followed by *Oreochromis niloticus* stomachs then *Auchenoglanis occidentalis* (Tab. 14) at Onitaha location. At Ogbaru site,

Table 14: Showing Fish species mean stomach without food during wet and dry seasons

Locations	**Season**	O. niloticus	A. occidentalis	M. rume	Total
Onitsha	Wet	0.75	0.5	3.88	1.71
		±0.707	±0.535	±3.137	±2.386
	Dry	1.5	0.38	2.13	1.33
		±1.773	±0.744	±0.991	±1.404

	Total	1.13	0.44	3	1.52
		±1.36	±0.629	±2.422	±1.946
Ogbaru	Wet	1	1.25	4.25	2.17
		±1.309	±1.035	±3.059	±2.444
	Dry	1.38	0.13	2.63	1.38
		±1.768	±0.354	±1.302	±1.61
	Total	1.19	0.69	3.44	1.77
		±1.515	±0.946	±2.421	±2.086
Nsugbe	Wet	0.63	0.88	4.63	2.04
		±0.916	±1.126	±3.701	±2.881
	Dry	2.75	0.25	2	1.67
		±2.315	±0.463	±0.926	±1.761
	Total	1.69	0.56	3.31	1.85
		±2.024	±0.892	±2.938	±2.37
Total	Wet	0.79	0.88	4.25	1.97
		±0.977	±0.947	±3.179	±.551
	Dry	1.88	0.25	2.25	1.46
		±1.985	±0.532	±1.073	±1.583
	Total	1.33	0.56	3.25	1.72
		±1.642	±0.823	±2.556	±2.131

$P > 0.05$ at the season and location. $P<0.05$ by species

There was no significant difference with the stomach content for both seasons and location but there was significant difference by species (Appedx xxxvi).

Result of mean number of foods collected from the stomach of studied fish species at wet and dry seasons.

Varying food items were found in the stomach of studied fish species, these include Volvox, Spirogyra, Dinophyte, Plant parts, Daphnia sp, Closterium sp, Rotifers, Copepod, Unidentified insects' larvae, Detritus, Fish remains and Crayfish at both seasons. Among the identified food in the fish stomachs, volvox, spyrogyra, plant parts, and detritus have higher frequency of

occurrence. However, it is good to note that all food items identified occurs in the fish stomach at both seasons (fig. 2) but at varying quantity.

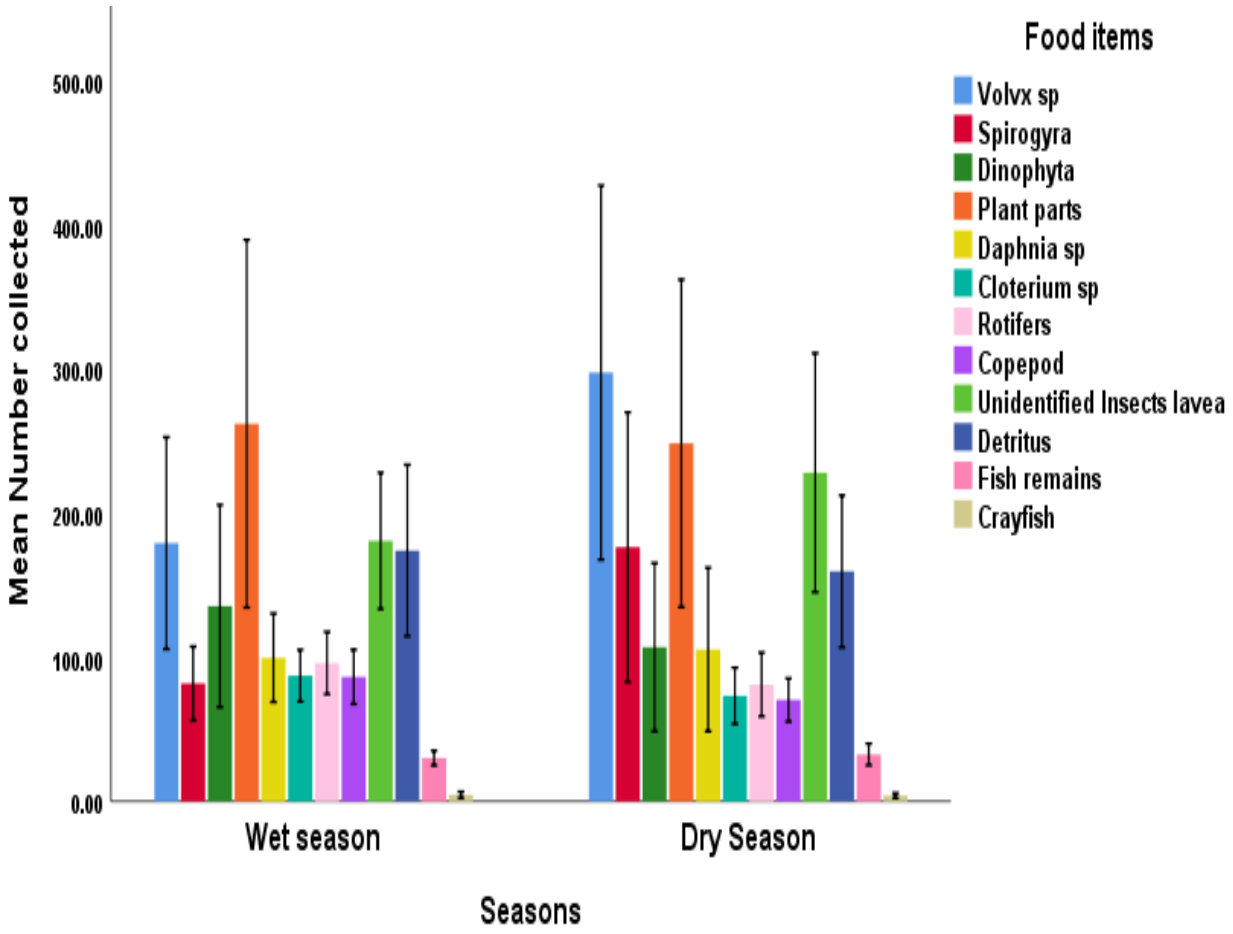


Fig 2; Graph showing seasonal relationship with mean number of food items collected from *Oreochromis niloticus, Auchenoglanis occidentalis* and *Mormyrus rume* stomachs

Result of the stomach content by location

Food items identified in the fish stomach by location showed that River Niger axis is rich in fish food and that loction does not affect their abundance (fig. 3). Season

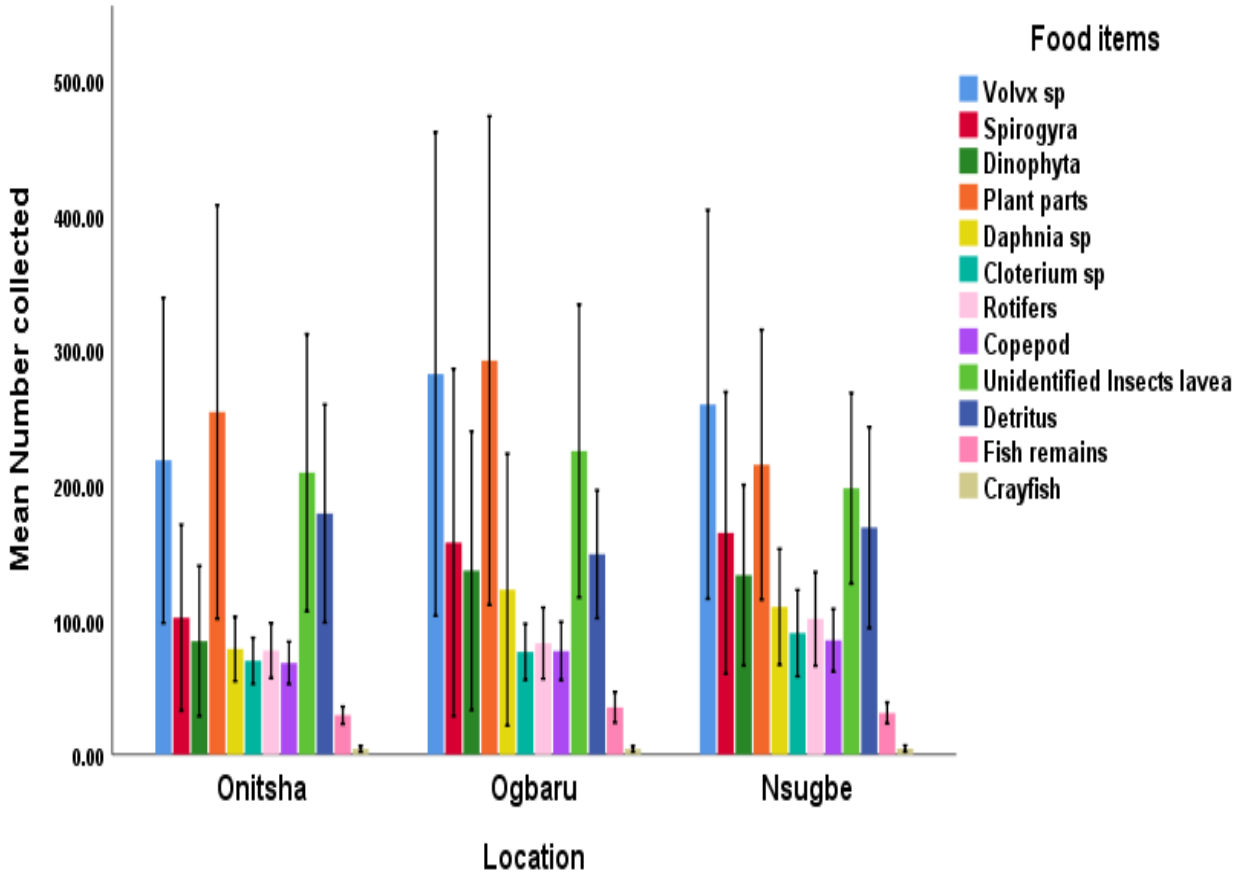


Fig 3: Graph showing mean number of food items collected from *Oreochromis niloticus, Auchenoglanis occidentalis* and *Mormyrus rume* stomachs at different locations.

Result of food items by species.

The result of stomach content by fish species studied showed that *Oreochromis niloticus* is a heavy eater and consumes food from both animals and plants sources as well as detritus followed by Auchenoglanis occidentalis and then Mormyrus rume (fig 4).

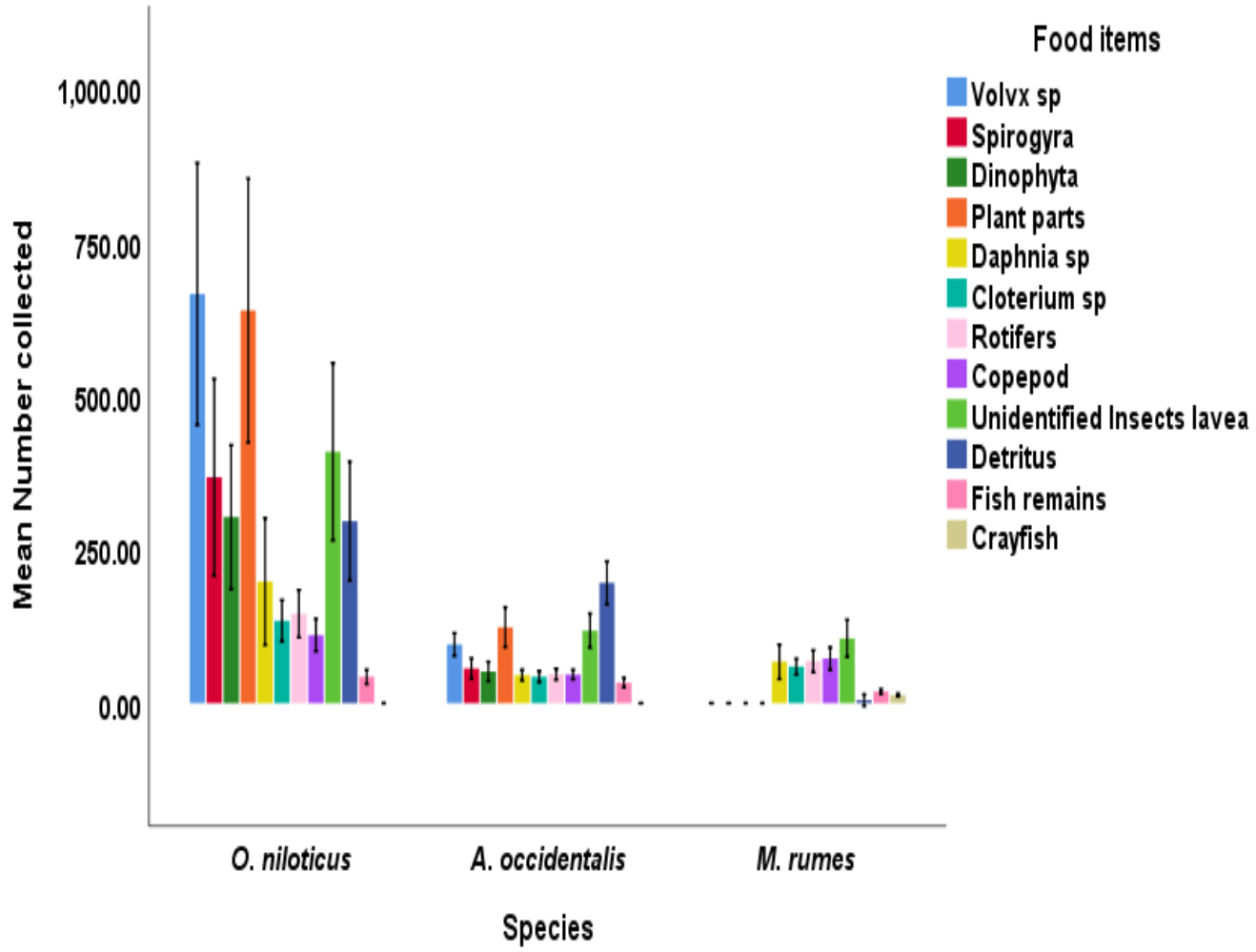


Fig 4: Graph showing mean number of food items collected from stomachs of *Oreochromis niloticus, Auchenoglanis occidentalis* and *Mormyrus rume*.

In fig 5 all the food identified in the examined fish species stomachs were consumed by *Oreochromis niloticus* and *Auchenoglanis occidentalis* except one (crayfish) while in the stomachs of *Mormyrus rume* food from plant sources and detritus were not found in their stomachs at both seasons (fig 5)

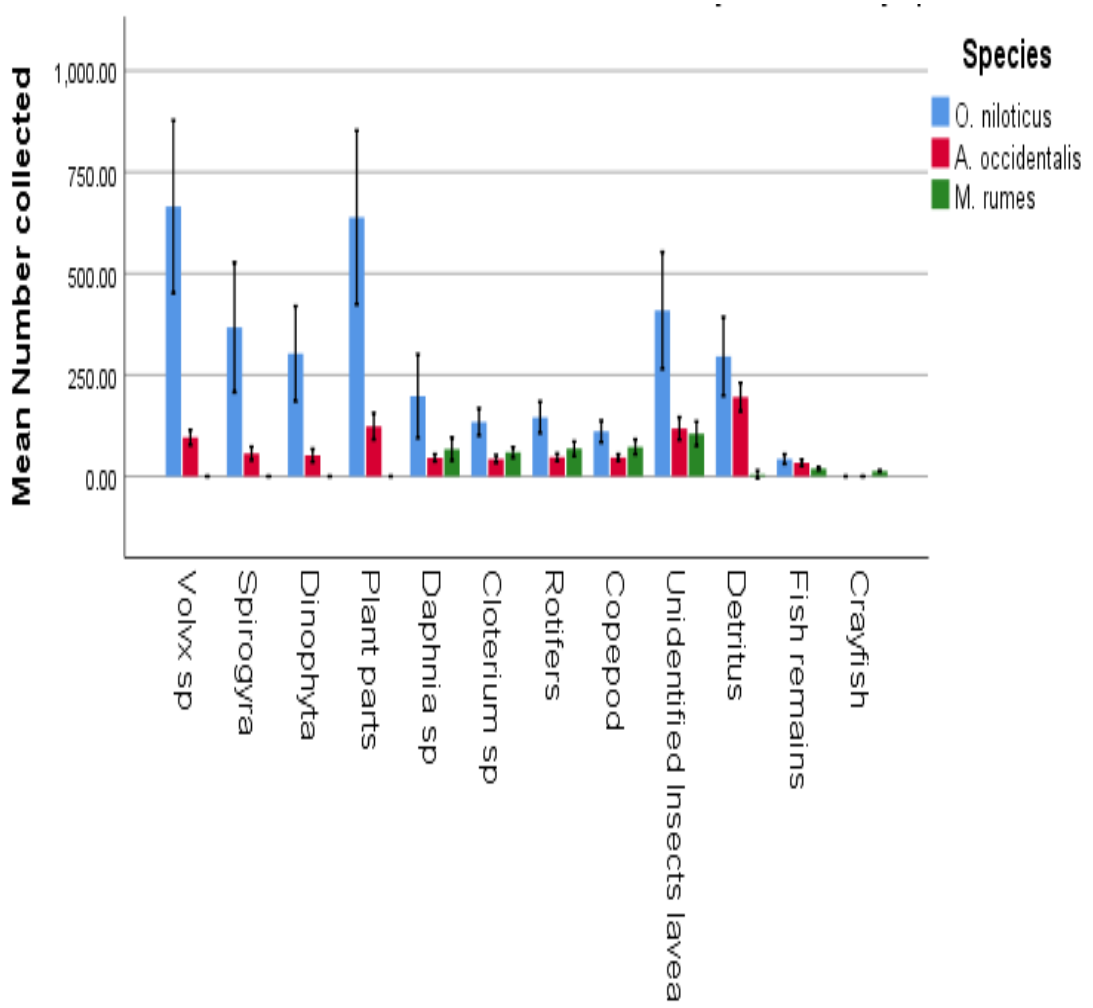


Fig 5: Graph showing mean number of food items collected from the three species studied.

5. DISCUSSION

Stomach contents in *Oreochromis niloticus* fish samples examined is found to have various food items like Volvox sp, Spirogyra, Dinophyte, Plant parts, Daphnia sp, Closterium sp, Rotifers, Copepod, Unidentified Insects larvae, and fish remains. This is in line with the work of Agbabiaka (2012), Abidemi-Iromini (2018) and Rini (2013) that reported Tilapia fish as having varying food in its gut. Plant parts had the highest mean dominance food item (fig.2) at wet season while Volvox dominate at dry season (fig.2). Therefore, stomach contents obtained conform with the report of Houehanou *et al.* (2016), who reported that cichlids exploit more than one source of food item. Their ability to utilize different varieties of food makes *Oreochromis niloticus* omnivorous in nature. He *et al.* (2015) also reported high degree of

overlap in food of fishes from the same community. The current report also observed that in their food items plant parts dominate followed by detritus and then unidentified insect larvae in both seasons (fig.5). This is in conformity with the work of Rao (2017) which supported the report that cichlids fed mainly on detritus, insects and plant materials.

Ali *et al.* (2015) also supported the result that the species fed on plants, leaves, buds and seeds of water lilies and are thus herbivorous feeders. The result that *Oreochromis niloticus* had higher frequency of plant material is supported by Oso *et al.* (2006) who also observed the species to be herbivores having highest percentage frequency of occurrence of higher plant remains as 49.2 %. Teferi et al. (2000) who studied the food and feeding of Nile tilapia in Lake Chamom Ethiopia on the stomach contents of adult and juvenile fish reported that *Oreochromis niloticus* fish is phytoplanktivorous, and that the component of the phytoplankton varied seasonally, and Ali *et al.* (2015) also reported that Nile tilapia are filter and benthic feeder as they consumed plankton, and detritus. The current result found phytoplankton among the food items and so in agreement with the result that the fish is planktivorous. Hence, stomach contents of *Oreochromis niloticus* examined along river Niger axis Onitsha, complemented and corroborated previous management assessments on stomach analysis of *Oreochromis niloticus* from Sub-saharan Africa.

In *Auchenoglanis occidentalis*, Seasonal variation in the food items include, detritus, plant material, insect remains which occurred regularly in the stomach of the fish throughout the period of study. However, the amount of food items was higher in the rainy months than the dry months. Quantitatively, in both wet and dry seasons, *Auchenoglanis occidentalis* fed on all the food items listed in fig 4, except crayfish. However, unidentified insect larvae, detritus and plant materials contributed more during the wet season than in the dry season (fig 2).

Auchenoglanis occidentalis is a versatile food consumer; this is reflected in the high proportion of stomachs containing food in wet season and dry season (fig. 2). Food items of animal origin contributed significantly to their diet, which was dominated principally by bottom dwellings, the remains of insects and detritus (fig. 5). In addition, plant materials contributed significantly to the stomach content of the fish. It may therefore be reasonable to identify *Auchenoglanis occidentalis* as an omnivore, hence supporting earlier reports on this species in Zaria, Nigeria (Onimiisi et al., 2009) and (Ikongbeh *et al*., 2014) report on food and feeding habits of *Auchenoglanis occidentalis* (Valenciennes,1775) from Lake Akata, Benue State, Nigeria. This

view gives the drive to suggest that *Auchenoglanis occidentalis* may be a good for breeding. This species of fish appears to feed both on or near the substratum and in the surface water column based on its wide range of food preferences. Nonetheless, given the significant portion of food items, detritus, and insect remains that it consumes from the bottom of the water, to its entire diet, it seems to be essentially a bottom feeder. The fish is a detritus or bottom feeder, and it's possible that it picked up the plant remnants while grazing at the river's bottom, but the presence of plant components in high percentages could indicate the presence of another food source.

Moreover, a few of the fish's stomachs were found to be empty; this could be the result of the fish either continuously digesting food after being caught before analysis or regurgitating their food when tangled in gill nets. In conclusion, *Auchenoglanis occidentalis* found in the Niger River consumes a wide range of foods, yet it is primarily thought of as an omnivorous fish. The foods that this fish eats in the wild must be taken into account for its proper breeding. The major food items of *Mormyrus rume* in river Niger axis were found to be insect remains and zoobenthos as the current result found in all stomachs containing food. Other food items are fish remains and crayfish this is in contrast with the report of Fawole, 2002 that reported only plant parts and detritus as their food. The results showed that *Mormyrus rume* are bottom dwellers, this corresponds with the findings of Onisimi and Shittu, 2015. The food items were seen in the stomachs irrespective of size, sex or season. The current study found that this species fed only on animal materials and so can be classified as carnivorous feeder which is in contrast with result of Odedeyi and Fagbenro (2010) who found detritus and plant materials in the gut of *Mormyrus rume* in their studies.

6. CONCLUSION

Varying food items (Volvox sp, Spirogyra, Dinophyte, Plant parts Closterium sp, Rotifers, Copepod, Unidentified Insects larvae, Detritus, Fish remains and Crayfish) are found in the river although they are significantly related to the seasons. *Oreochromis niloticus* and *Auchenoglanis oocidentalis* species are heavy eaters by having less stomach without food while *Mormyrus rume* has highest stomach without food. *Oreochromis niloticus* and *Auchenoglanis oocidentalis* exhibit ominiverous feeding relationship as they fed on both plant and animal food items while *Mormyrus rume* exhibit carnivorous feeding because it fed on only zooplanktons and benthos among the food items.

7. RECOMMENDATION

Farmers are recommended to copy the fish diet from the wild for a better fish growth and development.

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