



Stomach Content of *Tilapia zilli* and *Oreochromis niloticus* from Wanzun River, Lavun Local Government, Niger State Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors MYM, AMD, and AAC designed the study, wrote the protocols and collected sample from field performed laboratory analysis. Authors, MYM, MAM, MAS, BLU and HM managed the data analyses and literature search of the study. All authors read and approved the final manuscript.

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ABSTRACT

This study was conducted to investigate the stomach contents of two commercially important fish species (*Tilapia zilli* and *Oreochromis niloticus*) from Wanzun River, Northcentral Nigeria using frequency of occurrence and volumetric methods between January to April 2019. Fish samples were collected monthly with help of Fishermen using various fishing nets and traps. One hundred (100) individual fish of each species were collected and their stomach contents were examined. The results obtained expressed in mean percentage indicated that out of the one hundred (100) individual fish of each species examined, Twelve (12%) fish had an empty stomach contents in *Tilapia zilli*, and out of the 100 samples examined, Seventeen (17%) fish had an empty stomach content in *Oreochromis niloticus*. The stomach contents of both *Tilapia zilli* and *Oreochromis niloticus* consist of detritus, insects, fish remains. Algae/protozoans plant materials and molluscs. Both fish species are omnivorous feeders and occupy the same ecological niche. The study reveals the importance of algae, fish, insects and plant materials as food for fishes and they form important part in the diet of the species examined.

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1. INTRODUCTION

Fishes are food source for human and other animals. Globally fishes are the most feasible option in resolving protein shortage because they are very rich source of protein and contains lipids, mineral oils, and vitamins [1,2]. Fishes interact with most level of food chain and they influence habitat structure, since they are usually restricted to particular mode of life due to their food source and reproductive characteristics [2].

Fish needs energy for growth, reproduction and migration, which are derived from its food sources [3]. Fishes feed on potential food resources of all materials present in its environment and understanding their food and feeding habits is of great importance to all scientists who are concerned with any aspect of fisheries [3]. Fishes have been known to feed on a wide variety of items ranging from Sand particles, phytoplankton, zooplanktons, leaves, roots, crustaceans, insects, insect larvae, worms and fishes [4]. The nature and size of food item fishes consumed changes with age and size of the fish. This is mainly because fish can only feed on food items that can fit into their mouth and what their gut can digest [5]. Young fish feeds majorly on zooplankton, because they are easier to digest compared to phytoplankton and other plant materials. As fish grows the digestive system becomes more developed in terms of having more developed digestive enzymes, coupled with the gut length becoming longer and larger. This makes it possible for the fish to digest more complex food, items like plant materials which cannot be digested at young ages [5,6].

Fishes tends to show preference to some food items over others within their environment as a result of food size, availability and palatability [7]. Most fishes in different regions exhibit seasonal characteristics in their feeding which is caused many factors [8]. The amount of feed required in warm water conditions is higher than that in cold water because, at lower temperatures digestion and metabolic are slowed down [8].

Due to the increase in human populace, the demand for fish as a protein source is on the increase. This development expectedly led to wild fishery, and ultimately the domestication of certain fish species for intensive cultivation in captivity. Unfortunately, the few fish species

successfully domesticated have not been able to meet the increasing human demand for fishery resources. Thus, there is an urgent need for the domestication and intensive culturing of more fish species [9]. Interestingly, the success of expanded aquaculture must be predicted on a sound knowledge of the biology, ecology, and habitats of targeted fish species.

2. MATERIALS AND METHODS

2.1 Description of Study Area

Wanzun River is located in Mambe-Tifin, a rural settlement in Niger floodplain of Lavun Local Government of Niger state. The study area lies in savannah region of Northcentral Nigeria. The study area is characterized by two distinct seasons (rainy and dry season) the rainy season is from April to October while the dry season is from November to March. The river has potential as source of Fish, and the river serve as source of water for drinking, washing, and irrigation for nearby settlements.

2.2 Fish Sampling Preservation and Identification of Fish Samples

Fish samples were collected monthly for a period of four (4) months (January to April 2019) between the hours of 7:00am and 10:00am with the help of hired fishermen using gill nets, traps and canoe. The fish specimens were randomly collected into an iced box and transported to the laboratory of the Department of Animal Biology, Federal University of Technology Minna, Niger state.

At the laboratory, fishes were rinsed with clean water and fish samples were Identified and sorted out with the help of fish identification keys [10,11,12]

2.3 Determination of the Food and Feeding Habbit of the Fish

Stomach or gut content of the selected fish species were removed and preserved in a specimen bottle containing 4% formaldehyde in the laboratory and analyzed for their food and feeding habit. Each stomach was cut open and the contents washed into a petridish using 4% formaldehyde. The food items were identified to the least taxon possible and counted [13].

2.3.1 The numerical method

The numerical method used involves counting the number of each food item present in the stomach of the fish and summing up their number to obtain the grand total of all the food items found in all the stomachs containing food. The number of each food item will be expressed as a percentage of the grand total number of all food items, usually expressed as percentage number of a food item [13,14].

$$\text{Numerical method (N}_m\text{)} = \frac{\text{Total number of particular food item}}{\text{Total number of all food items}} \times \frac{100}{1}$$

2.3.2 Frequency of occurrence method

The frequency of occurrence method used involves counting the number of times a particular food item occurs in the stomach and expressing it as a percentage of the total number of stomachs with food and empty stomachs were excluded [13,14].

$$\text{Frequency of Occurrence (FO)} = \frac{\text{Total number of stomach with particular food item}}{\text{Total number of stomachs with food}} \times \frac{100}{1}$$

3. RESULTS AND DISCUSSION

3.1 Result

A total of 200 fish from Wanzun River were examined for stomach content which comprises of 100 samples each for *Tilapia zilli* and *Oreochromis niloticus*. From Table 1, the results obtained were expressed by percentage, out of the 100 individual fish of *Tilapia zilli* examined, 12 had and empty stomach while 88 individual were found with food. *Oreochromis niloticus* had 83 individual stomachs that contain food while 17 fish had empty stomach.

The result from the examination of the stomach content of *T. zilli* using frequency of occurrence method revealed that the fish feeds on detritus, insects, fish remains, algae/protozoans, plant materials and molluscs. The major food item present in the stomach of *Tillapia zilli* were detritus (97.7%) being the highest followed by plant materials (50.31%) detritus (90.9%), insects (86.3%) followed by algae/protozoan (62.5%), fish remains (32.9%), and molluscs (23.8%).

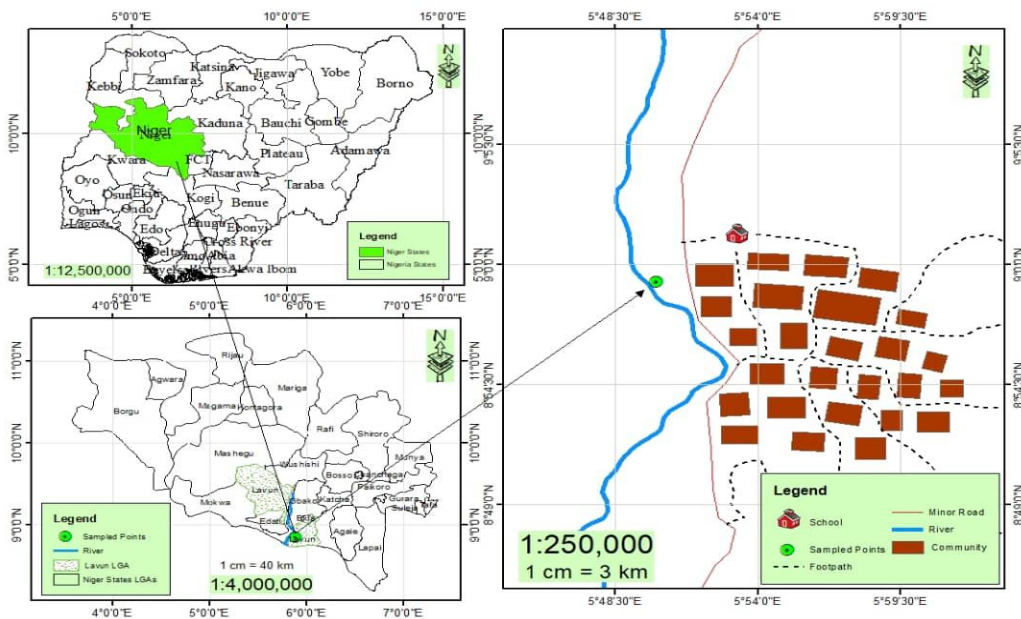


Fig. 1. Map of the study area

Table1. Fish examined for stomach content

	<i>Tilapia zilli</i>	<i>Oreochromis niloticus</i>
Number of fish examined	100	100
Stomach with food (%)	88	83
Empty stomach (%)	12	17

The numerical methods used to analyse the stomach content of *Tilapia zilli* showed that the most dominant food item present was insect constituting 35.4% of the total food items followed by algae/protozoan constituting (24.6%), detritus (16.6%), plant materials (13.7%), fish remain (7.7%) and the least occurring food item was molluscs constituting 1.7% of the food items. Using both the frequency of occurrence and numerical method of stomach content examination *Tilapia zilli* from Wanzun River can be described as omnivorous feeders (Table 2).

The result from the examination of the stomach content of *Oreochromis niloticus* using frequency of occurrence method revealed that the fish feeds on detritus, insects, fish remains, algae/protozoans, plant materials and molluscs. The major food item present in the stomach of *Oreochromis niloticus* were insects (97.5%) being the highest followed by algae/protozoan (91.5%), detritus (83.1%), plant materials (77.1%), followed by fish remains (14.4%), and mollusc (6.0%).

The numerical methods used to analyse the stomach content of *Oreochromis niloticus* showed that the most dominant food item present was insect constituting 36.8% of the total food items followed by plant materials (21.2%), detritus (17.8%), algae/protozoan constituting

(13.3%), fish remain (4.8%) and the least occurring food item was mollusc constituting 5.8% of the food items. Using both the frequency of occurrence and numerical method of stomach content examination of *Oreochromis niloticus* from Wanzun River can be described as omnivorous feeders (Table 3)

3.2 Discussion

From the observations and investigation of the stomach content of both *Tilapia Zilli* and *Oreochromis niloticus* of Wanzun River Niger state, the study reveal that both fishes species are Omnivorous Feeders. Omnivorous feeding behavior was identified among the two species of fish examined which shows that the fishes predominantly feeds on detritus, insect parts, fishes remains, algae/protozoan, plant materials and molluscs, this may be attributed to nature of this species [14,15,16,17]. The high percentage of stomach with food items in all the fish samples examined was an indication of food availability within Wanzun River. Food availability determines the growth of fish and maximum size a fish can attained in its environment [14]. The fish samples examined with empty stomach could be as result of time the fish spent in gill nets and on hooks before being removed for examination.

Table 2. Food and feeding habits of *Tilapia zilli*

Food items	Frequency of occurrence method		Numerical method	
	Number of stomach containing each food item	%	Total number of each food item found	%
Detritus	86	97.7	164	16.6
Insects	76	86.3	350	35.4
Fish remains	29	32.9	76	7.7
Algae/protozoan	55	62.5	243	24.6
Plant parts	80	90.9	136	13.7
Molluscs	21	23.8	17	1.7

Table 3. Food and feeding habits of *Oreochromis niloticus*

Food item	Frequency of occurrence method		Numerical method	
	Number of stomach containing each food item	%	Total number of each food item found	%
Detritus	69	83.1	148	17.8
Insects	81	97.5	305	36.8
Fish remains	12	14.4	40	4.8
Algae/protozoan	76	91.5	110	13.3
Plant parts	64	77.1	176	21.28
Mollusc	15	6	48	5.8

From the observations of the stomach content of *Tilapia zilli* in Wanzun River of Niger state, the study confirmed the fish to be an omnivorous feeder. This finding is in conformity with the report of [16] who studied the food and feeding habit of *Tilapia zilli* in Tiga dam Kano state. The author reported that the fish fed on wide varieties of food substance majorly plants, green algae and insect remains. This finding is also in agreement with the work of [14] who reported that *Tilapia zilli* feeds mainly on algae, vegetative matters Detritus and Aquatic invertebrates. Observation of the stomach content of *Oreochromis niloticus*, the fish exhibit omnivorous mode of feeding. This observation is in agreement with the work of [17] who reported that *Oreochromis niloticus* from Ero Reservoir in Nigeria fed mainly on plant materials, insect parts, Spirogyra detritus matter and mud.

4. CONCLUSION

The result of this study from examination of stomach content of *Tilapia zilli* and *Oreochromis niloticus* showed that they omnivorous feeders. The study shows the importance of algae, fish remains, insects and plant materials as food for fishes and they form important part in the diet of the two species examined.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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