International Journal of Life Science and Agriculture Research

ISSN (Print): 2833-2091, ISSN (Online): 2833-2105

Volume 03 Issue 01 January 2024

DOI: https://doi.org/10.55677/ijlsar/V03I1Y2024-07

Page No : 41-45

Food and Feeding Habits of *Oreochromis Niloticus* in Lower River Benue, Makurdi

Laurat, H. T.[1], Maimuna, A.[1], Isiyaku, M. S.[2], Yusuf, M.A.[3]

[1]Department of Zoology, School of Life Sciences, Modibbo Adama University of Technology, Yola, Nigeria.

[2]Department of Fisheries and Aquaculture, Bayero University, Kano, Nigeria.

[3]Department of Fisheries and Aquaculture, Federal University Dutsinma, Nigeria.

ABSTRACT: This study investigated the food and feeding habits of *Oreochromis niloticus* in the lower River Benue to determine the diet composition in the stomach of *O. niloticus* Fift samples of the species were collected, and their stomach contents were analyzed by frequency of occurrence, numerical and volumetric methods. The IRI (Index of Relative Importance) was used to determine the stomach contents. The results showed that green algae are the most important food item in the diet of *O. niloticus* with an IRI value of 22.61%. Other plant-based foods that make up a significant proportion of the diet include plant tissues (10.19%) and plant seeds (9.26%). The species have a moderate to high overlap in their consumption of certain food items such as rotifers (DOI = 0.83, sig = 0.03*), desmids (DOI = 0.67, sig = 0.05*), and snails (DOI = 0.51, sig = 0.05*). Generally, *O. niloticus* exhibited omnivorous feeding habits in their diet from the Lower River Benue. It is possible to conclude that food and feeding habits of *O. niloticus* influenced by seasons, and fish sizes from Lower River Benue. Therefore, water buffer zone management is needed to improve the food and feeding habits of this fish for the better sustainable utilization.

Published Online: January 23, 2024

Corresponding Author: Laurat, H. T.

KEYWORDS: Food, Feeding, *Oreochromis niloticus*, River Benue

INTRODUCTION

Food is an essential component of an organism, as its growth, development, reproduction, and other physiological activities are dependent on the energy generated by the consumed food material. Feeding is an important physiological activity of fish like other living organisms. Fish require nutrients for growth, reproduction, and other normal physiological functions. In a natural aquatic environment, phytoplankton, zooplankton, plant materials, insects, larvae, worms, and smaller fish are the major food types of fish. Fish tend to show a preference for some particular food items within their environment. The availability of food in any aquatic environment determines the well-being and reproductive potential of fish (Keyombe *et al.*, 2015). The weight and size of fish are a reflection of food availability in the aquatic ecosystem (Bolarinwa and Popoola, 2014). Many environmental factors, such as water temperature, food availability, stocking density and environmental conditions, influence the food selection behavior of fish. The size of food items and the size and age of fish can also determine their food selection behavior (Otieno *et al*., 2014).

Nile tilapia, *Oreochromis niloticus* is one of the most important fin fish used in aquaculture in

Nigeria because of their hardness, ease of breeding, fast growth rate, ability to efficiently convert organic and domestic wastes into high quality protein and good taste (Olojo *et al.*, 2003).

Nile tilapia has a versatile feeding behavior, characterized by generalist and opportunistic omnivorous feeding behavior (Canonico *et al.*, 2005). Its diet composition may vary within a wide range of seasonal and spatial condition of the environments (Houlihan *et al.*, 2001). The food composition may also vary depending on size of the fish, maturity, environmental condition and habitat types (Kamal *et al.*, 2010).

MATERIALS AND METHODS

Description of Study Area: The study was conducted in Makurdi, the capital city of Benue State located in Nigeria. The State is bordered by Nasarawa to the north, Cross River to the south, Taraba to the east, and Kogi to the west. The study area is geographically situated within the latitudinal range of 8° to 90° North and longitudinal range of 7° to 9° East, with a population of

approximately 4,219,244 people as per the 2006 Federal Official Statistics. The abundance of fish fauna in the river valley has led to fishing being a common means of livelihood in the area, serving as a source of income and alternative protein source.

Sample Collection: Fortnightly fish samples were collected from the Wadata Fish Landing site of the River Benue over a period of three months. Fish was captured by gillnets set overnight by artisanal fishermen. Collected the following day, the fish were kept in a bucket, preserved with ice blocks, and taken to the Fish Laboratory of the Department of Fisheries and Aquaculture for analysis in fresh condition.

Laboratory Analysis: The laboratory equipment such as trays, petri dish and dissecting tools were sterilized by washing and drying. The specimen were then dissected, and the guts were taken out. The gut length was measured. The weight of gut was measured. The stomach content was emptied into a labelled petri dish. Thereafter, the stomach of each sample was cut longitudinally to expose partly digested food contents. These were viewed under a microscope to identify the food the fishes fed on.

Statistical Analysis

Stomach contents were analyzed by frequency of occurrence, numerical and volumetric methods. The IRI (index of relative importance) was used to determine the stomach contents, Stomach vacuity index was used to measures the stomach fullness and then subjected to students T-test using the statistical package for social science (SPSS) version 21.0.

RESULTS

Stomach Content of *Oreochromis niloticus*

The stomach content of *Oreochromis niloticus* is shown in Table 1. The most important food items in *O. niloticus* diet, based on the IRI values, are green algae 17.59%, detritus 15.74%, unidentified food items 14.81%, plant tissues 10.19%, and plant seeds 9.26%. The less important food items in the diet includes desmids 3.70%, rotifers 3.26%, worms 3.12%, insects 1.02% and fish (whole/parts) 0.44%.

Table 1: Stomach Content Analysis and Index of Relative Importance of *Oreochromis niloticus*

Food Items	Methods of Stomach Content Analysis			IRI
	%F	%N	%V	
Green Algae	17.59	14.37	10.89	22.61
Rotifers	6.48	6.16	3.72	3.26
Worms	4.63	7.39	5.87	3.12
Desmids	3.70	6.37	5.16	2.17
Eggs/Larvae	3.70	4.11	5.59	1.83
Crustacean	5.56	6.16	5.87	3.40
Insect	2.78	3.08	4.15	1.02
Snail	4.63	5.13	6.88	2.83
Fish (whole/parts)	0.93	4.11	5.30	0.44
Plant Tissues	10.19	9.24	11.17	10.58
Plant Seeds	9.26	7.19	9.89	8.04
Unidentified Food Items	14.81	10.27	12.75	17.34
Detritus	15.74	16.43	12.75	23.36

Figure 1 shows Stomach Vacuity Index (SVI) values of *Oreochromis niloticus* during the study period**.** January had the highest SVI = 42.85% and November had the lowest value SVI of 33.33%.

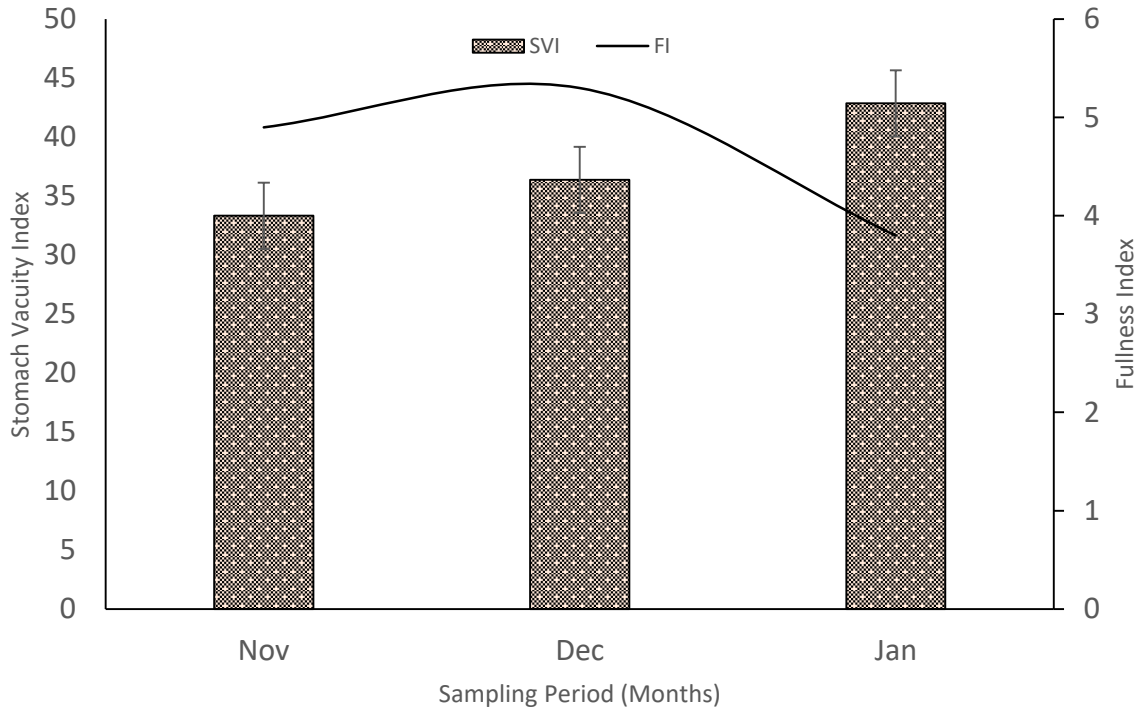

Figure 1: Stomach Vacuity Index and Fullness Index of *Oreochromis niloticus* collected from November to January

Figure 2 shows stomach fullness of *Oreochromis niloticus* during the study period. Variations in content of the stomach can be seen clearly.

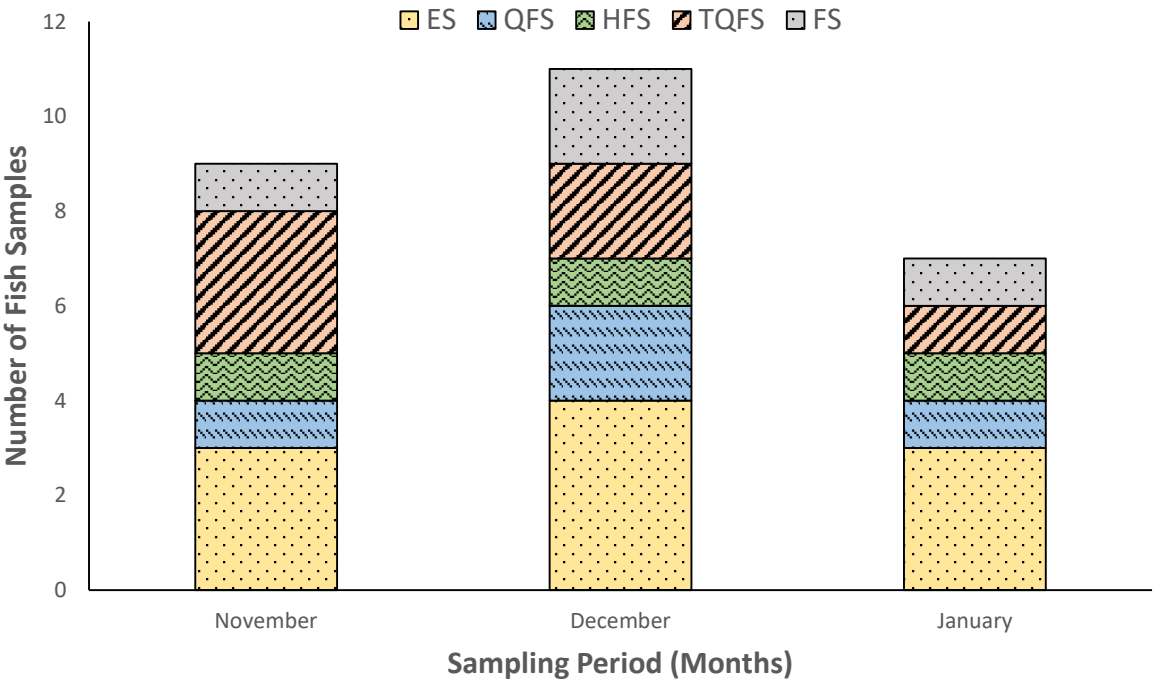

Figure 2: Stomach Fullness of *Oreochromis niloticus*

DISSCUSSION

The food items in the stomach content of *Oreochromis niloticus* indicates that herbivores feed mainly on plant food substances such as phytoplankton, desminds, diatoms, plant parts such as leaf parts, plant tissues, dead leaves, flower buds and some percentages of animal food substances comprising of insect pupae, insect larva, protozoa and detritus. This result was in agreement with

Fagade and Olaniyan (1973) who reported that *Oreochromis niloticus* are obligate herbivores feeding on algal filaments, diatoms, phytoplankton and unidentified organic matter. Similarly, Akintunde and Imevbore (1979) reported that the main stomach content of synodontis niloticus is phytoplankton.

The stomach content analysis of *O. niloticus* suggests that it is primarily an herbivorous fish that feeds on plant-based food items such as green algae, plant tissues, and plant seeds, as well as detritus. Herbivorous feeding habits of *O. niloticus* have also been reported in Ethiopian water bodies such as Lake Chamo (Teferi *et al*., 2000), Koka Reservoir (Engdaw *et al*., 2013) and Lake Hayq (Assefa and Getahun, 2015). However, this result was in disagreement with Oso *et al*. (2006), who suggested that *O*. *niloticus* has omnivorous feeding habits. The contrasting feeding habits of the fish was due to age of the fish and the differences in the abundance of food items in different locations.

The analysis also indicates that *O. niloticus* juveniles may occasionally consume small amounts of animal-based food items such as crustaceans, snails, and worms, but these are not a major component of their diet. El-Sayed *et al.* (2003) reported that *O. niloticus* juveniles are opportunistic feeders and can consume both plant and animal-based diets. They feed on detritus, zooplankton, insects, crustaceans, and small fish, among other things. Additionally, *O. niloticus* juveniles have a higher growth rate when fed a mixed diet of plant and animal-based feeds than those fed with a single diet (Iheanacho *et al.,* 2013).

The stomach vacuity index and fullness index of *Oreochromis niloticus* varied among the months, with the highest SVI value observed in January and the lowest in November. The fullness index was higher in December and November compared to January. The higher stomach vacuity index in January could be attributed to the reduced feeding activity during this month, which could be due to seasonal changes during colder months and other environmental factors such as dry season (Barry *et al*., 2019). These findings are consistent with a previous study on the feeding habits of *O. niloticus* in Lake Victoria, which also reported a higher stomach vacuity index during periods of reduced feeding activity (Mbabazi *et al*., 2016). The high fullness index in November and December indicates an increase in feeding activity during these months due to the availability of prey and seasonal variations. Similarly, a study on the feeding ecology of *O. niloticus* in Lake Kariba also reported seasonal variations in the stomach contents and feeding habits of the fish (Siziba *et al*., 2010).

This high stomach vacuity index may be attributed the post-harvest digestion or the method of catching of the specimens. Engdaw *et al*. (2013) also reported an empty stomach for *O. niloticus,* caught with gill nets in Ero and Koka reservoir. The reason for this may be due to the fact that the food items in their stomach may have been regurgitated or digested as the fish struggled for escape in gill nets during the catches. Overall, this result suggest that *O. niloticus* has a seasonal feeding pattern, with reduced feeding activity during the colder months of the year and dry season when food resources were less plentiful (Njiru *et al*., 2017).

Seasonal variations in stomach fullness levels was observed in this study as alsso reported by (Fayeye *et al*., 2021; Oludare *et al*., 2016). Oludare *et al*. (2016) reported that *O. niloticus* showed reduced stomach fullness during the dry season due to decreased food availability while Fayeye *et al*. (2021) observed that *O. niloticus* had lower stomach fullness levels during the dry season, but higher stomach fullness levels during the rainy season when food availability was higher.

CONCLUSION

Oreochromis niloticus a herbivorous fish that feeds on plant-based food items such as green algae, plant tissues, and plant seeds, as well as detritus and *O. niloticus* are omnivorous species during their juvenile stage, and their feeding behavior is influenced by various factors such as the age, availability of food and water temperature. Several studies have shown that *O. niloticus* juveniles have a higher growth rate when fed a mixed diet of plant and animal-based feeds than those fed with a single diet. The results also indicate that the majority of the examined fish samples had stomachs filled between half-full to three-quarters full capacity due to factors such as prey availability, seasonal changes, and feeding habits that influence the stomach fullness of both species.

RECOMMENDATION

There is need further study in the dietary aspect of the fish feeding habit.

REFERENCES

1. Akintunde, E.A. and Imevbore, A.M. (1979). Aspect of Biology of Cichlid Fishes of Lake Kainji with special references in *Sarotheroden galilacus*, *Nigerian Journal of Natural Science* 1:35-39.
2. Assefa, W.W. and Getahun, A. (2015). The food and feeding ecology of Nile tilapia, *Oreochromis niloticus*, in Lake Hayq, Ethiopia. *International Journal of Ecology and Environmental Sciences, 41, 55-65.*
3. Barry, M. J., Powell, M. D. and Allan, G. L. (2019). Effects of temperature on feeding rate, growth, and feed efficiency of juvenile barramundi (*Lates calcarifer*). *Aquaculture*, 498, 81-87.
4. Bolarinwa, J. and Popoola, B. (2014). Length-Weight Relationships of Some Economic Fishes of Ibeshe Waterside, Lagos Lagoon, Nigeria. *Journal of Aquaculture Research and Development*, 5:1-10.

5. Canonico, G.C., Arthington, A., Mccrary, J.K. and Thieme, M.L. (2005). The Effects of Introduced Tilapias on Native Biodiversity. *Aquatic Conservation Marine and Freshwater Ecosystems*, 15: 463-483.
6. El-Sayed, A-F. M., Kawanna, M. and Abdel-Warith, A-W. (2003).The role of plant protein sources in tilapia feeds: effects on growth performance, feed utilization, and body composition. *Aquaculture*, 220(1-4), 579-590.
7. Engdaw F, Dadebo, E. and Nagappan, R. (2013). Morphometric relationships and feeding habits of Nile tilapia (Oreochromis niloticus) from Lake Koka, Ethiopia. International Journal of Fisheries and Aquatic Studies, 2, 56-71.
8. Fagade, S.O. and Olaniyan, C.I.O. (1973). Food and feeding inter-relationship of fishes in Lagos Lagoon, J. fish Biol. 5:203-225.
9. Fayeye, T. R., Adebayo, A. O. and Bawa, G. S. (2021). Feeding ecology and reproductive biology of *Eutropius niloticus* (Rüppell, 1829) in the Ogun River, Southwest Nigeria. *Fisheries Science*, 87(3), 497-508.
10. Houlihan, D., Boujard, T. and Jobling M. (2001). Food Intake in Fish. Blackwell Science, Oxford, UK, 130-143.
11. Iheanacho, S. C., Anyanwu, P. E. and Iheanacho, E. C. (2013). Feeding habits and growth performance of *Oreochromis niloticus* (Linnaeus 1758) juveniles under different feeding regimes. *International Journal of Fisheries and Aquaculture*, 5(4), 62-69.
12. Kamal, M., Kurt, A. and Michael, L.B. (2010). Tilapia Profile and Economic Importance South Dakota Cooperative Extension Service USDA Doc. Retrieved form: http://pubstorage.sdstate.edu/ AgBio_Publications/articles/FS963-01.pdf, 108.
13. Keyombe J.L, Waithaka E. and Obegi B. (2015). Length-weight relationship and condition factor of *Clarias gariepinus* in Lake Naivasha, Kenya. *International Journal of Fisheries and Aquatic Studies*, 2:382-385.
14. Mbabazi, D., Njiru, M. and Kaufman, L. (2016). Seasonal variation in the diet of Nile tilapia *Oreochromis niloticus* (Pisces: Cichlidae) in Lake Victoria, Uganda. *African Journal of Aquatic Science*, 41(3), 333-340.
15. Njiru, M., Mwanja, M. T. and Kanyange, M. K. (2017). Feeding ecology of Nile tilapia *(Oreochromis niloticus)* and Nile perch (*Lates niloticus*) in Lake Victoria, Uganda *African Journal of Ecology*, 55(4), 720-727.
16. Olojo, E.A.; K.B. Olurin and O.J. Osikoya (2003). Food and feeding Habits of *Synodontis nigrita* from the Osun River, SW Nigeria NAGA, World fish center quarterly, volume 26, Number, A Pp 21–24.
17. Oludare, A. O., Otubusin, S. O. and Adebayo, A. A. (2016). Food and feeding habits of *Oreochromis niloticus* (Linnaeus, 1758) in the Oyan Reservoir, Nigeria. *Journal of Applied Life Sciences* International, 5(2), 1-7.
18. Oso, J.A., Ayodele, I.A. and Fagbuaro, O. (2006). Food and feeding habits of *Oreochromis niloticus* (L.) and *Sarotherodon galilaeus* (L.) in a tropical reservoir. *World Journal of Zoology*, 1, 118-121.
19. Otieno, O.N., Kitaka, N. and Njiru, J.M. (2014). Length-Weight Relationship, Condition Factor, Length at First Maturity and Sex Ratio of Nile Tilapia, *Oreochromis niloticus* in LakeNaivasha, Kenya. *International Journal of Fisheries and Aquatic Studies*, 2:67-72.
20. Siziba, N., Moyo, N. A. G. and Chimimba, C. T. (2010). Feeding ecology of the Nile tilapia, *Oreochromis niloticus* (L.) in Lake Kariba, Zimbabwe. *Lakes and Reservoirs: Research and Management*, 15(1), 47-56.
21. Teferi Y., Admassu D. and Mengistou S. (2000). The food and feeding habit of *Oreochromis niloticus* L. (Pisces: Cichlidae) in Lake Chamo, Ethiopia. *Ethiopian Journal of Science*. 23:1-12.