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

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ABSTRACT

This study investigated the food and feeding habits of *Eutropius niloticus* in the lower River Benue to determine the diet composition in the stomach of *E. niloticus* and determine the dietary overlap. Fifty 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 *E. niloticus* is an omnivorous fish that feeds on fish (IRI = 13.98%), crustaceans (IRI = 21.04, eggs/larvae (IRI = 14.78%), worms (IRI = 9.95%), insects (IRI = 11.52%), green algae (IRI = 0.87%), plant tissues (IRI = 1.15%), and plant seeds (IRI = 2.75%).

Keywords: Food, Feeding, *Eutropuis niloticus*, River Benue.

INTRODUCTION

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). Mainly, fish feed on items that can fit into their mouth and what their stomach can digest. As fish grow, the stomach becomes longer and their digestive system becomes more developed. However, the feeding rate relative to body weight decreases, whereas the absolute rate of food consumed increases (Wakil *et al*., 2014). *Eutropius niloticus*, also known as the Nile puffer or the Nile dwarf puffer, is a freshwater fish species belonging to the family Tetraodontidae. The fish is found in slow-moving or still waters, such as swamps, marshes, and small streams, with dense vegetation and mud bottoms. *E. niloticus* are opportunistic omnivores, feeding upon a wide range of plants and animals, depending on fish size, age, and feed availability. Young fish feed primarily on aquatic detritus, aquatic insects and zooplankton, while adults feed mainly on insects, snails, crawfish, green algae, aquatic plants, seeds, small fish and terrestrial insects. Young fish generally feed in shallow waters, while the adults prefer feeding in deeper water, downstream from sand bars. Adults are sedentary, and generally do not move from one area to another, while young fish move more extensively, mainly at night for feeding.

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 *Eutropius niloticus*

The stomach content of *Eutropius niloticus* is shown in Table 1. This table provides information on the relative importance of different food items in the diet of the species, based on the IRI values calculated from the frequency of occurrence (%F), numerical abundance (%N), and volume (%V) of each food item.

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

Food Items	**Methods of Stomach Content Analysis**			**IRI**
	%F	%N	%V	
Green Algae	1.96	4.71	3.16	0.87
Rotifers	6.86	3.53	5.36	3.45
Worms	7.84	15.29	7.15	9.95
Desmids	8.82	8.24	4.95	6.57
Eggs/Larvae	11.76	14.12	8.12	14.78
Crustacean	13.73	15.29	11.83	21.04
Insect	10.78	9.41	9.49	11.52
Snail	9.80	7.06	7.15	7.87
Fish (whole/parts)	14.71	7.06	9.77	13.98

Plant Tissues	1.96	3.53	6.88	1.15
Plant Seeds	3.92	4.71	7.70	2.75
Unidentified Food Items	5.88	4.71	9.90	4.86
Detritus	1.96	2.35	8.53	1.21

Figure 1 shows the stomach vacuity index of *Eutropius niloticus* observed in each month. The SVI value was highest in December (SVI = 45.45%) followed by January (SVI = 37.50%). The lowest value was observed in November (SVI = 30.76%). The fullness index was higher in December (FI = 7.20) followed by November (FI = 6.32) and January (FI = 5.3). The stomach vacuity index showed a direct trend to the fullness index.

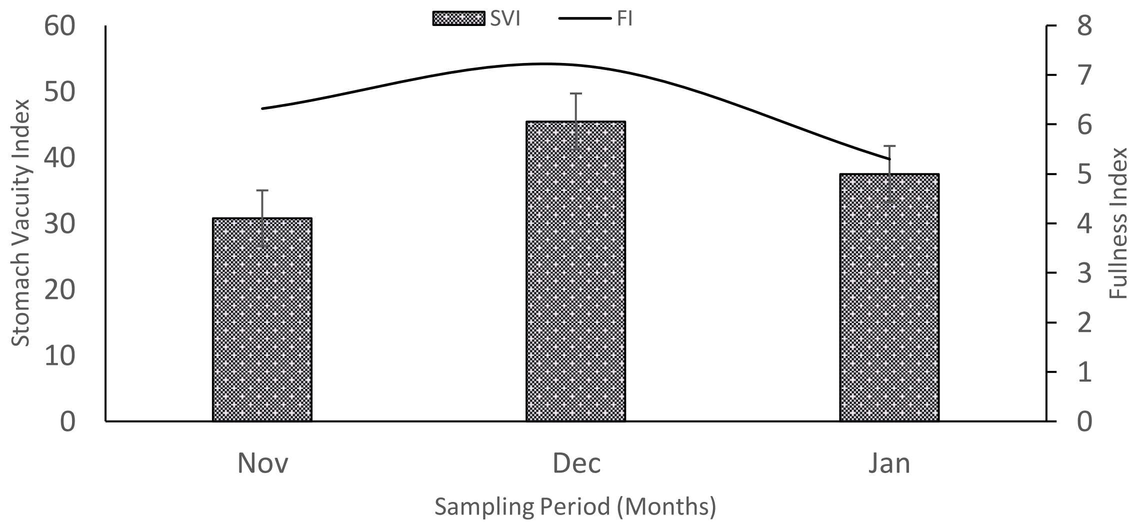

Figure 1: Stomach Vacuity Index and Fullness Index of *Eutropius niloticus* collected from November to January

Figure 2 below presents the stomach fullness levels of *Eutropius niloticus* samples caught from November to January

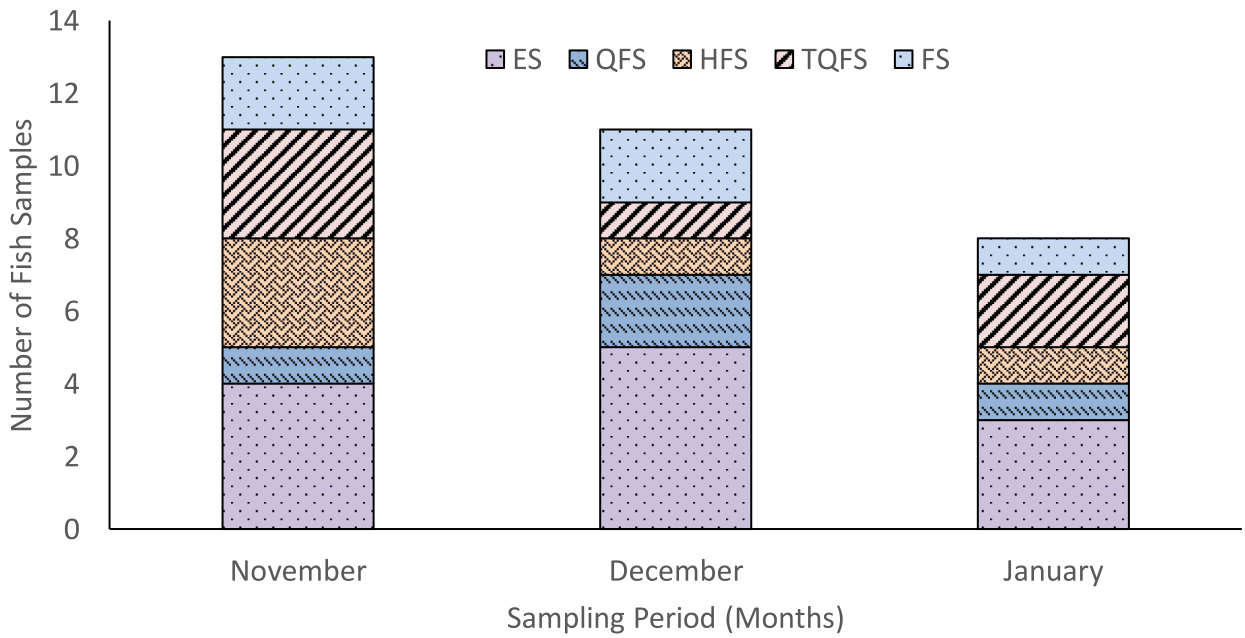

Figure 2: Stomach Fullness of *Eutropius niloticus* from November to January.

DISCUSSION

The results from this research indicates that *Eutropius niloticus* consumed a variety of animal-based food items such as rotifers, worms, eggs/larvae, crustaceans, insects, snails, and fish (whole/parts) Idodo-Umeh(2015). In particular, fish (whole/parts) were found to be the most important food item in the diet of *E. niloticus*. This implies that *E. niloticus* is an omnivorous fish that feeds on other fish, as well as a variety of other food items (Olaniyi *et al*. 2015). A study by Alam *et al*., 2021that *E. niloticus* in the River Nile fed on algae, detritus, fish and aquatic invertebrates. Okoye and Ezenwaji (2019) investigated the feeding habits of *E. niloticus* in a tropical reservoir in Nigeria, the fish consumed a variety of food items, including insects, crustaceans, and plant materials such as algae and detritus. It's also worth noting that a significant portion of the stomach contents were classified as unidentified food items indicating they are less important in the diet which implies the presence of additional food items in their diet that were not accounted for (Fayeye *et al*., 2021). The presence of detritus in the stomach contents of *E. niloticus* suggests that it may scavenge on dead organic matter in addition to actively hunting and consuming live prey. A study by Das and Baruah (2007) found that *Schilbe mystus* was able to feed on fish carcasses in laboratory experiments, while this study does not directly address the scavenging behavior of *E. niloticus*, it suggests that the species may have a scavenging component to its diet. However, detritus made up only a small fraction of the overall diet of *E. niloticus*.

The results indicates that there is a clear seasonal pattern in the feeding behavior of *Eutropius niloticus*, as evidenced by the fluctuation in both the stomach vacuity index (SVI) and the fullness index (FI) over the course of the study period. The highest SVI value was observed in December, which may suggest that *E. niloticus* experiences reduced feeding activity during the colder months of the year, as has been previously reported for other fish species (Barry *et al*., 2019). A study in Lake Victoria, Kenya found that *E. niloticus* had a higher SVI during the dry season compared to the wet season, suggesting that food availability may be a limiting factor during the dry season (Abila *et al*., 2009). The higher FI values observed in December and November shows fish tend to store more food in their stomachs during periods of reduced feeding activity in order to compensate for the reduced availability of prey. Gjelland *et al*., (2012) conducted a study on the feeding habits of *Labeo gonius* in the Ganges River of India and found that the fish stored more food in their stomachs during periods of low food availability, which is consistent with the results in this research. This supports the idea that fish have adaptive feeding behaviors that allow them to survive during periods of food scarcity. Interestingly, the stomach vacuity index showed a direct trend to the fullness index, which suggests that these two indices are closely related and may be used interchangeably to evaluate feeding behavior in *E. niloticus*. This finding is consistent with previous studies that have used both the SVI and FI to assess feeding patterns in fish (Gjelland *et al*., 2012).

The stomach fullness of *Eutropius niloticus* varies between months and among individuals within a given month. The number of individuals with empty stomachs was highest in December, followed by November and January. In contrast, the number of individuals with full stomachs was highest in November, followed by December and January. These findings are consistent with previous studies that have shown seasonal changes in feeding patterns in fish species (Papoutsoglou *et al*., 2019; Shikano *et al*., 2018). The higher incidence of empty stomachs in December could be attributed to the decrease in water temperature, which may lead to a decrease in metabolic rate and consequently, a decrease in appetite (Koumoundouros *et al*., 2016). Similarly, the higher incidence of full stomachs in November could be attributed to the fact that *E. niloticus* is known to be a voracious predator during this time of year due to the abundance of prey (Alam *et al*., 2021). The fish that did have food in their stomachs tended to have higher stomach fullness levels in November and December, due to compensatory feeding behavior during periods of reduced prey availability and colder months (Kassim *et al*., 2020). Similarly, a study by Ghanawi *et al*. (2018) reported that the stomach fullness of *E. niloticus* in the Tigris River, Iraq, varied among different seasons, with the highest levels observed in summer and the lowest levels in winter.

CONCLUSION

The findings from this study implies that *Eutropius niloticus* is an omnivorous fish that feeds on other fish, as well as other small aquatic organisms. 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 the species. The study also found that *E. niloticus* have moderate to high dietary overlap in some food items such as rotifers, desmids, and snails, but low overlap in others such as fish and plant seeds.

RECOMMENDATION

It is recommended that relevant stakeholders implement effective management strategies aimed at ensuring the sustainable conservation of fish populations should implement policies and practices that promote responsible fishing and protection of the aquatic environment in which these fish species thrive. It is also recommended that further studies be conducted on the effects of human activities such as overfishing, pollution, and climate change on the feeding behavior and diet of *Eutropuis niloticus.* This will provide a better understanding of the broader ecological impacts on these fish populations and aid in the development of more comprehensive management strategies.

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