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Research Article

An Investigation on the Food and Feeding Habit of *Sarotherodon Galilaeus* (Cichlidae) in Egbe Reservoir, Ekiti State, Nigeria

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Abstract

A study on the food and feeding ecology of *Sarotherodon galilaeus*, a species of cichlid found in Nigeria's Egbe Reservoir. For the investigation, 305 fish specimens were used. The stomach contents were analyzed using diet indices such as stomach fullness, numerical approach, and frequency of occurrence method. Additionally, the Geometric Index of value (GII) was used to determine the relative value of these food products. The findings showed that both adult and juvenile *Sarotherodon galilaeus* fed on nine various food sources. The variety of food items included rotifers, algae, desmids, diatoms, protozoa, detritus, aquatic insects, aquatic plants, and insect larvae. The inclusion of detritus in the food items suggests that the fish species graze on both surface water and bottom sediments. Algae had the highest frequency of occurrence (46.39%) in both sizes and seasons, whereas rotifer had the lowest value (1.55%). Since it is possible to create the artificial diet required for this species' mass production in Nigeria, the findings of this study are very significant for the culture of that species. *Sarotherodon galilaeus* can be classified as an omnivore because it consumed a variety of foods. Since feeding accounts for 60–65% of the aquaculture industry for any species being raised, research on fish diet and feeding habits is essential to developing an effective aquaculture management system. As a result, the fish species may be raised in our garden.

Keywords

Fish, Food Items, Egbe Reservoir, Cichlid, *Sarotherodon Galilaeus*

1. Description of the Problem

Fish belonging to the cichlid family include the mango tilapia (*Sarotherodon galilaeus*). With a maximum length of 41 cm (16 inches) and a weight of approximately 1.6 kg, this cichlid is comparatively large [12]. The species is common throughout northern and central Africa, where it can be found in lakes, rivers, and other freshwater environments [7]. It was discovered after reading through a number of periodicals and research papers that *Sarotherodon galilaeus*'s eating habits in Egbe Reservoir had not been investigated. Here are a few of the researchers that have been reviewed: *Clarias gariepinus* [5] food and feeding patterns in Egbe Reservoir by [3]. Previous research has examined *Clarias gariepinus* in its natural habitat, and observations of a diverse array of dietary components have been made in several regions of Africa. According to [4], the juvenile fish and zoo-plankton in Gbedikere Lake, Kogi State, Nigeria, are their food sources. They stated that the adult's diet was just as varied as the

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fish remnants of the little one made up the majority of the food's ingredients. Food and feeding habits are important biological factors for choosing a group of fish for culture in ponds so that they avoid competition for food among themselves and live in association and utilize all the available food [14]. Food and feeding habits of tilapia species in Ebonyi River, South Eastern Nigeria, by [17]. The study conducted by [6] on the diet and enteroparasitic infestation of Sarotherodon galilaeus in Oba Reservoir, Ogbomoso, Nigeria, revealed that the adult species consumed ten different types of food items, while the immature species only exposed to six. While studies on *Sarotherodon galilaeus's* length-weight connection and feeding behaviors have been conducted in other Nigerian settings [16], no research has been done on the species' eating habits in Egbe Reservoir. The purpose of this study was to ascertain the eating habits of *Sarotherodon galilaeus* in Egbe Reservoir in Ekiti State, Nigeria. Specifically, the study aimed to ascertain the species' stomach contents in the reservoir, assess the food habits of the species there, and assess the degree of size variation in the species' diets.

2. Materials and Methods

2.1. Description of the Study Area

The Ebge Reservoir is located in the Gbonyin Local Government Area of Ekiti State in Western Nigeria, across the Egbe River in the Egbe Ekiti neighborhood. The reservoir rises in Kwara State, flows through Ekiti, and finally empties into the well-known Ose River in Ondo State. The reservoir is located between longitude 5 ℗35' East of the equator and latitudes 7 ℗36N and 7 ℗39' North. The reservoir is 26.5 acres long and 64 meters deep overall. The highlands that encircle the reservoir, which is situated on an undulating level, provide runoff into the reservoir during the rainy season. The reservoir has a 3.58 km^2 total area cover and metamorphic rock beneath it.

2.2. Sampling Techniques and Laboratory Procedure

I collected the fish with the assistance of the fishermen working on the reservoir, fish specimens were gathered in 2017 from January through May. Among the tools used were hooks and lines, cast nets, and traps. Before being sent to the lab for analysis at the Adekunle Ajasin University's Department of Environmental Biology and Fisheries in Ondo State, Nigeria, samples were refrigerated in ice blocks at the site of collection. The most distinguishing feature of the family-having only one pair of nostrils and a rounded profile, as well as a simple tail devoid of any bands, bars, or spots were used to identify the fish [2]. After draining surplus water with a stack of filter paper, the weight of each specimen was measured using a top loading meter balance (model PNI200) to the nearest 0.1 g, and the standard length was measured in centimeters using a measuring board. In order to remove the stomach, specimens were dissected and their guts removed. To facilitate analysis, the contents were poured into a petri dish. In sterile petri dishes, the contents of the gut were distributed for microscope observation. Food remnants from those stomachs that could not be quickly identified or examined were stored for further identification in clearly labeled vials with a 10% formalin solution. Large food items were simple to identify with the unaided eye, but the use of a binocular microscope allowed for a better understanding and identification of food species at a magnification of X 100. Every food item that was recognized was identified. Two techniques for gut contents analysis, frequency of occurrence and numerical methods, as well as the Geometric Importance Index were used to analyze food items.

2.3. Stomach Content Analysis

Frequency of occurrence (FC) and Numerical methods (NM) were used for analysis [11, 13].

$$\%\ \mathrm{F.C} = \frac{\text{Total no of fish with food item}}{\text{Total no of stomachs with food sample}} \times 100$$

This method involves analyzing the stomach contents of sampled fish, where the quantity of each food item is identified and summed [8]. The total for each type of food is then calculated as a percentage of the overall food items found across all fish examined [1].

$$\%\text{Number of food items} = \frac{\text{Total no of a particular food item}}{\text{Grand total of all food item}} \times 100$$

Geometric Importance Index: The food items consumed by Sarotherodon galilaeus were also analyzed using the Geometric Importance Index (GII), which integrates the relative abundance of food items through the following formula:

$$\%\text{Number of food items} = \frac{\text{Total no of a particular food item}}{\text{Grand total of all food item}} \times 100$$

$$\mathrm{GII} = \frac{\sum_{i=0}^{n}(Vi)}{\sqrt{n}}$$

3. Results

Sarotherodon galilaeus specimens totaling 305 were acquired. *Sarotherodon galilaeus* had a total length and standard

length that varied from 10.8 cm to 20 cm and 6.3 cm to 15 cm, respectively, and a weight range of 38 g to 125 g. The most significant diet in the reservoir, according to the frequency of occurrence technique, was algae (46.39%), followed by diatoms (29.90%). The outcome also showed that, according to the reservoir's number, rotifer (1.08%) had the lowest numerical method and algae (32.49%) had the greatest. The fish's stomach's Geometric Importance Index (GII) was computed for every food item. Algae have the highest value (55.94), followed by diatoms (36.06) and aquatic insects (19.89), with rotifer having the lowest value (1.87). A review of the contents of the stomach revealed that 35 (11.48%) had an empty stomach and 70 (22.95%) had a full stomach.

Table 1. *Showing summary of the stomach content of Sarotherodon galilaeus in Egbe Reservoir, Ekiti State, Nigeria.*

Food items	Frequency of occurrence %	Numerical Method %	Geometric Importance index
Protozoa	9.79	6.86	11.81
Desmids	13.92	9.75	16.79
Diatom	29.90	20.94	36.06
Algae	46.39	32.49	55.94
Rotifer	1.55	1.08	1.87
Aquatic Insect	16.49	11.55	19.89
Aquatic Plant	7.22	5.05	8.70
Detritus	7.73	5.42	9.33
Insect Larvae	9.79	6.86	11.81

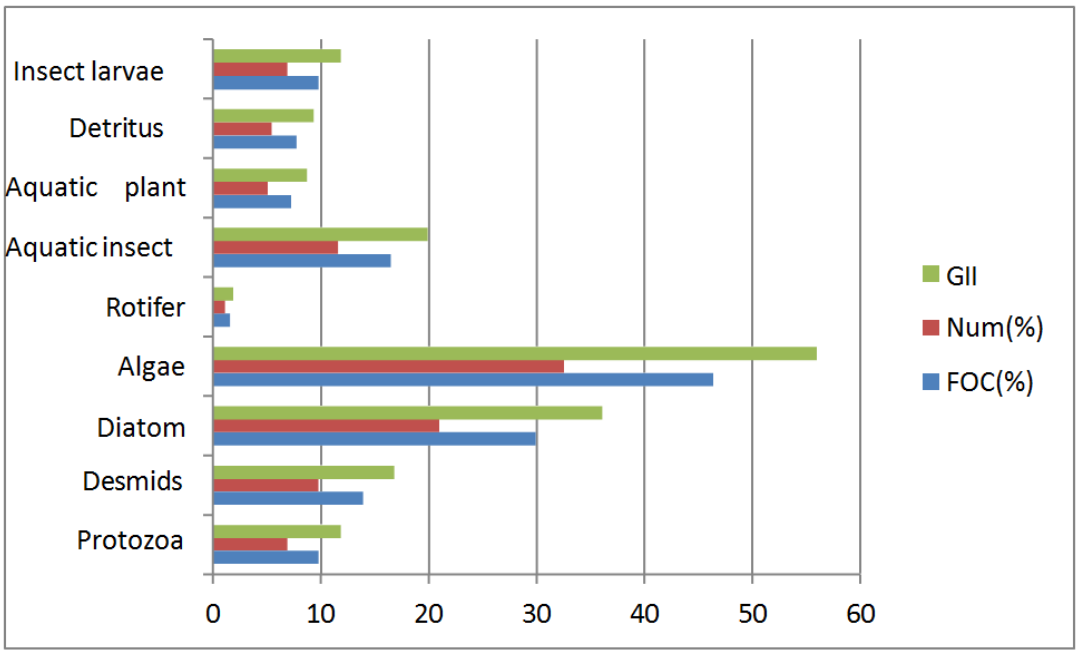

Figure 1. *Bar chart representing frequency of occurrence, numerical percentage and geometric importance index of various food items present in Sarotherodon galilaeus stomach.*

Table 2. Analysis of empty stomach of Sarotherodon galilaeus.

Degree of fullness	Number of Stomachs	%
Full (4)	70	22.95
Almost full (3)	56	18.36
Half (2)	65	21.31
Almost empty (1)	79	25.90
Empty (0)	35	11.48
Total	305	100

4. Discussion

S. Galilaeus is an omnivorous fish species, as evidenced by the results of its frequency of occurrence, numerical methods, and geometric importance index. It mostly feeds on algae, diatoms, desmids, protozoans, and some unidentifiable plant material. A related study demonstrates that *S. galilaeus* consumed a wide range of foods [9, 10]. Understanding a species' natural diet is crucial to determining its nutritional requirements and how it interacts with other living things. The results of this study show that *Sarotherodon galilaeus* is a non-selective opportunistic feeder and its diet includes a diverse spectrum of plankton, with rotifer, insect part, detritus, diatom, and algae being the dominant food items. Most aquatic animals appear to be opportunistic feeders, consuming a large diversity of prey [15]. Because it can take advantage of a variety of dietary sources, *Sarotherodon galilaeus* is an omnivore. Additionally, a review of the food revealed that the animal's stomach had some debris, suggesting that it may be a bottom feeder. According to the study's findings, around 35 people had empty stomachs. This could be because the fish were fighting to get out of the gill nets and traps, which caused the food in their stomach to be regurgitated or broken down. 35 of the 305 specimens that were inspected were empty, and 270 of the specimens had food inside of them. Additionally, there was a high level of feeding intensity during the study time as evidenced by the fact that a greater proportion of adults' and juveniles' full stomachs than empty stomachs during the study period, suggesting an abundance of food in the lake. *Sarotherodon galilaeus* has a high potential for aquaculture because it can eat a variety of foods. This is especially significant for the culture of this species since, although it hasn't been done in Nigeria yet, it is conceivable to create artificial diets that are required for its mass production.

5. Conclusions and Application

In the Egbe Reservoir, *Sarotherodon galilaeus* consumed nine different kinds of food. The fish are mostly herbivores and were discovered to graze on plant-based diet items. It is typically categorized as an omnivore since it also consumes animal sources. One could classify it as euryphagous. Since it is possible to create the artificial diets required for this species' mass production in Nigeria, this is especially significant for the culture of that species.

Abbreviations

GII	Geometric Importance Index
FC	Frequency of Occurrence
NM	Numerical Method

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Conflicts of Interest

The authors declare no conflicts of interest.

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