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Gut Contents, Feeding Ecology and Condition Factor of *Sarotherodon melanotheron* inhabiting Lagos Lagoon, Nigeria

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ABSTRACT

The gut contents, condition factor, food and feeding habit of *Sarotherodon melanotheron* in Lagos lagoon, Lagos State Nigeria were investigated. The specimens were collected by artisanal fishermen and were transported in ice-chest to the laboratory. The guts were carefully taken out to extract the stomach and preserved in 4% formalin for investigation of food items. Frequency of occurrence and numerical abundance methods were employed in this study. The calculated condition factor was 2.11. The result revealed that 3.75% of the sampled fish had empty stomach while 12.5%, 16.25%, 62.50% and 5.00% of the fish had 25%, 50%, 75% and 100% filled stomach respectively. The result showed that *S. melanotheron* fed mainly on *Synedra*, *Coscinodiscus*, *Mougeotia*, *Oscillatoria*, *Gyrosigma* and *Spirulina*. Other food items include *Zygnema*, *Pinnularia*, *Closterium*, *Melosira*, *Copepods*, *Penium*, *Cosmarium*, *Crustacean Parts*, *Microspora*, *Fish Scale*, *Rhizosolenia*, *Tabellaria*, *Crustacean Appendages* and *Spirogyra*. The analysis showed the presence of food items of both plant and animal origin indicating that *S. melanotheron* is omnivorous. This study also revealed that the species was 'very fat' since food was abundant in the lagoon. Thus, regular monitoring and management of the lagoon is recommended.

Key words: Diet composition, Food and Feeding Habit, *Synedra*, omnivore, Euryphagic fish.

1.0 INTRODUCTION

The knowledge of the ecological niche of a species of fish is a useful tool to investigating the food and feeding habit of the fish species. (Allan and Castillo, 2007). Studying their diet provides vital information which are used in ecological studies and aquatic management (Saikia, 2015). Continuous investigation of the feeding habits of both reared and cultured fish species could pave way for developing a successful fisheries management program (Oransaye and Nakpodia, 2005). Analysis of the food content of organisms in their homes aids the knowledge of the productivity, growth, abundance and distribution of the organism (Oso *et al.*, 2006).

A unique way of studying the trophic relationship and the interaction between the fish and its environment is to investigate the food content of the stomach (George *et al.*, 2013). This will help the fish farmers to have adequate knowledge of the type of food and the supplementary feed to be given to the fish (Olawusi-Peters *et al.*, 2015). This will also provide useful idea on the feeding strategy, interaction and role of the fish within the ecosystem (George *et al.*, 2013).

The analysis of the gut content of a fish species caught from its natural habitat provides more reliable information on the food and feeding habit than the reared or cultured ones (Olawusi-Peters *et al.*, 2015). According to Ajibare *et al.*, (2020), Maintenance of ecosystem balance and proper management of the species are enhanced by the adequate knowledge of the condition factor and life cycle of the fish species. The condition factor, as reported by Olawusi-Peters *et al.*, (2014) and Fagbuaro *et al.*, (2018), reflects the interaction between the living and non-living components in the physiological condition of fish, and also serves as indicator of health in fish biology.

Tilapias (family Cichlidae) are good and important sources of man's food. They have the capacity to display trophic plasticity as a result of their interaction with the environment and other species within the ecosystem (Kuton and Kusemiju (2000). Lots of investigations on dietary composition and condition factor of Cichlids as well as other fish species have been made by several researchers in Nigerian water bodies (Kotos, 1998; Kuton and Kusemiju, 2000; Akombo *et al.*, 2014; Oso *et al.*, 2017; Fagbuaro *et al.*, 2018). However, as a follow-up to these

researches, this study examined the gut contents and condition factor of *Sarotherodon melanotheron* in the Lagos lagoon in order to complement the existing data in the management and culture of the species.

2.0 MATERIALS AND METHODS

2.1 Study Area

The Lagos lagoon which has a surface area of 208km² lies between Longitude 003° 24. 473' E and Latitude 06° 31. 048' N (Figure 1). It is an open, shallow and tidal lagoon that is characterized by fresh and slightly brackish

conditions in wet and dry seasons respectively (Onyema, 2008).

2.2 Collection and Identification of Samples

Eighty (80) samples of *Sarotherodon melanotheron* were collected in August, 2020 by fishermen operating on the lagoon using cast nets. Samples were identified according to Olaosebikan and Raji (2013) and transported in ice chest to the Fisheries and Aquaculture Laboratory of the Olusegun Agagu University of Science and Technology, Okitipupa Nigeria.

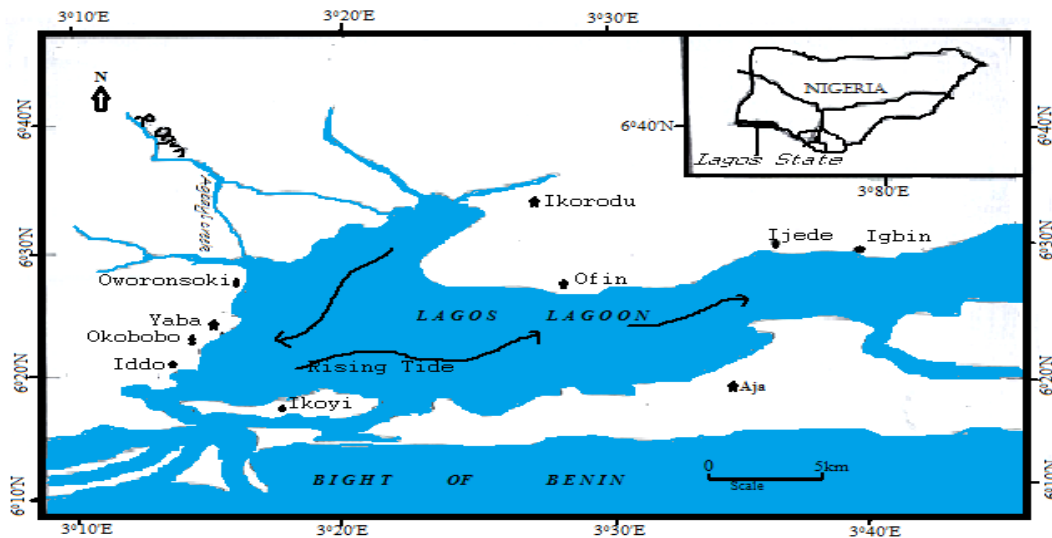


Figure 1: Map of Lagos Lagoon

2.3 Laboratory and Data analyses

The total length and standard length were taken to the nearest 0.1cm using a standard measuring board and the weight was measured with digital Sartorius top loading weighing balance (Model 1100) to the nearest 0.01g. Individual fish specimen was dissected and the gut was carefully removed by opening the abdominal portion of the fish. The gut was carefully taken out to extract the stomach and preserved in 4% formalin for further investigation of the food items. The food volume of each gut was determined by displacement method (Hyslop, 1980). This was done by placing 10ml of distilled water in a 50ml capacity glass cylinder. Each gut was individually dropped in the water contained in a glass cylinder. The quantity of water displaced by the gut represented the food volume in the gut. The stomachs were categorized as 0% (empty), 25%, 50%, 75%, or 100% (full) according to their fullness (George *et al.*, 2013). Individual stomach was then opened and the content was collected in a Petri dish. The contents were subsequently identified with the aid of a light microscope. Slides were prepared

and viewed under the light microscope using the x10 and x40 objectives. Analysis was done using frequency of occurrence and numerical methods as described by Olawusi-Peters *et al.* (2015) and Oso *et al.*, (2017).

Frequency of occurrence was calculated using the formula: $F = \frac{Ni}{N} \times 100$

Where; F = Frequency of occurrence of a particular food item in the sample

Ni = number of stomachs containing a particular food item

N = total number of stomachs with food in the sample;

While numerical abundance was determined as:

$$Ni = \frac{Fi}{F} \times 100$$

Where Ni = Numerical percentage of a particular food item in the sample

Fi = number of individual food item

F = total number of all identified food item from the gut.

2.4 Determination of Condition Factor (K)

The mean weight and length of the experimental fish were used to estimate condition factor using equation: $K = \frac{100W}{L^3}$ (Ajibare *et al.*, 2020)

Where: K = Condition factor

W = Mean Weight of fish in grams

L = Mean Length of fish in centimeters

Note: Condition Factor of the fish was categorized according to Indarjo *et al.* (2021) into; very thin (K=0.01-0.50), thin (K=0.51-0.99), ideal (K=1.0), fat (K=1.01-1.50), and very fat (K>1.50).

3.0 RESULTS

The minimum and maximum total length was 12.80cm and 16.30cm (average of 14.28±0.82cm) with corresponding standard length of 10.60cm and 12.80cm (mean of 11.67±0.51cm) while the weight ranged between 50.3g and 81.50g (mean of 63.80±8.71g) as shown in Table 1. The table also showed that the condition factor was 2.19. The stomach fullness of the eighty samples of *S. melanotheron* caught from Lagos lagoon is presented in Table 2. The table shows that 16.25% of the sampled stomachs were fifty percent (50%) full while 62.50% and 5.00% of the stomachs were seventy five percent (75%) and 100% full respectively. This suggests abundance of food items during the period of study. The table also shows that 3.75% of the sampled fish had empty stomachs while 12.50% were 25% full. This suggests digestion of food during the period of transportation from the lagoon to the laboratory.

The diets composition, percentage relative abundance (%RA) and percentage frequency of

occurrence (%FO) of stomach contents of *Sarotherodon melanotheron* inhabiting Lagos Lagoon are presented in Table 3 which shows that a total of 21 different diet components were recorded in the gut of *S. melanotheron* in this study, showing varying percentage relative abundance. The diet was composed of Synedra (16.97%), Coscinodiscus (14.81%), Mougeotia (9.79%), Oscillatoria (9.23%), Gyrosigma (7.85%), Spirulina (6.48%), Zygnema (4.73%), Pinnularia (4.43%), Closterium (4.21%), Melosira (3.28%), Copepods (2.87%), Penium (2.79%), Cosmarium (2.05%), Crustacean Parts (1.75%), Microspora (1.67%), Fish Scale (1.34%), Rhizosolenia (1.15%), Tabellaria (0.52%), Crustacean Appendages (0.41%) and Spirogyra (0.33%) while Unidentified materials/Detritus/Sand Grains/Digested food particles (3.35%) were also present. In the numerical analysis, Synedra (72.22%) were found to be the most preferred food in the examined fish samples followed by coscinodiscus (66.67%) and mougeotia, closterium and copepods (50.00%). The table also shows that spirulina and Gyrosigma occurred at 38.89% while Oscillatoria, Penium, Fish Scale and Pinnularia occurred at 33.33%. Furthermore, Melosira and Crustacean Parts were 27.78% while Microspora (22.22%), Rhizosolenia (22.22%), Zygnema (16.67%), Crustacean Appendages (16.67%), Tabellaria (11.11%), Cosmarium (11.11%), and Spirogyra (5.56%) were also recorded. Table 4 further shows that food items of plant origin accounted for 90.29% of the stomach content followed by items of animal origin (6.36%) and unidentified items (3.35%). The table also revealed that food items of plant origin were recorded in 100% of the fish while 88.89% had food items of animal origin.

Table 1: Length, Weight and Condition factor of *Sarotherodon melanotheron* inhabiting Lagos Lagoon, Nigeria

	Minimum	Maximum	Mean±SD
TL (cm)	12.8	16.7	14.57±0.97
SL (cm)	10.6	12.8	11.85±0.51
WT (g)	50.3	81.5	65.28±10.10
K			2.11

TL: Total Length, SL: Standard Length, WT: Weight, K: Condition Factor

Table 2: Analysis of stomach of *Sarotherodon melanotheron* in Lagos Lagoon, Nigeria

Stomach Fullness	N	%
Empty	3.00	3.75
25% Full	10.00	12.50

50% Full	13.00	16.25
75% Full	50.00	62.50
100% Full	4.00	5.00

Table 3: Diets composition, percentage relative abundance (%RA) and percentage frequency of occurrence (%FO) of stomach contents of *Sarotherodon melanotheron* inhabiting Lagos Lagoon, Nigeria

Food Item	% Relative abundance	%Frequency of occurrence
Oscillatoria	9.23	33.33
Spirulina	6.48	38.89
Mougeotia	9.79	50.00
Zygnema	4.73	16.67
Synedra	16.97	72.22
Coscinodiscus	14.81	66.67
Gyrosigma	7.85	38.89
Melosira	3.28	27.78
Closterium	4.21	50.00
Penium	2.79	33.33
Copepods	2.87	50.00
Crustacean Parts	1.75	27.78
Unidentified materials/Detritus/Sand Grains/Digested food particles	3.35	100.00
Microspora	1.67	22.22
Spirogyra	0.33	5.56
Rhizosolenia	1.15	22.22
Fish Scale	1.34	33.33
Pinnularia	4.43	33.33
Crustacean Appendages	0.41	16.67
Tabellaria	0.52	11.11
Cosmarium	2.05	11.11

Table 4: Summary of origin of food items in the stomach of *Sarotherodon melanotheron* inhabiting Lagos Lagoon, Nigeria

Food Item	No of Item	Relative Percentage Abundance (%)	Percentage of Occurrence (%)
Animal Origin	4	6.36	88.89
Plant Origin	16	90.29	100.00
Detritus/Sand Grains/Unidentified materials		3.35	100.00

4.0 DISCUSSION

In this study *S. melanotheron* were observed to prefer food items of plant origin because it the occurrence of food items from plant sources are the highest. This corroborates Ikomi and Sikoki (2001) who reported that the presence of tiny unicuspid teeth in the mouth of cichlids suggests that they feed on plants, leaves, buds and seeds of water lilies and are thus herbivorous feeders. However, apart from the major food items, they also picked other food items. Oso *et al.*, (2006)

stated that teleost including cichlids were able to exploit more than one source and that they fed mainly on plant materials, detritus and insects. This ability to exploit different varieties of food makes *S. melanotheron* of Lagos lagoon to be omnivorous.

The key feeding habit of any fish species can show where such fish can be found (George *et al.*, 2013). The food and feeding habits of *S. melanotheron* in Lagos lagoon as reported in this

study was similar to those reported by Fagade and Olaniyan (1972) for *Ethmalosa fimbriata* in the Lagos Lagoon; and Fagade (1979) on *Tilapia guineensis* from Lekki Lagoon; Oso *et al.*, (2006) on *Oreochromis niloticus* and *Sarotherodon galilaeus* in Ero reservoir, Olawusi-Peters *et al.*, (2015) for *E. fimbriata* from Badagry lagoon and Oso *et al.*, (2017) for *Oreochromis niloticus* in Ero Dam, Ikun Ekiti.

The result obtained in this study showed that 3.75% of the examined fish had empty stomach. The reason for this may be due to the fact that the food items in their stomach may have been digested or regurgitated as the fish struggled for escape in the nets. Oso *et al.* (2006) recommended that cast netting (as used in this study) should be used for study of food and feeding habits because, specimens caught with cast net had lesser amount of empty stomach. The percentage of occurrence of empty stomach was very low and this revealed that food is available for fish species in the lagoon. It could therefore be said that the lagoon was rich in natural foods. Thus, Lagos lagoon can support a very good fish production if proper management is implemented.

Moreover, according to Indarjo *et al.* (2021), the condition factor observed in this study classified *S. melanotheron* as 'very fat'. This indicated that *S. melanotheron* had good diet components which might not in any way be connected to favorable state of the environmental conditions. Ajibare *et al.*, (2020) reported that when an organism undergoes starvation or has become spent, its condition factor reduces even when every other ecological factor is optimum. Also, environmental changes, state of growth, food availability and pollution status of an ecosystem has been attributed to condition factor of fish. Thus, the results of this study revealed that the Lagos lagoon was a favourable ecosystem for the growth, abundance, productivity and distribution of *S. melanotheron*.

5.0 CONCLUSION

From the results of the qualitative examination of the gut contents using numerical methods, it was shown that *Sarotherodon melanotheron* exhibits the ability to exploit different food items available to it thereby making it an omnivorous fish. Also, based on the extent of variation in the selection of food, it can be classified as

euryphagic fish (feeding on any food item it could readily come across particularly when food is not in abundance). On the basis of trophic niche, they are grouped as benthic/bottom feeders. The results obtained in this study indicate that food is available for fish in Lagos lagoon since the observed condition factor indicated favourable ecological conditions. Thus further ecological research as well as regular monitoring and control of anthropogenic input in the water body is important.

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