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NATURAL DIETS OF *SYNODONTIS MEMBRANACEUS* FROM IKERE GORGE IN OYO STATE, NIGERIA

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ABSTRACT

Natural dietary items in the stomach of *Synodontis membranaceus* from Ikere Gorge in Oyo State, Nigeria were investigated between the months of October to December 2004 and June to August 2005. Fish species were obtained from fishermen every fortnight using gill net and cast net. Specimens were chilled with iced blocks at the point of collection and transported to the laboratory. 642 fish specimens were examined and their stomach contents analysed. Frequency of occurrence and numerical methods were employed in the study. The result of the analysis showed that the food items found covered a wide spectrum, ranging from various types of planktons to invertebrates and plants. A seasonal variation was also noted in the stomach contents of *S. membranaceus* over the period of study. The predominant food items found in the stomach were *Polycytis spp*, *Closterium spp*, *Oedogonium spp*., plant tissues, insect parts, *paramecium sp*., unidentified algae and detritus. This suggests that *S. membranaceus* is an omnivore.

Keywords: Diets, *Synodontis membranaceus, Ikere Gorge,* Stomach

INTRODUCTION

Nature offers a great diversity of organism that are used as food by fish and these differ in size and taxonomic group. Fish species is a subject of continuous research because it constitute the basis for the development f a successful fisheries management programme on fish capture and culture (Oronsaye and Nakpodia, 2005). Olurin (1994) reported diatoms, bluegreen algae, desmids and benthic protozoans as being present in the diet of *S. galilaeus* from Oyan lake. Adebisi (1978) had made an earlier similar observation in *S. galilaeus* from upper Ogun river. While these studies reported food from plant sources as being of prime importance to *S. galilaeus*. This investigation reveals the types of small sizes aquatic plants fed on and that the species feed on a mixture of phyto and zooplanktonic organisms. Adebisi (1978) found rotifiers as the only animal in the diet of *S. galilaeus*. Various investigations have been conducted into the food and feeding habits of fish with the aim of determining their dietary requirements. The significance of *Synodontis membranaceus* in ecology of the tropical inland water has been stressed by Elliot (1986) and Olurin (1994). In Nigeria, constructions of large reservoirs are important feature for development in providing water for domestic and industrial uses. Ikere Gorge creates an opportunity of growing more fish and developing fishery industries. *S. membranaceus* is the dominant

species, occupying unique and prominent position in the commercial fisheries of the lake Jebba (Owolabi, 2005).In this gorge *S. membranaceus* constitutes one of the most thriving commercial species in the water. Algae and diatoms were reported by Fagade and Olaniyan (1972) for the same species. *T. guineensis* and *T. mariae* have been reported to be omnivorous (Fagade 1978) and *E. fimbriata* (African shad) as zooplankton feeders (Fagade and Olaniyan 1972).The food and feeding habits of many predatory species have also been reported. The species *Hydrocynus forskali* (tiger fish). *Hepsetus odoe* (Africa pike), *Parachanna obscura* (snake head) and *Lates niloticus* (Nile perch) were found to be principally piscivorus in all studied habitats (Arawomo 1976, Adebisi 1981 and Adeosun, 2007) suggesting they are obligate piscivores and feed mainly on cichlid fish.

This study is therefore aimed at identify and providing further information on the nourishment and abundant of natural food items of *S. membranaceus.*

MATERIALS AND METHODS

Sample Site

Ikere Gorge is one of the 9 reservoirs owned by Ogun/Osun River Basin Development Authority (O-ORBDA). O – ORBDA is one of the 11 River Basin and Rural Development Authorities in Nigeria. These Authorities are under Federal Ministry of Water Resources and Rural Development Authority of Nigeria. Ogun Osun River Basin Development Authority has its jurisdiction covering land area of 66.264 square kilometers; this is extended throughout the whole of Oyo, Ogun and Lagos state. River Basin Authorities were established in Nigeria to develop and manage the water resources within the covering area of individual one (Authority).

Ikere Gorge is located within the latitude 3^{o} 40$^{'}$N and 3^{o} 50$^{'}$N, and longitude 8^{o} 10$^{'}$ E and 8 ^{o} 20$^{'}$ E. It is found in southwestern zone of Nigeria about 30km northeast of Iseyin in Oyo state and about 8km from Ikere village.

Samples of *Synodontis membranaceus* (642) were obtained fortnightly with the help of the artisanal fishermen using gillnet of 76.0, and 126.4mm mesh sizes from Ikere gorge in Oyo State during rainy and harmattan (dry) seasons (October-December 2004 and June-August 2005). On each occasion, the fish caught were transported to the laboratory in an ice-chest to reduce post-humus digestion to a minimum before subsequent treatment. In the laboratory each fish was dissected and the entire gut was taken out into the petri dish where the stomach was separated from intestine. The stomach was immersed in 4 per cent formalin. Each stomach was split open, the contents released into a petri dish and observations of the food were carried out with the naked eye. Following then, random samples of the stomach contents were dropped on slides with the aid of a dropping pipette and observed under a light microscope. The stomach contents were analysed using the Frequency of Occurrence method and the Numerical method (Bagenal and Tesch 1978). Food items present were identified at the level, whenever possible. In the Frequency of Occurrence method, the number of stomachs containing each food items is expressed as a percentage of all non-empty stomachs (Dunn 1959). Though this method is quick and requires minimal apparatus, it gives little indication of the relative quantities of each food category present in the stomach. In the numerical method, the number of individuals in each food category is expressed as a percentage of the total individu-

als in all food categories (Crisp *et al*. 1978). This method has the limitation that it over-emphasizes the importance of small prey items found in a large number of fish (Hynes, 1950). For many stomachs, it is difficult to identify the numbers in each food category because of mastication of the food. It is also not suitable for dealing with food items such as fragments and detritus that do not occur in discrete units. Occasionally, some food items were observed crushed and others were at varying stages of digestion. Consequently, it was not possible to identify these at the levels.

RESULTS

The results in Table 1 show that the composition of stomach contents of *Synodontis membranaceus* indicating the number of specimen examined the percentage of empty stomach and food items in the study period.

Table 1: Composition of stomach contents of *Synodontis membranaceus*

	June		July		August		October		November		December	
No. examined	53		45		34		34		70		85	
% empty stomach	7.6		26.7		35.3		47.1		27.1		30.6	
Food items	%N	%0	%N	%0	%N	%0	%N	%0	%N	%0	%N	%0
Diatoma sp. Syndra sp.	6.4	71.4	-	-	4.6	96.7	-	-	1.5	84.4	1.6	66.1
CYANOPHYCAE												
Lyngbtya sp.	0.4	28.6	-	-	-	-	-	-	0.3	19.6	0.4	18.6
Polycystis sp	10.2	100.0	23.6	100.0	17.1	100.0	26.8	100.0	10.8	100.0	10.5	100.0
Aphanocapsa sp.	1.9	40.75	-	-	-	-	-	-	3.0	58.8	3.0	69.5
Closterium sp.	8.5	71.4	14.8	100.0	14.0	100.0	19.1	100.0	10.4	94.1	10.0	100.0
Coelosphaerium sp.	2.9	59.2	-	-	-	-	-	-	4.5	70.6	4.4	55.6
Microcystis sp.	1.7	26.5	-	-	-	-	-	-	2.3	23.5	2.3	28.8
Oscillatoria sp	0.9	14.3	-	-	-	-	-	-	0.3	11.8	0.3	15.3
Spirotaenia sp.	0.02	6.1	-	-	-	-	-	-	0.3	5.9	0.4	11.9
CHLOROPHYCEAE												
Oedogonium sp	8.1	91.9	17.4	75.8	10.7	100.0	-	-	10.4	96.1	10.0	96.6
Ulothrix sp	2.1	61.2	-	-	-	-	-	-	3.3	60.7	3.6	59.3
Sphaeoplea sp.	1.0	67.4	-	-	-	-	-	-	4.1	62.8	3.9	76.3
Unidentified algae	7.2	100.0	-	-	-	-	-	-	9.8	100.0	9.3	100.0
ROTIFERS												
Polyarthra sp.	1.6	20.4	-	-	-	-	-	-	1.1	39.2	1.0	47.5
Kerattela sp.	1.3	20.4	-	-	-	-	-	-	1.2	39.2	1.2	40.7
Epiphanes sp.	0.6	28.6	-	-	-	-	-	-	0.5	52.9	0.4	50.5
Synchaeta sp.	0.8	24.5	-	-	-	-	-	-	0.3	49.0	0.9	45.8
Asplanchna sp.	0.7	12.3	-	-	-	-	-	-	0.5	59.4	0.4	28.8
Philodina sp.	0.8	36.7	-	-	-	-	-	-	0.3	54.9	0.3	44.1
CRUSTACEA												
Daphnia sp.	2.9	59.2	-	-	-	-	-	-	3.3	39.2	4.3	39.0
Eurycerus sp.	0.08	24.5	-	-	-	-	-	-	0.2	24.5	0.1	22.0
Ceriodaphinia sp	3.0	26.5	-	-	-	-	-	-	-	-	0.1	17.00
Syncaris sp.	0.1	40.8	-	-	-	-	-	-	-	-	0.1	8.5
Cyclops sp.	-	-	-	-	-	-	0.7	88.9	-	-	-	-
PROTOZOA												
Frontonia sp	0.4	26.5	-	-	-	-	-	-	0.3	25.5	0.1	6.8
Paramecium sp	0.5	10.2	-	-	-	-	-	-	0.2	9.8	-	-
Nematodes NEMATODA	0.5	30.6	0.7	90.9	0.3	50.0	1.2	100.0	3.8	54.8	3.7	35.0
Insect parts	7.3	71.4	28.4	100.0	17.1	100.0	14.5	100.0	2.3	29.4	2.4	33.9
Detritus	11.2	100.0	14.1	100.0	-	-	14.1	100.0	9.0	98.0	8.5	88.1
Unidentified food	5.1	93.9	1.0	60.7	-	-	7.4	50.0	3.3	76.5	4.3	72.9
Plant tissues	5.3	98.0	-	-	9.9	100.0	-	-	10.2	100.0	10.0	100.0

Table 2. shows the summary of the stomach contents of the total number of Synodontis membranaceus using the frequency of occurrence and numerical method. Monthly variations in stomach fullness and the percentage of empty stomachs are given in Ta-

Table 2: Summary of the Stomach contents of the total number of *Synodontis membranaceus*

Food items	No. of Occurrences	%O	No.	%N
Diatoma Sp	137	59.1	41.86	2.7
Syndra Sp	47	20.3	1.8	1.2
Gymnodinium sp.	47	20.3	17.8	1.1
Nitzchia	35	15.1	960	0.6
Stephanodiscus sp.	41	17.7	658	0.4
CYANOPHCEAE				
Lyngbya sp.	35	15.1	528	0.3
Polycystis sp	232	100	17863	11.5
Aphanocapsa sp.	91	39.2	3892	2.5
Closterium sp.	215	92.7	160.1	10.3
Ceolosphaerium sp.	98	42.2	58.1	3.7
Microcystis sp.	42	18.1	3	1.9
Oscillatoria sp.	22	9.5	627	0.4
Spyrotaenia sp.	110	47.4	4593	2.9
ROTIFERS				
Polyarthra sp	58	25.0	1676	1.1
Keratella sp.	54	23.3	1719	1.1
Epiphanes sp.	71	30.6	677	0.4
Synchaeta sp.	64	27.6	931	0.6
Asplanchna sp.	38	16.4	712	0.5
Philodina sp	72	31.0	583	0.4
CRUSTACEA CLADOCERANS				
Daphnia sp.	72	31.0	5145	3.3
Eurycerus sp.	39	16.8	186	0.1
Ceriodaphnia sp	23	9.9	1133	0.7
Syncaris sp.	25	10.8	107	1.0
Cyclops sp.	16	6.9	2.2	0.01
PROTOZOA				
Frontonia sp	30	12.9	367	0.2
Paramecium sp	10	4.3	236	0.2
Nematodes NEMATODA	125	53.9	4261	2.7
Insect parts	143	61.6	7804	5.0
Detritus	202	87.1	14500	9.3
Unidentified Food	157	67.7	6155	3.9
Plant tissues	180	77.6	13530	8.7

DISCUSSION

The food composition of *Synodontis. membranaceus* also shows a marked seasonal variation. The food range becomes drastically limited in the dry season (October – December) when the occurrence shows *Polycystis spp*., *Closterium spp., Oedogonium spp*., insect parts, detritus and plant tissues as predominant in the stomach contents of *S. membranaceus*. In the dry season, when the water becomes depleted and less fertile to support the plankton bloom which is characteristic of the rainy season, food items such as insect parts, nematodes, plant tissues and algae become the food items for survival in the diet of *S. membranaceus.* Generally, *S. membranaceus* has a wide range of food items in the rainy season when there were abundance of plankton and insects in the water.

The food category "algae" includes all green and blue-green forms, both unicellular and filamentous as well as diatoms. The predominant forms found in the stomach were *polycystis*, *Closterium, Oedogonium* and the diatoms *Diatoma sp*., insect part, detritus and plant tissues. Information on the dietary items of a fish species is of practical values in the culture practice.

The food items in the stomach of *S. membranaceus* suggest that they are feeding on a wide range of organisms. It was also observed that *S. membranaceus* can be classified as an omnivorous feeder as the diet covers a wide spectrum of food ranging from various types of plankton to invertebrates and plants. This is an important strategy for survival and an advantage over the fish species competing for a specific food items. This explains the availability of *S. membranaceus* all year round.

The ventral location of the mouth of *S. membranaceus* encourages a detritivorous mode of feeding while the simple horny structures around the mouth enable it to adapt to filter feeding. These structures also help *S. membranaceus* to gnaw at any hard plant tissue or insect parts which form part of its rich diet.
Seasonal variations in feeding habits showed an increase in the stomach fullness during the rainy season and decreased in the dry season. The proportion of empty stomachs was higher in the dry season. This may reflect a steady dwindling of food resources in a habitat that is continually decreasing in volume with the onset of the dry season. Some of the variability in the dietary composition of *S. membranaceus* may be explained on the basis of the change in water level. During the rainy season, there was a wide variety and abundance of food available due to high nutrient composition of the run-off from land promoting plant growth and increasing invertebrate productivity (Moss, 1980). This is reflected in the range of food items found in *S. membranaceus* captured from June to August, i.e in the rainy season. As the dry season approaches, the water level became shallow and the abundance and variety of food decreased. The *S. membranaceus* changed its dietary composition to algae, insect parts, nematodes, detritus and plant tissues predominantly from October to December. This agrees with the findings of Hyslop (1980) and Olurin (1994).

The seasonal change in temperature as a result of hamattan winds from the Sahara desert may also play an important role in reducing food availability and diversity. While the diversity of the *S. membranaceus* diet decreases, there were also major changes in its composition. A greater percentage of algae, detritus and insect parts during the dry season and the inclusion of crustaceans and ro-

tifers during the rainy season are the main changes in the dietary composition.

The study indicates the preference of *S. membranaceus* for phytoplankton, detritus, plant tissues and insect parts, which constituted more than 90 per cent of the stomach contents in the dry season. This preference is probably due to the seasonal predominance of these food items in the environment. The phytoplankton found in the stomach contents were mostly *Cyanophyta*, represented by *Polycystis sp,* and *Closterium sp., Oedogonium sp., (Chlorophyta)* and unidentified algae. *S. membranaceus* is not only a phytoplankton feeder, but it also feeds on a little quantity of zooplankton, like rotifers and crustaceans that are represented by cladocerans (Daphnia sp). The ingestion of detritus was earlier observed by Patrick – Dempster *et al*. (1993) for Tilapia species and carp, indicating that part of the ingested materials came from the bottom of the river. Protozoans that are typical of the river bottom fauna were found in the digestive tract of *S. membranaceus* and sand grains were also found.

The overall picture of the diet of *S. membranaceus* that emerges from this study is that of species which is largely unspecialized in its feeding habits. Unspecialized flexible dietary habits are an optimal strategy for survival in habitats where food sources are subject to flotation (Welcomme, 1983). Similarly, the inclusion of large amounts of detritus in the diet is of survival value. It is derived from the surrounding terrestrial habitats and is abundant in the river throughout the season. It also appears that growth precedes satisfactorily with a sizeable proportion of plant material in the diet. The maximum size of *S. membranaceus* obtained from Ikere Gorge was 323.15g in the rainy season. Hyslop (1980) made a similar observation in his study of *Clarias anguillaris* from the Sokoto flood plains.

CONCLUSION

The ability of *S. membranaceus* to feed on a number of different trophic levels coupled with the potential for fast growth makes this species a promising candidate for commercial culture. As the species is widely used as human food throughout the area in which it occurs, it could easily be incorporated into locally operated polyculture systems with minimal inputs of expensive animal protein in the feed.

REFERENCES

Adebisi, A.A. 1981. Analysis of the stomach contents of the piscivores fishes of the upper Ogun River in Nigeria. *Hydrobiologia* 79: 167-177.

Adebisi, A. A. 1978. Studies on the ecology, growth and reproduction of the fishes of upper Ogun river of Nigeria. Ph.D. Thesis, University of Ibadan, Ibadan.

Adeosun F.I. 2007. Bio-ecology of the fish fauna of Ikere gorge in Oyo State Nigeria, Ph. D. Thesis, University of Agriculture Abeokuta, Ogun State. 36 pp.

Arawomo, G.A.O. 1976. Food and feeding of three Citharinus species in Lake Kainji, Nigeria. *J. Fish Biol.* 9:3-10. Bagenal, T. 1978. Methods for assessment of fish production in fresh waters. *Blackwell Scientific Publications,* Oxford.

Bagenal, T. B., F.W. Tesch 1978. Age and Growth. In: Methods of Assessment of fish production in freshwaters. (Bagenal, ed.) Oxford, Blackwell Scientific Publications.

Crisp, D.P., R. H. K. Mann and J. C. McCormack. 1978. The effects of impoundment and regulation upon the stomach contents of fish at Cowgree, upper Teesdale. *J. fish Biol.* 12:287-301.

Dunn, D.R. 1959. The feeding habits of some of the fishes and some members of the vottom fauna of Llyn Tegid (Bala Lake). Merionethshire. *J. Anim. Ecol.* 23:224-233.

Elliot, O.O. 1986. Some aspects of the biology of the fishes of Asejire Lake. Ph.D. Thesis. University of Ibadan. Oyo State. Nigeria. Pp 155.

Fagade, S.O. 1978. The Biology of *Tilapia guineensis* (Dumeril) from the Lekki Lagoon, Lagos State, Nigeria. *Nig. J. Sc.* 12:73-83.

Fagade, S.O., Olaniyan, C.I.O. 1972. The biology of the West African shad, *Ethmalosa fimbrata* (Bowditch) in the Lagos Lagoon, Nigeria. *J. Fish Biol.,* 4:519-533.

Fagade, S. O., Olaniyan, C. I. O. 1973. The food and feeding habits of Tilapia species in the Lagos lagoon. *J. Fish Biol.* 3: 151-156.

Hynes, H.B.N. 1950. The food of freshwater sticklebacks (*Gasterosteus aculeatus* and *Pygosteus pungitus*) with a review of methods used in the studies of the food of fishes. *J. Ani. Ecol.*, 19: 36-58pp.

Hyslop, E.J. 1980. Stomach contents analysis – a review of methods and their application. *J. Fish Biol.*, 17: 411-429.

Moss, B. 1980. Ecology of fresh waters. Blackwell Scientist Publication, Oxford. 17pp.

Olurin, K.B. 1994. Ecology of feeding, reproduction and growth of the fisheries in Oyan lake, Abeokuta, Ogun State, Nigeria. Ph.D. Thesis, University of Ibadan, Ibadan. 270pp.

Owolabi, O.D. 2005. Some aspects of the Biology of *Synodontis membranaceus* (Geoffrey Saint Hillarie, 1809) in Jebba Lake, Nigeria. Ph.D. Thesis, University of Ilorin, Nigeria.

Patrick-Dempster., Mallon, P.G.M.,. Beveridge, D.B. 1993. Production de peces herbivoros en sistemas semi intensive. In: XII Reunion *Asso, Latino- Americana de production animal,* Santiago de Chile. P. 224-246.

Welcomme, R.L. 1983. River Basin FAO Fisheries Technical Paper No. 202 Rome. P.60.

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