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# Feeding habits of tilapia, *Sarotherodon nilotica* (Perciformis: Cichlidae) fry in Jos, Nigeria

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**Abstract:** Food and feeding habit of fry and fingerling *Sarotherodon nilotica* in some productive ponds in Rockwater Fish Farm, Jos were investigated. Results show that young fry (5-14.99mm standard length) preferred zooplankters. As size of fish increased, artificial food was preferred. In the cold months of December and January, there was a general decline in plankter abundance in the diet. This must be due to reduced abundance of these plankters in the water. Then fish depended more on artificial food. However, excessive feeding at this time would be wasteful, as more fish were observed with empty stomachs and this evidenced reduced appetite. Generally, considerable number of different zoo- and phyto-plankters were present in the food. Nutritive value of the stomach content was adequate.

**Key words:** *Sarotherodon nilotica*, fry, pond culture; food.

The feeding habits of many species of fish have been shown to be closely related to the availability and abundance of the food items (Eder & Carlson 1977). Contrarily, many food types have been observed to be utilized by fish to a greater extent than their abundance in the water body would suggest (Macdonald & Green 1986). Feeding habits of fish have also been related to the digestive enzymes present in such fish (Nagamaya & Saito 1978), though the presence of certain food items in the digestive system has been shown to induce production of some digestive enzymes (Ufodike & Matty 1984). In *Sarotherodon nilotica* the intestine is rather long, being about three times the standard length of the body. This elongation suggests enhancement of digestion and absorption especially of phytoplankters which are usually more difficult to degrade due to the presence of cellulose in them. However, from the diversity of findings in fish nutrition reported above, *Sarotherodon nilotica* could be a facultative feeder.

The pond fish in Rockwater Fish Farm receive some supplemental feeding. The present work analyzes the food choice of, and the food nutritive value in *Sarotherodon nilotica* reared in such productive tropical ponds.

## MATERIALS AND METHODS

**Study site:** Rockwater Fish Farm constructed in 1983 is situated approximately 5 kilometers south-west of Jos Central. The eleven ponds presently developed and in use measure between 1.2m and 2.07m in depth. For this study, ponds 3, 6 and 7 which respectively measure 2.07m, 1.45m and 1.72m were randomly selected.

**Procedure:** Sample collection was done once weekly from December 1987 to May 1988. Sampling was done using a 1.5mm drag net. This was carried out at 9.00am and 3.00pm, while feeding of the fish with supplemental artificial food was done once daily between 1.00pm and 2.00pm. The artificial food which was fortified with high level of binder was also coated with oil. This treatment prevented early disintegration of the diet.

*Sarotherodon* samples were preserved in 10% formalin and taken back to University of Jos for immediate analysis. To aid preservation and allay post-humous autolysis, some formalin was injected into the tissues and gut as soon as fish were caught and killed in benzocaine solution.

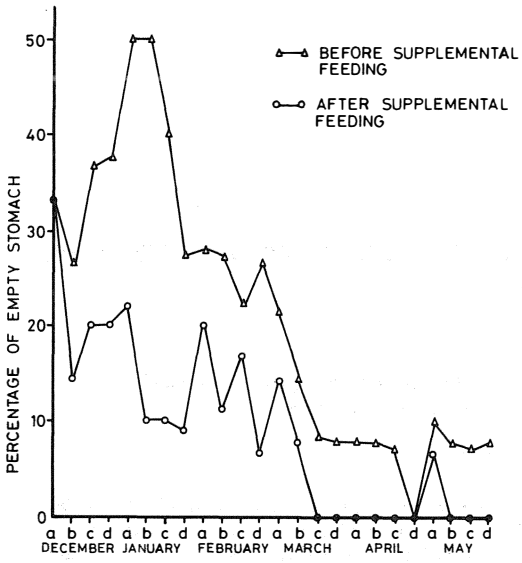


Fig. 1. Weekly variation of percentage of empty stomachs of *Sarotherodon nilotica* in Rockwater Fsh Farm, Jos, Nigeria

Standard length and gross weight were recorded before fish were perfused with formalin. The contents of the stomach and duodenum were pooled and observed under the microscope to identify as much as possible the composite materials.

The planktonic food items were identified using the key of Davies (1955) and Palmer (1959). Frequency of occurrence of each food item was expressed as percentage of stomach content after the methods of Bruton (1979).

Biochemical quantitative analyses of the stomach contents were carried out to determine the protein level using the micro-kjeldahl digestion method (Horwitz 1980). Fat was determined by soxhlet petroleum ether extraction method while ash content was estimated by incineration in a furnace at 600oC for 24 hours. A weekly record of water and air temperature was also obtained.

## RESULTS AND DISCUSSION

A total of 573 fish were sampled, out of which 84 (14.56%) had empty stomachs. More fish had empty guts before supplemental feeding than after. This showed that the fish depended as much on artificial as on natural food. There were more empty guts in the cold months of December/January (10$^{o}$C) than in late March and April when the water was very warm (25$^{o}$C) which shows the effect of this environmental factor on food consumption (Fig. 1). Excessive supplemental feeding during such cold months is therefore wasteful and ill advised. Counts of food items or particles confirmed that artificial food was most abundant in the gut (Table 1). In the 486 guts with food, a grand total of 1065 food particles were found in the stomach and 481 items were found in the duodenum. Since the fish were caught not more than 2 hours after supplemental feeding, this result shows that there was active feeding when supplemental food was supplied, as most of the food was still in the stomach region. Apart from the artificial food which dominated, *Anabaena* (71) and *Melosira* (90) ranked next (Table 1). *Pediastrum*, (10) was the least occuring.

The seasonal variation in the food content of the stomach indicated that during the cold months of December and January (Table 2), fish consumed more of artificial diets. This trend reversed as the weather warmed up, indicating that the cold weather must have also advversely affected the primary productivity of the ponds and hence the abundance of the plankters (Table 2).

When food type was compared with fish size, some relationship was observed. For this analysis, fish were categorised into 4 size groups. The first size group which were 5-14.99mm standard length (SL) fed mostly on zooplankters, including rotifers and cladocerans, and a few diatoms. Fry between 15-24.99mm SL had mostly diatoms, few blue-green algae and much fewer micro-encapsulated artificial pellets and green algae in their stomach. Fry between 25-34.99mm SL fed on all food items except cladocerans. The dominant food items were artificial food, green algae, blue-green algae, diatoms and fragments of higher plants, in that descending order of abundance. The fourth size which were fry measuring 35-44.99mm SL fed mainly on artificial food and green algae though all the food items were represented. From the foregoing, it is obvious that the younger fry prefer natural to artificial food. Also, the smaller the fish, the smaller the food size.

TABLE 1

*Occurence of food types in the stomach and duodenum of* Sarotherodon nilotica *in Rockwater Fish Farm*

| Food type | Units counted in stomach | % | Units counted in duodenum | % |
|---|---|---|---|---|
| Blue-green algae | | | | |
| *Anabaena* | 71 | 6.0 | 41 | 8.5 |
| *Oscillatoria* | 29 | 2.4 | 16 | 3.3 |
| *Aphamizomenon* | 39 | 3.3 | 11 | 2.3 |
| *Microcystis* | 25 | 2.1 | 13 | 2.7 |
| Green algae | | | | |
| (i) Filamentous | | | | |
| *Microspora* | 12 | 1.0 | 31 | 6.4 |
| *Spyrogyra* | 39 | 3.3 | 9 | 1.9 |
| (ii) Colonial | | | | |
| *Scenedesmus* | 29 | 2.4 | 11 | 2.3 |
| *Pediastrum* | 10 | 0.8 | 4 | 0.8 |
| (iii) Unicellular | | | | |
| *Chlamydomonas* | 21 | 1.8 | 20 | 4.2 |
| *Characium* | 11 | 0.9 | 9 | 1.9 |
| *Chlorella* | 20 | 1.7 | 15 | 3.1 |
| Diatoms | | | | |
| *Melosir* | 90 | 7.6 | 31 | 6.4 |
| *Tabellaria* | 73 | 6.1 | 16 | 3.3 |
| *Navianla* | 51 | 4.3 | 22 | 4.6 |
| *Cyclotella* | 45 | 3.8 | 40 | 8.3 |
| Rotifers | | | | |
| *Branchionus* | 43 | 3.6 | 13 | 2.7 |
| *Lecane* | 11 | 0.9 | 1 | 0.2 |
| *Syncheata* | 14 | 1.2 | 6 | 1.2 |
| Cladocerans | | | | |
| *Copepoda* | 14 | 1.2 | 3 | 0.6 |
| *Daphnia* | 15 | 1.3 | 2 | 0.4 |
| Fragments of higher plant | 41 | 3.5 | 5 | 1.0 |
| Supplementary feed (pellets) | 447 | 37.6 | 152 | 31.6 |
| Fish scales, sand particles & miscellaneous items | 39 | 3.3 | 10 | 2.1 |

TABLE 2

*Periodic variation in temperature and food types in stomach of* Sarotherodon nilotica *in Rockwater Fish Farm*

| Parameters | Dec. | Jan. | Feb | Mar. | Apr. | May |
|---|---|---|---|---|---|---|
| Mean temperature (oC) Air | 7 | 6 | 18 | 26 | 26 | 26 |
| Water | 10 | 10 | 17 | 25 | 25 | 25,5 |
| Food types (number present[1]) | | | | | | |
| Blue-green algae | 11 | 19 | 23 | 35 | 47 | 29 |
| Green algae | 13 | 9 | 21 | 42 | 45 | 12 |
| Diatoms | 28 | 40 | 42 | 52 | 61 | 36 |
| Fragments of higher plants | 3 | 6 | 9 | 11 | 8 | 4 |
| Rotifers | 1 | 3 | 14 | 17 | 21 | 12 |
| Cladocerans | 2 | 2 | 6 | 5 | 9 | 5 |
| Supplementary food (pellets) | 110 | 100 | 67 | 59 | 49 | 65 |
| Fish scales, sand particles and miscellaneous items | 10 | 7 | 6 | 6 | 4 | 6 |

[1] Number of fry with food in stomach: 486.

TABLE 3

*Proximate chemical composition of stomach content of* Sarotherodon nilotica *in Rockwater Fish Farm*

| Ingredient | Percentage (wet wt.) |
|---|---|
| Moisture | 13.78 |
| Fat | 5.60 |
| Protein | 41.11 |
| Crude ash | 16.52 |
| Sub-Total | 77.01 |
| Nitrogen free extract (NFE)[1] | 22.99 |

[1] NFE : computed as difference between subtotal and 100.

Analysis of the pooled stomach content revealed that the protein content was 41.11% (Table 3) which is considered adequate for the fry of an omnivorous fish like *Sarotherodon.*

It is concluded that food choice and food consumption of *S. nilotica* in a productive pond depends on fish size, food abundance and water temperature. The young fish prefer zooplankters while by the time fish is upto 25mm, it favours artificial food

Supplementary feeding in cold months in a productive pond is thus not essential in a *S. niloticа* culture when fry are below 25mm SL.

## REFERENCES

Bruton, M.N. 1979. Food and feeding of *Clarias baatrachus* in Lake Sabaya, South Africa. Trans. Zool. Soc. Lond. 3: 47-97

Davies, C.C. 1955. The marine and freshwater plankton. Michigan State Univ. Michigan. 25 p.

Eder, S. & C.A. Carlson 1977. Food habits of carp and white suckers in the South platte and St. Urain Rivers and Goosequill pond, Weld country, Colorado. Trans. Am. Fish. Soc. 106: 339.

Horwitz, W. (ed). 1980. Official methods of analysis of the AOAC. Association of Official Analysis of the AOAC., Washington DC. p.129-146

Jaiyeola, S. B. & E.B.C. Ufodike. 1986. Growth responses of tilapia fed on algal and cassava flour diets. Mat. Sc. Res. Abstracts, Univ. Jos. Nigeria 2: 64-65.

Macdonald, J.S. & R.H. Green. 1986. Food resource utilization by five species of benthic feeding fish in Passaquoddy Bay, New Brunswick. Can. J. Fish. Aquatic Sc. 43: 1534-1535.

Nagamaya, F. & Y. Saito. 1978. Physiology of digestion, Section II. Hans Mann. p. 104-110.

Otisi, A.O.A. & E.B.C. Ufodike. 1986. Growth and survival of snakehead, (*Chana obscura*) fed starter diets of different protein sources. Nigerian J. Appl. Fish. Hydrobiol. 1:21-25.

Palmer, C.M. 1959. Key for identification of freshwater supplies. US Pub. Health Serv. Publ. 657: 88.

Ufodike, E.B.C. & A.J. Matty. 1984. Nutrient digestibility and growth responses in rainbow trout (*Salmo gairdneri*) fed different levels of cassava and rice. Hydrobiologia 119: 83-88.