SOME ASPECTS OF THE BIOLOGY OF *Tilapia zillii* (GERVAIS) (PISCES: CICHLIDAE) IN OPA RESERVOIR, ILE-IFE, NIGERIA

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ABSTRACT
Some aspects of the biology of Tilapia zillii were examined between October 1997 and February 2000. Fish specimens were collected using a graded set of gillnets and castnets. Out of 1486 fish specimens, 867 were males while 619 were females. Regardless of their sex a significantly high number of fish were caught inshore (69.57%) than in the offshore areas (30.43%). In addition 48.65% of all fish specimens were caught in the middle segment of the reservoir. A wide range of fish sizes were caught and the species was not spatially distributed ($\chi^2_{cal.}$ 27.39<$\chi^2_{tab.}$ 67.51; df. 820). The species fed on a variety of food substances predominantly shoreline aquatic macrophytes, algae and plankton. The feeding rhythm which started around 6.00am reached a peak by 3.00pm in the afternoon and it declined gradually until 6.00pm.

Keywords: *Relative abundance, spatial distribution, stomach content, feeding rhythm, Tilapia zillii.*

INTRODUCTION

African cichlid fishes are widely distributed species in lakes, rivers and even penetrating the smallest water bodies (Reed *et al.*, 1967). Over 200 species of the cichlid family have been reported in inland waters of West Africa (Holden and Reed, 1978). In West African sub-region, various aspects of the biology of *T. zillii* have been reported by Reed *et al.*, (1967), Fryer and Iles (1972), Buddington, (1979) and Trewavas (1983).

Field observations by Lowe-McConnell (1969) showed that *T. zillii* lived in the shallow inshore and surface water bodies. Petr (1967b) reported *T. zillii* in Lake Volta while Arawomo (1987) reported the species in rivers Gurara, Usman and Jabi within the Federal capital territory of Nigeria.

The stomach content of a fish does not reflect consumers' food because some food items are quickly digested (Bagenal, 1978). However, stomach fullness and the percentage of empty stomach are direct evidences for evaluating feeding periodicity

(Bowman and Bowman, 1980). An understanding of the factors governing fish production is necessary so as to improve production in the West Africa sub-region which is still dependent upon fish imports. This study therefore aims at providing basic information needed for production and proper management of *T. zillii* in the habitat.

MATERIALS AND METHODS

Opa reservoir is located on the campus of Obafemi Awolowo University, Ile-Ife, Nigeria. With about 116 square kilometres of land as catchment area, the reservoir (Longitudes 4º31´ E to 4º 32´ E and Latitudes 7º 29´ N to 7º30´ N; Figure 1) has a surface area of about 0.95 square kilometre while the maximum capacity is about 675 cubic metres. The minimum and maximum depths are 0.75m and 6.4m respectively. The catchment area is characterized by dry (October to March) and rainy (April to September) seasons. The reservoir receives high discharge of water from the catchment area making its water turbid in the rainy seasons.

The substratum of the reservoir is mainly mud and sand with submerged logs of wood. Shoreline vegetation is dense with macrophytes, including *Commelina diffusa* Burn, *C. erecta* Linn, *Amarantus hibridus* Linn. and *Acroceras zizaniodes* (Kunth) Dandy some of which eventually decompose during the rainy season. In this study, *T. zillii* specimens were collected using a graded set of gill nets measuring 160 metres long and a width of 3.78m with five different mesh sizes of 32 metres each for the distribution study. The mesh sizes were 2.5cm, 5.1cm, 7.6cm, 10.2cm and 12.7cm respectively. The gillnets were set between 6.00pm and 7.00pm in the evenings and left to fish. The fish caught were removed between 6.00am and 7.00am the following morning. The inshore area of the reservoir was the littoral zone where light rays could penetrate to the bottom during dry season while the offshore area was beyond the photic zone. The reservoir was demarcated into three segments on the basis of the depth and distance to the dam wall. Dam area was the area from the dam wall to a distance of about 500 metres into the middle of the reservoir with a depth range of 4.0m to 6.4m in rainy season. Middle segment was the mid-basin of the reservoir with a depth range of 3.0m to 4.5m while Upper segment covered the upper reaches of the reservoir with a depth range of 1.5m to 3.5m (Figure 1). These were done so as to carry out equal ran-

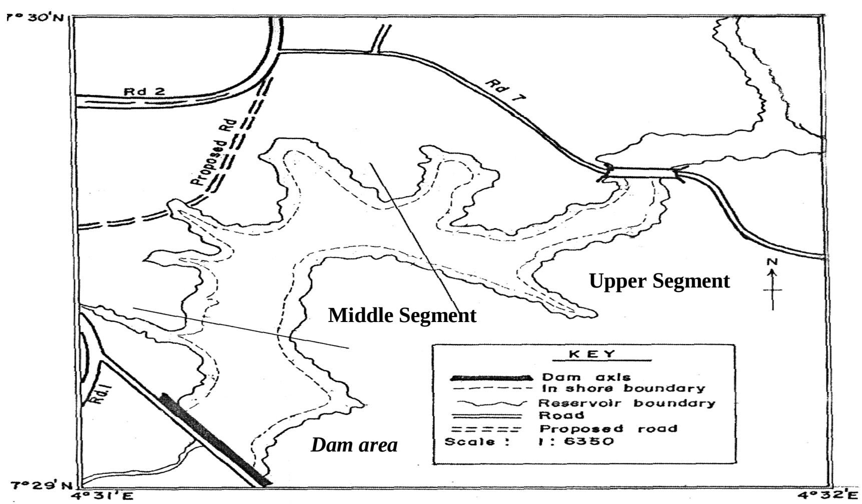

Fig. 1: Opa reservoir showing study site

dom sampling of fish and to facilitate the description of the actual area where the species was concentrated in the reservoir.

A cast-net of 2.5cm mesh size was used to catch various sizes of *T. zillii*. The fishes were transferred to the laboratory where standard morphometric parameters were taken. The content of each fish stomach was weighed to the nearest 0.1gm and the volume obtained by water displacement in a measuring cylinder. Analyses of the stomach contents of fish specimen were done by frequency of occurrence and numerical methods (Hyslop, 1980; Costa *et al.*, 1992). Food identification was done to genus and species level where possible. Feeding rhythm of *T. zillii* was studied on a three hourly basis starting around 6.00am until the same time the following morning. Stomach fullness of each fish specimen was noted and used to determine feeding rhythm.

RESULTS

In this study, eleven species of fish were caught. The most abundant fish was *Sarotherodon galilaeus* followed by *Oreochromis niloticus* and *Tilapia zillii*, respectively. These cichlid fishes constituted 99% of the total catch (Table 1). In the

Table 1: Relative abundance of fish species caught by castnet and gillnet in Opa reservoir

Fish species	Number of fish caught	Percentage
Sarotherodon galilaeus **Linnaeus**	1848	37.23
Oreochromis niloticus **Linnaeus**	1580	31.83
Tilapia zillii **Gervais**	1486	29.94
Hepsetus odoe **Bloch**	26	0.52
Mommyrus rume **Cuvier and Valenciennes**	4	0.08
Hemichromis faciatus **Petrs**	3	0.06
Hemichromis bimaculatus **Gill**	1	0.02
Schilble mystus **Linnaeus**	8	0.16
Heterobranchus bidorsalis **Geoffery Saint-Hilaire**	2	0.04
Clarias gariepinus **(Burchell)**	5	0.10
Malapterurus electricus **(Gmellin)**	1	0.02
Total	**4964**	**100**

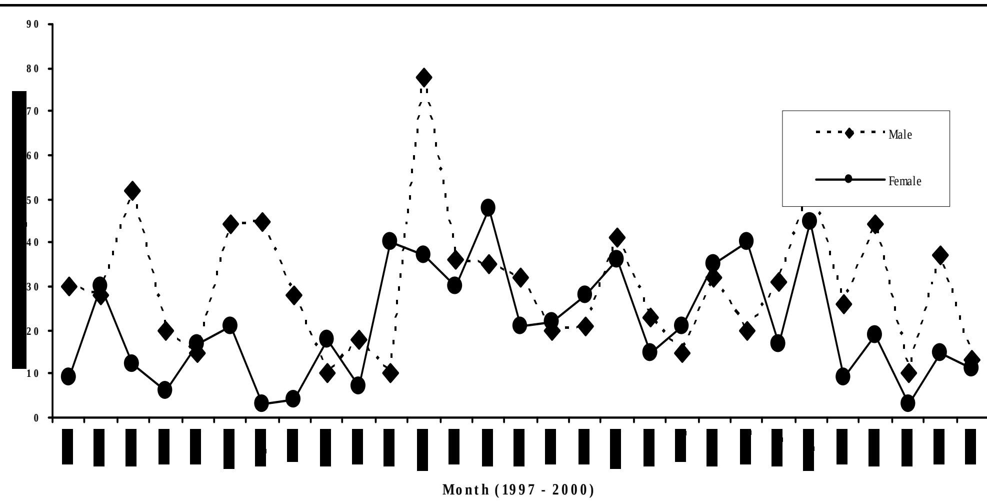

Fig. 2: Relative abundance of fish caught per unit effort on monthly basis

Table 2: Stomach content analyses of *T. zillii* by number and frequency of occurrence methods in Opa reservoir

Food items	Frequency of occurrence	Percentage	Number	Percentage
Bluegreen algae				
Anabaena sp.	10	3.95	193	1.03
Microcystis sp.	11	4.35	301	1.61
Oscillatoria sp.	6	2.37	116	0.62
Green algae-unicellular				
Closterium sp.	9	3.55	109	0.58
Cosmarium sp	15	5.93	308	1.65
Pediastrum sp.	3	1.19	8	0.04
Scenedesmus sp.	2	0.79	12	0.06
Green algae-filamentous				
Euglena sp.	8	3.16	27	0.14
Spirogyra sp.	2	0.79	5	0.03
Ulothrix sp.	12	4.74	683	3.65
Green algae-colony				
Ankistrodesmus sp.	29	11.46	3572	19.09
Diatoms				
Melosira sp.	22	8.70	2828	15.11
Navicula spp.	19	7.51	443	2.37
Dinoflagelate				
Peridinium sp.	4	1.58	138	0.74
Rotifier				
Branchinus sp.	6	2.37	27	0.14
Zooplankton				
Copepod sp.	3	1.19	7	0.04
Phacus sp.	20	7.91	394	2.11
Ostracod sp.	2	0.79	12	0.06
Higher plant fragments	42	16.60	9419	50.34
Insect remains	4	1.59	54	0.29
Fish scales	5	1.97	9	0.05
Fish eggs	19	7.51	46	0.25
Total	**253**	**100**	**18711**	**100**

Table 3: Variation in food consumption in relation to size

Small fish (10.00cm-17.9cm) total length	Big fish (18.0cm-29.0cm) total length
Microcystis sp	*Microcystis* sp
Ankistrodermus sp	*Ankistrodermus* sp
Closterium sp	*Closterium* sp
Navicula sp	*Navicula* sp
Melosira sp	*Melosira* sp
Phacus sp	*Phacus* sp
Anaebena sp	*Anaebena* sp
Cosmarium sp	*Cosmarium* sp
Scenedesmus sp	*Scenedesmus* sp
Euglena sp	*Euglena* sp
Insect remains	Insect remains
High plant fragments	High plant fragments
	Copepod sp
	Pediastrum sp
	Fish eggs
	Oscillatoria sp
	Spirogyra sp
	Fish scales
	Ulothrix sp
	Peridinium sp
	Branchionus sp
	Ostracod sp.

reservoir while 48.65% and 31.08% in the middle and dam area of the reservoir, respectively. This is similar to the distribution of *Oreochromis niloticus* in the same habitat where 30.57%, 41.78% and 27.65% of fish specimens were caught in upper segment, the middle and dam area of the reservoir, respectively (Komolafe and Arawomo, 2003). Fish specimens totalling 68.7% of the total catch were caught from the inshore area of Opa reservoir. This observation was also reported by Ita (1978) where 77.8% of *T. zillii* were caught at the inshore area of Lake Kainji. Petr (1967b) also reported a high concentration of *T. zillii* in the shallow inshore area of Volta lake. Inshore concentration of the cichlid fishes had been associated to the presence of breeding adults (Gwahaba, 1975). The concentration of *T. zillii* at the inshore area of Opa reservoir might be attributed to availability of the marginal aquatic macrophytes which form the main bulk of their food. This is in agreement with Arawomo (1982) for *Distichodus* sp. in Lake Kainji where the distribution was governed by the presence of emergent grasses and sedges in the shallow inshore area of the lake.

Table 4: Diurnal feeding rhythm of *T. zillii* in Opa reservoir

Feeding time/period	Fish Specimen with full stomach	Fish specimen with ¾ full stomach	Fish specimen with ½ stomach fullness	Fish specimen with ¼ stomach fullness	Fish specimen with nearly empty stomach	Total No of fish	Fish %
6am – 9am	21	50	32	7	1	111	16.69
9am – 12noon	84	39	21	9	15	168	25.26
12pm – 3pm	140	65	40	22	5	272	40.9
3pm – 6pm	16	14	17	31	0	78	11.73
6pm – 9pm	2	0	0	2	0	4	0.60
9pm – 12midnight	0	4	1	0	0	5	0.75
12am – 3am	0	0	0	0	15	15	2.26
3am – 6am	0	1	5	0	6	12	1.81
Total	**263**	**173**	**116**	**71**	**42**	**665**	
%	**39.59**	**26.08**	**17.42**	**10.62**	**6.29**		**100**

Natural food materials such as aquatic macrophytes and algae found in the stomach of *T. zillii* were similar to that of Abayomi (1986) and Komolafe and Arawomo (2003) on *S. galilaeus* and 0. *niloticus* in Opa reservoir respectively. Petr (1967a) in lake Volta and Akintunde and Imevbore (1979) in lake Kainji similarly reported that *T zillii* fed on aquatic macrophytes. Although there was an evidence of some selectivity on the plankton which the species ingested upon in Opa reservoir, aquatic macrophyte, which the fish mostly ingested have been reported by Buddington (1979) and Trewavas (1983) as food of cichlid fishes in West African water bodies. The species utilised the abundance of food in the habitat to its advantage. About 83% of all fish specimens fed during the day and the peak was between 12.00noon and 3.00pm (Figure 3). This was also the observation of Fawole (1996) and Komolafe and Arawomo (2003) in the same habitat were they reported the peak feeding periods between 12.00noon and 3.00pm for *O. niloticus* and *S. galilaeus*.

CONCLUSION

In every part of Opa reservoir were found *T.zillii* specimens during the period of study. About 49% of the fish were caught in middle segment showing that *T. zillii* was not spatially distributed in the reservoir where the fish ranked third in abundance. *T. zillii* was observed to feed during the day with a peak and 12.00noon and 3.00pm. A lot of natural food materials on which *T. zillii* selectively fed upon also supported its population in the habitat. The concentration of a large number of the specimens (70%) at the reservoir shoreline might also help to prevent a dense weed cover.

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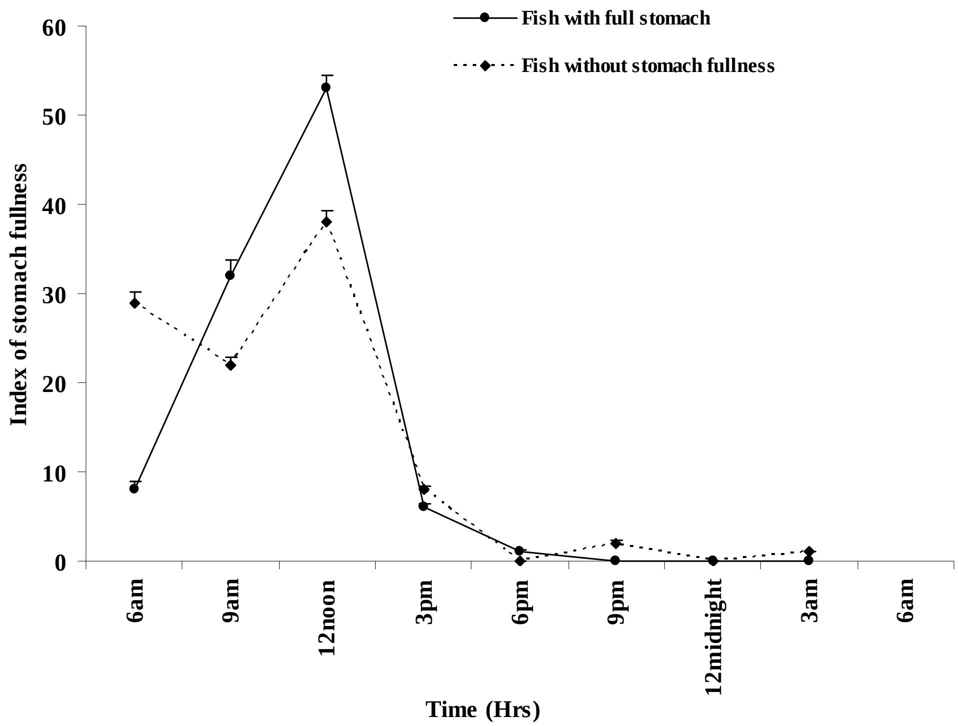

Figure 3: Feeding rhythm of *T. zillii* (Number of replicates = 8)

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