relationship. The computation of the coefficient of condition for these species was based on the formula

$$W = a L^b$$ Le Cren (1951) and Ricker (1975)

Where W = weight in grams.
L = total length in cm.
a and b are the regression coefficient.

The relative condition factor (K_b) was determined from the equation,

$$K_b = \frac{W}{w}$$ Le Cren (1951)

Where W = the observed weight and
w = the calculated weight obtained from
$w = a L^b$

For the analysis of the food content, the gut from 447, 1075, 442 and 459 fish namely ***S. galilaeus***, ***T. zillii***, ***O. niloticus*** and ***O. aureus*** respectively were used. These specimens were collected monthly from different regions of the lake and preserved in 5% formaline. The gut content was examined using a research microscope and the different food items were identified using the occurrence method. The number of stomachs in which each food item occurred was recorded and expressed as a percentage of total number of stomach examined as used by Abdel-Malek (1968, 1971, 1972). The variation of the gut contents was treated in respect to species and seasons.

RESULTS AND DISCUSSION

1- Species Composition of the four Cichlid species:

The abundance of different Cichlid species collected by the experimental trammel nets showed that ***T. zillii*** was the most abundant species constituting more than 50.0% of the total catch followed by ***O. aureus*** 27.52% and ***S. galilaeus*** 10.84%, while ***O. niloticus*** was the least frequent species contributing only 2.73% (Table 1). This may be attributed to the fact that ***T. zillii*** and ***O. aureus*** can adapt to variations in the ecological conditions in the lake. The preponderance of ***T. zillii*** over ***O. niloticus*** may be referred to the aggressive nature of the former species than ***O. niloticus*** Chen (1976). On the

other hand, the high rates of exploitation of ***O. niloticus*** may be the main reason of its lower abundance in the lake, since this species is characterized by a rapid growth rate among Cichlid species.

The length-weight relationship of fish is one of the most studied biological characters of fish biology. The mean weight per length group of the studied Cichlid species was shown in Fig. 1. It is known that, the weight of a fish increases as a function of its length ($W = a L^b$). The length-weight relationship for ***S. galilaeus*** . ***T. zillii***, ***O. niloticus*** and ***O. aureus*** respectively are as follows:

$W = 0.0272\ L^{2.9079}$,
$W = 0.0506\ L^{2.6427}$,
$W = 0.0424\ L^{2.7036}$ and
$W = 0.0567\ L^{2.5614}$

The present study indicated that the four Cichlid species exhibited an allometric growth as illustrates in (Table 2). This means that, the studied fishes grow lighter as it become longer i.e. the fish changes its body shape during growth Vaznetsov (1953) That is, in Lake Manzalah the addition of length is more than the addition in weight, this may be attributed to the worse ecological conditions of Lake Manzalah as a result of a progressive accumulation of pollutants. This fact agrees with opinion of Ezzat ***et al.*** (1982) and Abdel-Baky & El-Serafy (1990).

The relative condition factor "K_b" illustrated the deviation of an observed weight from the calculated one for a given size, Le Cren (1951). In the present study, ***S. galilaeus*** had better condition (1.0115) than any of the other tilapias, also, this species having the higher value of "b" (2.9079). This may be attributed to its success in such environmental condition in the lake. Comparing the present observation with other investigation through ten years (1982-1992) (Table 3). It is clearly seen that, the relative condition of present data is less than those obtained by Hosny (1987). This also can be explained as mentioned previously to the consecutive increase of eutrophication and pollution of lake water, Abdel-Baky & El-Serafy (1989).

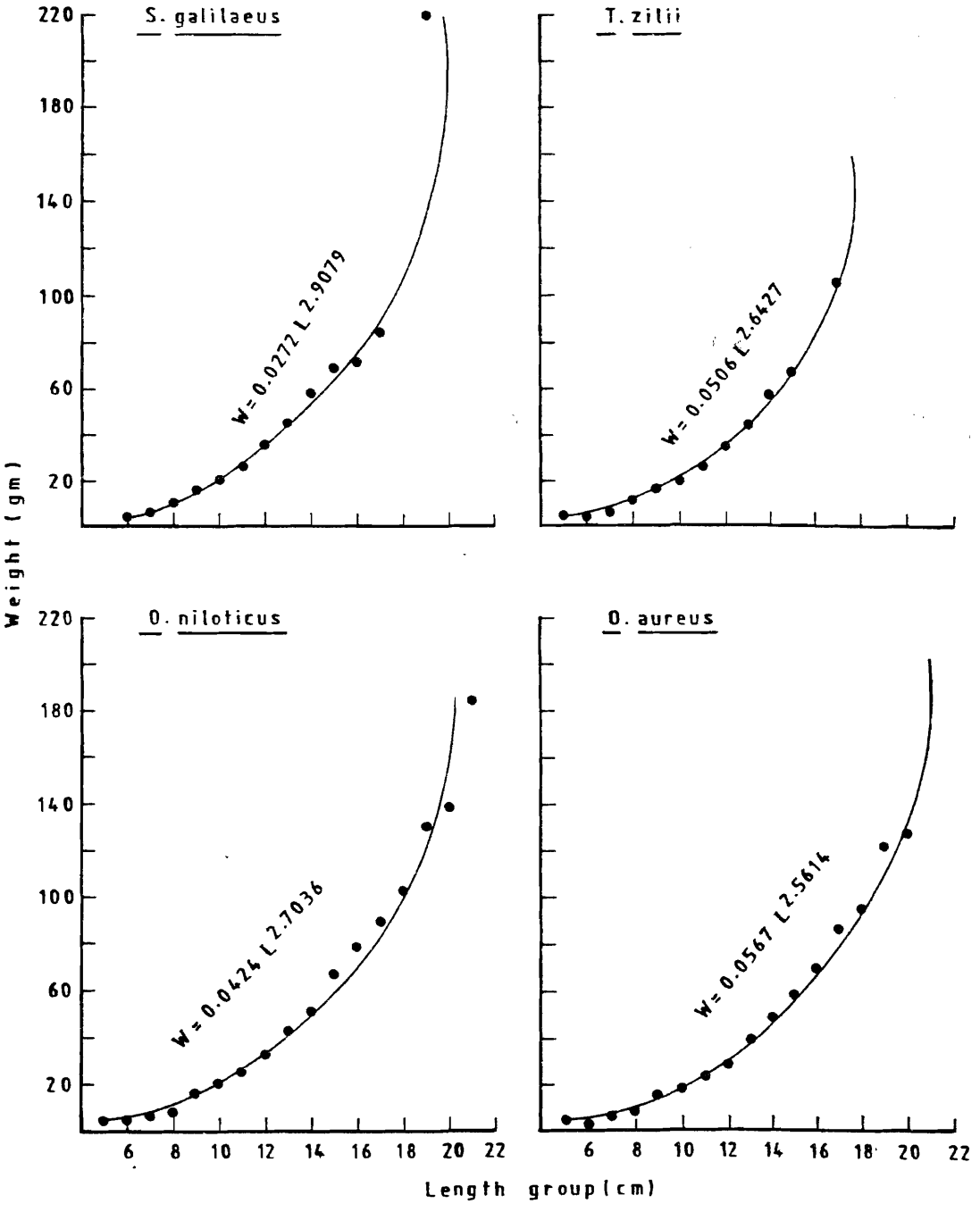

Fig. (1): Length - weight relationship of four cichlid species in Lake Manzalah (1992 - 1993).

Table (1): Species composition of Cichlid population collected by experimental trammel nets from Lake Manzalah (1992-1993).

Species	Number of fish	%
S. galilaeus	2350	10.84
T. zillii	12773	58.91
O. niloticus	592	2.73
O. aureus	5966	27.52
Total	21681	

Table (2): Parameters of dependence of length upon weight of different Cichlid species in Lake Manzalah 1992-1993.

Equ. Param. Species	a	b	S^2	Test of homoginity
S. galilaeus	0.0272	2.9079	3.9068^{-04}	- 0.7208
T. zillii	0.0506	2.6427	2.1949^{-04}	- 3.9940
O. niloticus	0.0424	2.7036	2.6857^{-04}	- 3.4346
O. aureus	0.0567	2.5614	2.0865^{-04}	- 5.6174

a & b = The equation parameters and S^2 = Variances.

Table (3): Comparison of the relative condition factor (Kb) of different Cichlid species with those from 10 years in Lake Manzalah.

Author	***S. galilaeus***	***T. zillii***	***O. niloticus***	***O. aureus***
Hosny (1987)	1.79	1.90	1.68	1.64
Present study	1.0115	1.005	1.010	1.009

Regarding the variation of food items in the fish guts in respect to species and seasons (Table 4), it is obvious that, the four studied Cichlid species are omnivorous, feed on both vegetable and animal materials but it tends to eat more plant material than food of animal origin (i.e. primary herbivores). These results agree with those obtained by other authors working on Cichlid, Abdel-Malek (1971 and 1972); Trewavas (1982) and Dempster ***et al.*** (1993). The present study showed that, phytoplanktonic elements (Chlorophyta, Cyanophyta and Chrysophyta) occurred in more than 60% of the examined stomachs of the

studied species. Chrysophyta (diatoms) Composed the highest percentage of occurrence in the guts of the four Cichlid species (89.3, 69.1, 76.5 and 67.8% for ***S. galilaeus*** , ***T. zillii***. ***O. niloticus*** and ***O. aureus*** respectively (Table 4). Fish (1955) reported that ***T. niloticus*** normally depend on diatoms in their food for their nutrition. According to Fryer & Iles (1972); that diatoms have a cell wall made of silica which is perforated by minute pores through which the digestive juices from the fish inflow inside the cell-contents of the diatom. Therefore, diatoms, are digested and thus are the most important source for phytoplankton feeders. It is clearly seen that from Table (4) that ***S. galilaeus*** is more phytoplanktonic feeders than the other three species. Getachew (1987) mentioned that, the growth of fish can be considered as a close approximation of fitness, so, assessment of condition factor of fish populations can give some idea of the level of nutritional benefit gained. This agrees with the previously mentioned that ***S. galilaeus*** had a better condition among Cichlid species in the present study.

Tissues of higher hydrophytes constitute a remarkable amount among food items in the guts of ***T. zillii***. since they occurred in 78.7% in the examined guts. Spataru (1978) reported that, the main food consumed by ***T. zillii*** in Africa consists of leaves and stems of macrophytes. He added that, ***T. zillii*** has preserved the phytoplankton characters of its feeding. The present study showed that, the food of animal origin was generally less frequent in fish stomachs. Similar findings were reported by Abdel-Malek (1972).

Regarding species variation; zooplankton organisms occurred in higher percentage in the guts of ***O. niloticus*** and ***O. aureus***, whereas they constitute the least frequent in the guts of ***T. zillii***. Spataru & Zorn (1976) pointed out that ***O. aureus*** is mainly a zooplankton consumer. Huet (1970) stated that ***T. nilotica*** is a microphagous and omnivorous species, with greater feeding preference for plant foods.

Regarding the stomach fullness, it could be stated that, ***T. zillii*** is the most voracious species since it had the highest stomach fullness (i.e. 64.8%). Spataru (1978) stated that, ***T. zillii*** consume huge quantity of food, its intestine is almost filled to a maximum capacity and having its successful competition for food.

Table (4): Percentage occurrence of various food items in differrent seasons of four Cichlid species in Lake Manzalah.

Season	Species	No. of Fish	Chloro-phyta	Cyano-phyta	Chryso-phyta	Higher plant tissues	Organic detritus	Rotifers	Crust-aceants larvae	Animal derivatives	Stomach Fullness		
											Full	Half	Empty
Summer	S.g.	165	59.4	62.4	86.7	10.9	72.1	33.3	17.0	26.1	30.9	52.7	16.4
	T.z.	413	74.6	84.7	96.6	88.1	54.1	27.1	5.1	61.0	72.9	23.7	3.4
	O.n.	147	87.8	77.6	89.8	36.7	85.7	63.3	34.7	51.0	28.6	55.1	16.3
	O.a.	118	73.7	66.1	78.8	5.1	88.1	44.1	11.0	46.6	49.2	40.7	10.2
Autumn	S.g.	93	61.3	79.6	89.2	11.8	75.3	45.2	15.1	33.3	41.9	51.6	6.5
	T.z.	238	41.2	45.1	42.9	83.6	85.7	27.3	14.3	28.6	71.4	28.6	--
	O.n.	102	83.3	33.3	88.2	16.7	90.2	--	--	--	66.7	33.3	--
	O.a.	110	57.3	52.7	75.5	43.6	98.2	43.6	27.3	59.1	72.7	18.2	9.1
Winter	S.g.	79	64.6	79.7	94.9	2.5	88.6	58.2	45.6	38.0	38.0	46.8	15.2
	T.z.	104	50.0	23.1	76.0	79.8	76.9	22.1	25.0	74.0	25.0	75.0	--
	O.n.	85	46.5	17.6	30.6	47.1	60.0	48.2	45.9	15.3	15.3	84.7	--
	O.a.	84	77.4	50.0	75.0	--	95.2	54.8	51.2	47.6	25.0	75.0	--
Spring	S.g.	110	83.6	86.4	89.1	13.6	87.3	38.2	48.2	54.5	53.6	43.6	2.7
	T.z.	320	37.5	25.9	50.9	62.5	87.5	24.1	38.4	74.1	62.5	37.5	--
	O.n.	108	52.8	55.6	83.3	58.3	50.0	66.7	33.3	74.1	50.0	50.0	--
	O.a.	147	61.9	66.7	49.0	9.5	71.4	23.8	9.5	47.6	52.4	42.9	4.8
Total	S.g.	447	66.7	74.9	89.3	10.3	79.4	41.4	29.3	36.7	40.0	49.2	10.7
	T.z.	1075	59.3	45.9	69.1	78.7	73.1	25.8	19.0	59.0	64.8	33.9	0.2
	O.n.	442	79.9	50.5	76.5	39.4	73.1	46.6	28.5	38.0	40.0	54.5	5.4
	O.a.	459	62.3	60.1	67.8	14.8	86.5	39.4	21.8	50.1	51.4	42.3	6.3

S.g. = ***Sarotherodon galilaeus*** T.z. = ***Tilapia zillii*** O.n. = ***Oreochromis niloticus*** O.a. = ***Oreochromis aureus***

The present study revealed that, there is an intensive feeding on phytoplankton and animal organisms occurred during summer and spring season. This is mainly correlated with water temperature, Khallaf & El-Ne-na-ei (1987) and also may be correlated with spawning season of Tilapia. The highest fullness of stomachs has been observed in spring, autumn and summer while the lowest one is in winter season. The low feeding activity in winter season may reflect a slowing down of the metabolism rate and digestive process at the lower temperature as well as a reduction in the amount of food eaten.

REFERENCES

Abdel-Baky, T.E. and S.S. El-Serafy, 1989. On the growth of ***Oreochromis aureus*** (Stein) in Manzalah Lake, Egypt, Fish symp. on: Fisheries resources as a source of food, Present and Future. Held in Oct., 1989, Alexandria, Egypt.

Abdel-Baky, T.E. and S.S. El-Serafy, 1990. Length-weight relationship and relative condition factor of three species of Cichlid fishes inhabiting Lake Manzalah. Bull. Nat. Inst. Oceanogr. & Fish., ARE, 16 (1), 1990: 147-169.

Abdel-Baky, T.E.; S.H. HASSAN and K.A.H. Shallof, 1991. Growth of Cichlid species in Lake Manzalah, Egypt. Bull. Fac. Sci., Mans. Univ. Vol. 18 (2), 422-443.

A bdel-Malek, S.A., 1968. Feeding of young three-sppined stickeback (Gasterosteus aculeatus L.) in the Kandalaksha Bay of the white Sea. Problems of Ichthyology. Vol. III, No. 2 (49).

Abdel-Malek, S.A., 1971. Food and feeding habits of some Egyptian fishes in Lake Quarun. Part 1- ***Tilapia zillii*** (Gerv.). C- According to different sexes. Bull. Inst. Oceanogr. & Fish., A.R.E.,, 2: 241-259.

Abdel-Malek, S.A., 1972. Food and feeding habits of some Egyptian fishes in Lake Quarun. Part 1- ***Tilapia zillii*** (Gerv.). B. According to different length groups. Bull. Inst. Oceanogr. & Fish, A.R.E., 2: 203-213.

Anonymous. 1975-1992. The central Agency for Public Mobilization and Statistics (CAPMAS), Statistical yearbook (1975-1992), Cairo, Egypt.

Chen, T.P., 1976. Aquaculture practices in Taiwan. Fishing News Books Ltd., Farnham, and Surrey, England.

Dempster, P.W.; M.C.M. Beveridge and D.J. Baird, 1993. Herbivory in the tilapia ***Oreochromis niloticus*** a comparison of feeding rates on phytoplankton and periphyton. J. Fish. Biol. (1993) 43, 385-392.

El-Zarka, S.E.; A.H. Shaheen and A.A. Aleen, 1970. Tilapia Fisheries in Lake Mariut. Age and growth of Tilapia nilotica L. in the Lake. Bull. Inst. Oceanogr. & Fish., 1: 149-182.

Ezzat, A.A.; M.T. Mikhail; W.F. Wadie and M.T. Hashem, 1982. Length-weight relationship and condition factor of Epinephelus aeneus and E. alexandrinus in the Egyptian Mediterranean waters. Bull. Oceanogr. & Fish. A.R.E., 8 (1): 173-185.

Fish, G.R., 1955. The food of Tilapia in East Africa. Uganda J. Vol. 19. No. 1, pp: 85-89.

Fryer, G. and T.D. Iles, 1972. The Cichlid fishes of the great lakes of Africa: Their biology and evolution. Edinburgh, Oliver and Boyed, 641 pp.

Getachew, T., 1987. A study on a herbivorous fish, ***Oreochromis niloticus*** L., diet and its quality in two Ethiopian Rift valley lakes, Awasa and Zwai. J. Fish. Biol. (1987) 30, 439-449.

Hosny, C.F.H., 1987. Studies on fish populations in Lake Manzalah. Ph. D. Thesis, Fac. Sci., Alex. Univ.]

Huet, M., 1970. Traite de pisce culture. Fourth ed. ch. de Wyngaert, Brussels.

Khallaf, E.A. and A.A. Al-Ne-na-ei, 1987. Feeding ecology of ***Oreochromis niloticus*** Linn. and ***Tilapia zillii*** Gerv. in a Nile Canal. Egypt. Hydrobiol. 164 (1): 57-62.

Le Cren, E.D., 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). J. Anim. Ecol. Vol. 20, No. 2, pp. 201-219.

Ricker, W.E., 1975. Handbook of computations and interpretations of biological statistics of fish production. Bull. Fish. Res. Board Canada 191: 382p.

Spataru, P., 1978. Food and feeding habits of ***Tilapia zillii*** Gerv. (Cichlidae) in Lake Kinneret (Israel). Aquaculture, 14: 327-338.

Spataru, P. and M. Zorn, 1976. Some aspects of natural feed and feeding habits of Tilapia galilaea (Artedi) and Tilapia aurea (Stein) in Lake Kinneret. Bamidgeh, 28: 12-17.

Toews, D.R. and M.M. Ishak, 1984. Fishery transformation of Lake Manzalah, a brackish Egyptian Delta Lake, in response to anthropological and environmental factors during the period 1920-1980, G.F.C.M., Studies and Review, No. 61, (1): 347-402.

Trewavas, E., 1982. Generic grouping of tilapia used in aquaculture. Aquacult., 27: 79-81.

Vaznetsov, V.V., 1953. Developmental stages of young fishes pp. 207-217 in Ocherki poobshchim roprosam I khtiologii. Akademiya Nauk Press, Moscow. 320 pp.