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Fish Populations in Lake Burullus (Egypt) - III.- Selective Feeding of *Mugil cephalus* and *Liza ramada*

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The food preferences and feeding patterns for different size groups, i.e. youngs-of-the-year (group I), yearlings (group II) and adults (group III), of Mugil cephalus and Liza ramada from Lake Burullus was studied using three methods of analysis.

The volumetric method of RICKER (1941) demonstrated the feeding patterns of both species based on a high correlation between the existence of sand particles and the occurrence of foraminifera in the stomachs of the individuals under consideration, on one hand, and the amount of detritus vs. the availability of bottom animals such as molluscs and annelids, on the other hand. It should be mentioned, however, detrital particles in the stomach of mullets were not considered as prey since ODUM (1970) have proved that mullets utilize the organic fraction of the soft mud deposited in coastal lagoons and are able to concentrate them in their bodies by a factor of 100:1.

The results suggest, therefore, that young-of-the-year L. ramada feed in mid-water, while older fish eat close to the bottom searching for foraminifera and annelids among sand that constitutes 17.5% of the food ingested. While adult fish tend to feed in mid-water on epiphytic algae attached to the surface of hydrophytes. In the case of M. cephalus, on the other hand, young-of-the-year were found to feed near the surface, and as the fish grow older they tend to feed close to the bottom and scratching epiphytic algae adhered to hydrophytes.

The numerical method of HYNES (1950) suggested the possible transform in the feeding habits of mullets in the lake. Thus M. cephalus was found to be strictly carnivorous as young-of-the-year and becomes omnivorous as adult. L. ramada, however, was found to be highly versatile in its feeding habits, the young-of-the-year were found to consume plant prey at a relatively higher level than animal prey. The yearling fish, on the contrary, were found to consume more animal prey than plants. The situation is reversed again in adult individuals.

The electivity index of IVELV (1961) demonstrated the selective behavior of the different size groups of mullets in lake Burullus. It was found that M. cephalus will prefer animal to plant matter, this is quite clear especially in the young-of-the-year individual, where strongly selective feeding of animal diet occurs. In the yearling and adult fish, however, the diet seem to be rather balanced, yet it is still deviated towards animal matter of the sedentary nature, suggesting that the individual of this species feed closer to the bottom as they grow older. Table 1 showed that the amount of sand, detritus increase soundly in older individuals as they are accidentally ingested while the fish is seeking for its target animal prey.

For L. ramada, on the other hand, the diet is more deviated to the plant matter of the diet options. Even with regard to plant matter, selectivity is discernible with preference to Dinoflagellates, green and blue-green algae to diatoms. Moreover, adult individuals have much of a choice in their plant diet than young-of-the-year and yearling individuals. Yearling L. ramada eats a larger variety of animal matter than the other size groups, this species have a positive selection to cladocerans. On the other hand, it is strikingly obvious that L. ramada of any size does not at all feed on molluscs, nematodes, or ostracods.

Electivity index of food items ingested by different size groups of M. cephalus and L. ramada from Lake Burullus during 1987.

	M. cephalus			L. ramada		
Food Items	Gp I	Gp II	Gp III	Gp I	Gp II	Gp III
Diatoms	-0.80	-0.77	-0.66	-0.41	-0.87	-0.87
Chlorophytes	-1.00	-0.66	+0.64	-1.00	-0.24	+0.67
Cyanophytes	-0.79	+0.40	-0.10	-0.71	+0.31	+0.14
Dinoflagellates	-1.00	+0.76	-0.58	+0.91	-1.00	+0.85
Foraminifera	-1.00	+0.28	+0.54	-1.00	+0.67	+0.70
Annelids	-1.00	-1.00	+0.99	-1.00	+0.99	-1.00
Copepods	+0.34	-0.39	+0.11	-1.00	-1.00	-1.00
Molluscs	-1.00	+0.99	-1.00	-1.00	-1.00	-1.00
Nematodes	+0.99	+0.98	+0.98	-1.00	-1.00	-1.00
Ostracods	+0.78	+0.70	-1.00	-1.00	-1.00	-1.00
Cladocerans	+0.77	+0.64	+0.64	+0.83	+0.75	+0.63

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Observations on *Tilapia* Fisheries in Lake Manzalah (Egypt)

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Lake Manzalah has long been recognized as the most important fishery ground among the Nile Delta lakes connected to the Mediterranean. According to available catch statistics, its yield has progressively increased from 37 kg/feddan during 1920-29 to 70 kg/feddan during 1962-66 to about 260 kg/feddan in 1979-84. This increase in the total yield per unit area was mostly attributed to the improvement of the productivity of the lake as a result of the progressive increase in nutrient load discharged into the lake by various sources of agricultural and wastewater rich in nutrients (HOSNY, 1987).

Beside these quantitative changes, the lake's fishery was subjected to qualitative variations in its yield that were governed by changes in its water properties, thus during 1930-35 when the average salinity was 24 mg/l, Lake Manzalah was primarily a marine-species-based fishery, when mullets constituted about 80% of its landings. With the gradual freshening of the lake water (average water salinity 8.3 mg/l during 1963-65 to 2.4 mg/l in 1982), it was transferred to a tilapia-based fishery. Quantitatively, tilapia fishery in the lake has increased progressively both in terms of tonnage and percentage reaching about 82.8% of the total yield of the lake during the period 1981-83.

Although it is a common agreement that tilapias constitute the major component of the fisheries of the lake, yet, their percentage contribution to the total catch varied widely according to the method of assessment used by different authors. In the present study tilapias were found to constitute 77.8% of the Tahaweet catch and 72.3% of the Nasha catch, while in the catch of Balla nets they only constituted 61.7%. On the average tilapias constituted about 73.2% of the catch of the three nets used. The last mentioned figure fairly represent the actual percentage of tilapias relative to the total yield from the lake, since the catch of these three gears represent more than 75% of the total landed catch in the lake.

Tilapia population in Lake Manzalah is composed of four species, viz.: Oreochromis aureus, O. niloticus, Tilapia zillii and Sarotherodon galilaeus. The order of abundance of tilapia species was also found to vary according to the method of assessment. The present study proved that the order of relative abundance of the four tilapias by weight are as follows :

	O. aureus	T. zillii	O. niloticus	S. galilaeus
Tahaweet	23.6	37.6	13.3	20.8
Nasha	43.9	29.95	20.0	6.0
Balla	45.6	22.8	24.7	6.9
Average	34.4	33.2	16.5	15.9

The averaging of this relative abundance, however, cancels the effects of gear selectivity and efficiency towards a given species or size. From the average, therefore, it is clear that O. aureus and T. zillii were the most abundant in the lake. The low percentage occurrence of O. niloticus and S. galilaeus may be due to the high rate of exploitation exerted on them in the last few year, being 0.7534 and 0.5345, respectively (HOSNY, 1987). Moreover, the reduction of the O. niloticus stocks reflected on their catch could be explained on the basis of its reduced tolerance to low water temperatures (CHERVINSKY and LAHAV 1976). During the present study, the lowest recorded water temperature was 10C and this is well tolerated by all of the four tilapias inhabiting the lake. However, massive kills of O. niloticus were frequently observed in the early morning following very cold winter nights when temperatures less than 10C must have occurred.

On the other hand, the relative abundance of O. aureus and T. zillii would be explained on the basis of interspecific superiority over S. galilaeus and O. niloticus, respectively. O. aureus is dominating on the expense of S. galilaeus in a similar way as was found in Lake Kinneret. GOPHEN et al (1983) mentioned that this was due to the interspecific competition between the two species, both are mouthbrooders of comparative fecundity, and spawn during the same period, they have a high degree of niche overlap and both feed on phytoplankton. However, O. aureus have the advantage of being able to shift to zooplankton when phytoplankton is not available. Moreover, O. aureus have a wider range of tolerance to salinity variations than S. galilaeus and is thus able to cope with salinity variations in the different zones of the lake.

The preponderance of T. zillii over O. niloticus is partly explained by the relative aggressiveness, both need species type of bottom and vegetation to live within (ITA 1978), but T. zillii is far more aggressive than O. niloticus (CHEN 1976). Furthermore, T. zillii is more euryhaline.

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