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EVALUATION OF *TILAPIA* SPP. IN LAKE MANZALAH AS POND FISHES

PROCJENA *TILAPIA* SPP. U JEZERU MANZALAH KAO RIBNJAČARSKIH VRSTA

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Lake Manzalah, the largest brackish delta lake of Egypt, is subject to large land reclamation projects which have diminished its area. There is now an intention to convert the periphery of this lake, which extends for about 300 km, into fish farms to compensate for the decrease in fish production. This study was made on *Tilapia aurea* and *T. nilotica* in winter 1980 and spring 1981, to evaluate their potential as pond fishes in the proposed fish farms.

Age analysis was carried out to show difference in growth for the fish in two seasons and for both sexes.

Sample standard deviation and the population standard deviation were calculated for length and weight in two species. Length-weight equations and the differential rate of increase in fish weight per unit length were calculated, together with the survival rate of the fish.

From this information, recommendations for the successful culture of *T. aurea* and *T. nilotica* in fish farms constructed on the periphery of Lake Manzalah are given.

INTRODUCTION

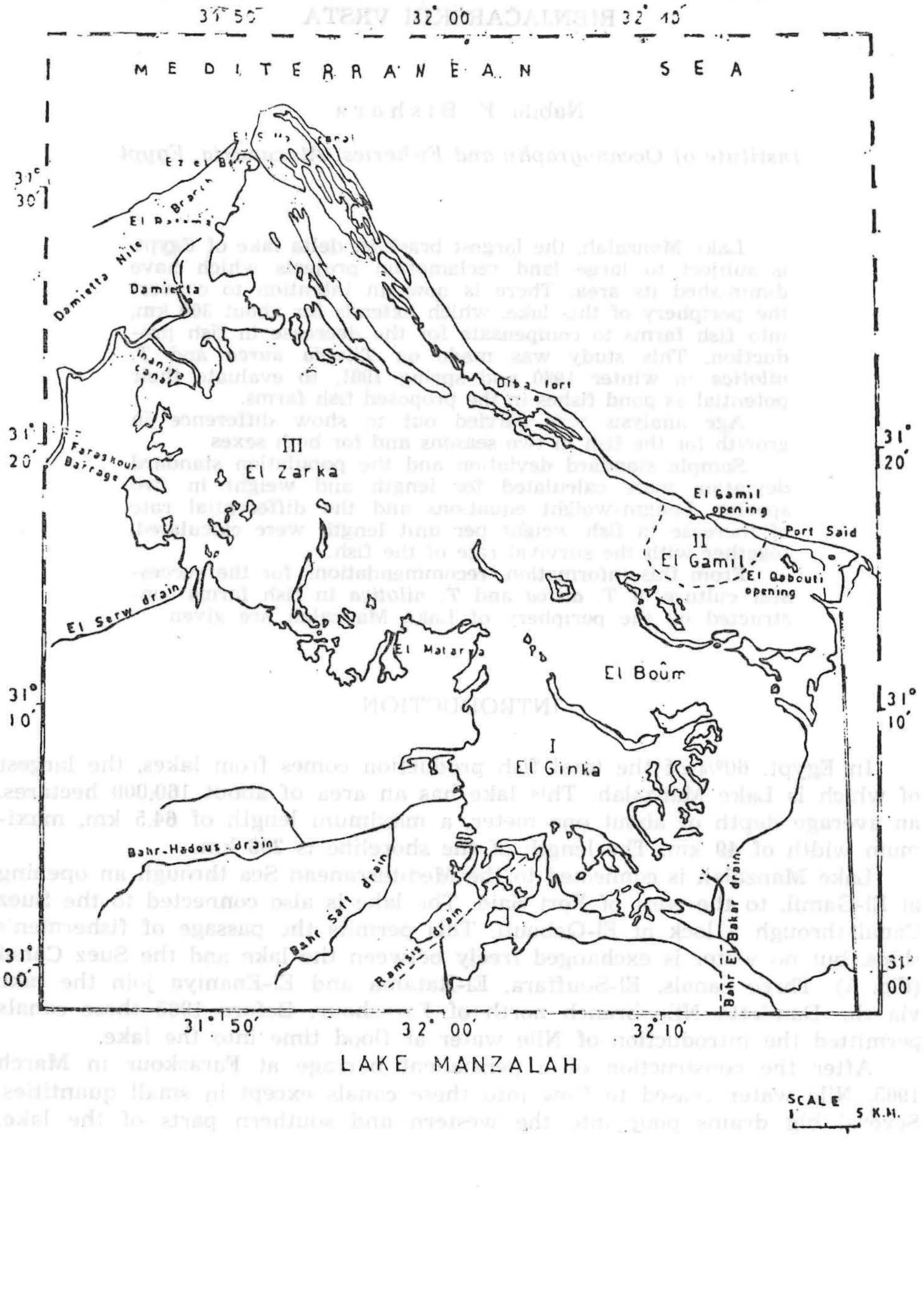
In Egypt, 60% of the total fish production comes from lakes, the largest of which is Lake Manzalah. This lake has an area of about 160,000 hectares, an average depth of about one meter, a maximum length of 64.5 km, maximum width of 49 km. The length of the shoreline is 293 km.

Lake Manzalah is connected to the Mediterranean Sea through an opening at El-Gamil, to the west of Port Said. The lake is also connected to the Suez Canal through a lock at El-Qabouti. This permits the passage of fishermen's ships, but no water is exchanged freely between the lake and the Suez Canal (Fig. 1). Three canals, El-Souffara, El-Ratama and El-Enaniya join the lake via the Damietta Nile branch north of Farashour. Before 1965 these canals permitted the introduction of Nile water at flood time into the lake.

After the construction of a permanent barrage at Faraskour in March 1965, Nile water ceased to flow into these canals except in small quantities. Several big drains pour into the western and southern parts of the lake.

Salinity of the lake varies between 10 g/l in the northern parts affected by the lake-sea connection to nearly 1 g/l in the southern borders affected by fresh water drainage.

In recent years, many land reclamation projects have been made in the lake, which have affected its fish production, of which *Tilapia* species constitute more than 75%. To compensate for this loss in production, a project has been launched to convert the shallow periphery of the lake into fish farms.



LAKE MANZALAH

This paper is an attempt to evaluate both *Tilapia aurea* and *T. nilotica* pond fishes, to help in the execution of this project.

The characters which have drawn attention to these two *Tilapia* species are the ease with which they can be cultured, the high production they yield under proper conditions, and their rapid growth compared with the other *Tilapia* species present in the lake, namely *T. zillii* and *T. galilae*.

MATERIAL AND METHODS

The present study is based on the examination of random samples of both *T. aurea* and *T. nilotica* obtained from fishing boats working in the periphery of the lake during winter 1980 and spring 1981.

A total of 533 *T. aurea* were examined in spring and 318 in winter. For *T. nilotica* 518 fish were examined in spring and 613 in winter. Samples were collected monthly during two seasons. The total length and weight of each fish were measured to the nearest 5 mm and 0.5 g respectively. A number of scales were taken from just behind the pectoral fin below the lateral line to determine the age composition of the catch.

Examination of various body structures of these species (otolith, vertebrae) proved not to be practicable, owing to the difficulty in determining the age using these structures. Scales were taken from ten different parts of the body of the fish, in order to find out the suitable position to take scales for age determination, giving best realiable results. It is found that a number of scales taken from just behind the pectoral fin below the lateral line, fulfil this aim with the best reliable results. Using these scales.

a — It is proved that the relation between body lenght and scale length in both *T. aurea* and *T. nilotica* is a straight line relationship, and the scales appear on the body of the fish when it attains 10.3 mm and 13.1 mm respectively and the equations representing such relation are:

T. aurea $L = 10.3 + 0.592\,S$

T. nilotica $L = 13.1 + 1.499\,S$

where L = Total length of fish in mm and
S = total scale radius, Bishara (1973).

b — In order to investigate the validity of scale formation examination of hundreds of scales-just behind the pectoral fin below the lateral line in two species in different months, showed that the annuli on the scales recognised by the formation of alternate zones of closer and wider circuli appeared during the winter and summer seasons respectively.

In ali the specimens of *Tilapia* species examined for age determination the band of crowded narrow circuli-compared with those immediately outside it is considered as the year mark and is commonly called the annulus, Bilton (1972). There is no substitute for experience in reading the scales.

c — The time of annulus formation is determined using the method adopted by Kennedy (1970) by estimating the value of the ratio (A) in different months of the year for fishes of age group I.

A = *Distance from the first annulus to the scale margins*

Distance from the facus to the first annulus and the values of this ratio were calculated for both *T. aurea* and *T. nilotica*, as follows:

Months	Jan.	Feb.	Mar.	Apr.	May	June
**T. aurea*	0.890	0.833	0.120	0.143	0.288	0.483
**T. nilotica*	0.897	0.857	0.214	0.250	0.349	0.429

Months	July	Aug.	Sep.	Oct.	Nov.	Dec.
T. aurea	0.724	0.550	0.685	0.675	0.736	0.875
T. nilotica	0.556	0.600	0.800	0.841	0.833	0.887

Cited from Bishara, (1973)

It is clear from the table that early spring (March) is the beginning of the formation of annulus with wide circuli and narrow ones during December, January and February.

The length-weight equations were calculated for both sexes in each age group in order to determine at which age best growth is achieved.

The rate of increase in fish weight per unit length was calculated together with the estimation of the survival rate of each sex at different ages.

RESULTS AND DISCUSSION

1. *Percentage composition of length groups within age classes*

For management purposes, it is important to know the age composition of the catch in order to predict the status of the stock in future years. Table 2. shows the highest percentage length composition at age class I of 12—14 cm range of both male and female *T. aurea* in winter. These percentages reach 75.8 and 71.4 for males and females respectively.

For age class II, these two length ranges are represented by 54.5 and 58.8% respectively. For age class III, males attain higher lengths than the females, 16—20% for males and 14—20% for females.

In spring, age class II had the highest percentage in the catch (57.2), while in winter, age class I had the highest percentage (50.9). Age classes III and IV were better represented in winter than in spring.

In winter, age class I had the highest percentage in the catch, (50.9), age class II had the highest percentage (57.2) in spring. Age classes III and IV were better represented in winter than in spring. This can be explained by that the age classes II, III and IV nest in spring and are not easily caught by fishermen. Although nesting, are class II is still present in catch in high percentages due to its high percentage of occurrence. On the other hand age group I had high percentage in the catch in winter as it is still immature and in search for food freely swimming in the lake.

In *Tilapia nilotica* age class I predominate in winter and age class II in spring. Age classes III, IV and V are better represented in spring than in winter (Table 1).

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* Identification of these species was confirmed by Dr. P. H. Greenwood of the British Museum (1969).

Table 1. Total number of fish examined during winter 1980 and spring 1981 together with the percentages of age classes in each season

T. aurea						*T. nilotica*					
Winter 1980			Spring 1981			Winter 1980			Spring 1981		
Age class	No.	%	Age class	No.	%	Age class	No.	%	Age class	No.	%
I	162	50.9	I	164	30.8	I	434	70.8	I	152	29.3
II	86	27.0	II	305	57.2	II	138	22.5	II	230	44.4
III	59	18.6	III	59	11.1	III	25	4.2	III	103	19.9
IV	11	3.5	IV	5	0.1	IV	16	2.6	IV	19	3.7
									V	14	2.7
Total number examined	318			533			613			518	

2. *Sex ratio*

As shown in Table 2, in winter and spring female *T. aurea* usually exceed the males in number. This is clear in fishes of age class II and III. For fishes of age class I, the percentage of males slightly exceeds that of the females. This may be due either to the original high percentage of males on spawning, or that males of *T. aurea* are more tolerant to environmental changes than females in their early life.

The same phenomenon was observed when studying the sex ratio in *T. nilotica*. (Table 3).

In Tables 2 and 3 the symbol (§) denotes the sex ratio in different average lengths irrespective of fish age.

* = sex ratio in different ages irrespective of different average lengths.

(v) = general sex ratio of the fish examined irrespective of age and different average lengths. In Table 3 in winter 1980 the high percentage observed in females at average length of 18 cm is due to the limited number of fish examined. Number of fish examined during spring 1981 for the males of age group II was also limited.

3. *Length and weight of fish attained at each age*

From Table 4 it can be seen that in winter growth rate of males of *T. aurea* considerably exceeds that of females up to 4 years of age. However, the difference in growth in weight between males and females of age class I is considerably small.

In spring this pattern of growth is noticed even in the first age fish, although with a lesser growth rate (Table 4). Three year old fish show pronounced difference in weight.

As shown in Table 5 in winter male *T. nilotica* in the first year of life exceed the female *T. nilotica* in both length and weight, although the difference is small. It is generally noticed that the difference in weight is greater than that in length especially in two year old fish.

In spring (Table 5), although the difference in weight is less pronounced than in winter, in the three year old fish the increase in weight is inversed, and the females exceed males in both length and weight. This may be attributed to the small number of fish examined in the III age class compared

Table 2. The percentage composition of different lengths within age classes and sex ratio od *T. aurea* during winter 1980 and spring 1981.

Average length	Age classes I		II		III		Winter 1980 general (§) % of length		Average length	Age classes I		II		III		Spring 1981 general (§) % of length	
(cm)	M	F	M	F	M	F	M	F	(cm)	M	F	M	F	M	F	M	F
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	13.7	35.7	0.0	0.0	0.0	0.0	1.2	10.2
8	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	8	20.7	21.4	9.3	12.1	0.0	0.0	12.7	13.2
10	11.2	14.6	0.0	5.9	0.0	0.0	11.8	4.0	10	27.6	25.0	23.3	29.3	0.0	15.4	22.2	26.5
12	41.9	45.7	27.2	47.0	0.0	0.0	38.2	37.5	12	30.0	17.9	41.9	51.7	20.0	38.5	38.4	37.7
14	33.9	25.7	27.3	11.8	0.0	40.0	19.6	27.1	14	8.0	0.0	23.2	6.9	50.0	23.1	19.3	8.1
16	9.8	11.1	18.2	29.4	40.0	33.3	11.8	20.9	16	0.0	0.0	2.3	0.0	10.0	15.3	3.8	2.0
18	1.6	0.0	18.2	5.9	0.0	20.0	5.8	8.4	18	0.0	0.0	0.0	0.0	10.0	7.7	1.2	2.3
20	1.6	0.0	9.1	0.0	60.0	6.7	5.9	2.1	20	0.0	0.0	0.0	0.0	10.0	0.0	1.2	
							v	v								v	v
*Sex Ratio	52.9	47.1	39.3	60.7	25.0	75.0	41.5	58.5	*Sex Ratio	50.9	49.1	42.6	57.4	43.5	56.5	44.3	55.7

Table 3. The percentage composition of different lengths within age classes and sex ratio of *Tilapia nilotica* during winter 1980 and spring 1981.

Average length	Age classes I		II		III		Winter 1980 general (§) % of length		Average length	Age classes I		II		III		Spring 1981 general (§) % of length	
(cm)	M	F	M	F	M	F	M	F	(cm)	M	F	M	F	M	F	M	F
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6	18.8	18.0	0.0	0.0	0.0	0.0	10.3	5.0
8	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	8	34.4	36.4	13.6	0.0	0.0	0.0	24.3	8.1
10	11.5	14.3	10.0	21.0	0.0	0.0	11.2	15.8	10	18.7	18.2	22.8	21.2	10.0	8.0	22.3	17.2
12	41.9	45.3	10.0	26.2	9.6	0.0	34.6	41.6	12	9.4	18.2	27.3	13.4	20.0	16.0	15.6	15.2
14	33.8	25.8	10.0	21.1	20.4	0.0	28.4	24.8	14	6.2	4.6	36.3	21.2	20.0	22.0	17.2	16.2
16	9.6	11.7	20.0	15.8	40.0	0.0	12.3	12.4	16	9.4	4.6	0.0	30.8	20.0	24.0	5.2	22.2
18	1.6	0.0	15.0	10.6	15.0	100.0	4.9	2.2	18	3.1	0.0	0.0	7.6	20.0	28.0	1.7	11.1
20	0.0	0.0	20.0	5.3	10.7	0.0	4.5	1.0	20	0.0	0.0	0.0	3.9	10.0	4.0	1.7	3.0
22	0.0	0.0	5.0	0.0	4.3	0.0	1.3	0.0	22	0.0	0.0	0.0	0.0	0.0	4.0	0.0	1.0
24	1.6	0.0	10.0	0.0	0.0	0.0	2.4	0.0	24	0.0	0.0	0.0	0.0	0.0	4.0	1.7	1.0
							v	v								v	v
*Sex Ratio	52.9	47.1	39.3	60.7	92.0	8.0	48.2	51.8	*Sex Ratio	59.3	40.7	29.8	70.3	7.4	92.6	36.9	63.1

with those of age classes I and II (Table 3). A considerably greater increase in weight growth rate in winter than spring is due to the fact that after the long spawning season which extends from early spring to late autumn, the fish begin to eat vigorously in order to overcome the exhaustive spawning period in which they stop feeding.

Table 4. The average length, average weight of *T. aurea* at different ages, corresponding calculated sample standard deviation (σn—1) and population standard deviation (σn).

Winter 1980

Age class		I		II		III		IV	
		M.	F.	M.	F.	M.	F.	M.	F.
Average length (cm)		12.5	13.3	15.8	14.6	18.8	16.1	19.0	18.0
L	σn	1.7	1.8	3.2	1.9	2.6	2.1	0.0	0.8
	σn—1	1.7	1.8	3.4	2.0	2.9	2.2	0.0	1.0
Average weigth (g)		37.4	44.4	72.5	57.7	129.2	79.3	130.0	70.0
W	σn	15.1	18.7	42.2	24.0	51.0	34.3	0.0	43.2
	σn—1	15.3	19.1	44.0	24.6	55.9	35.5	0.0	52.9

Spring 1981

Age class		I		II		III		IV	
		M.	F.	M.	F.	M.	F.	M.	F.
Average length (cm)		9,9	9.9	12.3	11.6	15.4	13.8	—	16.0
L	σn	2.3	2.2	1.6	1.5	2.3	2.1	—	—
	σn—1	2.3	2.2	1.6	1.5	2.5	2.2	—	—
Average weigth (g)		21.9	18.8	32.0	26.0	57.6	40.7	—	40.0
W	σn	11.8	10.0	11.9	8.9	28.4	23.3	—	—
	σn—1	12.0	10.2	12.0	8.9	29.9	24.3	—	—

Table 5. The average length, average weight of *T. nilotica* at different ages, corresponding calculated sample standard deviation (σn—1) and population standard deviation (σn).

Winter 1980

Age class		I		II		III		IV	
		M.	F.	M.	F.	M.	F.	M.	F.
Average length		13.6	13.2	17.2	13.8	20.5	—	22.0	19.5
L	σn—1	1.8	1.7	3.7	3.2	2.3	—	—	1.7
	σn—1	1.8	1.7	3.7	3.2	2.3	—	—	1.7
Average weight		51.1	44.0	103.4	57.6	178.2	—	170.0	152.5
W	σn	23.9	20.8	82.1	40.4	67.0	—	—	42.6
	σn—1	24.1	20.9	83.9	41.2	71.6	—	—	49.1

Spring 1981

Age class	I		II		III		IV		V	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Average length (cm)	10.1	10.0	14.2	13.9	16.6	17.5	24	20.0	—	20.3
L σn	3.1	2.8	4.6	2.8	3.9	3.5	—	—	—	1.1
L $\sigma n—1$	3.1	2.9	4.7	2.8	4.2	3.6	—	—	—	1.3
Average weight (g)	23.6	22.1	67.5	51.8	88.8	101.4	222	131.0	—	142.3
W σn	25.2	16.8	54.7	31.3	48.1	62.1	—	11.4	—	20.2
W $\sigma n—1$	25.6	17.3	55.6	31.6	51.4	63.2	—	12.7	—	23.3

Sample standard deviation and population standard deviation for both length and weight for two *Tilapia* species were calculated (Tables 4, 5). These two constants show higher values for weight in both *T. aurea* and *T. nilotica*, due to the fact that the difference depends mainly on the range of change in weight for fishes of the same and different lengths, while that of the length is considerably lower than that of weight.

4. *Length-weight equations*

$$W = a L^n$$

where: W = the fish weight in grams.
L = the fish length in centimetres.
a = the slope of the line relating length and weight.
n = an exponent value, serves to give an idea about the robustness of the fish and the degree of its well being, Ricker and Merriman (1945), Rounsefell and Everhart (1956), Brown (1957), Chatwin (1959), and Bower and Lee (1971).

To study the ability of growth of two *Tilapia* species in the periphery of Lake Manzalah during winter 1980 and spring 1981, length-weight equations were calculated (Table 6a and b) of each sex of the different age class.

In order to have a clear picture of the different seasonal growth rates, it was found necessary to calculate the ratio of the specific growth rate for length and weight, i.e. the exponent »n« value (Bower and Lee, 1971). However, it was found that there was a significant difference statistically proved in the slope of line relating the length-weight relationship. Therefore, in order to test the indicative values of the exponent »n« at different ages in two mentioned seasons, estimation of the differential increase in fish weight with respect to unit length $\frac{dw}{dl}$ was carried out (Bishara, 1973).

Where $\frac{dw}{dl} = (a) \times (n) \times (n—1) \log L.$

Therefore evaluating the two constans (a and n) the above equation is considered, three lengths were chosen i.e. (10, 15 and 20 cm) for each age class as shown in Tables 6 and 7.

5. *The differential increase in fish weight per unit length*

From Table 7 it is clear that the values of differential growth rate of two *Tilapia* spp. at different ages differs in two mentioned seasons. However, this difference is not statistically significant since the age of the fish does not mainly depend on its length or weight.

In winter, in the first year of its life, female *T. aurea*, at length of 15 and 20 cm, grow with a differential rate of increase greater than that of the males, while at 10 cm, males grow with a differential rate of increase slightly greater than that of the females. For fish of age class II, the differential increase in weight per unit length at selected lengths 10, 15 and 20 cm is considerably greater in males than in the females.

For fish of age class III, the differential increase in fish weight per unit length is more or less the same for fish up to 15 cm length, while for fish of 20 cm length, the differential rate of the females exceeds that of the males (Table 7).

Table 6 a. Length - weight equations for *T. aurea* in winter and spring (1980—1981) for both sexes.

Age class	Winter M	Winter F	Spring M	Spring F
I	$3.529 \times 10^{-2} L^{2.763}$	$2.624 \times 10^{-2} L^{2.866}$	$3.61 \times 10^{-2} L^{2.763}$	$7.938 \times 10^{-2} L^{2.349}$
II	$2.084 \times 10^{-2} L^{2.942}$	$8.966 \times 10^{-2} L^{2.390}$	$2.457 \times 10^{-2} L^{2.842}$	$3.452 \times 10^{-2} L^{2.680}$
III	$2.931 \times 10^{-2} L^{2.844}$	$1.489 \times 10^{-2} L^{3.066}$	$3.149 \times 10^{-2} L^{2.733}$	$2.269 \times 10^{-2} L^{2.807}$

Table 6 b.

T. nilotica

Age class	Winter M	Winter F	Spring M	Spring F
I	$1.439 \times 10^{-2} L^{3.109}$	$5.269 \times 10^{-3} L^{3.481}$	$4.446 \times 10^{-2} L^{2.644}$	$7.063 \times 10^{-2} L^{2.420}$
II	$3.391 \times 10^{-3} L^{3.932}$	$2.454 \times 10^{-3} L^{3.746}$	$1.662 \times 10^{-2} L^{3.036}$	$2.298 \times 10^{-2} L^{2.882}$
III	—	—	—	$1.524 \times 10^{-2} L^{3.038}$

In spring, the differential growth rate of the males considerably exceeds that of the females at all the lengths and ages considered. This may be due to the beginning of the spawning season, when the females starve to carry the mature eggs in their abdomen.

Considering *T. nilotica*, in winter, for age class I, the males at 10 cm length have differential growth rate slightly higher than the females. For 15 and 20 cm lengths the rate of increase in fish weight per unit length of the females considerably exceeds that of the males.

However, for age class II, the differential rate of increase of the males highly exceeds that of the females.

During spring, the rate of increase in fish weight per unit length of the males obviously exceeds that of the females at the ages and lengths considered. This is due to the physiological behaviour of *T. nilotica* during the spawning period.

6. Estimation of survival rate

The survival rate of two species of *Tilapia* was estimated according to Robson and Chapman (1961). The assumptions necessary to obtain a valid estimate of survival rate and its variance is worked out for the case when age is known exactly for the entire sample.

The year-class strength and annual survival rates are assumed to be constant, at least over a limited range of age classes in which case, the estimated survival rate is represented in Table 8. However, the variance of the calculated survival rates is estimated. Accordingly, the standard error of variance of the estimated survival rates of two *Tilapia* species is calculated in Table 8.

Table 7. The rate of increase in fish weight per unit length (differential rate) of *T. aurea* and *T. nilotica* at different ages during winter 1981 spring 1981 in the Lake Manzalah.

T. aurea

	Winter 1980						Spring 1981					
	M			F			M			F		
Lengths (cm)	10	15	20	10	15	20	10	15	20	10	15	20
Age class												
I	5.65	11.54	19.17	5.52	11.77	20.13	5.78	11.80	19.60	4.17	7.20	10.6
II	5.36	11.79	20.60	5.26	9.24	13.78	4.86	10.25	17.41	4.43	8.75	14.1
III	5.82	12.29	20.89	5.31	12.28	22.25	4.66	9.39	15.47	4.08	8.50	14.2

T. nilotica

	Winter 1980						Spring 1981					
	M			F			M			F		
I	5.74	13.51	24.78	5.55	15.18	31.00	5.18	10.09	16.19	4.50	8.00	12.01
II	13.22	43.39	100.84	5.12	15.59	34.34	5.48	12.51	22.47	5.05	10.83	18.60
III	—	—	—	—	—	—	—	—	—	5.05	11.54	20.75

Table 8. The estimated survival rates at 95 percent confidence level and standard error of variance of both males, females and combined sex of *Tilapia aurea* and *Tilapia nilotica* in Lake Manzalah.

		Winter (1980)	Spring (1981)
T. aurea	Males	32.3 ± 0.032 SE	44.1 ± 0.025
	Females	50.2 ± 0.027 SE	45.9 ± 0.020
	(Sex combined)	42.8 ± 0.020 SE	45.2 ± 0.017
T. nilotica	Males	28.0 ± 0.022 SE	42.7 ± 0.027
	Females	26.3 ± 0.022 SE	56.1 ± 0.020
	(Sex combined)	27.8 ± 0.014	51.5 ± 0.014

Since the sampling distribution of the survival rate estimate approaches the normal distribution as sample size gets large, approximate 95% confidence intervals on the survival rate are given in Table (8).

Thus, one could state with 95% confidence that if year class size and survival rates are actually constant in this *Tilapia* population, then the true annual survival rate falls somewhere between the ranges presented in Table 8.

From Table 8, it is clearly shown that in spring the survival rate considerably exceeds that in winter, except for female *T. aurea* in which the phenomenon is clearly inversed. Females of two species were found to have survival rates greater than the males.

In winter, both male and female *T. nilotica* suffer from a considerable drop in the survival rate, a case which is more evident in the females (26.3%), while in *T. aurea*, the females show an astonishing higher survival rates than the males, even higher than in spring and nearly twice that of *T. nilotica*, for both males females.

We must mention that during this study two environmental factors affected fish distribution:

1. Water temperature, being affected by air temperature, due to the shallowness of the area.
2. Salinity, being higher at the northern part of the lake affected by the lake sea connection, and lowest at the southern borders affected by fresh water drainage.

RECOMMENDATIONS

From the results of the present study we can give the following recommendations:

1. Whenever possible, *T. aurea* is to be caltured in the northern periphery of Lake Manzalah, where salinity is higher and temperature lower. This is confirmed by the fact that the survival rate of the females is higher in winter than in spring ,indicating the tolerant nature of this species.
2. Since, as given above, male and female *T. nilotica* suffer from a considerable drop in the survival rate in winter, it is recommended that *T. nilotica* is to be cultured in the southern borders of the lake since due to the drainage water higher plants grow in the periphery of the lake and make a kind of shelter from cold wind during winter. Low salinity of this region is more favourable for *T. nilotica*.
3. To get a robust fish it should be harvested in winter of the second year.
4. To help to increase the fish weight, supplementary food is to be added especially during the first year of life, to compensate for the relatively low productivity of Lake Manzalah waters (El-Wakeel and Wahby, 1970).

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PROCJENA *TILAPIA* SPP. U JEZERU MANZALAH KAO RIBNJAČARSKIH VRSTA

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KRATKI SADRŽAJ

U radu se daje procjena potencijala dviju vrsta riba roda *Tilapia: T. aurea* i *T. nilotica,* kao budućih vrsta ribarstvenih farmi u brakičnom jezeru Manzalah na delti rijeke Nil. U Egiptu 60% ukupne produkcije riba dobiva se iz jezera, a najveće od njih je upravo jezero Manzalah sa oko 160 000 hektara površine i srednje dubine od 1 m. Sa Mediteranom jezero je povezano prolazom kod El Gamila, a sa Sueskim kanalom kod El Qaboutia te sa tri kanala sa Nilom. Salinitet jezera varira između 10×10^{-3} u sjevernom dijelu do približno 1×10^{-3} u južnom dijelu. Tokom posljednjih godina u jezeru Manzalah ribe roda *Tilapia* čine više od 75% produkcije. Neki zemljani radovi koji se vrše u jezeru utjecali su na njegovu produkciju u negativnom smislu. Kao kompenzacija tome nastoje se periferna područja jezera urediti kao ribarstvene farme gdje bi se umjetnim putem povećala njegova produktivnost Razlog zašto se ove dvije vrste riba žele privesti kulturi je lakoća njihovog uzgoja, visoka produkcija u postojećim uvjetima i njihov brži rast u usporedbi s ostalim prisutnim vrstama riba roda *Tilapia* u jezeru *(T. zillii* i *T. galilae).*

Materijal za ovu studiju sakupljan je tokom zime 1980. i proljeća 1981. Obrađen je 851 primjerak vrste *T. aurea* i 1131 primjerak vrste *T. nilotica* Biometrijski podaci uzimani su vrlo detaljno. Obrada vrsta sadrži:

1. Postotni sastav dužinskih grupa unutar starosnih klasa odvojeno za zimu i proljeće. Numerički podaci dani su u Tablicama 2 i 3.

2. Odnos spolova (Tablice 2 i 3),

3. Analizu dužina i težina riba sadržanih u svakoj starosnoj klasi (Tablice 4 i 5),

4. Dužinsko težinski odnos tijela (Tablica 6),
5. Diferencijalni porast težine riba po jedinici dužine (Tablica 7) i
6. Procjenu preživljavanja (Tablica 8).

Na temelju ove studije autor daje slijedeće zaključke:

1. *T. aurea* moći će se umjetno uzgajati u sjevernim perifernim dijelovima jezera Manzalah gdje je salinitet viši a temperatura niža i to s razloga što je utvrđeno da je preživljavanje ženki veće u zimskom nego u proljetnom periodu,

2. Budući da mužjaci i ženke vrste *T. nilotica* pokazuju značajni pad nivoa preživljavanja tokom zime preporuča se da se ova vrsta uzgaja u južnijim rubnim zonama jezera obzirom da zbog drenaže slatke vode dolazi do bržeg rasta bilja koje ih na neki način štiti od hladnoće tokom zime. Niski salinitet u tim područjima jezera također pogoduje vrsti *T. nilotica,*

3. Za pospješenje rasta riba u težinu mogla bi se koristiti dodatna hrana, posebno tokom prve godine života riba, kao koxmpenzacija za relativno nisku produkciju vode jezera Manzalah,

4. Izlovljavanje riba moglo bi se vršiti u zimskom periodu svake druge godine.