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THE INFLUENCE OF WATER POLLUTION UPON THE GROWTH PERFORMANCE OF OREOCHROMIS AUREUS (STEIND.) IN LAKE MARIUT, EGYPT.

BY

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ABSTRACT

Lake Mariut is recently subjected to intensive pollution. The influence of this pollution upon the growth performance of O. aureus was studied. O. aureus, captured from non- polluted region grow to 7.71, 12.45 & 16.20 cm at the end of first, second and third year of life. These growth rates are better than those estimated for fish in polluted region where they attain the corresponding sizes of 7.29, 11.29 & 14.00 cm. Growth pattern was described by von Bertalanffy growth equation. Its parameters were estimated as K = 0.3893; t_o = - 0.1872 & $L\infty$ = 19.69 cm for polluted region and K = 0.2343; t_o = -0.2482 & $L\infty$ = 30.40 cm for non-polluted region. Maximum estimated age was 12.6 & 7.5 year for non- polluted and polluted regions respectively. The index of growth performance estimated for fish from non-polluted region (2.34) was better than that from polluted region (2.18).

INTRODUCTION

Lake Mariut is a small shallow lake lying beside Alexandria. It is artificially divided into four basins; lake proper, fish farm, southeast & southwest basins (Fig.1).

Recently Lake Mariut is seriously subjected to pollution with pesticides, sewage and industrial wastes (El-Sharkawy, 1978; Saad, 1987; Abdel-Moneim et al., 1987). The fisheries of Lake Mariut are mainly composed of tilapias which contribute about 89% of its total catch during the period of 1981-1990 (Anon. 1981-1990). Oreochromis aureus represents one of the abundant Tilapia species in the lake.

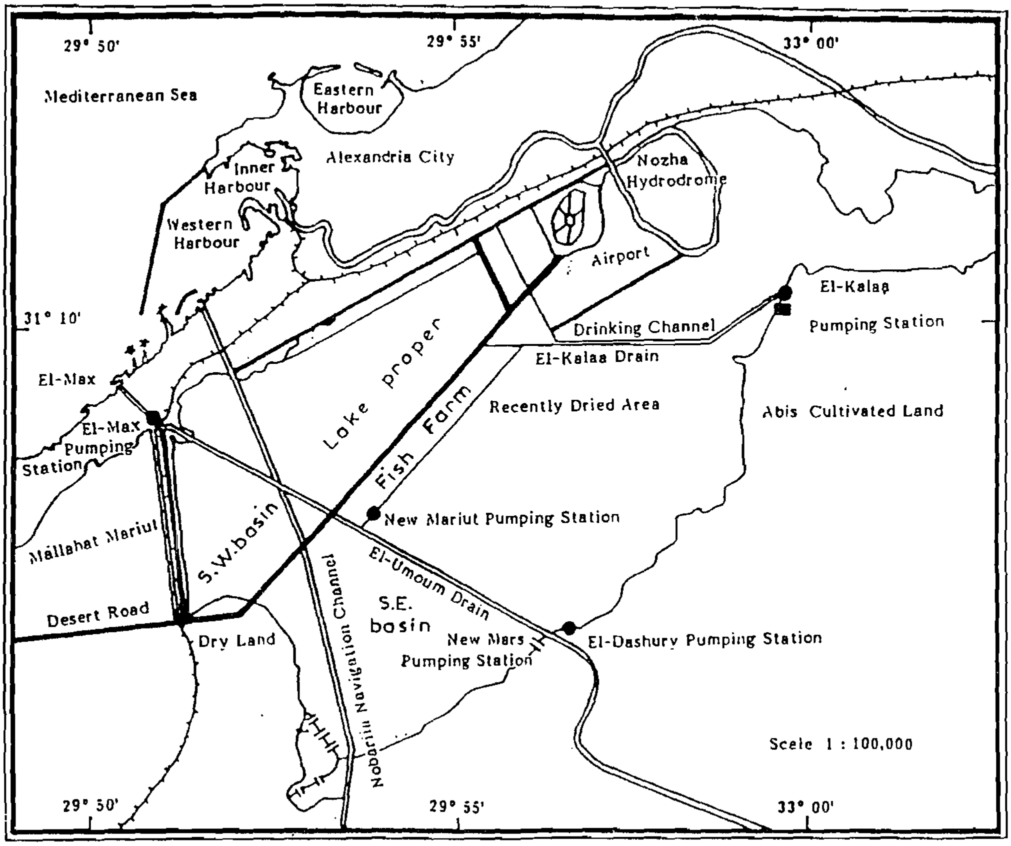

Figure 1: Lake Maruit.

Many investigators concentrated their studies on the effect of pollution upon the limnological characteristics of Lake Mariut (e.g. El-Sharkawy, 1978; Wahby et al., 1978; Halim; 1984; Abdel-Moneim et al, 1987). However the present work aims to study the influence of pollution upon the growth as one of the biological aspects of O. aureus.

MATERIALS AND METHODS

Random samples of tilapia fishes were collected seasonally from lake proper and southeast basins during the period from January to December, 1993. The first basin represents polluted region while the other one represents non-polluted region which is nearly free from pollution (Abdel-Moneim et al., 1987). Age determination was done by scale interpretation. Scales were taken from the left side of the fish above the lateral line and below the dorsal fin. The scales were cleaned in 10% ammonia solution and mounted dry between two glass slides, then examined using binocular microscope (magnification x 25).

RESULTS

1- Body length-scale radius relationship:

Relationship between scale radius (R in micrometer divisions) and total length (L in cm) are calculated for each region. The regression equations obtained are:

In polluted region: $L = -1.2547 + 0.3254\ R$

$(r = 0.9972)$

In non-polluted region: $L = -1.1117 + 0.3134\ R$

$(r = 0.9941)$

The relationships are graphically represented in Fig. (2). According to the covariance analysis (Snedecor & Cochran, 1967), these relations between the two regions are significantly different ($P < 0.01$).

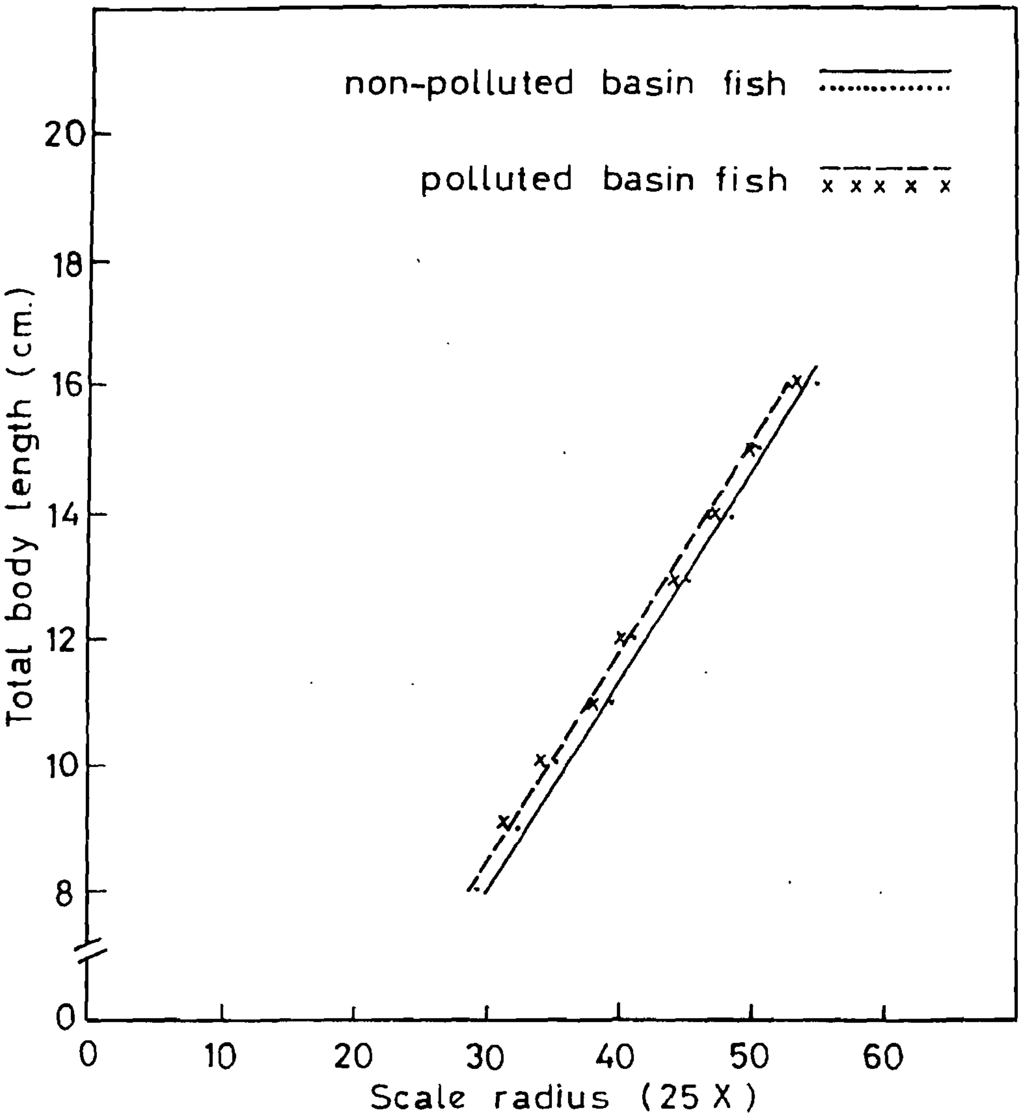

Figure 2: Relation between total length and scale radius of *Oreochromis aureus* from polluted & non-polluted regions of Lake Mariut.

2- Growth in length:

The lengths of fish at previous years of life are back-calculated from the relative positions of annuli on its scale (Chugunova, 1959) using the formula:

$L_n = S_n / S (L-a) + a$ (Lee, 1920)

Where L_n = Calculated length at the end of n years (cm.).
S_n = Scale radius to the nth annulus (micrometer divisions)
L = Total length at capture (cm.).
S = Total scale radius (micrometer divisions).
a = Intercept of body length/scale radius relationship

Table (1) shows the back-calculated length for each year of fish life for polluted and non- polluted regions. It is obvious that the growth of fishes from polluted region differs from that of non-polluted region which showed a relatively higher growth. Analysis of variance revealed that the difference is significant ($P< 0.05$).

3- Theoretical growth rate:

The von Bertalanffy growth equation is commonly used to describe asymptotic growth. Its parameters ($L\infty$, K & t_0) are calculated by the method proposed by Gulland (1964) by using two regressions. The first one is between L_t and L_{t+1} by means of which $L\infty$ and K are obtained. Corresponding value t_0 is calculated from the second regression between L_n ($L\infty$ - $L_t / L\infty$) and age. Hence the von Bertalanffy equations would be

L_t = 19.69 [1- exp - 0.3893 (t+ 0.1872)] for polluted region
L_t = 30.40 [1-exp-0.2343 (t+0.2482)] for non-polluted region.

From above equations, it appears that the growth of fish caught from non- polluted region is higher than those of polluted one.

4- Maximum age ($t_{max.}$):

It is a measure of the longevity of the fish species, was calculated from the relation $t_{max} = 3/k + t_0$ (Pauly, 1983).

The maximum estimated age of life for O. aureus of non- polluted region is 12.6 years, while O. aureus of polluted region has maximum age of 7.5 years.

Table (1)): The back-calculated total length (cm) at the end of different years of life of O. aureus.

Age group	No of fish	l_1	l_2	l_3
Polluted region:				
I	54	7.51		
II	36	7.03	11.28	
III	5	6.79	11.36	14.00
Average length	95	7.29	11.29	14.00
Average increment		7.29	4.00	2.71
Non-polluted region:				
I	79	7.98		
II	36	7.12	12.47	
III	7	7.70	12.35	16.20
Average length	122	7.71	12.45	16.20
Average increment		7.71	4.74	3.75

Table (2): The back-calculated total length (cm) at the end of different years of life of O. aureus in Lake Mariut (given by Akel, 1989).

Back calc. length	l_1	l_2	l_3	l_4
Polluted region:				
Average length	6.86	13.70	15.26	--
Non-polluted region:				
Average length	7.64	14.14	20.29	23.0

5- Growth performance index (ϕ):

For comparing the overall growth performance of the fish species, the index ϕ ($= \log_{10} k + 2 \log_{10} L\infty$) has been used since it is the best index for expressing the fish growth (Moreau et al., 1986).

It was found that the growth performance index of O. aureus of non-polluted region (2.34) is better than that of polluted region (2.18).

DISCUSSION

Age and growth knowledge of a particular fish has practical application in helping to discover environmental suitability of the stock (Lagler, 1956).

The present study revealed that O. aureus of non polluted region grow faster than those of polluted region. The same finding was recorded for O. aureus in 1975-1977 (Akel, 1989). The present calculated lengths are 7.71, 12.45, 16.20 at age from I to III respectively, for non-polluted region corresponding to 7.29, 11.29 & 14.00 cm in polluted region. Comparing the present results obtained for non-polluted and polluted regions with the previous results of 1975-1977 in the same regions (Akel, 1989); it appears that the lengths at different ages (Table 2) are relatively higher than that of present study. Similarly, in Lake Manzalah, growth rate of O.aureus found by Bishara (1973) was higher than that of Hosny (1987). This indicates that the decrease of growth can be attributed to the increased pollution. Also, El-Zarka (1959) reported that the pollution might contribute to the extensive decrease in growth rate of the Saginaw Bay yellow perch.

For validation, the growth performance indices were used confirming that O. aureus from non-polluted region (2.34) grow better than those of polluted region (2.18).

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