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COMMERCIAL FISH CATCHES AS AN INDEX OF LAKE'S EUTROPHIGATION IN EGYPT.

IBRAHIM A. EL-CARYONY AND A.F. EL-KARACHILY

Institute of Oceanography and Fisheries, Alexandria, Egypt.

ABSTRACT

The study is an attempt to identify the location of Egyptian northern lakes in relation to Vollenweider classification of lakes from oligo to polytrophy in the course of eutrophication process.

Time series approach has been used to achieve the aim of the study and to predict future catches from these lakes by main fish species.

It was found that Egyptain northern lakes can be considered in the 4th stage of Vollenweider model. It was assumed that Lake Mariut may pass into the 5th stage.

INTRODUCTION

Studies of limnological characters are dealing mainly, with the problem of lake's eutrophication, they aim to assertain the trophic degree in lakes and review the broad scale of lake classification from oligo to polytrophy (Vollenweider, 1968).

Such studies are of high theoretical and cognitive value. However, problems of how to study the dynamics of eutrophication process, to estimate its rates with time, and to predict changes in lake ecosystem in the course of eutrophication process are of great importance and require further studies, especially, the rate of change in lake's ecosystem which at present, is so high. (El-Wakeel, 1970 and Leopold et al., 1985).

It should be mentioned as well, that due to rapidly processing eutrophication, oligotrophic lakes are practically disappeared (Leoplod et al., 1985 and Vollenwider 1968). Such fact additionally, necessiates a more discerning approach to study lakes of different degrees of eutrophication.

The study is an attempt to identify the location of Egyptian northern lakes i.e., Manzala, Edku and Mariut in relation to Vollenweider classification and to predict future catch rates from these lakes which constitute about 70% of total water area of Egyptian northern lakes.

MATERIAL AND METHOD

Statistical analysis of time series was performed on the main commercial fish species in each of these lakes, namely **Tilapia** spp., **Mugil** spp., **Anguilla anguilla** and **Clariaas lazera**. The analysis embraces a period of 23 years from 1962 till 1984, (Table 1).

TABLE 1

Evolution of commercial fish catches in northern Egyptian lakes in 1962 - 1984.

Year	Tilapia spp.			Mugil spp.			Anguilla spp.			Clarias spp.		
	MZ*	EK	MR	MZ	EK	MR	MZ	EK	MR	MZ	EK	MR
1962	13600	2900	7000	2500	300	60	100	200	80	500	400	500
1963	12600	3100	8300	2600	400	70	100	300	50	800	600	100
1964	12700	3100	8300	3400	600	40	200	300	40	700	500	100
1965	10900	3200	7100	3300	600	40	200	200	40	500	800	100
1966	17400	2400	4300	2300	400	5	100	100	20	700	400	00
1967	20100	1500	1800	3100	200	8	100	170	20	700	200	40
1968	20000	900	1200	2000	100	7	100	70	20	600	100	50
1969	18100	1100	1400	1900	100	7	100	30	30	700	100	70
1970	17300	900	2300	1500	100	--	100	20	4	400	100	100
1971	18500	600	1900	1800	80	--	100	10	3	800	40	100
1972	16700	700	3800	2200	40	--	100	10	1	700	80	100
1973	18100	800	600	1300	30	40	100	20	100	800	80	1800
1974	22000	900	14400	3100	50	60	300	20	100	900	100	2000
1975	24200	800	13500	2400	80	300	300	30	200	800	100	3100
1976	18800	700	8300	7700	80	300	300	30	400	600	70	1800
1977	19800	1100	9200	1600	60	600	300	30	900	800	100	2900
1978	20000	800	11200	1700	40	400	800	30	400	800	60	2000
1979	21100	600	11000	1900	50	800	200	30	200	1000	100	2200
1980	19200	600	11400	2000	40	400	200	73	400	1000	100	1900
1981	21100	400	10300	3100	9	150	100	4	100	1200	60	900
1982	23000	400	10000	2000	8	100	200	3	100	1400	30	900
1983	26100	2100	7100	2900	40	100	200	20	40	1500	200	800
1984	26400	2200	7000	7000	70	60	100	20	30	1400	400	900

Source : Central Agency of Public Mobilization and Statistics-Fishery Statistics in Egypt-Cairo-Years (1962-1983).

National Institute of Oceanography and Fisheries-Fishery Statistics Year-Book in ARE-Alexandria, Egypt (1962-1984).

* MZ - Lake Manzala EK - Lake Edku MR - Lake Mariut.

Trend lines were calculated as follows , (Leopold et al., 1985):

$$y = a \pm bx \pm cx^2$$

Where: a,b and c are constants;
y is fish catch in kg; and x is number of years.

Maximum or minimum of parabola = b/2c

Marginal increments = [2 cx $\pm$ b x /$\bar{y}$] x 100%.

Where: $\bar{y}$ is the arithmatical mean of variability.

Co-efficient of variation:

V% = [standard deviation /$\bar{y}$] x 100%

And standard deviation (on) is:

$$\sigma_n = \sqrt{[\Sigma y^2 - (\Sigma y/n)^2] / n}$$

RESULTS AND DISCUSSION

Fishing intensity in each of the selected lakes, expressed in number of fishermen, did not undergo any major changes during the period of study. It was characterized by a relatively low variability equal to 6.8% in Manzala, 0.62% in Edku and 11.9% in Mariut (Table 2). Hence, it can be assumed that size of landing in each lake will reflect any changes which might be occurred in the intensity of fish stocks.

Results of time series analysis are presented in Table 3. Catches of **Tilapia** species in Lake Mariut show a decreasing trend, the average annual decrease being 20% in relation to the mean for the period 1961-1968. In the second period 1968-1984 **Tilapia** catches in Lake Mariut were approximated by a parabolic curve, which was characterized by a growing trend but with decreasing increments. It reached a maximum in the 12th year, i.e., in 1979, followed by a continous decrease at high variability (V = 52.3%).

In lake Edku Tilapia catches were approximated by a parabolic curve characterized by decreasing trend. It reached a minimum in the 15th year (1976), followed by a continous increase at high variability (V = 69.4%). (Table 3). In Lake Manzala Tilapia catches were approximated by growing trend with decreasing increment at low variability (V = 18.5%).

The decline of total catch from northern lakes was due mainly to the declining catches of Tilapia which constitute approximately 80% of total catches in northern Egyptian lakes (Shahin, 1985). It can be assumed that this fact has resulted in the progressive of lake eutrophication and the decline of fish landing because of the higher susceptibility of **Tilapia** fishes to the environmental conditions. An intensive artificial stocking of **Tilapia** fingers in northern Egyptian lakes may help in stopping any furthern deterioration.

TABLE 2

Coefficient of variation (V%) of number of fishermen in Egyptian northern lakes for the period 1962 - 1983.

Year	Number of fishermen		
	Manzala	Edku	Mariut
1962	9.2	4.1	4.0
1963	9.4	4.0	3.3
1964	9.1	3.9	3.3
1965	8.3	4.0	3.2
1966	9.2	4.0	3.2
[illegible]	[illegible]	[illegible]	[illegible]
1966	9.2	4.0	3.2
1967	9.0	4.0	3.1
1968	7.3	4.0	2.8
1969	8.8	4.0	2.3
1970	0.2	4.0	2.7
1971	8.1	3.9	2.4
1972	0.9	4.0	3.0
1973	7.6	3.9	3.0
1974	8.9	3.9	3.1
1975	8.4	3.8	3.1
1976	8.3	3.9	3.0
1977	8.3	4.3	3.0
1978	8.4	3.9	3.1
1979	8.3	3.9	3.4
1980	8.4	3.9	3.2
1981	8.4	3.9	3.2
1982	7.3	3.4	3.6
1983	8.1	3.8	3.2
average	8.4	3.9	3.1
V %	6.8	0.62	11.9

Source : Central Agency of Public Mobilization and Statistics. Year-book of fishery statistics, Cairo. Years 1962-1983.

Mugil species in Lakes Manzala and Edku as well, were approximated by decreasing trend with decreasing increments. It reached a minimum in the 10th year (1971) at Lake Manzala, followed by a continuous increase. As to Lake Edku it reached a minimum in the 10th year (1979), followed by a continous increase as well. The coefficient of variation of **Mugil species** was higher in Lake Edku than in Lake Manzala. Its values were 117.5% and 45.3% respectively (Table 3). In Lake Mariut, **Mugil species were** approximated by growing trend with increasing increments to infinity **at** higher variability which was equal to 125.88% (Table 3).

Anguilla anguilla in Lake Manzala was approximated by **a** growing trend with decreasing increments. It reached a maximum in the 4th year (1975), followed by a continuous decrease at low variability (V = 37.6%). **Anguilla**

TABLE 3

Time-Series analysis of commercial fish catches in Egyptian northern lakes for the period 1962-1984

Lake	Tilapia species	Mugil species
Manzala		
trend	$y = 12.5 + 0.6 X - 0.003 X^2$	$y = 3.6 - 0.4 X + 0.02 X^2$
extermum	Max 100	Min. 10
V%	18.5	48.3
M. increment %	+ 3.2 - 0	+14.4 - +20.8
Edku		
trend	$y = 3872 - 471X + 18.2 X^2$	$y = 146.3 - 60.1 X + 1.7X^2$
extermum	Min. 14.6	Min. 17.7
V %	89.4	117.9
M. increment %	- 32.1 - + 20.1	- 39.2 - + 18.9
Mariut		
trend	$y = 3165.1 + 2500 X^2$	$y =$ [illegible] $+ 2 X + 0.6X^2$
extermum	Max. 11.6	+
V %	52.34	125.08
M. increment %	+ 28.7 - - 9.2	+ 2.47 - + 21.94

Catches of Tilapia species in 1961-1968 were approximated with the straight line only, the annual decrease ammounting to 20.02%.

in Lake mariut was approximated by a growing trend as well, but with increasing increment to infinity at high variability (V = 130.38%). In Lake Edku Anguilla was approximated by decreasing trend with decreasing increment. It reached a minimum in the 16th year (1977), followed by increasing increments at high variability (V = 120.2%), (Table 3).

Clarias lazera in Lakes Manzala and Edku was approximated by a parabolic curve shows a decreasing trend with decreasing increments. It reached a minimum in the 5th year (1966) at low variability (V = 35.6%) at Lake Manzala, and will reach a minimum in the 148th year (2109) in Lake EDku with high variability (V = 85.8%) (Table 3). **Clarias lazera** in Lake Mariut was approximated by growing trend with decreasing increments. Maximum of the estimated function is predicted in the 31th year counting from 1961, at high variability (V = 110.24%) (Table 2).

TABLE 3

Continued

Lake	Anguilla anguilla	Clarias lazera
Manzala		
trend	$y = 0.06 + 0.02 X - 0.0007 X^2$	$Y = 0.8 - 0.06 X + 0.002 X^2$
extermum	Max. 14.3	Min. 9
Y X	37.6	35.9
N. increment %	+ 9.3 - - 6.1	-2.0 - + 9.0
Idku		
trend	$y = 261.1 - 32.4 X \quad ? x^2$	$y = 1106.7 - 80.4 X + 0.27 X^2$
extermum	Min. 16.2	Min. 140
Y X	120.2	85.8
N. increment %	- 50.4 - + 22.6	- 414.4 - 0
Mariut		
trend	$y = - 25.8 + 11.5 X + 0.3 X^2$	$y = - 653 + 184 X - 3 X^2$
extermum	+	Max. 30.6
Y X	130.38	110.24
N. increment %	+ 7.8 - + 16	+ 18.9 - + 5.5

Source:
Calculated from table (1).

In view to the above results, it can be concluded that **Mugil, Anguilla** and **Clarias** species are reacting to lake eutrophication in northern Egyptain lakes with growing trends to a maximum or even to infinity in some cases, in spite of decreasing trends to a minimum which followed by a continuous increase again. Such trends are similar with the case in the theoretical model of Vollenweider on eutrophication, which suggests that each of the selected lakes can be considered at present, in the 4th stage of eutrophication which is called highly eutrophy or transitory stage between eutrophy and polytrophy (Vollenweider, 1968).

It was found that **Clarias lazera** in Lake Mariut will reach a maximum by the year 1991, which will be followed by a decreasing trend. In view to the fact that this species is very resistant to any unfavourable environmental conditions, however its predicted decreasing trend and previsted maximum, suggest that the condition in Lake Mariut is deteriorated very rapidly and will pass into the 5th stage of eutrophication by 1991, according to Vollenweider model 5 (Saad, 1980 and 1978).

In order to conserve Egyptian northern lakes and to stop any further deterioration, it is recommended to control pollution in these lakes and to supply it with artificial fish stocking.

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