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ANALYSIS OF FISHERY EXPLOITATION IN LAKE BUROLLUS

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ABSTRACT

Time series and simple correlation analysis have been used to study time trend and relation between catch and corresponding effort (fishermen & boats) as well as gross fish income in Lake Burollus during the period of 1962-1984.

Fish catch in the Lake is estimated to increase over time. Annual fish catch has been fluctuated during the period of study, Coefficient of variation was equal to about 10 %. Total number of boats has raised by about 14 %,however, number of fishermen has dropped by about 7 %. Gross fish income has substantialy raised during the period of study by about 1396 %.

No significant correlation has been observed between fish catch from the Lake and total number of fishermen. On the other hand very highly significant correlation was found between fish catch and productivity of one fisherman.

It is suggested to consider lake stocking by cleaning its connection with the sea. The enumerators and other field staffs should be raised through a series of training programmes, and the requlations for fishing on the Lake need to be re-evaluated.

INTRODUCTION

The Egyptian lakes have been the main source of fish in Egypt for a long time. Their production historically constitutes some 65 percent of the total national fish production in spite of the fact that the fishing area does not exceed 15 percent of the total water surface in Egypt (El-Zarka, 1985).

The Egyptian lakes are usually grouped into 3 categories :

(1) Brackish lakes such as Lakes Manzalah, Burollus, Edku and Mariout.

(2) Saline lakes such as Quarun, the Bitter Lakes, Bardaweel and Port Fouad Lakes.

(3) Fresh water lakes such as High Dam lake.

Lake Burollus is the second largest Delta lake in Egypt (Menzalah, Burollus, Edku and Mariout), as to productivity of these lakes it was found that in 1984 Lake Burollus yielded only about 73 Kg/feddan compared to 110 Kg/feddan in Lake Menzalah, 156 Kg/feddan in Lake Edku and 502 Kg/feddan in Lake Mariout, (Fattouh, 1989).

Aim of Study

1. To review time trend of fish catch and the corresponding effort (fishermen & boats) as well as gross fish income from the lake during the period of investigation.

2. To relate fish catch attained from the Lake with each of the number of fishermen, catch per fisherman and gross fish income during the period of study.

MATERIAL AND METHODS

The materials consisted of the official data obtainedfrom the Central Agency for Public Mobilization and Statistics, computed from the data on the annual fishery production in Egypt. Materials were also collected from the General Authority for Fishery Resources Development.

These data were used to analyze the fish catch, gross fish income, and elements of fishery exploitation which include number of fishing boats and number of fishermen.

The analyses embrace the period 1962-1984, Latest published data about fish catch from Lake Burollus was of 1985, but these data of 1985 has been excluded for suddan increase in effort data.

Time-series approach was used to draw the conclusion as to the fishery management and its economics. Time series and simple correlation approaches have been used to achieve the aim of study. Statistical linear and non-linear equations have been analyzed and compared with regard to goodness of fittness. Statistical analysis adopted in the study is explained in (Anderson, 1971).

To calculate these trends and all relevant statistical parameters, a computer programme "BAMBOLAN" was used. The calculation was made on Amstrad CPC 6128.

RESULTS

1. Evolution of catch, effort and fishermen income: index number was calculated during the period of study (assuming 1962 as the basic year) to examine evolution of catch effort and fish income in the Lake,

It can be seen from Table 1 that ;

- Index number of fish catch fluctuated during 1962-75 between a maximum of 123 in 1969 and a minimum of 65 in 1974. Index numbers progressively increased later and reached 131 in the last year.

- Index number of number of fishermen decreased from 100 in the base year to 93 in the last year.

On the other hand index number of number of boats raised reaching a maximum of 117, then dropped to 114 in the last year.

Table 1.

Evolution of Catch Efforts and Gross fish income in Lake Burollus for the period 1962 - 1984*

Years	Catch		Fishermen		boats			
	index		index		index			
	ton	number	number	number	number	number	thousand pounds	index number
1962	7549	100	9009	100	2438	100	1129	100
1963	7796	103	9018	100	2515	103	1364	121
1964	7242	96	8994	99	2512	103	1592	141
1965	6796	90	9240	103	2537	104	1426	126
1966	9149	12	7095	79	2331	96	1989	176
1967	6002	80	7790	86	2995	106	1379	122
1968	8598	114	7855	87	2615	107	1903	169
1969	9257	123	8929	99	2705	111	2094	185
1970	6916	92	8625	96	2680	110	2285	202
1971	8236	109	8111	90	2691	110	2956	265
1972	7497	99	8115	90	2691	110	2687	238
1973	4556	60	8609	96	2855	117	1727	153
1974	4875	65	8611	96	2853	117	2157	191
1975	5469	72	8436	94	2812	115	2497	221
1976	6573	87	8433	94	2811	115	3073	272
1977	6587	87	8532	95	2844	117	3400	301
1978	6514	86	8544	95	2848	117	4118	365
1979	7018	93	8505	94	2835	116	4899	434
1980	7137	95	8496	94	2832	116	6181	547
1981	6742	89	8385	93	2795	115	6892	610
1982	7273	96	7530	84	2790	114	8962	794
1983	8205	109	8370	93	2790	114	13128	1162
1984	9854	131	8361	93	2787	114	15766	1396
Total	165814		193593		62162		93604	
Average	7209		8417		2703		4070	

* Data of 1985 was excluded for sudden sharp increase in effort data (fish catch 11947 to and 23382 fishermen).

According to : 1. The Central Agency for Public Mobilization and Statistics.
2. The General Authority for Fishery Resources Development.

- Index number of gross fish income had been substantially raised from 100 in 1962 to 1396 in the last year.

2. Time-series Analysis

2.1. Trend of fish catch

Fish catch in Lake Burollus was expressed during the period of study by a polynomial of third degree in the following equation:

$$Y = 6693.829 + 593.986\ X - 83.411\ x^2 + 2.738\ X^3 \quad (1)$$

It can be seen from Table 2 and as illustrated by Fig. 1.1 that the curve is highly significant ($r = 0.6685$, $p = 0.001$). Catch maximum took place in the 4^{th} year (1965) and a catch minimum took place in the 16^{th} year (1977). The curve has a growing trend later on.

2.2. Trend of number of fishermen

Number of fishermen in Lake Burollus was expressed during the period of study by a polynomial curve of the fourth degree of the following equation:

$$Y = 9984.525 - 729.259\ X + 98.901\ X^2 - 5.133\ X^3 + 8.985\ X^4 \quad (2)$$

It can be seen from Table 2 and as illustrated in Fig. 1.2 that the cruve is significant ($r = 0.5214$, $p = 0.02$). Minimum number of fishermen took place in the 5^{th} year (1966) and maximum took place in the 17^{th} year (1978). The curve has a moderate decreasing trend latter on.

2.3. Trend of number of boats

Number of boats in Lake Burollus was expressed during the period of study by a polynomial curve of the fourth degree of the following equation :

$$Y = 2522.226 - 54.703\ X + 14.785\ X^2 - 0.893\ X^3 + 1.631\ X^4 \quad (3)$$

It can be seen from Table 2 and as illustrated in Fig. 1.3 that the curve is very highly significant ($r = 0.9356$, $p = 0.001$). The curve trend is characterized by a minimum point in the 5^{th} year (1966) and by a maximum point in the 17^{th} year (1978).

2.4. Trend of gross fish income

Gross fish income was expressed during the period of study by a polynomial curve of the fourth degree, as well as, of the following equation:

$$Y = 1476.813 - 280.569\ X + 108.083\ X^2 - 10.350\ X^3 + 0.320X^4 \quad (4)$$

Table 2.

Standard deviation (6_n) coefficient of variation (V %), coefficient of determination (r^2 %), and coefficient of correlation (r) for the trends of fish catch, number of fishermen and fish income in Lake Burollus from 1962 to 1984.

Lake Burollus	Y (Total)	Y (Average)	On	V %	r^2 %	r*
1. Fish catch (tons)	165814	7209	1290	18	45	0.67
2. Fishermen (numbers)	193593	8417	493	6	27	0.52
3. Boats (numbers)	62162	2703	148	5	88	0.94
4. Fish income (thousand pounds)	93604	4070	3756	92	99	0.99

* P 0.001 for fish catch, boats and fish income.
P 0.02 for fishermen.

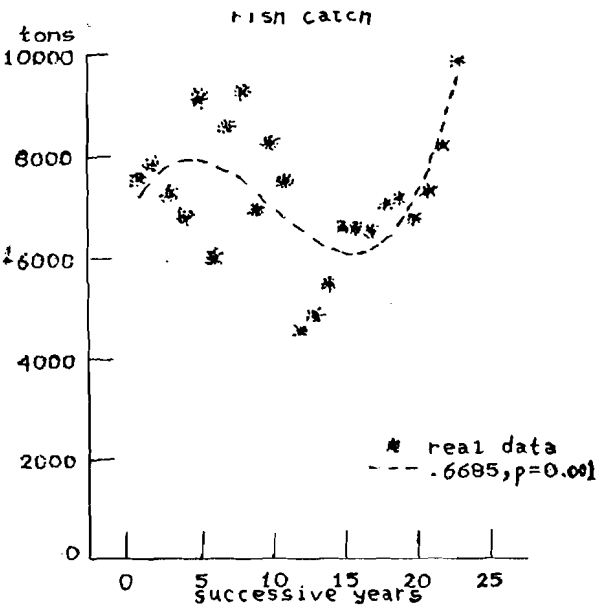

Fig. 1. 1.

Fish catch (Lake Burollos).

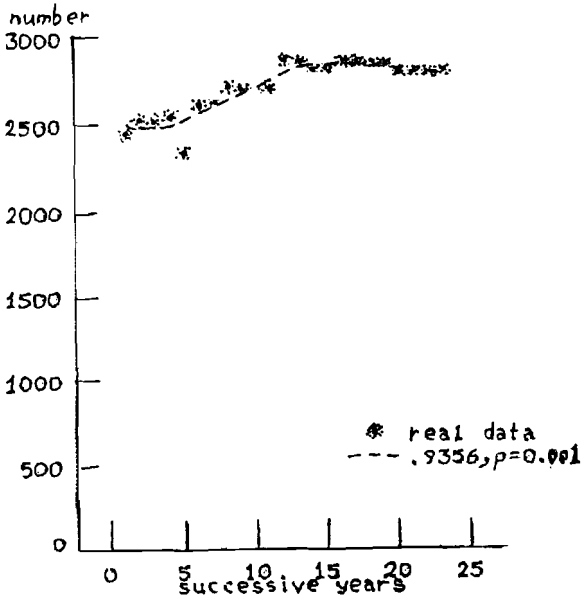

Fig. 1. 3.

Number of boats (Lake Burollos).

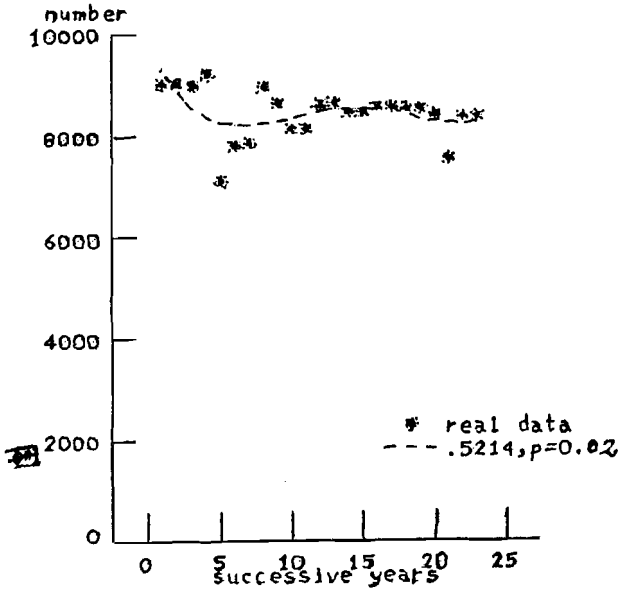

Fig. 1. 2.

Number of fishermen (Lake Burollos).

It can be seen from Table 2 and as illustrated in Fig, 1.4 that the curve is very highly significant ($r = 0.9950$, $p = 0.001$). The curve is characterized by a sharp ascending trend since the 15th year (1976).

3. Simple-correlation analysis

3.1. Fish catch/number of fishermen

Simple correlation between fish catch ($\dot{y}$) and number of fishermen (X) engaged in Lake Burollus during the period of study was in-significant.

None of any mathematical equation used in the study gives good fittness.

3.2. Fish catch/catch per fisherman

The correlation between fish catch and catch per fisherman in the Lake during the period of investigation was expressed by hiperbola 3 of the equation : (Table 3 and Fig. 2.1)

$$Y = \frac{1}{(-9.61 + \frac{9145.335}{X})}$$

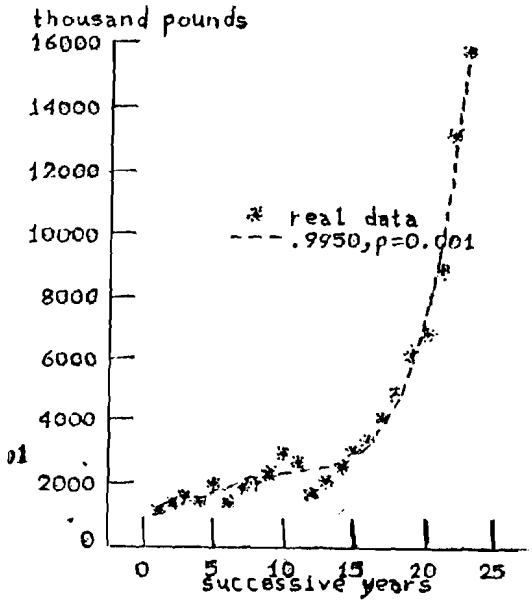

Fig. 1. 4.

Gross fish income (Lake Burollos).

Table 3.

Relationship between fish catch and catch per fisherman in Lake Burollus from 1962 to 1984.

Average fish catch	7209	(ton)
Average catch per fisherman	826	(Kg)
o n (standard deviation)	0.2540	
V % (Coefficient of variation)	30.75	%
r % (Corfficient of determination)	88.96	%
r (Coefficient of correlation)*	0.94	

* P 0.001

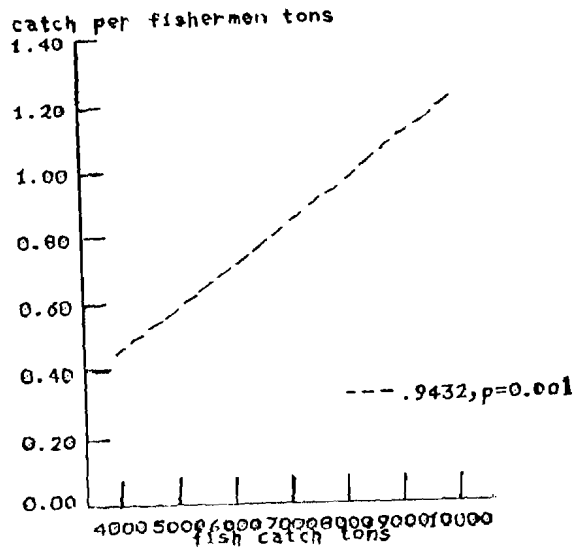

Fig. 2. 1.

Correlation between fish catch and catch / fisherman (Lake Burollos).

the curve is very highly significant (r = 0.943, p = 0.001).

3.3. Fish catch/gross fish income

Simple correlation between fish catch (Y) and gross fish income (X) in Lake Burollus during the period of study was expressed by polynomial curve of the fourth degree of the equation :

$$Y = 739240.806 - 451.833\ X_4 + 0.101\ X^2 - 9.887\ X^3 + 3.544$$

It can be seen from Table 1 and Fig. 2.2 that the correlation is significant (r = 0.6294, p = 0.01).

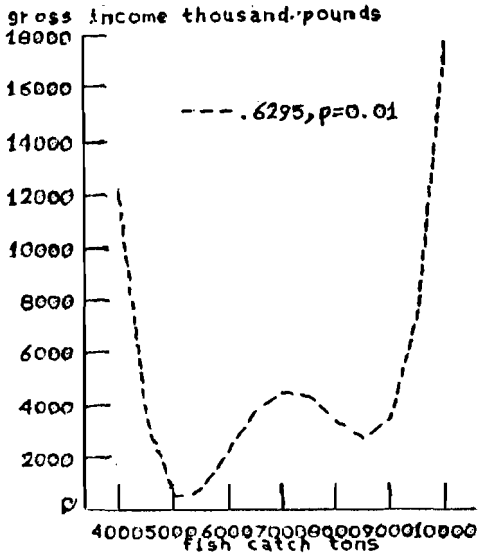

Fig. 2. 2.

Correlation between fish catch and gross income (Lake Burollos).

DISCUSSION

Annual fish catch from Lake Burollus was found to be fluctuating during the period of study, calculated coefficient of variations is equal to 14.6 percent.

Fish catch increased during the period of study by about 30 percent. It is estimated to increase if proper management policy is formulated and undertaken.

Gross fish income was progressively raised during the period of study by 14 folds It is important to study different factors affecting market prices and cost structure in the Egyptian fishing sector, as well as in different marketing levels.

No significant correlation was observed between fish catch and number of fishermen; on the other hand, very highly significant correlation was found between fish catch and productivity of fisherman. El-Karachily and El-Karyony (1986) found that level of fish catch in Egyptian Delta lakes was essentially determined by the fish density in these lakes and not by the fishing effort.

High productivity of the northern Delta lakes in Egypt can be attributed to several reasons; brackish water, shallow depth and rich supply of nutrients reaching the lakes through land drainage water (Fattouth, 1989). It is suggested to study possibilities of stocking in the Lake with different fish varities, instead of collecting small fishes from the Lake for fish farms.

Other steps suggested to conserve the Lake fisheries include cleaning Boghas El-Burollus, decreasing discharge into the Lake, and to introduce sampling techniques to obtain percise catch estimates about the Lake. The regulations concerning fishing in the Lake need to be re-evaluated and the enumerators and other field staffs should be qualified through a series of training programmes.

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