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STUDIES ON SOME ECOLOGICAL FACTORS AFFECTING THE FISH PRODUCTION OF LAKE QARUN, EGYPT.

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ABSTRACT

This study reveals the main factors accounted for the decline of fisheries in Lake Qarun.

Firstly, a considerable part of the coastal area i.e. the spawning grounds for the majority of fish species, has been dried due to lowering of water level. Many nests and egg masses are destroyed.

Secondly, during the period 1970-1977, some predatory marine fish species were introduced into the Lake. It seems that most of the transplanted fry are eaten by them.

Thirdly, the polluted drainage water contaminated with pesticides, heavy metals and etc., has greatly affected the Lake fisheries.

Finally, the increase of water salinity may also affect the growth rate of fishes in the Lake.

Some suggestions are recommended to solve the problems confronting the fish production from Lake Qarun.

INTRODUCTION

Lake Qarun is a closed depression located southwest of Cairo (Fig. 1). The Lake is a large saline system (about 21,400 hectars). It receives drainage water from the surrounding agricultural lands of Faiyum Province. The drainage water is loaded with salts, nutrients, wastes and pesticides. In ancient times this Lake was a freshwater reservoir and contained freshwater fish species and now it is a saline lake and the water salinity increased progressively from 14 ‰. to 38 ‰. (Bishai and Kirollus, 1980). The only freshwater fish species which remained from the original fauna is Tilapia zillii as it can tolerate high salinities.

Transplantation of marine fish species was found necessary to restore the fisheries of the Lake. Transplantation of mullet fry (i.e. Mugil cephalus, M. chelo, Liza capito, L. saliens and L. aurata) started in 1928. Solea vulgaris was introduced into the Lake in 1938

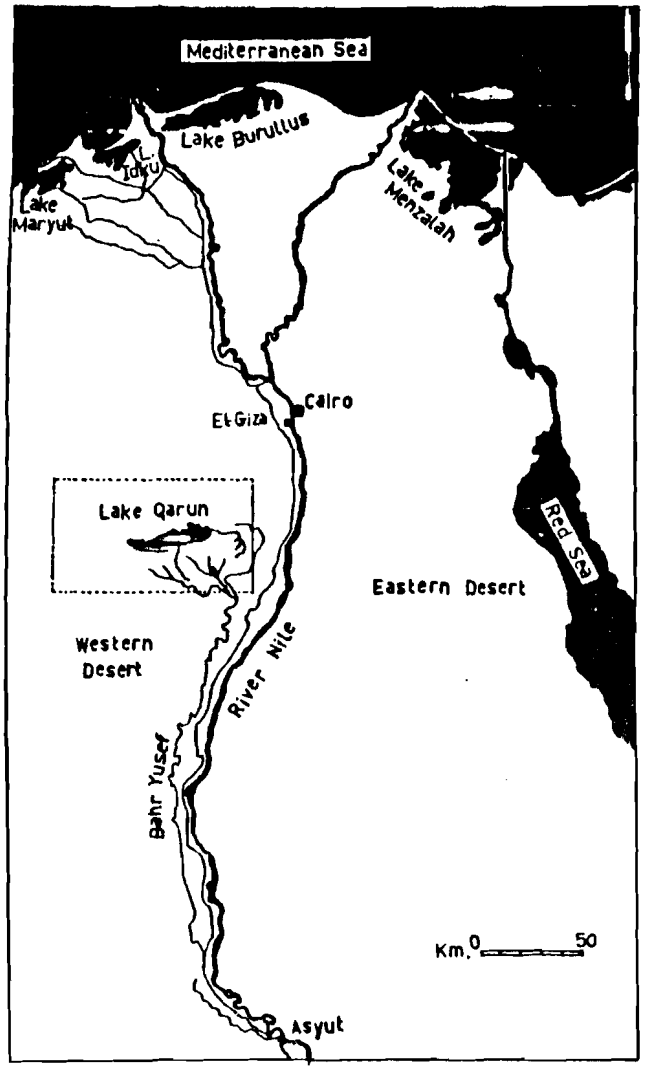

Fig. 1

Map of Northern part of Egypt to show position of Lake Qarun.

with later transplants during 1943, 1945 and 1948. During transplantation of the forementioned fish, other marine species as **Anguilla vulgaris** and **Atherina mochon** were carried accidentally. The fish species which bred successfully in the Lake were **Solea vulgaris, Liza saliens** and **Atherina mochon.** The other species have to be transplanted annually. In 1970 the sea bream **Chrysophrys auratus,** the sea bass **Dicentrarchus labrax** and **D. punctatus;** and in 1977 penaeid shrimp larvae and postlarvae were introduced into the Lake and all were successfully acclimatized.

Since the transplantation of the forementioned marine species, the fishery of the Lake has been flourished and the production of the Lake has been increased year after year. But in the middle of the 1970's the fish yield of the Lake has begun to decline sharply and up till now the Lake is still at an unequlibrium phase, and the annual catch fluctuates from year to year at a very low level (**Bishai** and Kirollus, 1987).

The aim of the present study is to investigate the possible physical, chemical and biological factors which may account for the deterioration of fisheries in Lake Qarun, especially that its potential productivity which is of the eutrophic type (Khalil, 1978) and it is considered one of the major sources of fishes in Fayoum Governorate, Egypt.

METHODOLOGY

The present study is based on fishery data collected from 1969 till 1989 from the Institute of Oceanography and Fishery records. Also, data of water inputs and lake water levels were computed from the Hydrobiological Station records at Fayoum Province. The dried coastal areas which had been formed due to lowering the water levels were computed during four periods from 1969 to 1989 (Table 1).

RESULTS AND DISCUSSION

The average monthly data for the water surface level in Lake Qarun (Table 1) shows a considerable fluctuation, with the maximum level (-43.25 m) recorded in March and the minimum one (-44.03 m) recorded at the end of September. Generally, since the end of 1960's a continuous increase of the Lake level is noticed (Fig. 2). In 1973, the water level began to decline considerably due to decrease of the drainage water inputs to the Lake. The reduction of the water inputs is primarily due to the creation of the new Lake Wadi in 1973 when the wastewater of Elwadi drain (Fig. 1) has been transferred to Wadi Elrayan depression, southwest of Lake Qarun. A continuous decrease in the annual water input to Lake Qarun from about 350 $x 10^6$ m^3 in 1972 to 310 $x 10^6$ m^3 in 1973 and then 240 $x 10^6$ m^3 in 1975. It is noticed that, this decrease in the annual water input was followed by a decline in the annual fish catch (Fig. 2).

Table 1.

The average monthly data for the water surface level in Lake Qarun during twenty years from 1969 to 1989.

Month	Water level (m)	Month	Water level (m)
January	- 43.63	July	- 43.89
February	- 43.48	August	- 44.00
March	- 43.25	September	- 44.03
April	- 43.51	October	- 44.01
May	- 43.64	November	- 43.80
June	- 43.67	December	- 43.72

TABLE 2.

The annual fish production and its relationship to water level in Lake Qarun during four periods (from 1969 to 1989).

Period (Years)	Maximum Water level (m)	Minimum Water level (m)	Area of the lake (km^2)		Coastal dried area (km^2)	No. of Transplanted fry	Annual fish production (Tons)
			At the maximum level	At the minimum level			
1969-73	- 43.85	- 44.05	235.56	231.52	4.045	1,553,800	1911.6
1974-78	- 43.56	- 43.95	240.02	232.91	7.105	9,775,400	1462.8
1979-83	- 43.50	- 44.00	241.68	232.43	9.250	20,192,000	1440.4
1984-89	- 43.15	- 44.00	248.33	232.43	15.900	48,614,600	1021.8

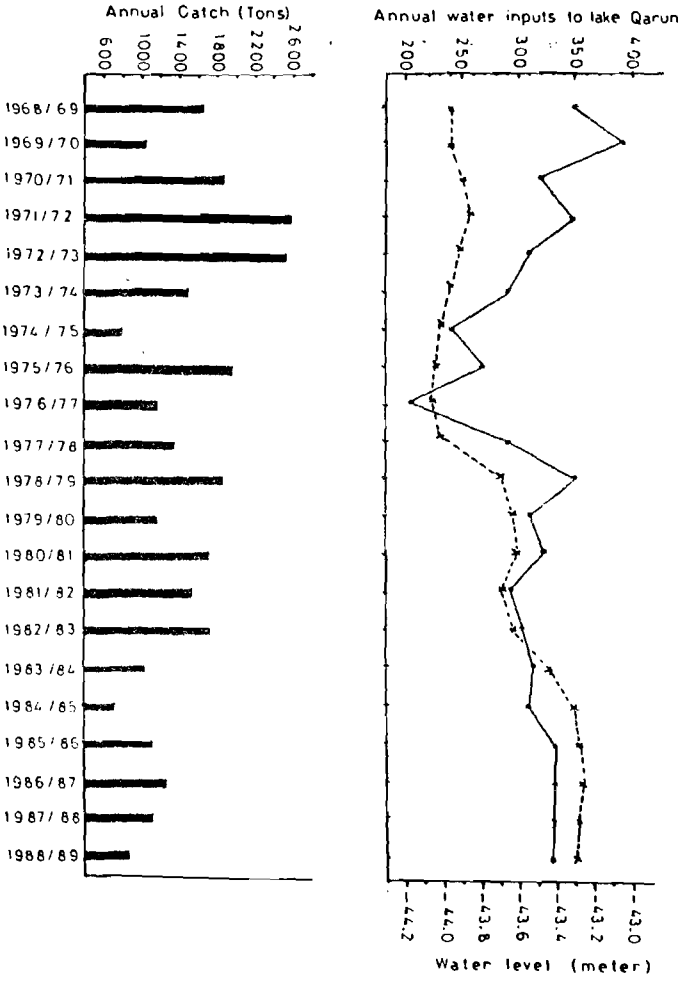

Fig. 2

Annual fish production and its relation to flow pattern and water level in Lake Qarun during 1968/1969 to 1988/1989.

So, in 1972/73 season the average annual catch was about 2500 tons, while in 1973/74 it decreased to 1500 tons and then to only 800 tons in 1974/75 season. This positive relationship between the water input and consequently the Lake level and fish production can be explained when we know that the Lake area varies, to some extent, with the variation of the water level. This is primarily due to shallowness of the coastal regions of the Lake. Table 1, shows the average water levels of Lake Qarun, their relationships to lake area and their effects on the annual fish production during four periods (from 1969 to 1989). Many males and females of sole and tilapia species were found dead on the coastal dried area of the Lake at the end of August and September. Egg masses and fry of the forementioned fish species together with transplanted mullet fry were also found dead. These coastal areas, when covered with water are used as spawning grounds for the mothers of both tilapia and sole species and also used as feeding grounds for the transplanted mullet fry as well as fry of other fish species. In May, the water level decreases and the water is cut off to the coastal area by small bridges in between them. Then, the water evaporates due to high temperature and consequently, the oxygen concentration decreases and the salinity increases. It happens that all the living organisms inside the coastal area die. Thus, the level of Lake water being lowered seasonally and year after year has led to the increase of the coastal dried area, the main spawning grounds for most fish species. Fish nests and their egg masses are destroyed and so the fish production declines.

During the period 1969-73, the average dried coastal area was only 4 Km^2, which has been increased four times to about 15.9 Km^2 during 1984-89 period. Table 2 shows that the average annual fish production was low (1021.8 tons), when the mean annual transplanted fry was very high (49 millions) during the period 1984/89. A reverse picture was observed during the period 1969/73 when the average annual yield was high (1911.6 tons) and at the same time the mean annual transplanted fry was less than two millions. Thus, the increase in the number of transplanted fry had no effect on the annual fish yield.

There is no doubt that since creation of Lake Wadi Elrayan, the decrease in the water input to Lake Qarun is one of the main reasons which led to the decline in fish production. At the same time, there are some other possible factors which may account for the decline of fisheries in the Lake. Among these, the introduction of predatory marine fish species (i.e. **Chrysophrys auratus** and **Dicentrarchus** spp.) during the period from 1970 till 1977. These species feed mainly on crustaceans, molluscs and fish fry etc. (Abdel-Malek and Eisawy, 1974) and it seems that most of the transplanted fry are eaten by these fishes. Also, these fish species compete with **Solea vulgaris** in the Lake which feed on polychaetes, crustaceans, molluscs and insect larvae (Naguib, 1961 and Abdel-Malek, 1980). After the introduction

of these predatory species in 1972 and 1973, a sharp decline of sole production was noticed (Bishai and Kirollus, 1987).

The fisheries of the Lake may be also affected by the continuous and increased pollution by the drainage water contaminated with sewage of El-Fayoum villages and pesticides of agricultural lands, mainly Bayluscide, Lannate and Dimethoate. It was found that the Lake water is contaminated with these pollutants which affect seriously most of the organisms of the Lake (Aboul-Ela and Khalil, 1987 a & b). Furthermore, the concentrations of heavy metals in the different trophic levels in the muscles of fishes in the Lake ranged from 0.11-0.25 mg/gm copper, 0.10-0.31 mg/gm iron, 0.59-0.72 mg/gm silicon and 0.19-2.30 mg/gm manganese (Anon., 1984).

Besides, the progressive increase in the salinity of the Lake is considered as one of the important factors that affect the fisheries of the Lake. The salinity increased from 11.6 %. in 1920 to 22.4 %. in 1932 to 25.5 %. in 1954 (Naguib, 1961) to 31.5 % in 1970 (Meshal, 1973) to 34.5 %. at the present time. This increase in salinity is due to the continuous addition of dissolved salts that have been washed into the Lake from the surrounding agricultural lands. It is noteworthly to mention that Tilapia zillii is almost the only remnant of the original freshwater fishes of the Lake and it is able to tolerate, till now, the progressive increase in the salinity of the Lake. But, recently, it appears that many parts of the Lake have become unsuitable for rearing and growth of tilapia fry and young. Further increase in salinity is expected in the future, and it is feared that one day the Lake may become a dead water mass.

All these physical, chemical and biological factors, apart from each other or combined together, may account for the decline of fisheries in Lake Qarun. Some suggestions are recommended to solve the problems confronting fish production and to improve the fisheries of the lake.

- Small channels should be dug in between the coastal areas and the open Lake when the water level is low to enable the fish and fry to get free into the Lake before they are blockaded inside the dried coastal regions. Digging these channels could be done during the closed season (April and May) when the water level is low.

- The number of translated fry should be increased, but with exclusion of predatory fish species. The fry should be reared in small nursery ponds at the coastal regions till they become finger lings before releasing them inside the Lake.

- Sewage and drainage wastewater should be treated before discharging into the Lake. The amount of pesticides used in the surrounding agricultural lands should be decreased to the minimum, and those which have fatal effect should not be used.

- Salts should be extracted from the Lake either through increasing the number of saltmines or by building plants which could use salts in chemical industries.

REFERENCES

Anon., 1984. **Investigation of level and effects of pollutants in saline lakes and littoral environments.** Lake Qarun Studies Report No. IV, Inland water, Inst. Ocean. FISH. EGYPT, 200 pp.

Abdel-Malek, S.A. and A.M. Eisawy, 1974. Food and feeding habits of acclimatized **Solea vulgaris** (Linn) in Lake Qarun. **Bull. Inst. Ocean. & Fish.,**

Abdel-Malek, S.A., 1980. Food and feeding relationship between fishes of Lake Qarun, **Egypt. Journal of Ichthyology,** 20, 2 (12): 272-276.

Aboul-Ela, I.A. and M.T. Khalil, 1987a. The chronic toxicity of three pollutants upon the freshwater snail **Helisoma trivalvis. Proc. Zool. Soc. A.R. Egypt.,** 13: 17-29.

Aboul-Ela, I.A. and M.T. Khalil., 1987b. The acute toxicity of three pesticides on fresh water organisms of different trophic levels in Lake Wadi Elrayan, El-Fayoum, Egypt. **Proc. Zooi. Soc. A.R. Egypt,** 13: 31-36.

Bishai, H.M. and S.Y. Kirollus, 1980. The water budget of Lake Qarun and its physico-chemical characteristics. **Water Supply and Management,** 4: 93-97.

Bishai, H.M. and S.Y. Kirollus, 1987. The sole - Solea vulgaris **Quensel** - Fishery of Lake Qarun, Egypt. Georgikon Days Conf. XXIX, Hungary, 281-289.

Khalil, M.T., 1978. Ecological studies upon zooplankton of Lake Qarun, Egypt. M.Sc. Thesis. Ain Shams UNIVERSITY, 139 PP.

Meshal, A.H., 1973. Water and salt budget of Lake Qarun, Fayoum, Egypt. Ph.D. Thesis, Alexandria University, 109 pp.

Naguib, M., 1961. Studies on the ecology of Lake Qarun (Fayoum-Egypt). Part 2, **Kiel. Meeres forach,** 17 (1): 94-131.