The Fisheries of Lake Qarun, Egypt

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LAKE QARUN occupies the lowest part of the Fayoum Depression located in the Western Desert, 83 km to the southwest of Cairo.

Historically, Lake Qarun is the remnant of a natural freshwater reservoir that existed in prehistoric times and which filled the entire Fayoum Depression to a level of about 25 m above the sea level. The ancient Egyptians of the Twelfth Dynasty built a dam on the channel of connection with the River Nile to control the flow of water. At that time, this large body of water was called "Lake Moeris." During the flood season, the lake received inflow from the Nile and was used as a supply of water to the Nile Valley during the drought period. Lake Moeris became disconnected from the Nile and mainly due to evaporation, the water surface of the lake shrank, thus leaving large areas of land suitable for cultivation. In time, the cultivated lands increased in area and the drainage of water from these lands was directed to Lake Moeris. The present saline Lake Qarun is the remnant of the freshwater Lake Moeris (Figure 1).

The existing lake is an inland, closed basin of about 40 km length, 5.7 km mean breadth and 4.2 m mean depth. The maximum depth is 8 m in a relatively limited area. Total area of the lake if about 20,235 ha.

The lake is surrounded by cultivated lands on its southern and southeastern sides that slope steeply towards the lake, thus making the lake a sink for their drainage water. The area and volume of water in the lake is controlled by the inflow of drainage water from the agricultural lands and by evaporation which represents the only outflow.

The lake has been undergoing a progressive increase in salinity as a result of the high rate of evaporation and the accumulation of salts that are washed out of the neighboring agricultural lands. Calculations show that the rates of inflow and of evaporation are almost equal, thus adding annually to the salt content of the drainage water. The mean salinity of the water increased from 11.06‰ in 1906 to 31.73‰ in 1970, and to 36.2‰ in 1978. The present average rate of increase in salinity is 0.5‰/ann. Since the capacity of the lake is limited, increasing the volume of the drainage water, so as to reduce the salt content of the lake, would seriously damage the neighboring agricultural lands through flooding. Feasibility studies are being carried out to develop the most effective and economical ways that will help to reduce the rate of increase in salinity.

As the salinity of the water increased through the years, Lake Qarun experienced significant ecological effects on its fauna and flora. The original freshwater fish fauna of the lake was drastically affected. Among them were *Clarias* sp., *Lates niloticus, Labeo nilotica, Barbus bynni* and *Tilapia nilotica.* The only species from the original freshwater fauna that still exists in the lake is *Tilapia zillii,* which was able somehow to resist the increase in salinity. *Tilapia nilotica* is rarely found in commercial catches; it is collected mainly from the regions near the drains.

The freshwater planktonic and benthic species that used to inhabit the lake disappeared when the salinity of the water reached 30‰. Some Rotatoria were able to withstand the high salinity. However, the present composition of plankters indicate the

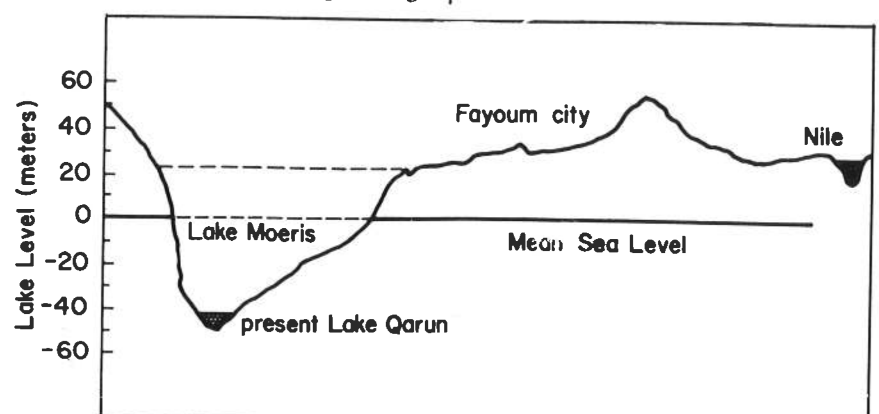

Fig. 1. The lake level at different times.

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presence of marine species that were introduced in the lake with the fishes that were transplanted from the Mediterranean Sea.

To compensate for the loss of the freshwater fishes, the Alexandria Institute of Hydrobiology* started in 1928 a program to transplant mullet fry from the Mediterranean into the lake. Fry of mullets, mainly *Mugil cephalus, Mugil capito* and *Mugil saliens* were introduced. In 1955 the mullet production contributed 21% of the commercial catch. Of the family Mugilidae, only *Mugil saliens* was able to spawn in the lake. *M. cephalus* and *M. capito* do not breed in captivity and, therefore, stocking the lake annually with these two species is continued.

It was found that the silverside, *Atherina mochon,* and the eel, *Anguilla* sp., were accidentally transplanted into the lake, along with the mullet fry.

The sole, *Solea vulgaris,* was first introduced in the lake in 1935. Additional plantings were made in 1943, 1945 and 1948. The young fish were collected from the coastal areas of the Mediterranean, eastern Alexandria and from Lake Idku in the region of the lake-sea connection. The acclimatization of sole was successful. It is now considered one of the main fishery resources of the lake. Additional plantings were made in 1977, with young fishes collected from the Lake Menzaleh-Mediterranean Sea connection, with the objective of renewing the stock of soles in Lake Qarun and improving the growth rate of the fish. Certain management measures are now being considered to protect the sole fishery of the lake against overfishing.

In 1970 the gilt-head bream, *Chrysophrys auratus,* was first introduced in the lake, but in relatively small numbers. The stocking rate was

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*Now called the Institute of Oceanography and Fisheries.

TROPICAL MAN-MADE LAKES, AFRICAN FISH AND CHEAP PROTEIN

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Reservoirs and Fisheries

THE FIRST man-made lakes (reservoirs) were built 6,000 yr ago in the Indo-Chinese region to irrigate rice fields. Reservoir construction then spread to many parts of the world, for water storage and crop irrigation. In modern times, reservoir construction with multipurpose objectives has been undertaken on a massive scale, especially since the advent of hydroelectric power generation. In many areas, however, the least utilized resource of reservoirs is the fishery. Often, no provision is made for a fishery. The most outstanding instance of such an unexpected fishery is that of Ubolratana reservoir in Thailand. This reservoir was built to produce electricity worth about $1 million a year, and it did. However, the fishery which developed unexpectedly was a bonus; it now is worth $1.2 million a year. Other instances of this type are not uncommon in the tropics.

Another success story in reservoir fisheries involves introduced African fish. This is also a case where a substantial amount of cheap protein is being produced from a relatively small reservoir. The reservoir is Parakrama Samudra. I shall use it because it is well documented. It also illustrates the importance of having the "right" type of fish in a reservoir, so as to get high yields. The reservoir is situated in the dry zone of Sri Lanka; it has a surface area when full of 2,246 ha. Records have been kept of the fishery in this reservoir since 1949. Up to 1953, the total fish catch varied from about 2-7 t/yr. The reservoir is 1,600 yr old.

In 1952 an African fish, a cichlid *(Tilapia mossambica),*[2] was introduced into Parakrama Samudra. By 1954, this fish started appearing in the fish catches. The fish yield rose spectacularly to over 500 t in 1966. There was another spectacular increase in 1974-1975 and, in the next few years, the yield hovered at around 1,300 t/yr. The yield in 1978 was about 900 t.

Global Considerations

To obtain a perspective of fish yields from tropical reservoirs, we must look at comparative fish yields from lakes and reservoirs throughout the world. If we compare the fish yield in Parakrama Samudra with yields from temperate reservoirs and lakes, the fish yield is an order of magnitude higher in Parakrama Samudra (Table 1). Fish yields in tropical reservoirs on three continents exhibit a wide range in fish yields (Table 1). This range extends from 15 t in a tropical Indian reservoir of the same size to about 900 t in Parakrama Samudra. High

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[1]The ideas embodied in this article were presented in more detail, and with extensive scientific documentation, entitled "Tropical reservoir fisheries: a preliminary synthesis," at the Fifth International Society of Tropical Ecology (ISTE) meeting in Kuala Lumpur, April 1979. This paper will be published in the proceedings of the meeting. The present adapted version is published with the permission of ISTE.

[2]*Tilapia mossambica* is also known as *Sarotherodon mossambicus.*

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significantly increased in 1976 and 1977. So far, *C. auratus* has shown the highest growth rate in weight when compared with the other fish species of Lake Qarun.

The sea bass, *Dicentrarchus labrax*, and the larvae of some penaeid shrimp species were also accidentally put in the lake, along with the breams.

In December 1977 the lake was stocked with 3 million *Peneaus kerathurus* larvae. A fairly good harvest of shrimps was produced. The biological and catch data are being evaluated to find out whether *P. kerathurus* was able to reproduce in the lake. If not, studies are planned to reproduce it artificially at the site.

The earliest record of fish production in Lake Qarun was in 1920. It was 4,000 t. In subsequent years, however, the annual catch varied between 2,000 and 1,000 tons and the apparent drop in the yield was attributed to the disappearance of the freshwater fishes from the lake. In 1936, *Tilapia zillii* constituted about 80 to 95% of the total catch. The production during the past 3 yr averaged about 1,516 t/yr. *T. zillii* contributed about 47% of the catch, while mullet species, soles, silversides and other fishes contributed 15.5%, 16%, 20% and 2.5%, respectively.

Investigations have been carried out to determine how the food resources (plankton and benthos) are used by the species inhabiting the lake. The studies included qualitative and quantitative determinations of the available food resources, the consumption of food by the different fish species and their representative age groups, as well as the nature of food relations between the different species. The results revealed that certain species may have to be stocked in the lake, to consume the available and unutilized natural food. ●