Fish production, fishing gears, economic and social impacts of the purification and development project on Lake Manzalah fisheries, Egypt

Sahar F. Mehanna*[1], Noura H. S. Hassan[2], Zeinab M. Koleib[1] and El-Azab E. El-Bokhty[1]

[1]National Institute of Oceanography and Fisheries NIOF, Fisheries Division, Egypt
[2]National Institute of Oceanography and Fisheries NIOF, Marine Environment Division, Egypt
*Corresponding Author: sahar_mehanna@yahoo.com

ABSTRACT

Egyptian fisheries including aquaculture, play a vital role in the national economy through its contribution to employment and income generation, foreign exchange earnings, and providing food and nutritional security to the people. All studies dealing with stock assessment and fisheries management in Egypt confirmed the over-exploitation situation for almost all commercial stocks which led to a serious decline in fish production from marine and inland fisheries resources. Egyptian lakes especially Delta lakes have been supporting rich and diversified fisheries and thus are critically important to the country for their food security and livelihood. Lake Manzalah, the largest Delta lake and the second in fish production after Burrulus Lake, is an important source of fish production in Egypt. In the last 50 years, the lake faced severe difficulties that retarded its environmental and fisheries development. The most serious one is the reduction of its area, pollution, overfishing, illegal and destructive fishing methods. This work will discuss the fisheries status of Lake Manzalah during the years 2006 to 2020 including the period of purification and development of the lake which started in mid-2017. The fishing gear, fish production, and the socio-economic indicators for the development and purification processes will be discussed.

INTRODUCTION

Fish and fisheries resources are considered one of the basic pillars of strategies, and programs to achieve food security, as it is considered one of the main sources of animal protein with low production costs compared to other types of animal protein, especially red meat. This has had the greatest impact on relying on fish production to provide protein food. Fish contains a high percentage of animal protein, reaching 18.8% in fresh fish, in addition to being free of harmful saturated fats and cholesterol and containing unsaturated amino acids that contribute to raising the activity of the human immune system. It contains also phosphorus, and iodine which are essential for brain and nervous system development at an early stages of life. Eating fish also helps prevent coronary heart disease and alleviate mental disorders such as depression.

Fisheries in Egypt represent an important sector in the Egyptian national economy, as the contribution of the fish sector to the national agricultural income in 2018 is estimated at about 48.3 billion pounds, representing 9.64%, while the plant sector contributed for the same year by 52.83%, and the animal sector contributed 37.52%. Looking at the capital costs, they were as follows for the same year: The fish sector used capital costs estimated at about 3.7 billion pounds, at a rate of 2.15%, the plant sector at 23.9%, and the animal sector at 73.95%. Comparing the percentages of different sectors, it is clear that producing animal protein from fish is less expensive than animal protein from other sources. From the above, it becomes clear how important it is to pay attention to fish production, protection, development, and benefit from these sources by achieving optimal production efficiency and sustainable development for current and future generations.

In recent years, Egypt started to pay a due care to the fisheries sector with the fact that most important natural fisheries in Egypt were deteriorating in a successive and rapid manner, whether environmentally, security-wise or spatially, which had the greatest impact on the fluctuation of production from this resources and its decline in general.

The northern lakes, especially lake Manzalah have been exposed to all the factors that contribute to the rapid deterioration and decline in fish production, both quantitatively and qualitatively (**Khalil and Baayumi, 1988; Khalil, 1997; Mehanna *et al.,* 2014; Mehanna *et al.,* 2020; Mehanna, 2021; Mehanna *et al.,* 2022**). What has made matters worse is that it has become a hotbed of crime and lawlessness, the inability of the lake's fishermen to fish, and the weakening and negative change in the social and economic conditions of the fishermen.

This bad situation makes the political leadership announced a great project to clean and develop the northern lakes, so the cleansing and development project for lake Manzalah was launched in May 2017. This study was conducted a comparative economic, statistical and social study for lake Manzalah before and during its cleansing and development. Also, the fish production, commercial species production and fishing gears used in the lake was discussed.

MATERIALS AND METHODS

1. *Study site*

The northern lakes of Egypt are located along the Mediterranean coast, extending from Bardawil lagoon in the east to lake Mariut in the west, for a distance of about 505 km, and occupy separate areas along this coast of about 2314 km^2. (GAFRD Statistical book, 2019; remote sensing maps). Lake Manzalah (Fig. 1) is located in the northeastern of the Nile Delta, between longitudes 31° 45', 34° 50' east, and latitudes 31°, 30° 32' north. The lake is bordered by the Mediterranean Sea to the north, the Suez Canal to the east, the Nile River (Damietta branch) to the west, and the Husseiniya Plain to the south. Lake Manzalah is also surrounded by three governorates: Port Said to the east and northeast, Damietta to the west and northwest and Dakahlia to the southwest. In the past, two other governorates Ismailia to the east and Sharkia to the south were have bodrers on the lake. However, this area has dried up, and thus lake Manzala lies on only three

governorates now after the serious declining of its area due to erosion, filling up and drought. At the beginning of the present 20th centaury the surface area of the lake was about 420,000 feddans. Because of the continuous processes of land reclamation for agriculture, the area has gradually decreased reaching in 1980 to about 200,000 feddans (**Macleren, 1981**) and by the day its area declined to less than 100,000 feddan (Fig. 2) (**Mehanna, 2008; ElKafrawy** *et al.,* **2019**).

2. *Collection of data*

The study relied on the published data of the General Authority for Fish Resources Development and what was issued by the National Institute of Oceanography and Fisheries, as well as research related to this subject during the study period.

In addition, a field study during the years 2020 and 2021 was conducted with a personal interview through a questionnaire for the different lake centers in which fish are landed (El-Kabouty in Port Said – Gheit Elnasara in Damietta – El-Gamaliya Dakahleya – El-Matarya). A total of 330 questionnaires were distributed in the four sites (21% of the total fishermen in the lake), 30 of which were excluded for lack of rationality. The questionnaire covered all data on the economic and social aspects of the fishermen and their families, such as age, fishing experience, fish income, educational status, health status, marital status, standard of living, fish training, indebtedness, their satisfaction about fishing work .... etc.

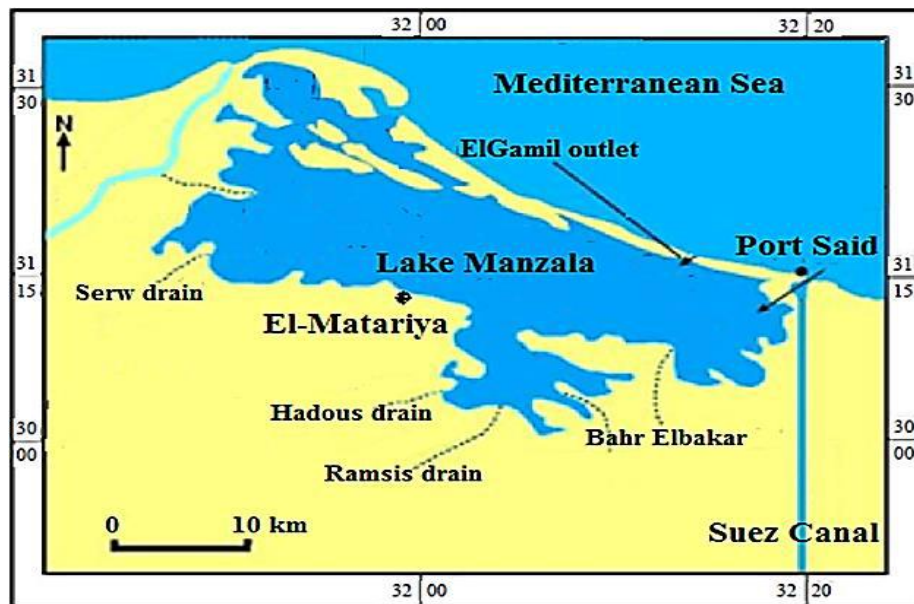Also, the field trips recorded and reported the different fishing methods used in the lake and their targeted species.
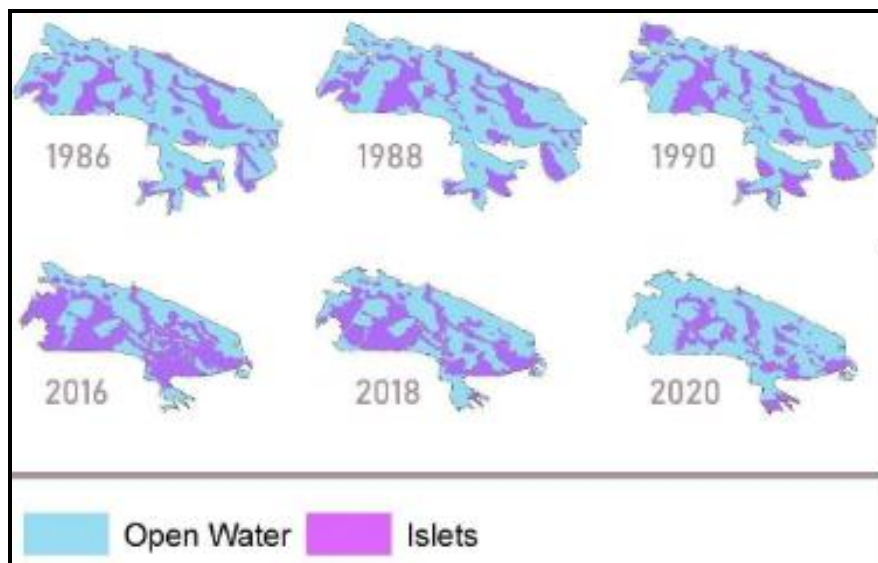

Fig. (1). Lake Manzala map (after Mehanna *et al.,* **2020)**

Fig. 2. Change in lake Manzalah surface area from 1986 to 2020 (Abdelellah, 2021)

3. *Analytical framework*

Various mathematical models were used to determine the general statistical trend, using straight line equations in addition to using the second degree equations, in addition to using both the cubic equation and the growth equation to test the best of them to clarify the trend of production during the study period. Also, predicting production in the years following the study, and after the clearing and developing the lake.

RESULTS AND DISCUSSION

1. *Fishing gears description*

There are many fishing gears used in lake Manzalah, the most common ones are:

1- Entangling nets (Gill and trammel nets)

The trammel nets (locally known as dabba) with different mesh sizes ranged between 2 and 2.75 mesh size or mesh bar and targeting tilapia, mullet and catfish species. It composed of three layers, a small inner panel of netting between two large meshed outer panels. The mesh size of the outer panel had little or no effect on the catch rate, while the inner panel plays the major role in catching fish. Another type of trammel net that widely used in lake Manzalah is known locally as El-Kaffaya method. It consists of three layers as trammel net but of more wider inner layer of 3.0 cm mesh bar. Trammel net looks like the gill net, but the gill net has a single panel of meshes. Fishing by trammel nets is mostly carried out in boats of the third class "Canoe – like faloukas without sails" with a mean crew size of two men (**El-Bokhty, 2004**).

2- Trawl nets or frame nets

These are dragged nets locally known as Al-Kerba, and one of the illegal and destructive fishing methods used in lake Manzalah. This type of nets is made of a wooden triangular

frame. The base of which is a sharp iron plate of 1.5 m long fixed with two "X" shaped wooden bars and each of 3 m long. A funnel shaped webbing of about 3 to 4 m long, with an average mesh size of 1.7 cm (± 0.219), is attached to it. The frame net is tied to one side of the fishing boat with strong ropes. Fishing by this method is mostly done in the eastern and middle regions of the lake. This method should be forbidden because it catches a large quantity of fish fry and young as well as it destructs the fish nests and negatively impacted the whole ecosystem of the lake.

3- Traps

Including wire Wire basket traps (Gawabi), Spiral traps (Tahaweet), Hosha and barriers, and *Clarias* traps and widely used in all northern Egyptian lakes.

In addition to these common gears, a number of fishing methods were recorded in the lake like Cast net or Torraha, encircling fishing gear or El-Tarra, Lawat and Lokkafa (**El-Bokhty, 2007**).

2. *Fish production from lake Manzalah*

For many years, lake Manzalah is the first in the northern Delta lakes in its area and productivity. It is also considered one of the main source of fish production in three governorates, Port Said, Damietta and Dakahlya. By investigation the fish production from lake Manzalah during the period before (2006-2016) and during (2017-2020) the purification and development project, it is noticed that the yield fluctuated between a minimum of about 36.8 thousand ton in 2007 and a maximum of 81.4 thousand ton in 2013, with an annual average of 52.9 thousand ton (Table 1) in the first period. While during the project, the catch was 60.5, 65.1, 80.0 and 82.5 thousand ton during 2017, 2018, 2019 and 2020 respectively with an average of 72.06 thousand ton (Table 1). Generally, the fish production from lake Manzalah showed a decreasing trend with time (Fig. 2) until 2019 where a sudden increase in the lake production was reported in the annual statistical book of GAFRD (GAFRD, 2020). It is worth mentioning that, the lake Manzalah achieved 78.3 thousand ton in 1998, 74.1 thousand ton in 2000, 68.4 thousand ton in 2001 and 81.4 thousand ton in 2013 i.e the lake before the development processes was able to produce a reasonable quantities of fish and the cleansing process successed in rehabilitate the lake and improve its water quality. By analyzing the time series associated with fish production from lake Manzalah during the period 2006-2016, it was found that the best estimated results are the quadratic model in its following form:

$$\hat{Y}= 20203.8 + 12744\ X - 946.79\ X^2 \quad (R^2 = 0.66,\ F = 6.33\ \text{and}\ p>0.01)$$ where $\hat{Y}$ is fish production in ton and X is the time (Fig. 3).
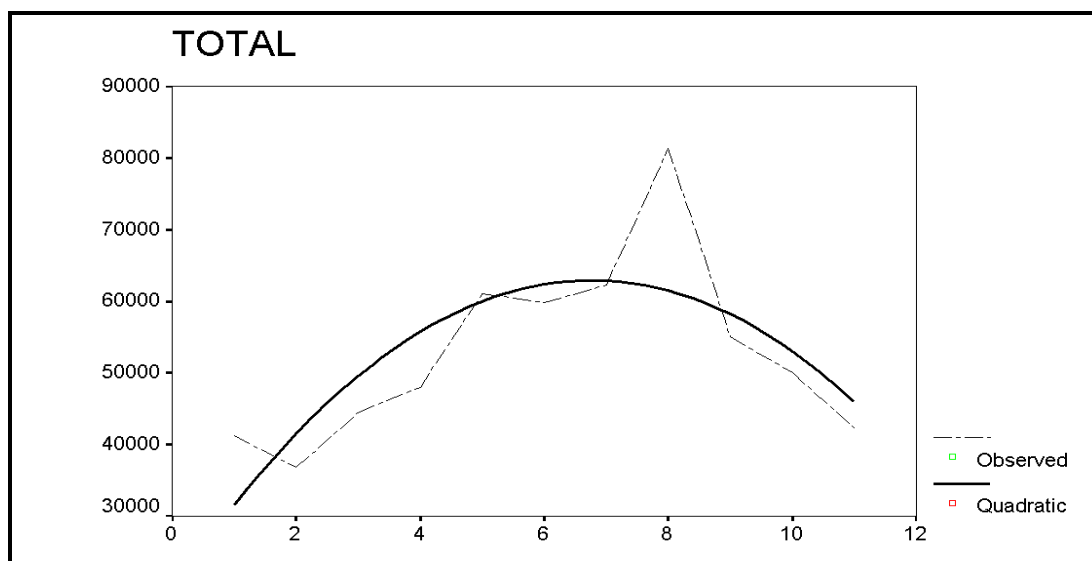
Fig. 3. Total fish production from lake Manzalah as a function of time

In respect to the catch composition from lake Manzalah, it was composed of 14 fish and crustacean species (GAFRD, 2006-2020) with cichlid species are the common forming 45.6% of the total catch from the lake. Grey mullet species constitute 24.1% followed by catfish (family claridae) which constitute 20.9%, while the all other species (Atherinidae, Bagridae, European eel, shrimp, seabass, seabream, spotted seabass, meager, crab) constitute only 9.4% (Table 1).

Cichlid (Tilapia) species production from the lake showed a decreasing trend during the period 2006-2016 with minimum catch in 2006 (17.5 thousand ton) and maximum catch in 2010 (33.5 thousand ton). Clariid catfish (*Clarias* spp.) catch varied from 5.4 thousand ton (2007) and 21.9 thousand ton (2013) followed by grey mullet which fluctuated between 1.8 thousand ton (2006) and 25.3 thousand ton (2013).Grass carp (2.6%), Shrimp (1.9%), bagrid catfish (1.7%), while the rest nine groups their contribution veried between 0.04 and 0.4% of the total catch. It's worth mentioning that the catch composition in lake Manzalah has been changed along the past two decades. Declining of the lake area, overfishing, illegal fishing gears, blockage of Boughazes and the severe pollution are key factors in production detraction and quality alteration rather than health and economic effect.

In respect to tilapia species, they constitute 46.4% of the lake's production for the period before clearing and development operations. It has been shown that the following statistical function is the best model that represents the development of tilapia fish production during the period (2006-2016) before the lake clearing and development operations, and it is a second-degree equation (Quadratic Function) as follows (Fig. 4):

$\acute{Y}$=**10853.9**+ **5931.56X** −**473.77X^2** (R^2 = 0.677, F = 6.40 and p>0.01) where $\hat{Y}$ is fish production in ton and X is the time.
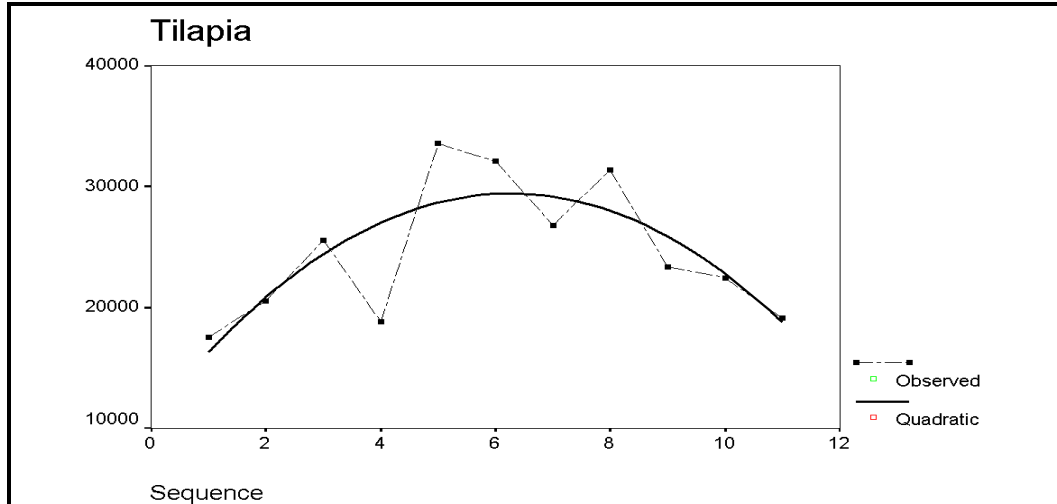
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Fig. 4. Tilapia species production from lake Manzalah as a function of time

The average annual catch of tilapia before and during the cleaning and development operations was 24,650 and 31,383 tons, respectively, an increase of 27.3%. Which indicates that the cleansing and development operations of the lake had an impact on increasing the production of tilapia fish

For catfish fish (Table 1), the relative importance of catfish represented about 21.2% of the lake's fish production during the period preceding the clearing and development operations. It turns out that the Growth Function is the best model for predicting catfish production during the period (2006-2016), as follows (Fig. 5):

$$\acute{Y} = e^{8.88 + 0.061\,X} \quad (R^2 = 0.536, \quad F = 2.79 \text{ and} \quad p > 0.01)$$

The annual average catch of catfish before and during the cleansing and development operations was 11,215 and 14,842 tons, respectively. Although the catfish catch increased by about 32.3%, its contribution to the total catch decreased from 21.2% to 20.6%. These results indicate that clearing and development operations had an impact on increasing the production of catfish from the lake and in the same time the contribution of other fish species increased.
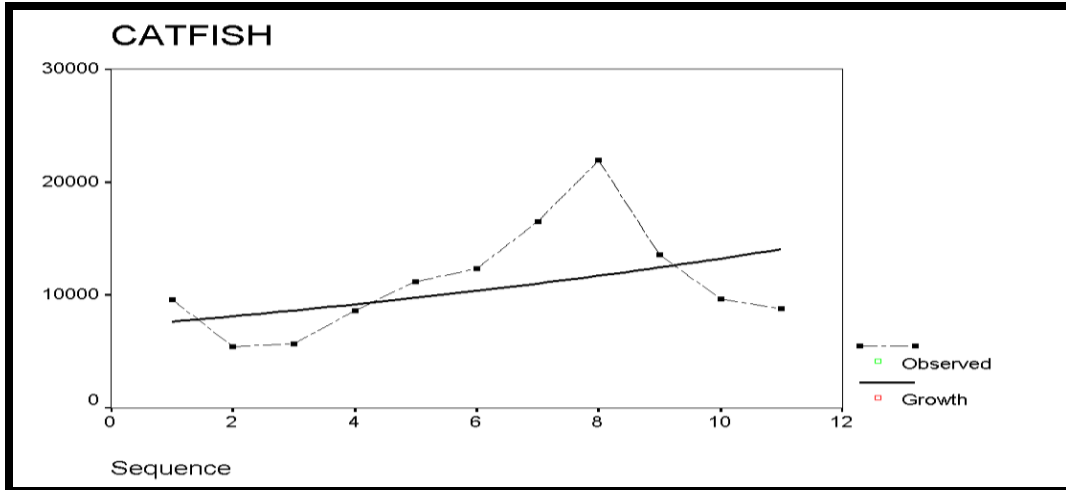
Fig. 5. Clariid catfish production from lake Manzalah as a function of time

For grey mullet catch, it is clear that the contribution of the grey mullet species to the lake production increased from 19.6% during 2006-2016 to 29.6% during 2017-2020 The mullet family includes varieties: mullet, tobar and suhaili.

It is clear from the following statistical function shown in Figure (6) that it is the best model for measuring the development of the total production of the mullet family during the period (2006-2016), which is the linear equation as follows:

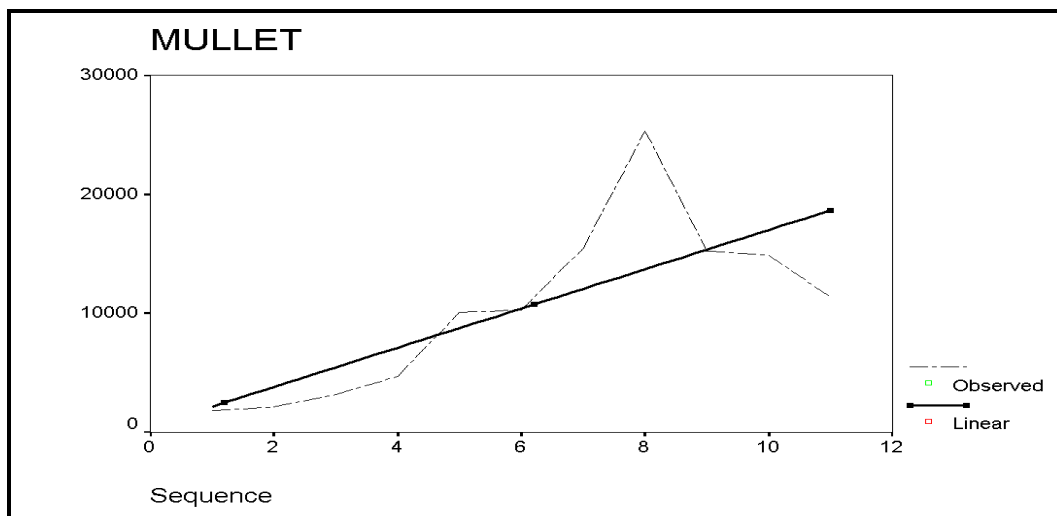$$\acute{Y}=512.96 + 1648.54\ X\ (R^2= 0.576,\ F= 12.23\ and\ p>0.01)$$

Fig. 6. Grey mullet production from lake Manzalah as a function of time

It was found that the average annual catch before the purification and development operations was about 10,404 tons, increased to 21,304 tons during the development operations. This reflects the importance of this project in increasing the production of grey mullet from the lake.

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It is noted that the relative importance of the production of tilapia and grey mullet species in lake Manzala increased significantly during the cleansing and development operations. Also, a number of marine species started to appear again in the catch after dredging the Boughazes as well as new marine species are recorded recently (**El-Azab and Mehanna, 2023**). So, a monitoring program and contineous studies should be established to record any change in the lake ecology and fisheries during and after the cleansing and development operations.

Table 1. Fish production (ton) from lake Manzalah during the period from 2006 to 2020.

Year	Total catch ton	Cichlid	Clariid	Grey mullet	Grass carb	Shrimp	Bagrids	Crab
٢٠٠٦	41193	17547	9597	1838	4249	2349	1631	366
٢٠٠٧	36783	20539	5445	2130	2270	1671	1029	215
٢٠٠٨	44457	25557	5689	3175	1946	2560	1891	268
٢٠٠٩	48023	18818	8643	4709	3373	2761	4016	282
٢٠١٠	61075	33545	11202	10062	849	501	515	266
٢٠١١	59779	32076	12347	10282	486	512	396	220
٢٠١٢	62272	26805	16513	15476	305	195	198	266
٢٠١٣	81365	31380	21926	25317	222	195	77	136
٢٠١٤	55022	23347	13544	15237	360	145	50	135
٢٠١٥	50034	22438	9671	14867	507	160	70	189
٢٠١٦	42305	19096	8790	11353	494	126	54	224
Average	52937.1	24649.8	11215.2	10404.2	1369.2	1015.9	902.5	233.4
%		46.56	21.19	19.65	2.59	1.92	1.70	0.44
٢٠١٧	60538	23885	14229	18922	744	47	-	242
٢٠١٨	65113	25355	14015	20902	837	57	76	309
٢٠١٩	80038	35145	17565	22374	898	55	59	235
2020	82541	41147	13559	23020	781	66	97	233
Average	72057.5	31383	14842	21304.5	826	56.3	77.3	254.7
%		43.6	20.6	29.6	1.2	0.08	0.11	0.35

3. *Socio-economic analysis*

The most important social and economic characteristics of lake Manzalah fishermen and their families, which affect fishing practices and fish production are: age structure, educational status, marital status, health status, fishing experience, family size, family type, apartment size, level of Living, source of income, number of people on board, fishing methods used, fish income, indebtedness, extent of commitment to fish work, participation in cooperatives and insurances, knowledge of fish authorities, training to raise skills, fish marketing, governorates to which fish marketing is carried out, fish marketing problems. Table 2 summerize these socio-economic characters based on the analysis of data collected through the quesionnaire.

Age structure of fishermen

The importance of fishermen age is due to his strong vitality and activity in various social and economic fields. The sample included ages up to 80 years, of which 58% were in the age group up to 50 years, that is, the stage characterized by vitality, activity, and the ability to acquire different experiences. For the ages between 50 and 80 years, 37% of them range in age from 51 years to less than 70 years, while there are 5% of fishermen between the ages of 70-80 years, whose activity is characterized by the traditional fishing practices and their difficulty in accepting modern fishing practices. The results showed that the majority of fishermen are in the age of maximum activity and can be benefited from and influenced by training and guidance programs in order to preserve the lake, maintain its sustainable development, and increase their fish production sustainably.

Educational status

There is no doubt that a high level of education raises the status of the fisherman and increases his desire to accept new ideas, methods and regulations that will increase fish production to increase his income and raise his standard of living economically and socially. Unfortunately, the phenomenon of illiteracy is widespread among fishermen working in lake Manzalah, reaching about 80% of the study sample, which is a very high percentage and has a major role in affecting the lake's fish productivity. While the percentage of those who can read and write and hold various qualifications is only about 20%.

Marital status

It was found that about 92% of the study sample members are married and socially stable, and only about 8% are unmarried.

Health condition

It turned out that 54% of the study sample members were healthy, while the percentage of sick people was about 46%, most of whom suffered from kidney failure, liver cirrhosis, and skin diseases, which necessitated preserving the lake from pollution of various kinds.

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Table 2. Socio-economic variables for the fishermen in lake Manzalah

Property	%	Property	%
Age (year)		**Indebtedness**	
Up to 50 years	٥٨	debtor	٦٥
٥١to 69 years	٣٧	Not indebted	٣٥
٧٠ to 80 years	٥	**The extent of satisfaction to fishing work**	
Educational status		Holding	٨٥
Uneducated	٨٠	Not Holding	١٥
Educated	٢٠	**Participation in cooperatives and social insurance**	
Marital status		subscriber	٨٠
Single	٨	Not subscribed	٢٠
Married	٩٢	**Knowledge of fish bodies**	
Health condition		Known	٩٥
Sick	٤٦	Doesn't know	٥
Healthy	٥٤	**Training to raise fishermen's skills**	
Fishing experience		Receive training	٣
From 10 to less than 20 years	٣٠	Did not receive training	٩٧
From 20 to less than 50 years old	٦٣	Willingness to receive training	٤٠
Older than 50 years	٧	**Fish marketing**	
Family size (individual)		Fish marketing places	٩١
Up to 4 people	٨	outlets	٩
From 5-12 individuals	٩٢	**Problems of fish marketing**	
Family type		facing problems in marketing fish	65
Simple	٨٠	Not facing problems	35
complex	٢٠	**What are these problems؟**	
House size		High production costs	٨٠
Less than two rooms	٥٦	Prices do not match production costs	٦٥
٢ rooms and a hall	٤٠	Intermediaries control marketing	٧٠
٤-٣rooms and a hall	٤	High percentage of spoilage during marketing	٤٠
The standard of living		**Lake problems from the fisherman's point of view**	
high	١٥	Pollution of various types	١٠٠
middle	٦٠	Security problems	٦٠
low	٢٥	Poaching problems	٧٠
Source of income		Economic and social problems	٩١
From fishing only	٩٤		
From other sources in addition to fishing	٦		
Number of people/boat			
From 1-3 individuals	١٠٠		
Fishing methods used			
Legal	٥٥		
Illegal	٤٥		

Fishing experience

Fishing experience expresses the number of years of practicing the fishing, which can clearly reflect knowledge and experience in fishing operations, and the extent of competence in using fishing equipment and tools and how to face the changing conditions of that operations. The results of the questionnaire show that about 30% have fishing experience ranging from 10 to less than 20 years, about 63% range from 20 to less than 50 years, and about 7% have more than fifty years of experience, which may lead to difficulty in accepting new practices and methods in fishing industry but they have good experience with weather conditions, fish species, fishing locations, fish movements, and other experience factors that positively affect production.

Family size

It was found that the average size of fishermen's families ranges from about 7 members, with the family size of up to 4 members being estimated at only about 8%, while the size of family members between 5-12 members is estimated at about 92%, and this is due to the high rate of illiteracy and the high fertility rate and low health awareness.

Family type

The results of the questionnaire showed that 80% of the sample members live in simple families (husband, wife, and children only), and about 20% live in complex families (husband, wife, children, and grandchildren). This means an increase in the tendency of fishermen to live independently in contrast to the traditions that prevailed regarding the marriage of children with their parents.

House size

It was found that about 56% of the sample lived in houses of less than two rooms, about 40% lived in houses with two rooms and a hall, and only about 4% lived in houses ranging between 3-4 rooms and a hall.

Standard of living

It turned out that about 15% of the sample had a high standard of living, meaning the availability of basic services for fishermen, such as lighting, pure water, and various types of electrical household appliances, such as the refrigerator, television, and other electrical appliances. While about 60% of the sample members have an average standard of living, meaning they have basic services such as lighting and pure water, in addition to the availability of only one electrical home appliance, and about 25% of the sample members have a low standard of living, meaning they have no services other than lighting and pure water only.

Source of income

The majority of fishermen (94% of the sample size) do not have additional sources of income besides fishing. While some fishermen (6% of the sample size) obtain additional income from other sources, such as working in agriculture, trade, or local transportation.

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The number of people per boat

The number of fishermen on boats ranges between 1-3 individuals/boat, representing 100% of the sample.

Fishing methods used

It was found that about 55% of the sample members use legal fishing methods, such as Guwabi and lines, while about 45% of the sample use illegal fishing methods such as fry collecting, Kerba or trawl net, fishing using electricity, and others. This percentage is considered high and is likely to destroy the future of the lake if they are not banned.

Fish income

The amount of the fisherman's monthly fishing income depends on the number of monthly fishing trips, the quality of the fish catch, and weather factors. The number of trips ranged between 12-20 trip/month, while the value of one trip was estimated between 50-100 Egyptian pounds per trip. Accordingly, the monthly income of the fisherman in the case of a minimum number of trips (12 trips per month) and a minimum of 50 pounds per trip can be estimated at about 600 pounds. If the value of one trip increases to 100 pounds/trip, the income becomes 1200 pound/month. In the case of acheiving 20 trip/month with a minimum of 50 pounds/trip, and the monthly income becomes about 1000 pounds, while it is estimated at about 2000 pounds/month in the case of the maximum value of one trip (100 pound). This means that in the case of the minimum number of trips (12 trip/month), the income ranges between 600-1200 pounds, with an average monthly income of about 900 pounds/month. In the case of the maximum number of trips (20 trip/month), the monthly income of the fisherman ranges between 1000-2000 pounds, with an average of about 1500 pound/month. Therefore, it can be said that the average income of the fisherman in lake Manzalah ranges between 900-1500 pound/month.

Indebtedness

It was found that about 65% of the sample were indebted to others, especially fish traders. The spread of illiteracy among fishermen communities had a major impact on spreading the poverty and diseases, as this phenomenon resulted in frequent births and large family sizes, and failure to meet their basic needs and the various requirements of life, such as food, clothing, health, and education. Lenders, who are major fish merchants who exploit the fishermen's need for permanent financing to meet their family needs, continue fishing operations, and deliver fish to them to pay off their debts, which has led to the merchants controlling the marketing of fish, setting their prices, affecting the standard of living of fishermen, and limiting access to a high income. Which results in the inevitability of accepting some jobs with quick and high income, such as illegal collecting of fish fry, using electricity in fishing, using trawl, and other illegal fishing methods in the lake, which has led to the seriousness of the situation in the lake in security, production, and social terms. To protect the lake, the ountry has developed a

giant project with the aim of cleansing, developing and raising the efficiency of the lake starting in May 2017. The project has four parts; the first to remove the weeds and aquatic plants from the lake, the second to dredge the bottom of the lake in order to increase the depth of the lake, the third is to remove the encroachments in all their forms (nests, houses, courtyards), and the fourth to construct a road around the lake to protect it from encroachments. It is expected that this project will be completed by the end of 2022 but it still working.

The extent of satisfaction to fishing activities

About 85% of the study sample are committed to working in the field of fishing as it is a profession that is passed down to children from parents and grandparents, while only about 15% are not committed to it because the return from fishing operations does not meet their requirements, but they work in it because there is no other work.

Participation in cooperatives and insurance

The majority of fishermen (about 80%), participate in cooperatives and social insurance while about 20% of the sample members do not participate. Although the majority of fishermen participate in cooperatives, they believe that these cooperatives do not fulfill their assigned role, especially the Associations Support Fund, which fishermen did not benefit from and did not provide them with any notable services.

Knowledge of the various fisheries bodies in the country

The majority of fishermen (about 95%) know the different governmental fisheries bodies like General Authority for Fish Resources Development GAFRD, National Institute of Oceanography and Fisheries, coast guards,..etc, while 5% do not know anything about these bodies.

Training to raise skills

It appears from the results of the questionnaire that only about 3% received training in the field of fishing at GAFRD and the National Institute of Oceanography and Fisheries, while the vast majority, 97%, did not receive any training. However, there are about 40% of the sample members willing to receive training in the field of fisheries resources. This may be due to the widespread of illiteracy among the fishermen. This causes the decrease in the desire of fishermen to attend or follow guidance seminars and training courses, and it also reduces the interaction between fishing experience and innovation in new fishing methods. It has been shown that fishermen derive their fish and fishing knowledge from their fathers and grandfathers.

Fish marketing

The results of the questionnaire study showed that about 91% of the sample individuals market their fish through fish rings, while about 9% market their fish through other outlets.

Fish marketing problems

The results of the questionnaire showed that about 65% of fishermen face some problems while marketing their fish, while about 35% of them do not face any problems.

Among the most important problems that fishermen face when marketing their fish are the following:

a. About 80% of them reported higher production costs

b. About 70% of them reported that brokers controlled marketing

c. About 65% reported that prices were not proportional to production costs

d. About 40% of them reported a high percentage of spoilage during fish marketing operations

4. Lake problems from the fishermen's point of view

a. All the lake's fishermen (100%) face the problem of all kinds of pollution (health, agricultural, and industrial) that has prevailed in the lake.

b. About 70% of the fishermen mentioned the problems of illegal fishing, whether fishing the fry and small-size fish, encircling and trawl fishing, or fishing with electricity.

c. About 60% reported the security problems such as bullying and drug trafficking.

d. Many fishermen (about 91% of the study sample) suffer from some economic and social problems, such as the high retirement age and problems with social and health insurance.

CONCLUSION

In conclusion, the present analysis of the lake Manzalah fisheries before and during the purification and development of the lake revealed that the cleaning and raising the water quality of the lake as well as deepening the Boughazes and lake helping in recovery and development the lake's fishery. In addition, new species especially marine ones migrate to the lake and established As the rehabilitate the lake is very important in creating many new jobs, securing food and raising the standard of life of the fishermen, a number of recommendations are suggested. Prevention of pollution and monitoring the industrial and sewage waste dumped into the lake to conserve the aquatic life and improve the water quality as well as the quality and quantity of caught fish. The fishing effort should be controlled based on sound scientific research to detect the optimum number of both boats and fisherment that conserve the fish stocks in the lake. A continuous monitoring program should be established to follow up any biological and ecological changes in time. Combating the collecting of fry, which are caught in huge quantities and continuously during their various seasons around Boughaz Al-Gameel.

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