

An analytical Economic Study of Fish Production in Egypt

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ABSTRACT

Egypt fisheries sector is a major pillar in food security and economic and social development. It is currently relied on to provide a large part of the animal protein. Red meat stands in front of its development with different determinants. White meat is currently facing many problems and obstacles. The fisheries sector also contributed to the national agricultural income in 2016 by 20 billion pounds, or about 9.8% of the net agricultural income, which amounted to about 209.9 billion pounds in 2016, while the estimated fish production for the same year about 935 million pounds Or equivalent to 2.6% of the total agricultural production requirements. Despite the diversity of fish resources in Egypt between natural fisheries (seas, lakes, fresh water) and fish farming. The results showed that marine fisheries in general increased during the period 2005-2016, but this increase is not commensurate with the large fishing area of marine fisheries, which is estimated at 82.7% of the area of Egyptian fisheries, while the area of capture fisheries is about 11.2 Million fish, representing 82.3% of the total area of Egyptian fisheries. Fresh water includes Lake Qaroun, Al Rayyan, High Dam, Time, Crocodile, Touthaki flood and water bodies in the New Valley. It was found that the area of fresh inland lakes is estimated at 1.4 million Feddan represents about 10.3% of the total area of Egyptian fisheries, and estimated the quantity of the net of fresh water by about 69.8 thousand tons in 2016 contributed about 4.1% in coverage of domestic consumption of fish. It was found that the area of fish farms was estimated at 377 thousand feddans representing about 2.8% of the total area of Egyptian fisheries. The production of rice fields was estimated at 35.9 thousand tons in 2016, which contributed about 2.2% covering the local consumption of fish, which is about 1706.3 thousand tons for the same year. The results show that most of the coastal depressions come from Lake Bardawil and represent about 95% of the total fish production. It also has a growth rate of about 6.7%, the local production of fish has recently increased significantly. This increase is due to aquaculture, which constitutes a large proportion of the domestic production. However, despite this large increase, in spite of the large increase in the volume of imports, the self-sufficiency ratio decreased from 82.9% in 2005 to about 67.3% in 2016 and increased the amount of exports by about 23 thousand tons a year, also increased fish imports by about 278.3 thousand tons a year, and increased the average per capita fish to about 23.9 kg / person / year in 2016. Finally, despite the relative stability in the fishing area and the decline in fish production from capture fisheries, the local production of fish has recently increased significantly, due to the increase in aquaculture, which constitutes a large proportion of domestic production, but despite this increase. However, there is still a food gap, despite the large increase in the volume of imports. A random sample was selected from Fayoum and Beni Suef governorates according to the relative importance of a number of fish farms. About 65 observations were selected from Fayoum Governorate because of the relative importance of fish farming. The percentage of illiteracy was about 40.9% and the percentage of university education was 22.7%. The average area of the farm was 24.5 feddans and the average number of ponds was about 6.5% Basin and the average area of the basin about (5.5) fed. In the study of the water source of fish ponds, it was found that the agricultural drainage accounts for about 60% of the total water source. The data on the average amount of feed used for each pond in the fish farms is about 8.5 tons / year, with an average price of LE 310, Cost of LE 2635 for the basin, and the study of human work used for the basin was about 3 workers and the average wage of the technical worker amounted to about 1400 pounds / month.

Keywords: growth of fish, local production, domestic consumption, fish food gap, quantity of exports, imports, average per capita, average individual income, food gap self-sufficiency ratio of fish.

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Introduction

Fish are an important source of food and contribute to the provision of animal protein and an alternative to meat substitutes. Recently, the demand has increased, especially after the increase in the prices of meat and poultry, which has become one of the objectives of the development process and the main axis of its axes, as its development policies affect the balance between the rates of growth of fish production and population growth rates and to raise the rates of fish production from different sources until Consumption needs and contribute to food security. Global per capita fish stocks have increased from about 15.3 kg in 2005 to about 19.9 kg in 2016. Population growth, urban expansion, rising standards of living, development and income are key to increasing demand for fish. In Egypt, fish production is one of the components of agricultural production and is a source of high quality protein. Fish production contributes about LE 20 billion, representing about 9.5 % of the net agricultural income of about 209.9 billion pounds in 2016. Fish is an economical alternative to meet the demand for animal products with local fish production reaching about 1.61 million tons in 2016, while consumption amounted to 2.96 million tons, indicating a fish gap estimated at 1.35 million tons. Fish farming is the most important source of fish production in Egypt, accounting for 73.3% of the total fish production in Egypt in 2016. The rest of the fish production from all other natural resources represented by the sea, lakes, river Nile and its branches amounted to about 391.8 thousand tons representing about 26.7 % of the total fish production. This illustrates the importance of fish farming in increasing fish production in Egypt, in contrast to the natural sources, which shows a decline in fish production year after year. Thus, aquaculture is the main source of development and increased production.

Problem of the study

The production activity of fish is one of the economic activities that depend on the quantity and type of available fish resources. The quantity and type of fish production is determined according to the availability of these resources. Despite the availability of these resources and the diversity of fish production sources in Egypt, 13.9 million feddans, the relative contributions of different sources of fish have varied, despite the increase in fish production in recent times, but there is a significant decrease in the production of some sources of fish wealth, especially in the lakes of Fayoum Governorate, and the amount of fish production from pelvic farms and Fish stocks are the main sources of fish production, estimated at 12,116 million tons for 2016, and contributed about 71.1% of the domestic consumption of fish in the same year. Despite the large production, fish farms suffer from many problems hindering their development and improving their efficiency and increase fish production, This is due to many environmental variables and the various factors that the study will address in an attempt to overcome them.

Objectives of the Study:-

The study aims to identify the current status of fish farming in Egypt by identifying the development of fish production from various sources, national and individual consumption, food gap, quantity of imports and self-sufficiency rate of fish in Egypt.

- 1-Study of the main economic parameters for the production of Egyptian fisheries during the period (2005-2016).
- 2-Determination of the self - sufficiency ratio and the quantity of fish food gap during the period (2005 – 2016).
- 3-Study the economic factors specific to the consumption of fish in Egypt during the same period.
- 4-Statistical estimation of the production and cost functions of fish in fish farms by sample of field study and study of some indicators of production and economic efficiency of fish culture, rate of return of costs, and profitability of the pound spent in the sample of the study.
- 5-to identify the most important problems suffered by the fish farms of the study area and the solution from the point of view of the respondents of the sample field study.

Research Methodology and Data Sources: -

The study is based on two main methods: - descriptive economic analysis and quantitative economic analysis of the variables studied by using some statistical and economic standard models

including directional models, multiple and logarithmic regression, and estimation of the relative importance of the fishing area, production and productivity, Variable and net return. The productivity and economic efficiency of fish farms, and the profitability of the spent pound.

The study was based on secondary statistical data published by the Ministry of Agriculture, Land Reclamation and the Central Authority during the period (2005-2016) issued by the General Authority for Fisheries Development (Fish Production Statistics), the National Institute of Oceanography, Fisheries and References and some websites. : Preliminary data collected through a specially designed survey questionnaire. A random field sample was taken from some fish farms in Fayoum and Beni Suef governorates because of their relative importance in fish farming in the agricultural season (2015-2016) to cover the NAT required.

Characterization of the study sample:

A sample was selected:

A random sample was selected from Fayoum and Beni Suef governorates according to the relative importance of a number of fish farming farms and total fish production through a specially designed survey questionnaire, and 65 observations were selected from Fayoum Governorate because of their relative importance in aquaculture, The percentage of illiteracy was about 40.9%, the percentage of university education was 22.7% and finally the percentage of those who read and write and the percentage of education was 18,8% .The average farm size was 24.5 feddans and the average number of ponds was about 6, 5) Basin, the average area of the pond about (5.5) feddans, and the study of the source of water ponds fish farming showed that the agricultural drainage accounts for about 60% of the total water source, followed by both the mixing of agricultural drainage and water from the River Nile by about 40% The average amount of feed used for one pond in fish farms in the sample of the field study is about 8.5 tons / year, with an average price of about 310 pounds, with a total cost of 2635 pounds for the basin, and the study of human work used for the basin is about 3 workers and the average wage of the technical worker amounted to about 1400 pounds / month . It was found that the average farm productivity of the fish in the sample field field is about 55 tons / feddan to reach the optimum production, and the average productivity of feddan is about 3.34 tons / feddan. The total cost production was estimated at 23300 pounds and the average variable cost was about 19122 pounds representing about 82.1%. The average fixed costs were about 4178 pounds representing about 17.9% of the average production costs. The cost per kilo of tilapia was about 16.3 pounds / kg . The farm income per feddan was about 4.03 tons x 16000.3 pounds / ton = 64481.21 pounds / fed. The net yield per feddan was about 41181.21 pounds per feddan for the sample of the study. The rate of revenue for the costs indicated that it reached about $64.481.21 / 23300 = 2.8$ pounds, ie, the pound spent in the farm / per feddan is equal to 2.8 pound In the calculation of the profitability of the pound invested, it was found that it amounted to about 1.76 pounds, and in calculating the ratio of revenues / variable costs it turned out to be about 3.37 pounds, and by calculating the total margin was about 308699.04 Pounds.

Research results and discussions

Table 1 shows that domestic fish production increased from about 889 thousand tons in 2005 to about 1.61 million tons in 2016, with an average annual rate of 0,339 thousand tons, with an annual growth rate of about 2.1% of the annual average as shown in Table (2), and the increase in the quantity of imports from about 188.52 thousand tons in 2005 to about 278.7 thousand tons in 2016 with an annual average of 4.57 thousand tons as shown in Table (2) The annual growth rate is statistically significant at 0,01% and estimated at 1,5% of the annual average. As shown in Table (1), the quantity of Egyptian fish exports increased from about 5.13 thousand tons in 2005 to about 23 thousand tons in 2016, with an annual average during the period of study estimated at 13.03 thousand tons with an annual growth rate that is statistically significant at 0.01 As shown in table (1), the increase in consumption available for consumption increased significantly, and it increased from about 1072.6 thousand tons in 2005 to about 2123.11 thousand tons in 2016. The average annual rate during the study period was about 712 thousand ton, And 2 thousand tons. Table (2) shows that the annual growth rate is statistically significant at about 6.5% of the annual average. As shown in Table (1), the self-sufficiency rate of fish decreased from 82.9% in 2005 to about 67.3% in 2016. Table (2)

shows that the annual growth rate was about 1.46% of the average annually. While the average per capita fish consumption increased from about 15.3 kg / person in 2005 to about 24 kg / person in 2016 with an average of 19.14 kg / person during the period 2005-2016. Table (2) shows that the annual growth rate is statistically significant at about 1.9%. Table (1) shows the increase in fish food gap during the study period from 183.38 thousand tons in 2005 to about 520 thousand tons in 2014, with an annual average during the study period of about 0,677 thousand tons and an annual growth rate that is not statistically significant Estimated at about 10.3%. The results showed that despite the relative stability of the fishery areas and the decline in fish production from natural fisheries, the local production of fish has recently increased significantly. This increase is due to fish farming, which represents about 60-65% of the domestic production However, despite this increase, domestic production is still not sufficient for consumption, and therefore there is still a thicker food gap. Fish self-sufficiency in Egypt can be achieved through interest in marine culture in the Aegean and Aegean Sea and Red Sea, and there are successful experiments for the cultivation of white and white fish in the Mediterranean Sea west of Alexandria.

Table 1: Development of production, consumption, self-sufficiency and average per capita of fish during the period (2005 - 2016).

Years	Local production (thousand tons 1)	Quantity imports (thousand tons 2)	Quantity Exports (thousand tons 3)	Available for consumption (thousand tons 4)	Number of inhabitants (Thousand people)	% Self - sufficiency rate/1 4	Average per capita share available Consumption	% Fish gap from consumption in thousand tons -41
2005	889.0	188.5	5.13	1072.68	69997	82.9	15.3	183.40
2006	971.0	208.0	4.05	1174.4	70653	82.7	16,6	203.55
2007	1008.0	259.0	4.42	1262.5	74357	79.8	16.9	254.48
2008	1068.0	137.0	6.73	1197.7	75097	89.1	15.9	130.07
2009	1092.5	220.0	7.59	1251.9	79225	90.6	15.9	127.94
2010	1130.6	230.0	10.60	1551.1	82050	84.1	19.7	219.7
2011	1181.1	245.0	9.49	1534.90	85760	88,8	19.1	235.51
2012	1221.3	335.02	15.81	1691.19	87560	81.2	20.6	319.22
2013	1454.40	235.85	20.45	1669.80	88350	87.1	19.7	215.40
2014	1482.2	548.00	28.0	2038.00	88995	72.7	23.5	200.00
2015	1385.0	261.3	21.1	2035.12	89524	68.1	22.57	261.30
2016	1619.0	278.7	23.0	2123.11	90211	67.3	23.96	240.70
Average	1208.51	262.19	13.03	1550.2	65355.7	81.2	19.14	242.60

Self-sufficiency ratio = quantity of local production / quantity available for consumption 1/4

(*)Central Agency for Public Mobilization and Statistics - Foreign Trade Bulletin, Survey of Fisheries during the period (2005 - 2016) - April 2017 - Miscellaneous Numbers .

Source: - Data collected from the Ministry of Agriculture and Land Reclamation, the General Authority for the Development of Fish Resources, the Bulletin of Fish Production Statistics - various numbers .

The most important economic production indicators for fish in the Arab Republic of Egypt during the period (2005-2016):

The identification of economic indicators of production and consumption and indicators related to the food gap of exports and imports and average per capita fish consumption are the main steps on which the future plans of the fish sector are based to reduce the gap between production and fish consumption and reduce dependence on imports.

1-The local gap of fish in the Arab Republic of Egypt:

Table (2) and Equation (1) shows the general time trend of local production of fish during the period (2005-2016). The increase in the local production of fish in the Republic shows an annual increase of, 339 thousand tons representing about 2.14% of the total average of fish production during the study period. The selection factor was about 0.26, meaning that about 26% of the changes in total fish production in the Republic were due to time, and 74% of those changes were due to other factors.

Table (2) shows the general trend of domestic consumption of fish during the period (2005-2016). The increase in local consumption of fish in the Republic shows an annual increase of 79 thousand tons per year representing about 6.55% of the average fish consumption during the period. The mean factor was about 0.83, meaning that about 83% of the changes in total fish consumption in the Republic were due to time, and 17% of those changes were due to other factors. The period reached a maximum of 516.11 thousand tons in 2016 and the lowest about 127.94 thousand tons in 2009 in Table (2) shows that the general time trend of the food gap of local fish in the Republic may increase annually by about 6.7 thousand tons per year and that this increase is statistically significant at a significant level 0.05, and the coefficient of selection is about 0.24.

Table 2: Shows the general time trend equations of the most important economic indicators of fish and the most important factors affecting the consumption of fish in Egypt during the period (2005 - 2016).

Equation Number	Variable	Equation	R ²	F	Mean	Rate of Change %
1	Local production per thousand tons	$\hat{y}_1 = 297 + 0,339 h_1x$ (1,139)*	0.026	1.296	16.41	2.14
2	Domestic consumption per thousand tons	$\hat{y}_2 = 345 + 0.792h_2x$ **(7.51)	0.835	56.48	121.4	6.55,
3	Fish food gap thousand / ton	$\hat{y}_3 = 207.4 + 0.677h_3x$ *(2.91)	0.403	8.44	65.45	10.3
4	Quantity of exports thousand / ton	$\hat{y}_4 = 0.001 + 0.251 h_4x$ *(143.4)	0.63	0.672	9.010	2.7
5	Quantity of imports per thousand tons	$\hat{y}_5 = 9.218 + 4.57 h_5x$ **(17.9)	0.130	2.64	29.92	1.5
6	Average per capita kg / year	$\hat{y}_6 = 0.03 + 0.712 h_6x$ **(3.11)	0.441	9.67	70.31	1.9
7	Population	$\log \hat{y}_7 = 1,97 + 0,971 h_7 \log x$ **(12.8)	0.94	165.6	13.4	7.24
8	Average individual income for observation	$\log \hat{y}_8 = 9.68 + 0.210 h_8 \log x$ **(91.12)	0.52	0.460	6.29	3.3
9	Average Retail Price	$\log \hat{y}_9 = 199.7 + 0.984 h_9 \log x$ **(17.6)	0.966	311.10	135.5	7.1
10	Average meat price for	$\log \hat{y}_{10} = 0.11 + 0.902 h_{10} \log x$ **(6.6)	0.795	43.59	114.3	7.9
11	Average price of poultry	$\log \hat{y}_{11} = 0.048 + 0.989 h_{11} \log x$ **(20.77)	0.975	431.7	139.7	7.1
12	Self-sufficiency	$\log \hat{y}_{12} = 208.6 + 0.499 h_{12} \log x$ **(3.32)	0.174	3.32	35.65	1.4

(*) At the level of 0.05 , (**) is significant at the level of 0.01
 The values between the arcs are the calculated T value, where \hat{y} = the estimated value of the dependent variable in year e and represent 3,2,1, 12, x = the time variable .
 Source: - Collected from Table (1), (3) .

2:-Imports and exports of fish in Egypt

A- Fish exports:-

The number of exports of fish in the Republic during the period (2005-2016) has increased by an annual increase of 2.5 thousand tons per year, representing about 2.7% of the average fish exports during the studt period. The selection factor was about 0.63, meaning that about 63% of the changes in the total fish exports in the Republic were due to time, and 27% of these changes were due to other factors.

B:- Fish imports

The number of fish imports in the Republic during the period (2005-2016) increased by about 4.5 thousand tons per year representing about 1.5% of the average fish imports during the study

period. Which is about 262.19 thousand tons per year, and the coefficient of selection was about 0.13, which means that about 13% of the changes of the total fish imports in the Republic due to time, and 87% of those changes attributed to other factors.

C: - Average per capita fish

The number of imports of fish in the Republic during the period (2005-2016) has increased by an annual increase of about 0.70 kg per year. This increase is statistically significant, representing about 1.9% of the average share The total number of fish during the period of study, which is about 13.03 thousand tons per year, the coefficient of selection was about 0.44, meaning that about 56% of the average per capita fish in the Republic due to time, and 44% of those changes attributed to other factors.

3-The most important factors affecting the quantities consumed fish in Egypt.

The simple and multivariate regression analysis in the logarithmic image was used under the available data that these factors are the population (s1e), the average individual income (H2h), the average retail price (X3e), the average meat price (x4e), the average retail price of poultry The number of Egyptian fish imports (Q6H), the quantity of Egyptian fish imports (Q7H), as independent factors during the period (2005 - 2016), and the relationship between the quantity consumed (variable) and the variables mentioned above (independent variables) As shown in Table (2), the relation between the quantity of fish consumed and the number of population (S 1 H) and MTU is positive ,The average price of meat (Q4H), the average price of meat (C4H), the average retail price of poultry (Q5H), the quantity of Egyptian imports of fish (Q7H), The elasticity factor was 0.97,0,021, 0.98, 0.90, 0.98 4.5, respectively, which explains that if each of them changes by 1%, this increases the quantity consumed by 9.7%, 0.21%, 0.98% . the relation between the quantity consumed and both the price of fish, the quantity of Egyptian exports of fish 0.9%, 4,5% , where the elasticity coefficient was It had about 0.894, 0.25 respectively and did not agree with the reference Statistical Logic .

Table 3: The most important economic factors affecting the consumption of fish in Egypt during the period 2005 – 2016

Years	Domestic consumption Per thousand tons	Population Million	Average income LE / Year	Average Retail Price (LE) per kg		
				Fish	Red meat	Poultry
2005	1072.68	69.9	7168.8	12.8	25.3	9.8
2006	1174.47	70.6	8069.8	13.1	27.7	10.7
2007	1262.49	74.3	9646.4	13.6	33.0	11.3
2008	1197.70	75.2	11375	16.4	35.8	14.4
2009	1220.83	79.2	12923	15.7	38.7	14.6
2010	1551.00	82.1	14623	17.3	51.6	17.3
2011	1538.90	80.5	16266	18.8	85.3	18.5
2012	1691.19	85.7	17871.5	21.5	62.2	21.4
2013	1669.80	87.5	19826.9	21.7	67.7	24.9
2014	1686.5	88.9	22011.7	23.8	79.8	26.0
2015	1695.2	89.5	24581	25.2	81.6	29.5
2016	1706.3	90.2	26789	27.8	92.5	31.3
Average	1550.2	65.36	15929.3	18.9	56.8	19.2

Source: - Compiled and calculated from :-

1 :-From the data of the Ministry of Agriculture and Land Reclamation , the General Authority for Fisheries Development, Bulletin of Fish Production Statistics - various numbers.

2 :-Central Agency for Public Mobilization and Statistics - Foreign Trade Bulletin, Statistical Yearbook of Fish, various numbers.

Second: Development of the quantity of fish production from Egyptian marine fisheries and the size of the fish gap during the period (2005-2016):

The fisheries are produced from two sources. The first source is: - Natural fisheries represented in marine fisheries (Mediterranean and Red Sea), North and inland lakes fisheries (Bardawil, Edkou - Mariout - Qaroun - Rayan) and then fresh water production represented in the Nile River and its branches and Lake Nasser. The second source: - It is a fish culture in its various forms and includes pelvic farms, fish cages, and farming in rice fields.

1-Marine capture fisheries

The total area of capture fisheries is estimated at 11.2 million feddans, representing 82.3% of the total area of Egyptian fisheries. Table (4, 5 and 6) shows that the amount of fish production from marine fisheries was estimated at 107.5 thousand tons in 2005, Contributed 10.2% to cover the domestic consumption of fish, which is about 1072.5 thousand tons, while the amount of fish production from marine fisheries by 111,8 thousand tons in 2016 contributed about 6.6% in the coverage of domestic consumption of fish, about It was found that the production of marine fisheries increased at an annual rate of insignificant growth of about 1.46% per year, with a coefficient of about 0.15 with mean that about 15% of the average marine fisheries production of fish is due to the time of the Republic, and 85% of those changes are due to other factors during the study period .

2-Sea fisheries:-

The northern lakes include Lake Manzala, El-Borlos, Adko, Mariout, and the North Sea area is estimated at about 252 thousand feddans and represents 2.1% of the total area of marine fisheries. Table (5,4,6) shows that the amount of fish production from sea fisheries Which was estimated at 158.3 thousand tons in 2005, contributed 14.7% to cover the domestic consumption of fish, which is about 1072.5 thousand tons, while the quantity of fish production from the fisheries of the lakes about 210.2 thousand tons in 2016 participated in about 12, 3% in the coverage of domestic consumption of fish, which is about 1706.3 thousand tons, and it has been shown that the production of the northern lakes has increased at a rate of annual growth is insignificant whith estimated at 8,19 per year .

3. Fresh water

The area of the fresh inland lakes is estimated at 1.4 million feddans, representing about 10.3% of the total area of Egyptian fisheries. The total area of the Nile River and its branches is estimated at 187 thousand feddans and represents about 1.37% of the total area of Egyptian fisheries. Table (6.5.4) shows that the quantity of fresh water production reached 83.8 thousand tons In 2005, it contributed 7.8% to the coverage of domestic fish consumption of about 1072.5 thousand tons, while the quantity of fresh fish production of about 69.8 thousand tons in 2016 contributed about 4.1% in coverage of the domestic consumption of fish Which is about 1706.3 thousand tons. According to the results, the high dam lake, despite the many problems found in it, contributes about 69.9% of the total production of inland lakes, followed by Lake Mersa, Al-Tanshan, Qaroun, Mafid Toushki, Al-Rayyan, and finally the water bodies in the New Valley, estimated at 9.7%, 7.7% , And it was found that the production of fresh water increased at an annual growth rate of about 8.8% per year, with a coefficient of about 0.582 which means that about 58% of the average freshwater production of fish In the Republic due to time, and 42% of those changes were attributed to other factors during the study period.

Third: - Development of aquaculture production during the period (2005 - 2016) :-

Due to the high risk and uncertainties in natural fisheries, because fish are of special nature (the speed of movement and movement), as well as the inability to control nutrition and varieties in estimating the quantity that can be caught all these things encouraged the trend towards fish farming, In the quantity, type and size of the product through the intervention of the human element. Fish farming is considered one of the most modern activities. Its significant contribution to production began in the late 1980s and early 1990s, with varying levels ranging from experimental levels that did not reach a commercial level and then turned into contributions representing a large proportion of total fish production, which now exceeds 60%. It was found that the area of fish farms is estimated at 377 thousand feddans, representing about 2.8% of the total area of Egyptian fisheries.

1-The first source of fish farming:

Pelvic farms and fish cages Table (4, 5, 6) shows that the production was estimated at 522.1 thousand tons, which accounted for 50.3% of the domestic consumption of fish in 2005, while the quantity Fish production from pelagic farms and fish cages reached about 1211.6 thousand tons in 2016, contributing 71.1% to the coverage of local fish consumption of about 1706.3 thousand tons for the same year. It has been shown that fish farming from pelagic farms and fish stocks has increased With an annual growth rate of about 7.1% per year during the study period .

Table 4: Evolution of fish production from Egyptian marine fisheries and size of fish gap during the period 2005-2016 .(Quantity: thousand tons).

Years	Aquaculture				Fisheries*			Quantity of domestic production	Quantity of domestic consumption	the size of the fish gap between production and consumption
	Navy	Lakes	Fresh water	Total Aquaculture	Pelvic and fish cages	Rice fields	Total fish farming			
2005	107.5	158.3	83.8	349.6	522.1	17.6	539.7	889.3	1072.7	183.4
2006	119.6	108.3	104.9	332.8	589.5	5.5	595.0	970.9	1217.6	246.7
2007	130.7	144.0	97.7	372.4	630.2	5.3	635.5	1008	1262.5	254.5
2008	136.2	157.9	79.7	373.8	665.9	27.9	693.8	1067	1197.7	130.7
2009	127.8	172.2	87.3	387.3	693.0	37.7	730.7	1093	1205.9	112.9
2010	121.4	179.2	84.6	385.2	890.4	29.2	919.6	1304.8	1551	246.2
2011	122.3	163.3	89.7	375.3	951.2	35.1	986.3	1362.2	1535	162.8
2012	114.2	173.4	66.6	354.2	983.2	34.5	1017.7	1372	1691	319
2013	106.7	182.5	67.7	356.9	1063.4	34.1	1097.5	1454.4	1670	215.6
2014	109.5	190.2	68.2	367.9	1122.2	34.6	1156.8	1536.6	1686.5	149.9
2015	110.9	197.3	69.1	377.3	1198.3	35.1	1233.4	1616.6	1695.2	78.2
2016	111.8	210.2	69.8	391.8	1211.6	35.9	1247.5	1686.6	1706.3	19.7

(*) Central Agency for Public Mobilization and Statistics (CAPMAS) - Fisheries Research during the period (2005-2016) - April 2017.

Source: - Data collected from the Ministry of Agriculture and Land Reclamation, and the General Authority for Fisheries Development.

Table 5: The relative importance of the sources of fish production and its role in covering domestic consumption and the size of the fish gap in Egypt during the period 2005-2016. (thousand tons Quantity):

Years	Aquaculture%				Fisheries%			Quantity of domestic production	Fish imports
	Navy	Lakes	Fresh water	Total Aquaculture	Pelvic and fish cages	Rice fields	Total fish farming		
2005	10.2	14.76	7.8	32.6	48.7	1.6	50.3	82.9	17.1
2006	10.13	11.98	8.3	29.7	46.8	0.43	47.1	82.7	18.3
2007	10.35	11.40	7.7	29.4	49.2	1.13	50.33	79.8	21.2
2008	11.4	13.20	6.6	31.2	55.6	2.3	57.9	89.1	10.9
2009	10.6	14.3	7.3	32.1	57.5	3.1	60.6	90.6	11.3
2010	7.8	11.6	5.5	24.8	57.4	1.9	59.3	84.1	16.6
2011	8.0	10.6	5.8	24.4	62.0	2.3	64.3	88.7	11.9
2012	6.8	10.3	3.9	20.9	58.1	2.0	60.2	81.1	19.4
2013	6.4	10.9	4.1	21.4	63.7	2.0	65.7	87.1	14.1
2014	6.5	11.3	4.1	21.9	66.5	2.1	68.5	91.1	23.4
2015	6.7	11.6	4.1	22.4	70.7	2.1	72.2	95.3	15.5
2016	6.6	12.3	4.1	23.0	71.1	2.2	73.3	98.8	16.3

(*)Central Agency for Public Mobilization and Statistics - Statistics of fish production during the period (2005 - 2016) different numbers.

Source: - Data collected from the Ministry of Agriculture and Land Reclamation - General Authority for Fisheries Development, Bulletin of Fish Production Statistics - Various Numbers

2. Second source of fish farming from rice fields

The cultivation of carp in rice fields is one of the types of fish farming. Due to its high growth rate, production of rice fields was estimated at 17.6 thousand tons, which covered about 1.6% of the domestic consumption of fish in 2005, while the quantity of fish production from rice fields About 35.9 thousand tons in 2016 contributed about 2.2% in the coverage of domestic consumption of fish and about 1706.3 thousand tons for the same year, and it was found that fish farming from rice fields has increased at a rate of annual growth is insignificant about 9.2 % Per year during the study period .

3-Fish imports:

Fish imports were estimated at 188.5 thousand tons, covering about 17% of the total consumption needs of 2005, amounting to 1072.5 thousand tons. In 2016 imports were estimated at 278.7 thousand tons, covering about 16.3% of the total consumption needs for 2016, The production

of marine fisheries was estimated at 111.8 thousand tons, covering about 6.6% of domestic consumption. The production of lake fisheries was estimated at 210.2 thousand tons, covering about 12.3% of domestic consumption, and the production value of freshwater fisheries About 69.9 thousand tons, which covered about 4.1% of the domestic consumption of fish estimated at about 1706.3 thousand tons for the same year, and thus participated production from all sources To meet about 23 percent of the total domestic fish consumption in 2016. With a growth rate of about 1.5%. Fish culture from pelagic farms and fish cages reached 1211.6 thousand tons, contributing 71.1% of domestic consumption, with a growth rate of 7.1%. Production from rice fields reached About 35.9 thousand tons, which covered about 2.2% of the consumption needs of fish for the same year, with a growth rate of about 9.2%. Thus, the production of the whole aquaculture contributed about 1247.5 thousand tons and contributed about 37.3% Fish consumption needs for the same year and growth rate estimated at about 7.7% .

Table 6: Shows the equations of the general time trend for the view of fish production from different sources for the year (2005-2016):-

Equation number	Fish production of different source	Equation	2-R	F	Mean	% The change average
1	Marine fisheries	$Y1=0.18 X + 0.477xt^{\wedge}(1.7)^*$	0.150	2.94	32.52	1.46
2	Lakes	$^{\wedge}Y1=0.015 X + 0.853xt(5.168)^{**}$	0.700	26.7	104.04	8.29
3	Freshwater	$^{\wedge}Y1= -0.22 X - 0.788 xt(4.145)^{**}$	0.582	16.33	88.7	8.8
4	Total capture fisheries	$^{\wedge} Y1= 0.10 X + 0.465 xt(3.5)^{**}$	0.137	2.75	30.8	1.5
5	Pelvic farms	$Y1= 0.62 X + 0.989 xt^{\wedge}(20.45)^{**}$	0.975	43.4	139.7	7.1
6	Rice fields	$Y1= 0.235 X - 0.753 xt^{\wedge}(3.62)^{**}$	0.524	13.11	81,12	9.2
7	Total fish farming	$Y1 = 0.205 X + 0.909 xt^{\wedge}(3.62)^{**}$	0.809	47.58	118.2	7.7
8	Gross domestic product	$^{\wedge}Y1= 0.207 X + 0.609 xt(2.42)^{**}$	0.308	5.88	53.1	1,14
9	available for consumption	$^{\wedge}Y1= 6.68 X + 0.118 xt(0.376)$	0.085	0.142	1.99	5.9
10	Fish gap size Fish gap size	$Y1=201.5X + 0612xt^{\wedge}(2.5)^{**}$	0.312	5.99	53.5	1.15

(*)At the level of 0.05, (**) is significant at the level of 0.01

The figures between the arcs are the calculated T value, where Y^{\wedge} = the estimated value of the dependent variable in the year e - represents 3,2,1, 12

(Y) where the estimated value of production, consumption, size of the gap, imports, exports and per capita .

Xt: Time factor in year

Source: - Data collected from the Ministry of Agriculture and Land Reclamation, and the General Authority for Fisheries Development.

Fourth: - Food gap and self-sufficiency ratio of fish

Table 1, 2 shows that domestic production of fish increased from about 889 thousand tons in 2005 to about 1.62 million tons in 2016, with an annual average during the study period estimated at 1208.5 thousand tons, with a statistically significant growth rate of about 1, 14% of the annual average as shown in Table (1.6), while imports increased from about 188.5 thousand tons in 2005 to about 278.7 thousand tons in 2016. With an annual average of 262.19 thousand tons. Table (2.1) shows that the annual growth rate is not statistically significant at 1.5% of annual average. As shown in Table 2.1, fish exports increased from about 5.13 thousand tons in 2005 to about 23 thousand tons in 2016, with an annual average during the period of study estimated at 13.03 thousand tons and an annual growth rate is statistically significant estimated at 0.251 thousand ton per year of consumption increased from 1072.68 thousand tons in 2005 to about 2123.11 thousand tons in 2016. The average annual rate during the study period was about 1550.2 thousand Ton. As shown in Table (1, 2), the annual growth rate is statistically significant at about 6.5% of the annual average. As shown in Table

2.1, the self-sufficiency rate of fish decreased from 82.9 in 2005 to about 67.3% in 2016. Table 2 shows that the annual growth rate was about 1.4% of the annual average. While the average per capita fish share increased from about 15.3 kg / person / year in 2005 to about 23.96 kg / person / year in 2016. Table (2) shows that the annual growth rate is statistically significant at about 1, 9% of the annual average. As shown in Table (2.1), the volume of food fish gap during the study period increased from 183.4 thousand tons in 2005 to 240.7 thousand tons in 2016 with an average annual rate of about 242.6 thousand tons at a growth rate Is not statistically significant, which is estimated at 10.3% of the annual average. The results showed that despite the relative stability of the fishery areas and the decrease in fish production from natural fisheries, local fish production has increased significantly recently.

This increase is due to fish farming, which accounts for 73.3% of the domestic production. However, despite this increase, domestic production is still insufficient for consumption. Consequently, there is still a nutritional gap. However, the self-sufficiency ratio has declined despite the large increase in imports. The rate of change was about 1.4%, while the value of exports increased and the average per capita consumption increased from about 15.3 kg / in 2005 to about 23.9 kg / person / year in 2016 with a change rate of about 1.9%. Self-sufficiency in fish can be achieved in Egypt through the interest of the marine culture in the Aegean and the Mediterranean and the Red Sea and there are successful experiments for the cultivation of fish and white peat in the Mediterranean Sea west of Alexandria.

Fifth: - Statistical Estimation of the Functions of Fish Production in Fish Farms by Study Sample:

The analysis of the sample of the field study showed that the simple, multiple, and logarithmic regression is the most accurate image in the economic logical statistical results. It represents the quantity of production of the fish produced in tons from the variable farms and among the independent variables affecting the production. (H2e), the number of human working hours (x4e), and the value of fish production of all types (Q5H). The logarithmic equation was as follows

Equation (No. 1).

$$\text{Log } Y^H = 382.79 + 0.996 \text{ LOS } 1 H + 0.0969 \text{ L S } 2 H + 0.363 \text{ L S } 3 H + \text{L } 0,334 \text{ LS4H}$$

$$(0.389) \quad (-2.192) \quad * (2.045) \quad * (1.064) \quad * (0.089)$$

$$R^2 = 0.74 \quad F = 172.29$$

Where: - Y^H = the amount of estimated production of fish in tons

Independent variables = $x_1 H, x_2 H, x_3 H, x_4 H$

R^2 = Selection Factor

F = Calculated Value (F)

At the level of 0.05

(**) significant at the level of 0.01

significant (*)

It is clear from Equation (1) that the estimated relation between the quantity of fish production in tons as a dependent variable and the independent variables which are: - Area of fish ponds, number of fingerlings used, amount of feed used in kg and number of working hours, there is a positive correlation between the quantity of fish production in fish farms and the area of each fish ponds, the number of fingerlings used, and the amount of feed used, ie, the increase of each of the previous variables by 1%, the total amount of fish production increases by , 99%, 0.096%, 0.36%, 0.33% respectively, as authors and There is a positive correlation between the quantity of fish production and the number of human working hours. In other words, the farmers' use of the variables studied is considered rational. The coefficient of selection, which is about 0.74, indicates that the independent variables studied explain about 74% Fish production in tons, and about 26% is due to other factors .

Sixth: - Statistical Estimation of the Functions of Production Costs of Fish Production in Fish Farms by Study Sample.

The study of the different images of the functions of production costs shows that the squared image is the best function in terms of economic and statistical. The functions of the total costs, the marginal costs and the optimal size of production were calculated (average total costs = marginal costs).

1-Estimation of the total costs of fish production in fish farms by sample

In calculating the total costs of fish farms in the sample of the study, it was found that the squared image is the most accurate picture in the statistical and logical economic results. The average total costs, marginal costs and the optimal size of production were calculated. The square cost function of the sample as a whole and the feddan per fish farm were calculated. As can be seen from equation (2).

Equation (2)

$$\text{MtkH} = 8.45751 - 200.779k + 1.847k^2$$

$$(0.540)^* \qquad (4.131)^{**}$$

$$R^2 = 0.59 \qquad F = 8.3$$

Mtk = Production costs of fish in pounds

K = Quantity of fish production produced in fish farms per ton.

R² = Selection factor

F = calculated F value

(*) significant at 0.05

(**) significant at the level of 0.01

The marginal costs of the fish produced in the fish farms were calculated by means of the first differential of Equation (2) as follows to reach the optimum size to reach the lowest cost of the farm where it reached about 55 tons while the average quantity of fish farms was about 14.39 tons.

Equation (3)

$$\text{Mc} = 200.779 + 3.68k$$

$$\text{Optimized size} = 204.56 / 3.68 = 55 \text{ tons}$$

$$\text{Average output quantity} = 55 / 3.86 = 14.39 \text{ tons}$$

(*) significant at 0.05

(**) significant at the level of 0.01

2-Estimation of the unit cost of the unit area (feddan) of the fish farms:

In calculating the total costs of the fish farms in the sample of the study, it was found that the squared image is the most accurate image in the statistical and logical economic results as shown in equation.

Equation (4)

$$\text{MCK} = 9717.5 + 36645.3K + 6044.78K^2$$

$$(1.540)^*$$

$$R^2 = 0.599$$

$$(1.591)^*$$

$$F = 9.48$$

MCK = Production costs of fish per feddan / pound

K = Quantity of fish production produced in fish farms per feddan / ton

R² = selection factor

F = calculated F value

(*) significant at 0.05

(**) significant at the level of 0.01

The marginal costs of the fish produced in the feddan farms were calculated by means of the first differential as follows to reach the optimum size to reach the lowest production costs of the farm, which amounted to about 4.03 tons / fed, while the average quantity of actual fish farms was about 3.34 tons / feddan

Equation (5)

$$\text{Mc} = 36645.3 + 12089.56K$$

$$\text{The optimum size per feddan} = 48734.86 / 12089.56 = 4.03 \text{ tons / feddan}$$

$$\text{Average production per feddan} = 4.03 / 12089.56 = 3.34 \text{ tons / feddan}$$

3- Productive and economic efficiency indicators of the study sample

Table (7) shows that the average farm productivity of the fish in the sample field is about 55 tons / feddan to reach the optimum production, and the average productivity of the feddan is about 3.34 tons / feddan. The cost of the total production costs was estimated at 23300 pounds and the average variable cost was about 19122 pounds representing about 82.1%. The average fixed costs were about 4178 pounds representing about 17.9% of the average production costs. The cost per kilo

of tilapia was about 16.3 pounds / kg / g. The farm income per feddan was about 4,03 tons x 16000.3 pounds / ton = 64481.21 pounds / fed. The net yield per feddan was about 41181.21 pounds / fed for the sample of the study. The calculation of the percentage of revenue for the costs indicated that it amounted to $(64481,21 / 23300) = 2.8$ pounds, meaning that the pound spent in the lot / Dan equivalent to 2,8 pounds profitability in the acres. The calculation of the profitability of the pound invested showed that it amounted to about LE 1.76, and in calculating the ratio of revenues / variable costs, it is estimated that it amounted to about 3.37 pounds, and by calculating the total margin was about 308699.04.

Table 7: Productivity and Economic Efficiency Indicators for Farm, Lloyds and Fish Tons in Fishery Farms by Sample Field Study for 2015-2016 .

M	Indicator	Unit	Farm	Unit per Feddan
1	Average Fish Productivity	ton	14.39	0.59
2	Average Fixed Costs	LE	102361	4178
3	Average variable costs	LE	468489	19122
4	Total average cost is LE	LE	570850	23300
5	average income of the total LE	LE	159789.96	64481.21
6	The Net Return1	LE	1008939.64	41181.21
7	Profit per pound invested 2	LE	1.76	1.76
8	Revenue/Total Cost Ratio3	LE	2.8	2.8
9	Percentage of income / variable costs	LE	3.37	3.37
10	Total Margin4	LE	308699.04	45359.211

1- Net return = Revenue – costs.

2- Profitability of invested pound = (net return / total costs) x 100.

3- Revenue / Total Cost Ratio = Total Revenue / Total Costs.

4-Total Margin = Total Revenue - Total Costs .

Source: Computed from the questionnaire data for the sample of the field study for the production year 2015- 2016 .

Seventh: The most important problems and obstacles facing fish farming in the sample of the study :-

Since the production of fish farms can be controlled in terms of varieties, nutrition and sizes, along with the breeding of some species in the form of intensive aquaculture, fish production in Egypt has achieved a significant growth in production, it has been able to increase the total fish production from various fisheries at an increasing rate, Natural fisheries and degradation of each other. But there are some drawbacks to fish farming, which must be taken into account because of its importance because of its negative impact on the environment and also on consumers and these negative.

- (1) The use of hormones and growth stimuli to change sex and increase the efficiency of growth.
- (2) Water is the limit of environmental determinants, it is difficult to consider the rates required to change the water and thus increase the waste and solids in the water and lack of oxygen.
- (3) Intensive use of nutrition to increase production, which increases organic matter in water and reduces its quality and lead to increased nitrogen and phosphorus. Therefore, the state should also turn its attention to marine aquaculture because it has become the desired goal because of its great importance, including the interest in the production of marine fish free from pollutants and growth catalysts that affect human health.

Table 8 shows that there are many problems facing fish farming, mainly the problem of high fish feed costs, which represents a relative recurrence of 19.8%, followed by the problem of market instability and fluctuation of market prices for fish, representing 17.6% The rental value of the leased farms represents a relative recurrence of about 15.9% and falls to the lowest in the problem of high prices of fingerlings of some families such as Albori and represents a relative recurrence of 3.5%, followed by the competition of low-priced imported fish to the local product, which reduces the demand and represents a relative recurrence of about 3 %

As shown in Table 9, there are several proposals for the promotion of fish farming from the point of view of the sample of the field study, which is mainly the work of cooperative societies for the owners of the farms to provide the production requirements at discounted prices and choose the appropriate periods for sale, (29.8%), followed by finding substitutes for feed ingredients to reduce the cost of nutrition, representing 15.9%. The dependence on groundwater is approximately 14.8%,

followed by attention to the extension role, which represents a relative recurrence of about 13.9%. The lowest is 4.5%, 3.5% on Arrange for each of the training courses for workers to increase their efficiency in fish farming, the provisions of control over fish farms violating .

Table 8: shows the most important problems and obstacles faced by fish farms in the sample field study for 2015.

M	Problems	Relative Frequency %
1	High feed and feeddan costs	19.8%
2	Fish market price instability	17.6%
3	High rental value of farms	15.9%
4	Higher wages of trained workers	13.8%
5	Absence of the Fishery Role in Fish Farms	12.9%
6	Water pollution of some ponds	10.2%
7	Some fish farms for plant production turned to high ground water level	8.5%
8	Small lease period for fish farms	7.5%
9	Lack of trained labor on aquaculture	4.5%
10	The prices of fingerlings of some families such as the Burial family	3.5%
11	Competition of low-priced imported fish to the local product, reducing the demand for it.	3%

Source: - Data from the questionnaire form for the 2015 field study sample.

Table 9: Shows the most important proposals of sample respondents to improve the fish farms sample field study for the year 2015.

M	Suggestions	Relative Frequency %
1	Work cooperatives for fish farms to provide production requirements at reduced prices	29.8%
2	Establishment of associations for the marketing of fish producing farmers	17.9%
3	Find alternatives to feed ingredients and support for farms	15.9%
4	Dependence on groundwater as an alternative to wastewater	14.8%
5	Attention to the guiding role and guides in fish farms 13	13.9%
6	Amendment of Irrigation Law in Fish Farms, Directorate of Agriculture	11.2%
7	Standardization of the status of fish farms until the transformation of plant production	8.5%
8	Increase the lease period for fish farms	7.5%
9	conducting training courses for workers and extension fields on fish farming to raise their efficiency	%4,5
10	Health control provisions on fish farms violating	%3,5

Source: - Data from the questionnaire form for the 2015 field study sample.

Recommendations and proposals

For the means of promotion of fish farms
 To seek sustainable development in the fisheries sector requires: -

1- For natural fisheries

- Expansion of fish culture in Egyptian beaches and application of modern systems in farms.
- Reduce pollution and depletion of fish stocks and collection of fry from marine fisheries.

2- For fish farming:

Development of existing production systems and transfer of technology for this activity from developed countries.

Expansion of hatchery construction to supply fish farms with the required types.
 Establish an information system for production, processing and marketing sites and build realistic policies on fish farming activity and transfer of expertise from abroad.

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