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EFFICIENT USE OF FISH RESOURCES IN THE PRODUCTION OF FISH FRY IN AL-ABBASSA HATCHERY

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ABSTRACT

The research aims in general to identify the most important private and governmental fish hatcheries and possibilities of developing it, especially AL-Abbassa hatchery, in light of the current trend of the state in establishing projects for the development of fish farming. The results concluded that the total production of hatcheries averaged about 403.7 million unit, with an annual growth rate of about 5%, during the period (2010-2020). in view of the importance of AL-Abbassa hatchery, it was found that it represents about 57.3% of the total number of hatcheries in AL-Sharkia Governorate, and about 12.7% of the total number of hatcheries in the Republic. By studying the number of the workforce, it was found that the productivity of the worker decreased from 3294 thousand fry in 2017 to 1941 thousand fry unit only in 2020, i.e. at an annual rate of decrease estimated at about (-0.132), By examining the measures of economic efficiency, it was found that the rate of return to costs amounted to about 1.16 L.E, and the return of the invested pound amounted to about 16.15%, and the profit margin of the product reached about 13.90%. As for relative profitability, it amounted to about 94.06%, and as for economic efficiency, it reached about 0.35. The research recommends that this hatchery should be taken care of and utilizes all the potentials in it, as well as increase investments in single-sex tilapia.

INTRODUCTION

Fish farming is one of the most important optimal methods for obtaining the highest productivity per unit area if the production factors are exploited with the highest efficiency, and it also contributes to achieving food security, employment and the provision of foreign currency in light of the decline in production from natural fisheries **(Abu Fotouh, 1997; Zayed and ElGarhy, 2023; Ali *et al.*, 2020)**.

Fish fry play a major role in the development of fish farming in particular, and thus the development of fisheries in general **(Sadiq, 2000; Ramadan *et al.*, 2023)**, especially in the Sharkia governorate, in which fish production from aquaculture occupies more than 96% of the total Fish production in the governorate also depends on providing fry of the right quality and at the right price. Ambitious plans for fish farming and intensifying its production. The study will cover an assessment of the use of resources in the production of fry and their incubation to reach the fingerling stage, ie treating the fry as a final product for the hatchery and not as a production input within the fish production inputs. Fish seed is available from two sources, the first is the collection of seed from natural

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sources, and the second is from hatcheries,whether governmental or private, The importance of aquaculture in Egypt is highlighted in that it has become at the top of the sources of production, as its relative importance increased from about 17.6% in 1995 **(Amer, 2007)** to about 79.18% of the total fish production in 2020, estimated at about 2.1 million ton, and the average per capita consumption was estimated at about 22.68 kg in 2020 **(Lakes and Fish Resources Protection and Development Authority, 2020)** with a self-sufficiency rate of 86.86%, of which 86.78% is from fish farming, and with the development of the need to increase fish production The importance of farming highlights the importance of providing fish fry for fresh water, which is the main determinant of fish farming, as the production of government hatcheries from freshwater fingerlings in 2020 reached approximately 55.902 million fry unit, and decreased from the previous year by 158.24 million fry unit. Fish production costs in fish farming systems, where their relative importance ranged from 17% to about 48% of production costs and from 17% to 65% of variable costs, according to the difference in the given fish species, crop composition, or loading rates. In the eighties, farms were closer to Al-Haush is a farm and all its production costs are variable **(Amer, 2018)**.

STUDY PROBLEM

The problem of the study is that there is a shortage of fish fry for all cultured species, whether freshwater or marine fish, which are not available in natural fisheries in appropriate numbers, sizes, and the appropriate timing for use in cultivation, as their collection from natural sources is the important source for obtaining marine fish fry, as hatching fish Marine water faces difficulty and needs complex and expensive technology as a result of the high cost of providing natural food with special specifications for larvae, and the mortality rate of this type of larvae may reach 90%, these obstacles made marine water fish hatching an activity that is not widespread, as there are very few From marine hatcheries, whether governmental or private. In addition to the multiplicity of authorities supervising and authorizing the collection of fish from one region to another, where the permit to collect fry requires approvals from the Border Guard Intelligence, State Security Investigation, Military Intelligence, Flats Police and Canal Security for the Suez region. As well as the limited contribution of the private and cooperative sector in the process of establishing industrial hatcheries, especially marine hatcheries, with the scarcity of experiments and biological studies necessary to work on adapting marine fish and subjecting them to industrial hatching. As for freshwater fry, the shortage in them and their fingerlings requires a continuous increase in production from them to meet the increasing demand. However, the scarcity of fresh water required for farming, and the use of water mixed with agricultural drainage water, whether in hatcheries or fish farms, hinders the development of fish farming.

STUDY OBJECTIVES

The research aims in general to identify the most important private and governmental fish hatcheries and the possibilities of developing it, especially AL-Abbassa hatchery, especially with the current trend in the country to establish projects for the development of fish farming though.

1-Identify the most important governmental and private hatcheries.

2-Studying the evolution of seed production in these hatcheries.

3-Studying and evaluating AL-Abbassa hatchery in terms of the quantity of production and its costs.

4-Studying the most important obstacles and problems facing increasing the production of government hatcheries.

5-Develop some proposals and solutions that help fill the shortage of fry in government hatcheries.

RESEARCH METHOD AND SOURCES OF DATA COLLECTION

The research relied to achieve its objectives on descriptive statistical analysis to determine the problem of the study using arithmetic averages, relative importance, and quantitative statistical analysis in order to determine economic variables in terms of their general trends and growth rates using appropriate statistical analysis methods and mathematical models such as simple regression, and general time trend equations, using statistical analysis programs such as (SPSS, Microsoft Excel). The research relied on published and

unpublished primary and secondary data from the authorities that issue them, such as the General Authority for Fisheries Development and the Central Agency for Public Mobilization and Statistics, in addition to master's and doctoral dissertations, scientific research and books interested in this field.

RESULTS AND DISCUSSION

First: Evolution of the production of fingerlings and fry of fish hatcheries:

Table (1) indicates the production of fingerling fish hatcheries and fry collection sites in million unit during the period (2010-2020). And it turns out:

1- Government hatcheries marine water:

It is clear from the data in Table (1) that the minimum number of fingerlings produced was about 0.5 million unit in 2012, while the maximum amount reached about 534.3 million unit in 2020. With an annual average of about 2.3 million unit, the annual growth rate was about 0.1%.

2- Governmental fresh water hatcheries:

It is clear from the data in Table (1) that the minimum number of fingerlings produced amounted to about 55.9 million unit in 2020, while the maximum amount reached about 302.6 million unit in 2014. With an annual average of about 206.7 million unit, the annual growth rate was about -12%.

3- Total government hatcheries:

It is clear from the data in Table (1) that the minimum number of fingerlings produced amounted to about 97.1 million unit in 2017, while the maximum amount reached about 590.2 million unit in 2020. With an annual average of about 16.4 million unit, the annual growth rate was about 9%.

Table 1. Production of fingerling fish hatcheries and fry collection sites in million unit during the period (2010-2020)

Year	Government hatcheries			National hatcheries			Total hatcheries	Collecting fry
	Marine water	Fresh water	Total	Marine water	Fresh water	Total		
2010	1.5	216.1	217.6	13.6	169	182.6	400.1	78
2011	2.3	285.1	287.3	13.6	174	187.6	474.9	62.5
2012	0.5	209.6	210	9.6	191	200.6	410.6	73
2013	0.9	281.2	282.1	8	219	227	509.1	42.7
2014	5.1	302.6	307.7	8	244.5	252.5	560.2	71.7
2015	4.4	279.4	283.8	25	66.5	91.5	375.3	95.4
2016	3.6	155.9	159.5	40.6	76.5	117.1	276.6	51.4
2017	1.8	95.2	97.1	10.6	76.5	87.1	184.2	77.1
2018	1.3	178.2	179.5	16.5	76	92.5	272	45.5
2019	1.5	214.1	215.6	16	72	88	303.6	62.3
2020	534.3	55.9	590.2	18.9	64.8	83.7	673.9	46.7
Average	**2.3**	**206.7**	**257.3**	**16.4**	**130**	**146.4**	**403.7**	**64.2**
growth rate%	**0.10%**	**-12%**	**9%**	**3%**	**-8%**	**-7%**	**5%**	**-5%**

Average and growth rate of government hatcheries (marine water) were calculated until 2019.

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

4- Private hatcheries, marine water:

It is clear from the data in Table (1) that the minimum number of fingerlings produced was about 8 million unit in 2013 and 2014, while the maximum amount reached about 40.6 million unit in 2016. With an Annual average of about 206.7 million unit, the annual growth rate was about 3%.

5- Private hatcheries, fresh water:

It is clear from the data in Table (1) that the minimum number of fingerlings produced amounted to about 64.8 million unit in 2020, while the maximum amount reached about 244.5 million unit in 2014. With an annual average of about 130 million unit, the annual growth rate was about -8%.

6- Total private hatcheries:

It is clear from the data in Table (1) that the minimum number of fingerlings produced amounted to about 83.7 million unit in 2020, while the maximum amount reached about 252.5 million unit in 2014. With an annual average of about 146.4 million unit, the annual growth rate was about -7%.

7- Total hatcheries:

It is clear from the data in Table (1) that the minimum number of fingerlings produced amounted to about 184.2 million unit in 2017, while the maximum amount reached about 673.9 million unit in 2020. With an annual average of about 403.7 million unit, the annual growth rate was about 5%.

8- Fry collection sites:

It is clear from the data in Table (1) that the minimum number of fingerlings collected amounted to about 42.7 million unit in 2013, while the maximum amount reached about 95.4 million unit in 2015. With an annual average of about 64.2 million unit, the annual growth rate was about -5%.

Table (2) indicates the production of government hatcheries and nursery stations of freshwater fingerlings in million unit during the period (2010-2020).

From it, it was found that the Fouh hatchery comes in the first place in terms of production, with an average of about 27.1 million fingerlings, and an annual decrease rate of about 16%, While the Saft Khaled hatchery comes in second place with an annual average of about 26.5 million fingerlings, and an annual decrease rate of about 26%. The Abbassa hatchery came in third place, with an annual average of about 26.2 million fingerlings, and an annual decrease rate of about 18%. The Abu Shaqaf incubation station ranked fourth, with an annual average of about 26 million fingerlings, with an annual decrease rate of about 17%. Al-Khasha'a incubation station came in fifth place, with an annual average of about 21.5 million fingerlings, and an annual rate of decrease of about 19%. The hatcheries of San Al-Hajar, Al-Manzala, Sohag, Jurf Hussein, Sahari, Al-Raswa incubation station, Nagaa Hammady, Akyad, Al-Minya, Beni Suef, Assiut in ranked sixth to the last, with an annual average of about 17.4, 16.2, 9.9, 9.9, 9.0, 7.4, 6.4, 5.8, 5.3, 3.4, 2.3 million fingerlings, respectively, with an annual growth rate of about -14%, -15%, -4%, 1%, 7%, -12%, -8%, -60%, -8 %, -24%, -3%, respectively.

Table (3) indicates the production of governmental fish hatcheries from fingerlings in marine waters in one million unit during the period (2010-2020), and from it was found that the minimum production of the 21 kilo Alexandria hatchery of the Fish Wealth Authority was about 0.5 million unit, while the maximum was about 5.1. million unit, with an annual average of about 2.2 million unit, and an annual rate of decrease of about 3%.

It was also found that the National Company's Ghalioun hatchery entered the production phase beginning in 2020, with a quantity of approximately 533.3 million units.

Table (4) indicates the production of private fish hatcheries from fingerlings in marine waters in one million units during the period (2010-2020), and from it it was found that the most important production areas are represented in the Sinai shrimp hatchery, Ismailia hatcheries (Al-Wafa, Al-Balah, Haraz), Tharwat Taha hatchery, Medhat al-Sharif hatchery, Mona Azzan hatchery, whose production reached an annual average of about 10.8, 5.8, 5.4, 2.3, 0.5 million fingerling, during their production periods, at an annual growth rate of about 11%, 10%, -14%, 11%, 0% during the period their production.

Table 2. Production of governmental hatcheries and incubation stations of freshwater fingerlings in million unit during the period (2010-2020)

Year	Beheira		Kafr El-Sheikh		Sharqiya		Dakahlia		Beni Suef	Al-Minya	Assiut	Sohag	Qena	Aswan		Port Said	Total
	Saft Khaled	incubation Abu Shaqaf	Fouh hatchery	Abu Shaqaf incubation	Al-Abbasa	San Al-Hijr	Akyad	Al-Manzala	Beni Suef	Al-Minya	Assiut	Sohag	Nagaa Hammady	Jurf Hussein	Sahara	Al-Raswa incubation	
2010	**28.2**	**25.6**	**24.9**	**32.6**	**26.2**	**22.5**	**-**	**15.2**	**7.0**	**7.8**	**3.1**	**8.8**	**8.2**	**-**	**-**	**6.0**	**216.1**
2011	**50.6**	**28.1**	**34.5**	**37.8**	**34.3**	**25.3**	**-**	**23.2**	**7.0**	**5.3**	**2.0**	**12.3**	**16.8**	**-**	**-**	**7.9**	**285.1**
2012	**31.4**	**31.1**	**32.5**	**30.6**	**21.9**	**21.5**	**-**	**10.3**	**0.8**	**4.6**	**1.6**	**10.6**	**4.1**		**-**	**8.3**	**209.5**
2013	**42.9**	**36.9**	**33.5**	**26.6**	**31.6**	**23.9**	**-**	**24.9**	**5.2**	**7.8**	**4.5**	**17.0**	**11.0**	**-**	**-**	**15.5**	**281.2**
2014	**33.6**	**40.5**	**37.6**	**38.8**	**38.6**	**23.5**	**-**	**25**	**6.4**	**3.8**	**4.0**	**16.4**	**11.3**	**-**	**-**	**22.2**	**301.6**
2015	**28.6**	**55.3**	**33.1**	**26**	**34.7**	**24.9**	**-**	**23.7**	**5.5**	**8.9**	**5.5**	**12.8**	**4.9**	**-**	**-**	**15.4**	**279.4**
2016	**18.6**	**23.9**	**18.1**	**17.7**	**24.7**	**13.8**	**-**	**10.6**	**0.8**	**1.6**	**0.4**	**3.8**	**0.9**	**9.6**	**7.0**	**4.4**	**155.9**
2017	**1.6**	**3.1**	**4**	**0.6**	**10.3**	**8.4**	**2**	**18.2**	**2.1**	**9.7**	**0.5**	**11.7**	**3.9**	**9.4**	**9.3**	**0.5**	**95.2**
2018	**27.3**	**18.2**	**42.9**	**8.8**	**18.1**	**18.5**	**6.8**	**7.5**	**1.2**	**2.4**	**0.6**	**4.6**	**1.8**	**10.2**	**9.5**	**-**	**178.2**
2019	**27.9**	**19.7**	**33.3**	**14**	**44.9**	**4.7**	**14.5**	**17**	**1.5**	**3.5**	**2.2**	**5.5**	**4.4**	**9.8**	**9.7**	**1.7**	**214.1**
2020	**1**	**3.2**	**3.7**	**3.3**	**3**	**4.5**	**0.1**	**2.5**	**0.4**	**3.2**	**2.2**	**5.6**	**3.5**	**10.3**	**9.6**	**-**	**55.9**
Average	**26.5**	**26**	**27.1**	**21.5**	**26.2**	**17.4**	**5.8**	**16.2**	**3.4**	**5.3**	**2.4**	**9.9**	**6.4**	**9.9**	**9.0**	**7.4**	**206.6**
growth rate%	**-26%**	**-17%**	**-16%**	**-19%**	**-18%**	**-14%**	**-60%**	**-15%**	**-24%**	**-8%**	**-3%**	**-4%**	**-8%**	**1%**	**7%**	**-12%**	**-12%**

Average and annual growth rate calculated according to different time periods for each hatchery.

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Table 3. Production of government fish hatcheries from marine water fingerlings in million unit during the period (2010-2020)

Year	Alexandria (K21) Fisheries Authority	Kafr El-Sheikh (Ghalion) national company	Total
2010	1.5	-	1.5
2011	2.3	-	2.3
2012	0.5	-	0.5
2013	0.9	-	0.9
2014	5.1	-	5.1
2015	4.4	-	4.4
2016	3.6	-	3.6
2017	1.8	-	1.8
2018	1.3	-	1.3
2019	1.5	-	1.5
2020	1.0	533.3	534.3
Average	**2.2**	**-**	**-**
growth rate%	**-3%**	**-**	**-**

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Table 4. National fish hatchery production from marine water fingerlings in million unit during the period (2010-2020)

Year	Ismailia				Port Said	Alexandria	Suez	North Sinai	Total
	Al-Wafa	Al-Balah	Haraz	total	Tharwat Taha	Medhat Al-Sharif	Mona Azzan	S. for shrimp	
2010	-	3.1	0.6	3.7	-	-	-	9.9	13.6
2011	-	3.1	0.6	3.7	-	-	-	9.9	13.6
2012	-	3.1	0.6	3.7	-	-	-	5.9	9.6
2013	2.0	-	1.0	3.0	-	-	-	5.0	8.0
2014	2.0	-	1.0	3.0	-	-	-	5.0	8.0
2015	4.0	-	1.0	5.0	-	-	-	20.0	25.0
2016	5.0	-	2.5	7.5	10.6	2.0	0.5	20.0	40.6
2017	5.0	-	2.5	7.5	0.6	2.0	0.5	-	10.6
2018	5.0	-	3.0	8.0	6.0	2.0	0.5	-	16.5
2019	-	-		8.5	5.0	2.0	0.5	-	16.0
2020	-	-		10.0	5.0	3.4	0.5	-	18.9
Average	3.8	3.1	1.4	5.8	5.4	2.3	0.5	10.8	16.4
growth rate%	16%	0%	20%	10%	-14%	11%	0%	11%	3%

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Table (5) indicates the production of tilapia fingerlings in freshwater by private hatcheries in one million unit during the period (2010-2020), and from it it was found that: Kafr El-Sheikh governorate ranks first in terms of production, with an annual average of about 100.6 million units, with an annual decrease rate of about 7%. The governorate of Fayoum came in the second place with an annual average of about 11.8 million units and an annual increase rate of about 6%, and the governorates of Behaira and Ismailia came in the third and fourth place with an annual average of about 4.6 and 3.3 million units, respectively, and an annual rate of decrease of about 21%, 12 % Respectively. There were some hatcheries that had production, but it stopped, such as AL-Qalyubia, AL-Dakahlia, AL- Giza, Sohag, Aswan, with an average of about 1.6, 2.0, 5.0, 1.0, 30 million unit during their production period.

Table (6) refers to the production of governmental hatcheries and incubation stations of tilapia fingerlings in one million unit during the period (2010-2020), and from it it was found that the Jurf Hussein hatchery ranks first in terms of production, with an annual average of about 9.9 million unit, and an annual increase rate of about 1%. While the Sahara hatchery came in second place an annual average of about 9.0 million unit and an annual increase rate of about 7%, and the third place was the Manzala hatchery with an average of about 8.5 million units and an annual decrease rate of about 7%, and AL-Abbassa hatchery ranked fourth with an annual average production of about 6.5 million unit, at an annual decrease rate of about -14%, while the Abu Shaqaf nursery station came in fifth place, with an annual average of about 4.6 million unit, at an annual decrease rate of about 7%. Then the hatcheries of Fowa, Saft Khaled, Al-Khasha'a nursery station, San Al-Hajar, Sohag, Naga Hammady, Al-Raswa nursery station, Minya, Assiut, and Beni Suef ranked sixth to last in the order, with an annual average for each of them of about 4.4, 4.1. , 4.1, 3.8, 3.4, 2.8, 2.7, 2.6, 1.2, 0.7 million units, with an annual growth rate of about -6%, -27%, -5%, -4%, 0.02%, -3%, 43%, -8%, -5%, 12% respectively, while the Akyad hatchery did not produce fingerling tilapia.

Table 5. National fish hatchery production of tilapia fingerlings in fresh water in million unit during the period (2010-2020)

Year	Kafr El-Sheikh	Ismailia	AL-Fayoum	AL-Buhaira	AL-Qalyubia
2010	113.0	4.0	7.0	5.0	2.0
2011	117.0	4.0	8.0	5.0	2.0
2012	130.0	4.0	12.0	5.0	2.0
2013	189.0	7.5	12.0	10.0	0.5
2014	215.0	7.5	12.0	10.0	-
2015	55.0	1.5	10.0	-	-
2016	60.0	2.0	14.0	0.5	-
2017	60.0	2.0	14.0	0.5	-
2018	60.0	2.0	14.0	-	-
2019	57.0	0.5	14.0	0.5	-
2020	50.8	1.0	13.0	-	-
Average	**100.6**	**3.3**	**11.8**	**4.6**	**1.6**
growth rate%	**-7%**	**-12%**	**6%**	**-21%**	**-29%**
Year	**AL-Dakahlia**	**AL- Giza**	**Sohag**	**Aswan**	**Total**
2010	2.0	5.0	1.0	30.0	169.0
2011	2.0	5.0	1.0	30.0	174.0
2012	2.0	5.0	1.0	30.0	191.0
2013	-	-	-	-	219.0
2014	-	-	-	-	244.5
2015	-	-	-	-	66.5
2016	-	-	-	-	76.5
2017	-	-	-	-	76.5
2018	-	-	-	-	76.0
2019	-	-	-	-	72.0
2020	-	-	-	-	64.8
Average	**2.0**	**5.0**	**1.0**	**30.0**	**130.0**
growth rate%	**0%**	**0%**	**0%**	**0%**	**-8%**

Average and annual growth rate calculated according to different time periods for each governorate.

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Table 6. Government hatcheries and nursery production of freshwater tilapia fingerlings during the period (2010-2020) in million unit

Year	Beheira		Kafr El-Sheikh		Sharqiya			Dakahlia	Beni Suef
	Saft Khaled	incubation Abu Shaqaf	Fouh hatchery	Abu Shaqaf incubation	Al-Abbasa	Saft Khaled	incubation Abu Shaqaf	Al-Manzala	Beni Suef
2010	2.7	4.1	4.4	3.6	5.0	3.2	-	5.0	0.3
2011	11.4	5.3	5.3	7.0	4.2	5.0	-	13.6	0.5
2012	3.1	9.7	7.0	6.0	3.5	5.5	-	8.9	0.5
2013	8.0	8.0	8.0	5.5	5.0	5.5	-	15.0	0.9
2014	7.0	9.0	8.0	11.0	11.0	6.0	-	15.0	2.0
2015	3.5	7.2	6.0	6.0	10.0	6.0	-	11.5	1.3
2016	0.6	0.3	0.3	0.0	5.4	0.4	-	1.4	0.1
2017	-	-	-	-	-	-	-	18.1	0.6
2018	1.9	0.0	3.0	0.1	2.0	2.8	-	0.0	0.1
2019	2.5	0.6	2.5	0.0	18.1	1.7	-	3.0	1.0
2020	0.1	2.0	-	2.0	1.2	2.0	-	2.2	-
Average growth rate%	4.1	4.6	4.4	4.1	6.5	3.8	-	8.5	0.7
	-27%	-7%	-6%	-5%	-14%	-4%	-	-7%	12%

Year	Al-Minya	Assiut	Sohag	Qena	Aswan		Port Said	Total
	Al-Minya	Assiut	Sohag	Nagaa Hammady	Jurf Hussein	Sahara	Al-Raswa incubation	
2010	4.8	1.5	3.1	2.9	-	-	0.5	41.1
2011	1.6	0.6	4.5	11.0	-	-	1.0	71.0
2012	2.2	0.8	2.0	1.5	-	-	1.0	51.6
2013	2.5	1.5	5.0	3.0	-	-	3.0	70.9
2014	1.5	1.0	6.0	5.5	-	-	6.0	89.0
2015	5.0	2.5	4.5	3.0	-	-	4.5	71.0
2016	0.0	-	0.2	0.0	9.6	7.0	-	25.3
2017	5.0	-	6.0	1.5	9.4	9.3	-	49.9
2018	-	-	0.1	0.1	10.2	9.5	-	29.8
2019	1.5	1.0	3.0	0.0	9.8	9.7	-	54.5
2020	2.1	1.0	3.1	2.0	10.3	9.6	-	37.6
Average growth rate%	2.6	1.2	3.4	2.8	9.9	9.0	2.7	53.8
	-8%	-5%	0.02%	-3%	1%	7%	43%	-1%

Average and annual growth rate calculated according to different time periods for each hatchery.

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Second: Evolution of fish production from fish farming from the different sources and the total number of the Republic during the period (2010-2020).

Table (7) indicates the development of the amount of fish production from aquaculture and the total number of the Republic in thousand ton during the period (2010-2020). And it turns out:

1- Quantity of fish production from governmental farms:

Data in Table (7) indicate that the minimum fish production is from government farms amounted to about 8.3 thousand ton in 2014, while the maximum amount reached about 19.8 thousand ton in 2020. With an annual average of about 9.8 thousand ton, and the annual growth rate was about 6%.

Table 7. Evolution of the quantity of fish production from aquaculture and the total amount of the Republic in thousand ton during the period (2010-2020)

Year	government farms	Community farms	floating cages	Rice fields	semi-intensive	intensive production	running water system	total cultivation	total fish production	importance of farming in the total fish production%
2010	10.680	716.801	160.288	29.223	1.893	0.700		919.585	1304.796	70.477
2011	10.092	721.684	216.122	35.107	3.115	0.700		986.820	1362.174	72.444
2012	9.509	720.412	249.385	34.537	1.451	2.444		1017.738	1371.976	74.180
2013	9.300	722.870	327.344	34.135	1.451	2.444		1097.544	1454.401	75.464
2014	8.255	916.757	176.266	33.978		1.835		1137.091	1481.882	76.733
2015	9.747	972.503	176.632	17.537		2.412		1174.831	1518.943	77.345
2016	13.078	1166.147	175.632	13.535		2.268		1370.660	1706.302	80.329
2017	12.190	1260.735	169.269	7.735		1.912		1451.841	1823.469	79.620
2018	13.652	1368.314	165.352	11.797		2.324	0.018	1561.457	1934.741	80.706
2019	12.611	1410.017	200.980	15.893		2.420	0.028	1641.949	2038.994	80.527
2020	19.822	1362.577	201.040	5.942		2.447	0.068	1591.896	2010.579	79.176
Average	9.774	750.667	127.052	19.941	1.978	1.991	0.038	1268.310	1941.122	77.472
growth rate%	6%	6%	2%	-13%	-6%	12%	56%	5%	10%	1%

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

2- quantity of fish production from the private farms:

Data in Table (7) indicate that the minimum fish production is from private farms amounted to about 716.8 thousand ton in 2010, while the maximum amount reached about 1410.0 thousand ton in 2019. With an annual average of about 750.7 thousand ton, the annual growth rate was about 6%.

3- quantity of fish production from general cages:

Data from Table (7) indicate that the minimum fish production from floating cages is amounted to about 160.3 thousand ton in 2010, while the maximum amount reached about 327.3 thousand ton in 2013. With an annual average of about 127.1 thousand ton, the annual growth rate was about 2%.

4- quantity of fish production from the rice fields:

Data in Table (7) indicate that the minimum fish production is from rice fields amounted to about 5.9 thousand ton in 2020, while the maximum amount reached about 35.1 thousand ton in 2011. With an annual average of about 19.9 thousand ton, and the annual decrease rate was about 13%.

5- quantity of fish production from semi-intensive culture:

Data in Table (7) indicate that the minimum fish production from semi-intensive farming amounted to about 1.4 thousand ton in 2012 and 2013, while the maximum amount reached about 3.1 thousand ton in 2011. With an annual average of about 1.98 thousand ton, and the annual rate of decline was about 6%.

6- quantity of fish production from intensive farming:

Data in Table (7) indicate that the minimum fish production comes from intensive farming amounted to about 0.7 thousand ton in 2011 and 2012, while the maximum amount reached about 2.4 thousand ton in 2020. With an annual average of about 1.99 thousand ton, and the annual growth rate was about 12%.

7- quantity of fish production from culture in running water:

Data in Table (7) indicate that the minimum fish production is from farming in running water amounted to about 0.02 thousand ton in 2018, while the maximum amount reached about 0.07 thousand ton in 2020. With an annual average of about 0.04 thousand ton, and the annual growth rate was about 56%.

8- quantity of fish production out of the total aquaculture:

Data in Table (7) indicate that the minimum fish production out of total aquaculture amounted to about 919.6 thousand ton in 2010, while the maximum amount reached about 1641.95 thousand ton in 2019. With an annual average of about 1268.3 thousand ton, the annual growth rate was about 5%.

9- quantity of fish production for the total republic:

Data in Table (7) indicate that the minimum fish production out of the total fish production amounted to about 1304.8 thousand ton in 2010, while the maximum amount reached about 2038.99 thousand ton in 2019. With an annual average of about 1941.1 thousand ton, the annual growth rate was about 10%.

10- Relative importance of the quantity of fish production from aquaculture to the total Egyptian fish production

Data from Table (7) indicate that the minimum relative importance of fish farming reached about 70.5% in 2010, while the maximum reached about 80.7% in 2019, with an annual average of about 77.5%, and the annual growth rate reached about 1%.

Third: The effect of fingerlings and fry of hatcheries and price per ton on fish farming:

Table (8) indicates the effect of fingerling production and fish fry from governmental and private hatcheries and the price per ton on the amount of fish production from aquaculture using simple regression during the period (2010-2020).

By studying the simple regressive relationship between the amount of fish farmed in marine waters and the number of fingerlings produced from government hatcheries in marine waters to show the degree of response of production to the change in the number of fingerlings, where it was found that there is a statistically significant direct relationship, that is, an increase in the number of fingerlings by one million fingerlings will lead to an increase in the amount of fish production about 393 ton. The value of the Adjusted R Square indicates that the number of fingerlings explains about 39% of the variation in productivity.

By studying the simple regressive relationship between the amount of fish farmed in marine waters and the average price per ton of the most important marine fish farmed to show the degree of response of production to the change in the average price of a ton, where it was found that there is a statistically significant direct relationship, that is, an increase in the average price per ton by one thousand pounds will lead to an increase in the amount of Fish production is about 2.003 thousand ton. The value of the Adjusted R Square indicates that the average price per ton explains about 90% of the variation in productivity.

By studying the simple regressive relationship between the amount of fish farmed in fresh water and the number of fingerlings and fry produced from private hatcheries in fresh water to show the degree of response of production to the change in the number of fingerlings, where it was found that there is a statistically significant inverse relationship, that is, an increase in the number of fingerlings by one million fingerlings will lead to a decrease in the amount of production fish, about 1.862 thousand ton. The value of the Adjusted R Square indicates that the number of fingerlings explains about 46% of the variation in productivity.

By studying the simple regressive relationship between the amount of fish farmed in fresh water and the average price per ton of the most important freshwater fish farmed to show the degree of response of production to the change in the average price of a ton, where it was found that there is a statistically significant direct relationship, that is, an increase in the average price per ton by one thousand pounds will lead to an increase The amount of fish production is about 22.99 thousand ton. The value of the Adjusted R Square indicates that the average price per ton explains about 81% of the variation in productivity.

Table 8. Effect of fingerling production and fish fry from governmental and private hatcheries and the price per ton on the amount of fish production from aquaculture in the form of simple regression during the period (2010-2020)

dependent variable	independent variable	Equation	$R^{/2}$	F
quantity of fish production from marine water in thousand ton	Number of fingerlings produced from government hatcheries in marine water, in million unit	$Yi= 217.42 + 0.393_x$ $(9.32)^{**}$ $(2.71)^{*}$	0.39	7.35^{*}
quantity of fish production from marine water in thousand ton	average price of a ton of the most important marine fish farmed in thousand L.E	$Yi= 86.06 + 2.003_{xi}$ $(4.65)^{**}$ $(9.38)^{**}$	0.90	88.02^{**}
amount of fish production from fresh water in thousand ton	Number of fingerlings and fry produced from private hatcheries with fresh water in million unit	$Yi= 1273.06 – 1.862_{xi}$ $(14.47)^{**}$ $(-3.09)^{**}$	0.46	9.50^{**}
amount of fish production from fresh water in thousand ton	average price per ton of the most important freshwater fish farmed in thousand L.E	$Yi= 609.25 + 22.99_{xi}$ $(9.05)^{**}$ $(6.69)^{**}$	0.81	44.72^{**}
quantity of fish production from tilapia in thousand ton	Number of fingerlings of tilapia fry produced from private hatcheries with fresh water in million unit	$Yi= 1104.87 - 2.07_{xi}$ $(14.29)^{**}$ $(-3.90)^{**}$	0.59	15.19^{**}
quantity of fish production from tilapia in thousand ton	average price of a ton of farmed tilapia fish is in thousand L.E	$Yi= 501.95 + 26.93_{xi}$ $(5.66)^{**}$ $(4.09)^{**}$	0.61	16.73^{**}

* Significant at the 5% level, ** Significant at the 1% level.

where:

Ŷi: Estimated value of dependent variables in thousand ton.

Xi: Independent variables in million units, in thousand L.E.

I: 1,2 ..... 11. **( )**: t calculated

Source: Collected and calculated from the data of Table (1) in the Appendix.

By studying the simple regression relationship between the amount of fish production of tilapia and the number of fingerlings and fry of tilapia from private hatcheries to show the degree of response of production to the change in the number of fingerlings, where it was found that there is a statistically significant inverse relationship, that is, an increase in the number of fingerlings by one million fingerlings will lead to a decrease in the amount of fish production from tilapia by about 2.07 thousand ton. The value of the Adjusted R Square indicates that the number of fingerlings explains about 59% of the variation in productivity.

By studying the simple regressive relationship between the amount of fish production of tilapia and the average price of a ton of tilapia to show the degree of response of production to the change in the average price of a ton, where it was found that there is a statistically significant direct relationship, that is, an increase in the average price of a ton by one thousand pounds will lead to an increase in the amount of fish production of tilapia by about 26.93 thousand ton. The value of the Adjusted R Square indicates that the average price per ton explains about 61% of the variation in productivity.

Fourth: current situation of AL-Abbassa hatchery production:

Fish hatcheries produce fry through artificial hatching of Nile tilapia fry and fry of different types of carp, especially common, silver and grass carp

to supply fish farms and natural water. AL-Abbassa hatchery was established in 1982 and produced about 8 million fry of carp in 1983, which increased to about 18 million in 1984. This hatchery belongs to the General Authority for Fisheries Development. The statistics of the Fisheries Department of the Directorate of Agriculture in the Eastern Province indicate that its total area reached 100 Fadden and has 82 basin with a water surface of 89 Fadden divided into 13 basin for mothers of carp of all kinds (grass, normal, silver), and 32 basin for mothers of tilapia. And 37 basin for incubating fish fry of different types, and the area of the tank ranges from 6 square meters to 2 Fadden. The rest of the area, which is 11 Fadden, or 11% of the total area, is administrative buildings, rest houses, services, and bridges. The hatchery's production capacity is about 25 million fry units. According to the hatchery itself, the planned production capacity of this hatchery is about 47 million fry unit since its establishment **(El-Morsy, 2017)**.

Table (9) indicates the relative importance of AL-Abbassa hatchery out of the total number of hatcheries in million units during the period (2010-2020). From it, it was found that the minimum relative importance of AL-Abbassa hatchery in relation to the hatcheries of AL-Sharkia Governorate amounted to about 39.3% in 2020, while the maximum amounted to about 70.1% in 2019, with an annual average of about 57.3%. It was also found that the minimum relative importance of AL-Abbassa hatchery in relation to the republic's hatcheries amounted to about 5.3% in 2020, while the maximum reached about 21% in 2019, with an annual average of about 12.7%.

Table (10) indicates to the production of AL-Abbassa hatchery of freshwater fingerlings in million unit during the period (2010-2020). From it it turns out that:

1- Tilapia:

It is clear from Table (10) that the minimum level for tilapia production amounted to about 1.2 million unit in 2020, while the maximum amount reached about 18.1 million unit in 2019, with an annual average of about 6.5 million unit and an annual rate of decrease of about 14%.

2- Common carp:

It is clear from Table (10) that the minimum production of ordinary carp amounted to about 0.8 million unit in 2020, while the maximum amount reached about 24.1 million unit in 2019, with an annual average of about 15.7 million unit and an annual rate of decrease of about 24%.

3- Grass carp:

It is clear from Table (10) that the minimum production limit for grass carp was about 0.5 million unit in 2020, while the maximum amount was about 9.6 million unit in 2011, with an annual average of about 3.1 million unit and an annual rate of decrease of about 19%.

4- Silver carp:

t is clear from Table (10) that the minimum production limit for silver carp amounted to about 0.1 million unit in 2018, while the maximum amount reached about 4.7 million unit in 2011, with an annual average of about 2.2 million unit and an annual rate of decrease of about 5%.

5- Total carp:

It is clear from Table (10) that the minimum carp production amounted to about 1.8 million units in 2020, while the maximum amount reached about 30.1 million units in 2011, with an annual average of about 2.2 million units and an annual rate of decrease of about 20%.

6- Total hatchery

It is clear from Table (10) that the minimum hatchery production amounted to about 3.0 million unit in 2020, while the maximum amount reached about 44.9 million unit in 2019, with an annual average of about 26.2 million unit and an annual rate of decrease of about 18%.

7- Relative importance:

It is clear from Table (10) that the minimum relative importance of tilapia was about 0% in 2017, while the maximum was about 40.4% in 2019. As for carp, it was found that the minimum relative importance of tilapia was about 59.6% in 2019, while it reached The maximum is about 100% in 2017.

Table 9. Relative importance of AL-Abbassa hatchery out of the total number of hatcheries in million unit during the period (2010-2020)

Year	Total number of hatcheries in Sharkia governorate (%)	Total Governmental Hatcheries and Incubation Stations (%)
2010	53.9	12.1
2011	57.5	12.0
2012	50.5	10.5
2013	56.9	11.2
2014	62.1	12.8
2015	58.2	12.4
2016	64.1	15.9
2017	49.6	10.8
2018	41.8	10.2
2019	70.1	21.0
2020	39.3	5.3
Average	**57.3**	**12.7**

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Table 10. Production of freshwater fingerlings by AL-Abbassa hatchery during the period (2010-2020) in million unit

Year	Tilapia	Carp				Total hatchery	% for tilapia	% for carp
		Common	Grass	silver	total			
2010	5.0	16.4	4.0	0.9	21.2	26.2	19.2	80.8
2011	4.2	15.8	9.6	4.7	30.1	34.3	12.3	87.7
2012	3.5	14.7	2.3	1.5	18.5	21.9	15.8	84.2
2013	5.0	19.6	3.5	3.5	26.6	31.6	15.8	84.2
2014	11.0	21.2	2.4	4.0	27.6	38.6	28.5	71.5
2015	10.0	18.6	2.1	4.0	24.7	34.7	28.8	71.2
2016	5.4	17.3	2.0	-	19.3	24.7	21.8	78.2
2017	-	8.0	2.3	-	10.3	10.3	-	100.0
2018	2.0	16.0	-	0.1	16.1	18.1	11.0	89.0
2019	18.1	24.1	2.3	0.3	26.7	44.9	40.4	59.6
2020	1.2	0.8	0.5	0.6	1.8	3.0	39.3	60.7
Average	6.5	15.7	3.1	2.2	20.3	26.2	-	-
growth rate%	-14%	-24%	-19%	-5%	-20%	-18%	-	-

Average and annual growth rate calculated according to different time periods for each hatchery.

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues

Evaluation of the use of resources in the production of fry in the industrial hatchery in AL-Abbassa:

The research used the criterion of the ratio of the actual production compared to the productive capacity of the hatchery, whether in terms of the quantity and types of fry, or in terms of their value. The second criterion was through the relative importance of the worker's productivity and its development compared to the worker's wage. It is clear from Table (11) and (12) the deterioration and decline of both the quantity and value of fry during the period (2017-2020) according to the two data sources referred to previously, and from the data of the two tables, it is clear:

The hatchery production focused on the production of fry of all kinds of carp, especially silver carp, as it was estimated on average for the period (2017-2020) at about 108 million fry unit, according to statistics from the hatchery itself, increasing to about 257.75 million fry unit only, according to the statistics of the Public Authority for Fish Resources Development, which ranges between 4.49 % to 1.3% of the total hatchery production of fry according to the statistics sources, respectively, estimated at about 2.408, 19.057 million fry unit, respectively. The production of tilapia fry varied according to the different statistics, while the annual average was estimated at about 1.7 million unit as an annual average for the period (2017-2020), or about 69.1% of hatchery production, according to unpublished hatchery statistics estimated at about 2.4 million unit only, the statistics of the Public Authority for Wealth Development The fishery indicates the production of about 5.3 million unit of tilapia fry as an average for the same period.

That is, only about 27.95% of the average total hatchery production of fry, this according to this source rose to about 19.057 million unit. Hence it is clear that the variation in the production of tilapia fry between the two sources of statistics is the reason for the variation in the total production of fry for the hatchery from only about 2.408 million unit as an annual average to about 19.057 million unit.

The actual production rate of fry ranged from about 2.408% to about 19.057% of the production capacity of the hatchery. This indicates the presence of inert energies that ranged from about 81% as a minimum to about 98% of the production capacity of the hatchery, which indicates a low production efficiency of the hatchery.

With the decrease in the actual capacity in relation to the production capacity of the hatchery, the value of production decreased from the target, and the percentage of the actual achieved as an annual average for the period (2017-2020) was about 211.630 million L.E, and this may be due to the high prices of feed, high temperatures, and the lack of pituitary gland as a result of a deficiency The quantity of carp fish, due to the rental of carp production farms, in addition to changing the fry distribution plan.

Table 11. Evolution of AL-Abbassa hatchery production of fish fry in million unit during the period (2017-2020)

Item	Carp						Tilapia		total quantity		Hatchery production capacity in million fry units (1)	% of production capacity	
	Grass		Common		silver								
Year	for hatchery (1)	Authority Statistics (2)	for hatchery (1)	Authority Statistics (2)	for hatchery (1)	Authority Statistics (2)	for hatchery (1)	Authority Statistics (2)	for hatchery (1)	Authority Statistics (2)		for hatchery (1)	Authority Statistics (2)
2017	692	2.25	163	8000	148	-	2358	-	3.361	10.25	47	7.15	21.81
2018	15	-	31	16000	85	0.140	1662	2000	1.793	18.14	47	3.81	38.6
2019	650	2.291	72	24.096	202	0.339	1577	18.140	2.501	44.866	47	5.32	95.46
2020	473	0.499	449	0.754	-	0.552	1055	1.1680	1.977	2.937	47	4.21	6.33
Average	4.580	1.260	1.790	12.213	108	257.750	1.663	5.327	2.408	19.057	47	5.120	40.550

Source:

- Industrial fish hatchery in Abbassa - Abu Hammad - Sharkia (2020). Unpublished data.
- Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) Fish Statistical Year book, separate issues.

Table 12. Evolution of the value of fish fry in the industrial fish hatchery in AL-Abbassa, in thousands L.E, during the period (2017-2020)

Item	Carp			Tilapia	Total Revenue*	general target	% of the target
Year	Grass	Common	Silver				
2017	110720	12900	16280	81.967	221.867	850	26.10
2018	8150	1305	20250	95920	125.625	1000	12.56
2019	159480	13400	32200	82212	287.292	1000	28.73
2020	59475	46313	-	105.95	211.738	1000	21.17
Average	84.456	18.479	17.183	91.512	211.630	962.500	22.140

*Calculated as the sum of multiplying the quantity of each item x its price

Note that the price of a thousand ordinary carp = 1000 L.E, grass carp = 250-400 L.E, tilapia = 55 L.E, silver carp = 150 L.E

Source: Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development Fish Hatchery Management (2020), scattered unpublished data.

It appears from Table (13) that the number of manpower in the hatchery reached 102 of different specializations, administrators, technicians, workers, engineers, drivers and security. It is clear that the average productivity of the worker decreased from about 3.294 thousand fry in 2017 to about 1.941 thousand fry unit only in 2020, i.e. a growth rate. An annual estimate of about (-0.132) was calculated using Equation No. (1) derived from Equation No. (2) **(Chaing, 1972)**

Equation (1) $r = \ln (yt) – \ln(y0) /T$ _____ (1)

Equation No. (2) $yt = y0\ er$ _____ (2)

where:

r = estimated annual growth rate of the variable y

y0 = value of the variable (average worker productivity) in the base year

yt = value of the variable (average worker productivity) in year T

t = number of years from the base year to year T

ln = logarithm of the natural base.

Accordingly, it turns out that the average wage of the worker in relation to the return from this productivity increased, as the return decreased in relation to wages, and that percentage was estimated, on average, to be about 59% of the total value of his production.

Structure of input and output items for AL-Abbassa hatchery in (2020/2021):

Table (14) indicates to the structure of input and output items for AL-Abbassa hatchery in 2020/2021. From it becomes clear that:

By studying the items of the input structure, it was found that the main revenue amounted to about 258.48 thousand L.E, where the revenues of single-sex tilapia fry came in the first place with about 105.18 thousand LE, then the pituitary gland fish came in the second place with about 46.75 thousand L.E, and came from the third to the fifth rank each The value of fry of grass carp, common carp, and Nile tilapia is about 59.47, 46.31, 0.77 thousand L.E, respectively. The Secondary revenues amounted about 425.39 thousand L.E and accordingly, the total revenue amounted to about 683.87 thousand L.E.

By studying the output items, it was found that the value of fixed costs represented in the repair of machinery and equipment amounted to about 6 thousand L.E, and the value of variable costs amounted to about 582.79 thousand L.E, and the value of electricity ranked first with 336 thousand L.E, then fuel and oils came in the second place with 108 thousand pounds, then mothers' feed. 25% at about 40 thousand L.E came in the third place, then came in the fourth place fodder for fry 25% at about 20 thousand L.E, then fishmeal 72%, testosterone hormone, vitamins and antibiotics, disinfectants, ethanol alcohol 12, 4.15, 1, 1, 0.65 thousand L.E, respectively. The total costs amounted about 588.79 thousand L.E, and the net profit was about 95.082 thousand L.E.

Profitable margins and measures of Economic efficiency within AL- Abbassa hatchery for the year (2020/2021):

Table (15) indicates profit margins and measures of economic efficiency for the Abbassa hatchery in 2020/2021. It turns out that.

By examining the profit margins, it became clear that the net return of the hatchery amounted to about 95.08 thousand L.E, and the value of the return over variable costs amounted to 101.08 thousand L.E. As for the added value, it amounted to about 206.42 thousand L.E.

Table 13. Evolution of worker productivity in the industrial fish hatchery in AL-Abbassa compared to his wages in the period (2017-2020)

Year	number of employment	Average worker productivity per thousand fry units	Average worker productivity in thousand pounds per year (1)	The average wage of a worker is one pound per year (2)	% of the average wage to the employee's earnings
2017	102	3.294	2.175	111342	51.19
2018	102	1.755	1.231	111342	90.40
2019	102	2.451	2.816	111342	39.53
2020	102	1.941	2.075	111342	53.64
Average	102	2.360	2.074	111342	58.69

Hatchery worker productivity = total wages divided by the number of hatchery workers.

Source: Compiled and calculated from Table 1, 2.

Table 14. Structure of inputs and outputs for AL-Abbassa hatchery (2020/2021)

Clause	Unit	Quantity	Price	value	Relative importance %
		main revenue			
tilapia fry Single-sex	**thousand unit**	1041	101.0375	105180	15.4
Nile tilapia fry	**thousand unit**	14	55	770	0.1
fry of Common carp	**thousand unit**	449	103.147	46313	6.8
Grass carp fry	**thousand unit**	143	415.8741	59470	8.7
Pituitary thickness	**Kg**	2527	18.5	46749.5	6.8
Secondary revenue (fish)	**Kg**	23960	17.75417	425390	62.2
Total revenue hatchery	**L.E**			683872.5	100
		Costs			
mothers forage 25%				40000	6.79
fry forage 25%				20000	3.4
testosterone				4150	0.7
ethyl alcohol	**Ton**	32	20	640	0.11
fishmeal 72%	**Ton**	4	3000	12000	2.04
Vitamins and antibiotics				1000	0.17
Disinfectants				1000	0.17
Transport costs			**There is no**		
fuel and oils	**Liter**	16000	6.75	108000	18.34
Repairs to machinery and equipment				6000	1.02
Electricity				396000	67.26
total costs				588790	100
Profits				95082.5	

Without employee wages

Source: Collected and calculated from field study questionnaires.

Table 15. Profitable margins and measures of Economic efficiency within AL- Abbassa hatchery for the year (2020/2021)

profit margins	
main revenue	258482.5
Secondary revenue (fish)	425390.0
total revenue (1)	683872.5
Total costs (2)	588790.0
net return (3)	95082.5
Variable costs (4)	582790.0
Return over variable costs (5)	101082.5
added value (6)	206424.5
measures of economic efficiency	
return to cost ratio (7)	1.16
Return on invested pound% (8)	16.15
Product profit margin% (9)	13.90
Relative Profitability% (10)	94.06
Economic Efficiency% (11)	0.35

3 = (1-2), 5 = (1-4), 6 = (3 + wages), 7 = (1/2), 8 = (3/2) x 100, 9 = (3/1) x 100, 10 = (3/5) x 100, 11 = (6/2).
Source: Collected and calculated from field study questionnaires.

By examining the measures of economic efficiency, it was found that the rate of return to costs amounted to about 1.16 LE, and the return of the invested pound amounted to about 16.15%, and the profit margin of the product reached about 13.90%. As for relative profitability, it amounted to about 94.06%, and as for economic efficiency, it amounted to about 0.35.

From the foregoing, it is clear that the profitability of the hatchery and its economic efficiency are low, which indicates that this hatchery must be taken care of and benefited from all the possibilities in it, as well as increased investments in single-sex tilapia.

Fifth: Problems suffered by government hatcheries, including AL-Abbassa hatchery:

Productive problems:

1- The high prices of fuel and oils, as well as gasoline, and there is difficulty in obtaining it.

2- High levels of water pollutants and high salinity during the summer season as a result of evaporation **(Ghenmy *et al.*, 2022)**.

3- Lack of skilled labor in government hatcheries.

4- The official data does not match the data inside the hatcheries.

5- The difficulty of producing economical fish, which are single-sex tilapia fish, without the use of hormones.

6- Government hatcheries produce large quantities of fish of no economic value such as carp.

7- Decrease in the numbers of mothers with suitable numbers and good breeds.

8- Statistical records do not record data with credibility, especially costs.

9- High percentage of fish hatching, especially in the first periods of incubation.

Marketing problems:

1- The high costs of packing and transportation, with the lack of trained workers.

2- The distance between government hatcheries and fish farms.

3- Decreased demand for small fry of fish due to the rates of hatchlings, which leads to an increase in the costs of hatcheries.

4- Continuous changes in prices.

Sixth: Suggestions and recommendations Solutions that help fill the shortage of fry in government hatcheries:

1- It is necessary that the largest proportion in the production of government hatcheries be the economic fish, which is the tilapia fish that the Egyptian citizen needs in large quantities.

2- The selection of trained workers inside the government hatcheries who are able to preserve the fry from the chicks during the incubation periods.

3- Provision of all requirements such as hormones, antiseptics and vehicles prepared for marketing in appropriate quantities.

4- Providing suitable quantities of feed in the event of the inability to sell the fry and their continuation in the hatcheries until they become fingerlings.

5- The need to maintain excellent mothers inside the hatcheries.

6- Statistical registration shall be carried out continuously and in a proper manner until we reach the best results.

7- Activating the role of government hatcheries in new projects, which helps to reactivate them again.

8- Providing work stations to reduce water pollution.

9- Continuous follow-up of these hatcheries by the Authority to determine their quality and extent of production.

10- The need to sell fish during the fry period, not fingerlings, so as not to increase costs.

11- Continuous follow-up of farms that take their fry from government hatcheries to help them keep the fry from dying after transportation and cultivation.

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APPENDIX

Table 1. Factors affecting the amount of production from different sources of fish farming in Egypt during the period (2010-2020)

Statement Year	Fish production from marine aquaculture thousand ton	Fish production from freshwater aquaculture thousand ton	Fish production of tilapia fish thousand ton	Fingerling production in marine water from government hatcheries million unit	Production of fingerlings with fresh water from private hatcheries million unit	Fingerling production of freshwater tilapia fish from private hatcheries million unit	price of a ton of the most important marine fish farmed thousand L.E	price of a ton of the most important freshwater fish farmed in thousand L.E	price of a ton of farmed tilapia fish is thousand L.E
2010	160.440	759.145	557.049	1.50	169.0	169.0	39.90	10.7	7.16
2011	158.729	828.091	610.617	2.30	174.0	174.0	39.50	11.8	7.47
2012	167.683	850.055	768.752	0.50	191.0	191.0	42.21	12.0	8.64
2013	153.761	943.783	635.843	0.90	219.0	219.0	43.57	13.1	8.60
2014	164.898	972.193	759.601	5.10	244.5.0	244.5.0	50.70	14.3	9.71
2015	196.943	977.888	875.513	4.40	66.5.0	66.5.0	52.30	14.6	9.81
2016	221.200	1149.46	940.309	3.60	76.5.0	76.5.0	61.45	18.4	9.86
2017	301.302	1150.54	967.301	1.80	76.5.0	76.5.0	74.35	23.5	16.27
2018	322.264	1239.190	1051.440	1.30	76.0	76.0	124.57	24.1	16.28
2019	335.610	1306.340	1081.200	1.50	72.0	72.0	145.26	29.3	20.63
2020	427.639	1164.260	954.154	534.30	64.8	64.8	157.01	30.0	22.23

Source:

- Lakes and Fish Resources Protection and Development Authority (formerly the General Authority for Fish Resources Development) **Fish Statistical Year book**, separate issues.
- Central Agency for Public Mobilization and Statistics (sparse issues), **Annual bulletin of food and raw materials prices (producer, wholesale, consumer)**