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ECONOMICS OF FISH FRY PRODUCTION IN EGYPT (CASE STUDY OF KAFR EL-SHEIKH GOVERNORATE)

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Abstract:

The research mainly aims at studying the economic analysis of fish fry production in the Arab Republic of Egypt. The study reached the following results: 86.4% of fish hatcheries are concentrated in the governorates of Kafr El-Sheikh, Fayoum, Aswan and Sharkia. The number of hatcheries in each of them is about 94 hatcheries, 7 hatcheries, 4 hatcheries, 3 hatcheries for each of them, respectively. By studying the most important production factors that have a significant impact on production in fish hatcheries in earthen ponds are the number of ponds in the hatchery (X_1), the amount of alcohol (x_4), the amount of vitamins (x_5), the amount of disinfectants (x_6), and the fry and feed for fry and mothers (x_8), where the total elasticity reached 0.87, indicating a decrease in the return on capacity for these elements. The most influential factors in the production of the net enclosure are the number of ponds in the hatchery (x_1), the number of hormones (x_3), the amount of alcohol (x4), the number of vitamins (x_5), feed for fry and mothers (x_8), where the total elasticity reached 0.92, indicating a decrease in the return on capacity. As for the production of fish fry from concrete ponds, it was found that the most influential factors in production are the number of ponds in the hatchery (x_1), the number of workers in the hatchery (x_2), the number of vitamins (x_5), and feed for fry and mothers (x_8) Where the

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production elasticity reached 1, which indicates the return stability.

Key words: Economic efficiency, Hatcheries, ponds.

Introduction:

Egypt has a vast water area estimated at about 13.3 million acres, but its fish production does not meet consumer needs, so it is necessary to encourage fish farming with the development of natural resources (Al-Dakla, 2021). With the development of the need to increase fish production and the importance of fish farming, the importance of providing fish fry from fresh and salt water, which is the main determinant of fish farming, emerges, as the total production of fry from various fish hatcheries in 2021 amounted to about 950.275 million fry units. Despite the availability of government fish hatcheries, the importance of the major role of private hatcheries has recently increased, especially for freshwater fish, whose fry production is estimated at about 74 million fry units in 2021(Ministry of Agriculture and Land Reclamation), representing about 7.8% of the total fry production from private and government hatcheries. Kafr El-Sheikh Governorate is considered one of the leading governorates in fish fry production, as the number of hatcheries in it reached about 104 hatcheries, representing 79.39% of the total number of hatcheries in Egypt in 2021. The number of fish hatcheries in Kafr El-Sheikh Governorate consists of private hatcheries and governmental hatcheries, as the number of hatcheries is about 102 hatcheries, 2 hatcheries for each of them, respectively, in 2021

Problem of Study:

The research problem is represented in the increasing demand for fish fry to meet the needs of fish production projects in general and national projects in particular, in light of the trend of fish fry production to decrease, as it decreased from 244.56 million fry units during 2014 to about 74 million fry units during 2021. This results in the current fish fry production being unable to meet the increasing needs of fish production projects, in addition to the weakness of some of the most widespread fish fry production systems, the weak efficiency of fish fry production in Egypt, and the lack of optimal exploitation of resources.

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Research objectives:

The research mainly aims to conduct an economic analysis of fish fry production in the Arab Republic of Egypt through the following sub-objectives.

1- Studying the current status of fish fry production in the Arab Republic of Egypt during the period from 1999-2021 AD.
2- Studying the geographical distribution in the Arab Republic of Egypt during the period from 2017-2021 AD.
3- Studying the production efficiency of fish hatcheries in the study sample for the 2024 season.
4- The economic performance efficiency index of fish hatcheries in the study sample for the 2024 season.
5- Problems and obstacles facing fish hatcheries for the 2024 season.

Data sources and research method:

The study based on qualitative analysis methods and quantitative analysis methods for the variables of the phenomena under study to achieve its objectives. Simple statistical methods such as percentages and averages were used, in addition to using mathematical methods such as the productive and economic efficiency of producing an acre in each of the different fish hatcheries. Quantitative statistical analysis was also used, represented by the use of simple and multiple regression methods to estimate the development of the economic variables under study, and to study the impact of the most important elements and factors affecting the production of fish fry from these hatcheries, as well as to estimate both the productive and economic efficiency of the fish hatcheries in the study sample. The variance analysis method was also used to study the difference between the productivity of the three types of hatcheries (net enclosure and, concrete, earthen). Two main sources were relied upon, which are secondary data published from fish statistics bulletins during the period (1999-2021). Unpublished data from the General Authority for Fish Resources Development, in addition to field data collected from questionnaire forms that were prepared specifically for research

purposes. The study relied on a random sample selected from fish hatcheries in the centers of Kafr El-Sheikh Governorate, where the sample size amounted to 76 hatcheries from private fish hatcheries for the production year 2024. The sample was selected from Riyadh Center and Sidi Salem Center, where the percentage of the number of hatcheries was about 85.3%, 14.7% of the total number of hatcheries in Kafr El-Sheikh Governorate for each of them, respectively. A number of 66 hatcheries were selected from Riyadh district randomly as follows: 50 hatcheries in Riyadh district, 12 hatcheries in Matoubas El-Brensa village, 2 questionnaire forms /hatchery in Gharb El-Tira village, 1 hatchery questionnaire form in El-Hoksa Talmbat 11 village, and 1 questionnaire form in Talmbat 9 El-Ghabaisha village, 10 hatcheries were randomly selected from Sidi Salem district as follows: 3 hatcheries from Demro Sidi Salem, 6 hatcheries from Demro Talbat 8 and 1 hatchery from Demro Talmbat 9, 8 questionnaire forms for 8 hatcheries were excluded: 5 questionnaire forms from Riyadh district and 3 questionnaire forms from Demro Talmbat 8 in Sidi Salem district due to incomplete data on these forms.

Results and discussion:

First: The development of fish fry production from its various sources the Arab Republic of Egypt during the period (1999-2021):

It is shown from the data in Table No (1) that the production of fish fry in Egypt amounted to about 468.9772 in average during the study period. Fish fry production is trending upwards, as the quantity produced increased from about 463.3 million fry units in 1999 to about 950.275 million fry units in 2021, in an increase estimated at 486.975 million fry units, representing 105.11% of fish fry production in 1999. The annual average increase in fish fry production in Egypt is estimated at about 21.17 million fry units during the study period.

By studying the time trend of the total fish fry production from various production sources in general at the level of the Republic, it is shown from the data in Table No (2) that the quadratic form is the most appropriate from that illustrates the general trend of the development of fish fry production in Egypt, as the data of function No (1) in Table No. (2) indicates that fish fry production took a decreasing trend until it reached 362.29 million fry units in 2009, then took a general trend that was statistically significant and increasing at a

significance level of 0.05, and the annual increase is estimated at about 2.82 million fry units, in a growth rate of 0.6% of the general average of the total fish fry production, which is estimated at about 468.628 million fry units during the study period. The coefficient of determination (R^2) is about 0.21, indicating that 21% of the changes in fish fry production at the republic level are due to factors whose effect is reflected the time element. The significance of the model used for measurement has been proven in general by using the calculated (F) value.

Second: The development of fish fry production from private hatcheries during the period (1999-2021):

It is shown from the data in Table (1) that the percentage of fish fry production from local hatcheries represents about 26.98% of the total fish fry production from various sources in Egypt. The production of fish fry from local hatcheries depends on the production of fish fry from local freshwater hatcheries, which represents about 24.25% of the total fish fry production from various sources during the study period, while the amount of fish fry production from local saltwater fish hatcheries represents about 2.73% of the total fish fry production from various sources during the study period. In this section, the development of fish fry production from local hatcheries is studied as follows:

(A): Development of fish fry production from local freshwater hatcheries during the period (1999-2021):

Data from Table No (1) indicates that the production of local fish fry from freshwater reached 113.724 million fish fry units in average during the study period. The production of fish fry from local hatcheries in freshwater is declining, as the quantity of fry production decreased from about 75.3 million fry units in 2009 to about 74 million fry units in 2021, a decrease estimated at about 1.3 million fry units, representing 1.756% of fish fry production in 2021.

By studying the temporal development of the total production of fish fry from private hatcheries at the level of the Republic, it is shown from equation No (2) in Table No. (2) that the quadratic form is the most appropriate form that illustrates the general trend of the development of fish fry production from private freshwater hatcheries, as the production of fish fry from private hatcheries took a general increasing trend until it reached 174 million fry units in 2011, then took a general statistically significant decreasing trend at a significance level of 0.01, and the

annual decrease is estimated at about 1.442 million fry units, at a change rate of 1.268% of the general average of the total production of fish fry from private hatcheries, which is estimated at about 113.724 million fry units during the study period. The coefficient of determination (R2) is about 0.32, indicating that 32% of the changes in the production of fish fry in local hatcheries at the republic level are due to factors whose effect reflects the time element. The significance of the model used was proven using the calculated (F) value.

(B): Development of fish fry production from local hatcheries from saltwater during the period (1999-2021):

It is shown from the data in Table No. (1) that the production of local fish fry from saltwater reached 12.8109 million fry units in average during the study period. The production of fish fry from local saltwater hatcheries increases from about 1.8 million fry units in 1999 to about 41 million fry units in 2021, an increase estimated at 39.2, representing 2177.77% of the fish fry production in 1999. The annual average increase in fish fry production is estimated at 1.7 million fry units during the study period.

By studying the general time trend of the development of fish fry production, it is clear from equation No (3) in Table No. (2) That fish fry production from local saltwater hatcheries is increasing significantly at a significance level of 0.01, as the annual increase rate is about 1.095 million fry units with a growth rate of 8.55%. It is also shown that the coefficient of determination (R^2) reached 0.41. That is, the change in fry production from local saltwater hatcheries is affected by about 41% by factors that their impacts are reflected by the time element.

Third: Development of fish fry production from governmental hatcheries during the period (1999 - 2021):

It is clear from the data in Table (1) that the percentage of fish fry production from governmental hatcheries represents about 56.54% of the total fish fry production from various sources in Egypt. The production of fish fry from government hatcheries depends on the production of fish fry from government freshwater hatcheries, which represents about 44.71% of the total fish fry production from various sources during the study period, while the amount of fish fry production from government saltwater fish hatcheries represents about 11.65% of the total fish fry production from various sources during the study

period. In this section, the development of fish fry production from government hatcheries is studied as follows:

(A): Development of fish fry production from government hatcheries from fresh water:

The data in Table No (1) show that the production of government fish fry from freshwater reached 209.69 million fry units on average during the study period. The quantity of fish fry production from government hatcheries in freshwater is decreasing, as it decreased from about 253.7 in 1999 to about 118.155 million fry units in 2021, a decrease estimated at about 91.53 million fry units, representing about 77.47% of fry production in 2021. The average annual decrease in fish fry production from government freshwater hatcheries is estimated at about 3.98 million fry units.

By studying the general time trend of the development of fish fry production, it is clear from equation No (4) in Table No. (2) That fish fry production from government freshwater hatcheries has taken a statistically significant decreasing trend at a significance level of 0.05, where the annual decrease amounted to about 246.685 million fry units with a rate of change of 2.094. It is also clear that the coefficient of determination (R^2) amounted to 0.216. It is indicated that the change in fry production from government freshwater hatcheries is affected by about 21.6% by factors that their impacts are reflected by the time element.

(B): Development of fish fry production from government hatcheries from salt water:

Data from Table No (1) indicate that the production of government fish fry from saltwater reached about 54.622 million fry units on average during the study period. The production of fish fry from government hatcheries in saltwater is trending upwards, as the quantity of fry increased from about 2.5 million fry units in 1999 to about 667.120 in 2021, an increase estimated at 664.62, representing 26584% of the production of fish fry in 1999. The average annual increase in fry production is estimated at about 28.896 million fry units.

By studying the general time trend of the development of fish fry production, it is shown from equation No (5) in Table No. (2) That the production of fish fry from government salty hatcheries is increasing, and this increase is statistically significant at the level of significance 0.05, as the annual increase amounted to about 12.395

million fry units at a rate of change of 22.69%. It is also shown that the coefficient of determination (R^2) amounted to 0.235, indicating that 23.5% of the changes in the production of fish fry from private hatcheries at the republic level are due to factors that their impacts are reflected by the time element. The significance of the model used was proven using the calculated value (F).

Table (1) Development of production of private and governmental fish hatcheries and centers of collecting fresh and saltwater fry at the level of the Arab Republic of Egypt during the period from 1999-2021

years	Governmental Hatcheries			Private Hatcheries				Total hatchery production in the Arab Republic of Egypt
	Fresh water	Salt water	total	Fresh water	Salt water	Total	Centers of fry collection	
1999	253.7	2.5	256.2	75.3	1.8	77.1	130	463.3
2000	258	7	265	88.8	4.25	93.05	94	452.05
2001	293.4	7	300.4	101.3	4.75	106.05	134	540.45
2002	210.27	5.5	215.77	104	19.75	123.75	137	475.52
2003	216.51	1.801	218.311	112	1.25	113.25	109	440.56
2004	243.954	1.295	265.249	108.5	0.05	108.55	96	449.8
2005	181.988	1.295	183.283	113	1.25	114.25	69	366.53
2006	154.385	0.795	155.18	113	1.45	114.45	41	310.63
2007	189.614	2.236	191.85	113	1.45	114.45	77	383.3
2008	213.748	1.015	214.763	119	13.55	132.55	77	424.31
2009	215.88	1.555	217.435	64	23.85	87.85	57	362.29
2010	216.055	1.515	217.57	169	13.55	182.55	78	478.12
2011	285.072	2.25	287.322	174	13.55	187.55	63	537.87
2012	209.592	0.456	210.048	191	9.55	200.55	73	483.6
2013	281.153	0.916	282.069	219	8	227	43	552.07
2014	302.587	5.107	307.694	244.5	8	252.5	72	632.19
2015	279.361	4.406	283.767	66.5	25	91.5	95	470.27
2016	155.892	3.636	159.528	76.5	40.6	117.1	51	327.63
2017	95.246	1.821	97.067	76.5	10.6	87.1	77	261.17
2018	178.243	1.272	179.515	76	16.5	92.5	45	317.02
2019	214.142	1.5	215.642	72	16	88	62	365.6
2020	55.902	534.336	590.238	64.75	18.9	83.65	47	720.89
2021	118.155	667.12	785.275	74	41	115	50	950.275
average	209.69	54.62291	265.182	113.724	12.8109	126.535	77.2609	468.9772
percentage	%44.71	%21		%24	%3	-	%16	-

Source: Collected and calculated from the Ministry of Agriculture and Land Reclamation, General Authority for Fish Resources Development, Fish Production Statistics Book, different issues.

Fourth - Development of fish fry production from fry collection centers during the period (1999 - 2021):

It is shown from the data in Table No. (1) that the production of fish fry from fry collection centers reached 77.2609 million fry units on average during the study period. Fish fry production is trending down, as the quantity of fry decreased from 130 million fry units in 1999 to about 50 million fry units in 2021, decreasing by 80 million fry units, representing 160% of the total fish fry production in 2021.

By studying the general time trend of the development of fish fry production, it is clear from equation No (6) in Table No. (2) That fish fry production from fry collection centers is trending down statistically significantly, as the annual decrease reached about 3.04 million fry units with a change rate of 3.93%. It is also shown that the coefficient of determination reached (R^2) 0.51. That is, the change in fry production from fry collection centers is affected by about 51% by factors that their impacts are reflected by the time element.

Table (2) Equations of the general time trend for the development of fish fry production in Egypt from its various sources. (Quantity in millions)

No.	Dependent variable	The equation	R^2	F	Growth Rate
1	Fish fry production in the Arab Republic of Egypt From its various sources	Y_1= 540.487 – 28.194X + 1.414X^2 (5.663)** (-1.54)- (1.9)*	0.21	(2.68)**	6%
2	Production of private freshwater fry hatchery	Y_2= 45.38 + 16.992X – 0.721X^2 (1.495)- (2.92)** (-3.06)**	0.32	(4.706)**	14.9%
3	Production of private saltwater fish fry hatchery	Y_3= -0.327 + 1.09X (-0.083)- (3.821) **	0.41	(14.604)**	8.5%
4	Production of fresh government fish fry hatchery	Y_4= 262.37 – 4.39X (10.498)** (-2.409)*	0.216	(5.802)**	2.1%
5	Production of salty Government fish fry hatchery	Y_5= -94.11 + 12.395x (-1.40)- (2.53) **	0.235	(6.44)**	22.7%
6	Fry production from fry collection centers	Y6= 113.75 – 3.04x (12.74) ** (4.67-)**	0.51	(21.84) **	3.9%

Where: Y is the estimated value of the dependent variable
Y1: Estimated quantity of hatchery fry production in the Arab Republic of Egypt (million units)
Y2: Estimated quantity of private hatchery fry production from fresh water (million units(
Y3: Estimated quantity of private hatchery fry production from salt water (million units)
Y4: Estimated quantity of governmental hatchery fry production from fresh water (million units)
Y5: Estimated quantity of government hatchery fry production from salt water (million units)
Y6: Estimated quantity of hatchery fry production from fry collection centers (million units)
(**) Significant at probability level (0.01) (-) Not significant
(*) Significant at probability level (0.5)
Source: Calculated from data in Table No. (1) of the study.

Second: The relative importance of the governorates of the Republic in terms of the number of hatcheries:

It is shown from the data in Table No. (3) That 86.4% of fish hatcheries are concentrated in the governorates of Kafr El-Sheikh, Fayoum, Aswan and Sharkia. By studying the relative importance, it is shown that Kafr El-Sheikh Governorate occupies the first rank in terms of the number of hatcheries, as the number of hatcheries in it is about 94 hatcheries in the average, representing about 75% of the average total number of hatcheries at the republic level during the study period. Fayoum Governorate occupies the second rank with an average of 7 hatcheries, representing 6% of the average total number of hatcheries at the republic level during the study period. Aswan Governorate also comes in third rank with an average of 4 hatcheries, representing about 4% of the average total number of hatcheries at the republic level during the study period. Sharkia Governorate comes in fourth place with an average of 3 hatcheries, representing 3% of the average total number of hatcheries at the republic level during the study period. El-Beheira Governorate comes in fifth rank with an average of 2 hatcheries, representing 2% of the average total number of hatcheries at the republic level during the study period. Ismailia, Alexandria and Port Said Governorates also come in sixth rank with an average of 2 hatcheries, representing 2% of the average total number of Hatcheries at the republic level during the study period, and the governorates of Dakahlia, Beni Suef, Minya, Assiut, Sohag, Qena, and Suez came in seventh rank with a number of hatcheries amounting to about 1 hatchery on average, representing 1% of the average total number of hatcheries at the republic level during the study period.

By studying the relative importance of the distribution of the number of private and governmental hatcheries in Kafr El-Sheikh Governorate during the period (2017-2021), it is clear from the data in Table No. (3) that private hatcheries occupy the first rank with a number of hatcheries amounting to about 92 hatcheries on average in Kafr El-Sheikh Governorate during the study period, while governmental hatcheries occupy the second place with a number of hatcheries amounting to about 2 hatcheries on average in Kafr El-Sheikh Governorate during the study period.

Table (3): Geographical distribution of the number of fish hatcheries at the level of the Arab Republic of Egypt during the period 2017-2021

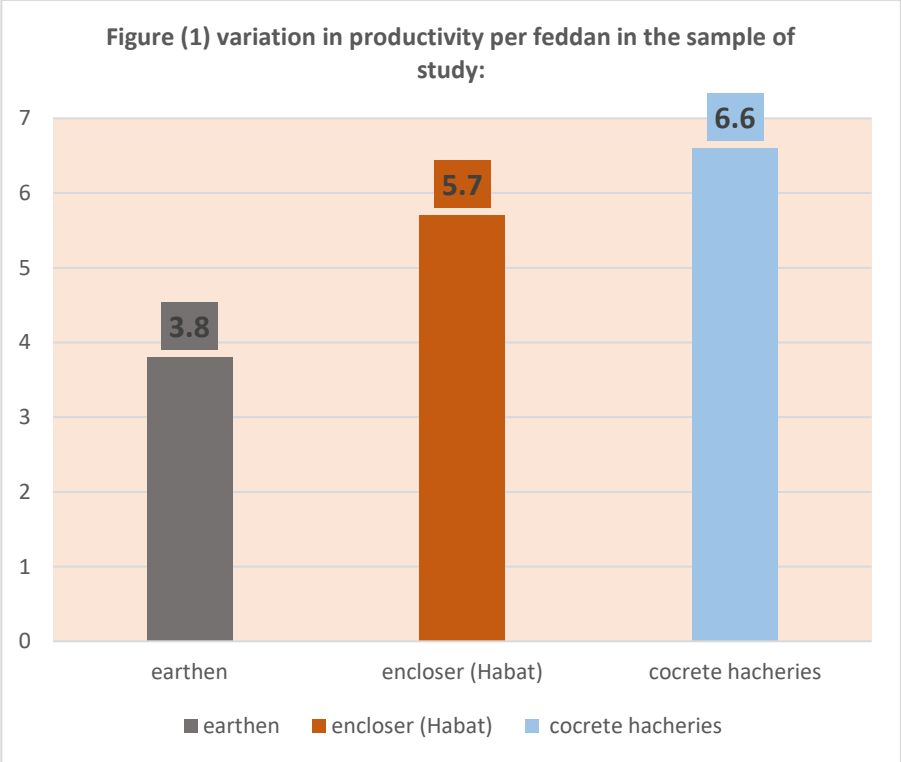
	2017		2018		2019		2020		2021		total	average	%
	Priv.	**Govern.**	Priv	**Govern.**	**Priv.**	**Govern**	**Priv.**	**Govern.**	**Priv.**	**Govern.**			
El-Beheira	1	2	0	2	1	2	1	2	0	2	13	2.6	2%
Kafr El Sheikh	95	2	95	2	89	2	80	3	102	2	472	94.4	75%
Sharqia	0	3	0	3	0	3	0	3	0	5	17	3.4	3%
Dakahlia	0	1	0	1	0	1	0	1	0	1	5	1	1%
Port Said	0	2	1	0	1	1	1	0	1	0	7	1.4	1%
Beni Suef	0	1	0	1	0	1	0	1	0	1	5	1	1%
Minya	0	1	0	1	0	1	0	1	0	1	5	1	1%
Assiut	0	1	0	1	0	1	0	1	0	1	5	1	1%
Sohag	0	1	0	1	0	1	0	1	0	1	5	1	1%
Qena	0	1	0	1	0	1	0	1	0	1	5	1	1%
Alexandria	0	2	1	1	1	1	1	1	1	0	9	1.8	2%
North Sinai	0	1	0	0	0	0	0	0	0	0	1	0.2	0%
Ismailia	0	0	4	0	2	0	2	0	3	0	11	2.2	2%
Fayoum	4	0	12	0	12	0	5	0	5	0	38	7.6	6%
Aswan	12	2	0	2	0	2	0	2	0	3	23	4.6	4%
Suez	1	0	1	0	1	0	1	0	1	0	5	1	1%
average	7.0625	1.25	7.125	1	6.6875	1.0625	5.6875	1.0625	7.0625	1.125	39.125	7.825	-

Source: Compiled and calculated from the Ministry of Agriculture and Land Reclamation, General Authority for Fish Resources Development, Fish Production Statistics Book, various issues.

Third: Variation in the productivity per acre of the three fish hatcheries (concrete, earthen, and net enclosure (Habat)) in Kafr El-Sheikh Governorate during the 2023/2024 season.

It is shown from Figure (1) that the average productivity per feddan for earthen hatcheries was 3.8 million units, for net enclosure (Habat) 5.7 million units, and for concrete hatcheries 6.6 million units. The data in Table (4) also indicate that there is a difference in the productivity per feddan of fry between the three types of hatcheries. The results of the one-way analysis of variance (F) test to identify the variance between the study sample items in the most important production indicators according to the types of fish hatcheries, whether concrete, earthen, and net enclosure (Habat) showed that there were statistically significant differences and variation in the productivity per

feddan between fish hatcheries based on the type of hatchery at the probability level of 0.01, where the value of (F) reached about 5.849.



Source: Collected and calculated from study sample questionnaires.

Table No. (4) Results of the analysis of variance between the productivity per acre of fish hatcheries (concrete, earthen, and net enclosure (Habat)) in the study sample in Kafr El-Sheikh Governorate during the 2023/2024 season.

		Sum of Squares	df	Mean Square	F	Sig.
Productivity per acre of fry and fingerlings	Between groups	81.195	2	40.598	5.849	.005
	Within groups	458.081	66	6.941		
	total	539.276	68			
Production value of fingerlings	Between groups	1314387.893	2	657193.947	8.336	.001
	Within groups	5203243.833	66	78837.028		
	total	6517631.726	68			
Production quantity: fry and fingerlings	Between groups	1593.850	2	796.925	119.021	.000
	Within groups	441.913	66	6.696		
	total	2035.763	68			

Source: Collected and calculated from study sample questionnaires.

To identify the reasons for the existence of significant differences in the productivity per feddann between the three production patterns, the least significant difference (L.S.D) method was used, as it was shown that the productivity per feddann of earthen basins was low and there were significant differences between them on the one hand and their counterparts in both net enclosure (Habat) and concrete basins on the other hand, as the average difference between clay basins and hapas was (-1.9) at the probability level of 0.5%, and the same average between earthen basins and concrete basins was about (-2.7) at the probability level of 0.1%. While it was shown that there were no statistically significant differences between concrete, earthen, and net enclosure (Habat) basins in the productivity per acre of basins, as the average difference between net enclosure (Habat) and concrete basins was about (-0.8), which is a simple difference, but it can explain the higher production of concrete basins to the difference in the larger areas in them.

Fourth: The most important variables affecting the production function in hatcheries of the three types (concrete, earthen, and net enclosure (Habat)) in the study sample in Kafr El-Sikh Governorate during the 2023/2024 season.

The statistical relationship between the production quantity (Yi) as a dependent variable, and the independent variables affecting production (X's) is measured using the multiple regression method and the double logarithmic form by entering the production elements affecting the production of hatcheries for one season of the individuals in the study sample according to the estimated model in the form of (Cobb - Douglas) The following model is shown in Table No. (5) The average values of the production elements variables according to the estimated model in the form of (Cobb - Douglas) where the average number of ponds in the hatchery (x1) reached 70 ponds in concrete hatcheries and 10 pond in net enclosure (Habat) and 5ponds in earthen hatcheries, and the average number of workers in the hatchery (x2) reached 2.3 workers in concrete hatcheries and 2.4 workers in net enclosure (Habat) and 1.1 workers in earthen hatcheries, the average amount of vitamins (x5) reached 290.1 grams in concrete hatcheries and 420.2 grams in net enclosure (Habat) 540.6 Gram in clay hatcheries, the average amount of disinfectants (x6) was 0.8 kg in cement hatcheries and 1.1 kg in net enclosure (Habat) 1 kg in clay hatcheries indicating

the use of large quantities of disinfectants in earten and net enclosure (Habat), the average years of experience (x7) was 13.2 years in concrete hatcheries and 14 years in net enclosure (Habat) and 14 years in earthen hatcheries, and the average feed for fry and mothers (x8) was 2.5 tons in cement hatcheries and 2.4 tons in net enclosure (Habat) and 2.4 tons in earthen hatcheries indicating the use of large quantities of fry feed in earthen and net enclosure (Habat).

Table (5): A statement of the most important variables affecting the production of fish fry in the study sample in Kafr El-Sikh Governorate during the period 2023/2024

Variable	Unit	The symbol	Average		
			earthen hatcheries	net enclosure (Habat)	concrete
Number of ponds in the hatchery	pond	X1	5	10	70
Number of workers	worker	X2	1.1	2.4	2.3
Number of hormones	Gram	X3	3.6	3.5	3.4
Amount of alcohol	Litre	X4	62.5	95.6	126.6
Number of vitamins	Gram	X5	540.6	420.2	290.1
Number of disinfectants	Kilogram	X6	1	1.1	80.
Years of experience	Year	X7	14.1	14	13.2
Feed for fry and mothers	Ton	X8	2.4	2.4	2.5

Source: Collected and calculated from the questionnaire data of the study sample.

The most important variables affecting the production function in hatcheries of the three types (earthen - concrete - net enclosure (Habat)) were identified in the study sample. The STEP WISE regression was estimated as follows:

1- Production functions in fish hatcheries in earthen ponds:

It was found that the most important production elements that had a significant impact on production in fish hatcheries in earthen ponds in the step-wise regression function were the number of ponds in the hatchery (x1), the amount of alcohol (x4), the amount of vitamins (x5), the amount of disinfectants (x6), and the feed for fry and mothers (x8), where their production elasticity reached about (0.22, 0.13, 0.17, 0.21, and 0.19) respectively, meaning that increasing these production

elements in order by 1% leads to an increase in the amount of production in earthen fish hatcheries by (0.22%, 0.13%, 0.17%, 0.21%, and 0.19%).

The total production elasticity of the function indicates a decreasing return to capacity. This means that increasing these production elements by the estimated function by 1% leads to an increase in the total production of one cycle of fry in fish hatcheries in earthen ponds in the study sample at a decreasing rate of 0.87%. The adjusted coefficient of determination (R^2) reached about 0.89, which indicates that these independent variables explained by the estimated function are responsible for about 89% of the total changes occurring in the total production of one cycle in fish hatcheries in mud ponds in the study sample. The value of (F) indicates the statistical significance of the estimated function.

$$\text{Ln } Q = 2.6 + 0.22 \text{ Ln } X_1 + 0.13 \text{ Ln } X_4 + 0.17 \text{ Ln } X_5 + 0.21 \text{ Ln } X_6 + 0.19 \text{ Ln } X_8$$
$$(2.4)^{*} \quad (2.6)^{**} \quad (2.9)^{**} \quad (4.4)^{**} \quad (2.3)^{*} \quad (2.1)^{*}$$
$$R^{-2} = 0.89 \qquad F = (58)^{*}$$

Production elasticity = 0.87, which means diminishing returns to capacity.

2- Production functions in fish net enclosure (Habat) hatcheries:

It was found that the most important production elements that had a significant impact on production in fish net enclosure (Habat) hatcheries in the step-wise regression function were the number of ponds in the hatchery (x1), the amount of hormones (x3), the amount of alcohol (x4), the amount of vitamins (x5), and the feed for fry and mothers (x8), where the production elasticity of these elements reached about 0.21, 0.22, 0.11, 0.12, 0.21 for each of them respectively, meaning that increasing these production elements in order by 1% leads to an increase in the amount of production in fish net enclosure (Habat) hatcheries by 0.21%, 0.22%, 0.11%, 0.12%, 0.21%.

The total production elasticity of the function indicates a decreasing return to capacity. This means that increasing these production elements by the estimated function by 1% leads to a decrease in the total production of fish per cycle in the fish hatcheries in the hapas in the study sample by 0.92%. The adjusted coefficient of determination (R2) reached about 0.84, which indicates that these independent variables explained by the estimated function are responsible for about 84% of the total changes occurring in the total production per cycle in the fish

hatcheries in the enclosure (Habat) in the study sample. The value of (F) indicates the statistical significance of the estimated function.

$$\text{Ln } Q = 1.9 + 0.21 \text{ Ln } X_1 + 0.22 \text{ Ln } X_3 + 0.11 \text{ Ln } X_4 + 0.12 \text{ Ln } X_5 + 0.21 \text{ Ln } X_8$$
$$(2.15)^{*} \quad (3.6)^{**} \quad (2.9)^{**} \quad (3.1)^{*} \quad (4.8)^{**} \quad (2.2)^{*}$$
$$R^{-2} = 0.84 \qquad F = (203.9)^{**}$$

Total production elasticity = 0.92, which means diminishing returns to capacity.

3- Production functions in fish hatcheries in concrete ponds:

It was found that the most important production elements that had a significant impact on the production of concrete ponds in hatcheries in the step-wise regression function are the number of ponds in the hatchery (x_1), the number of workers in the hatchery (x_2), the amount of vitamins (x_5), and the feed for fry and mothers (x8), where the production elasticity reached about 0.19, 0.16, 0.25, 0.19, 0.21 for each of them, respectively, meaning that increasing these production elements in order by 1% leads to an increase in the production quantity in cement fish hatcheries by 0.19%, 0.16%, 0.25%, 0.19%, 0.21%. The total production elasticity of the function indicates the stability of the return to capacity, which means that increasing these production elements in the estimated function by 1% leads to an increase in the total production of one cycle for fish concrete hatcheries by the same percentage, and the adjusted coefficient of determination (R^2) reached about 0.88, indicating that these independent variables explained by the estimated function are responsible for about 88% of the total changes occurring in the total output of one cycle in fish hatcheries in concrete ponds in the study sample, and the value of (F) indicates the statistical significance of the estimated function.

$$\text{Ln } Q = 1.3 + 0.19 \text{ Ln } X_1 + 0.16 \text{ Ln } X_2 + 0.25 \text{ Ln } X_3 + 0.19 \text{Ln } X_5 + 0.21 \text{ Ln } X_8$$
$$(5.1)^{**} \quad (4.1)^{**} \quad (2.6)^{**} \quad (5.4)^{**} \quad (2.5)^{**} \quad (2.1)^{*}$$
$$R^{-2} = 0.88 \qquad F = (87)^{*}$$

Total production elasticity = 1, which means constant return on capacity.

Production efficiency index for the performance of the three fish hatcheries (concrete, earthen, and net enclosure (Habat)) in Kafr El-Sheikh Governorate, 2024 season.

Production efficiency is used to measure the efficiency of using the available resources of the three fish hatcheries. Increasing the productivity of these hatcheries is considered one of the most important requirements for the advancement of the fisheries sector. In this part of

the study, the productivity indicator of the most important resources that represent the determinants of fry production is measured, where the production efficiency indicator is measured using the following indicators:

First: The production efficiency indicator for the performance of concrete, earthen, and net enclosure (Habat) in Kafr El-Sheikh Governorate for the 2024 season.

Average quantity of mothers feed per feddan: It is clear from the data in Table No. (4) that the average consumption per feddan of mothers feed for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) is about 1.91, 1.92 and 1.91 tons/feddan in the average for each of them, respectively.

By studying the production efficiency of the mothers feed in the three fish hatcheries (concrete, earthen, and net enclosure (Habat)), it is clear from Table No. (4) that the average productivity of the mothers feed is estimated at about (5.955 million, 2.846, million 3.833 million) in the average.

Average amount of fry feed per feddan: Data from Table No. (4) indicates to that the average consumption per feddan of fry feed for fry and fingerling production from concrete, earthen, and net enclosure (Habat) hatcheries is about 0.58, 0.44 and 0.53 tons/acre on average for each of them, respectively.

By studying the production efficiency of fry feed in the three fish hatcheries (concrete, earthen, and net enclosure (Habat) hatcheries), it is clear from Table No. (4) that the average fry feed productivity is estimated at about (19.540 million, 12.360 million, 13.824 million) in the average.

Average amount of testosterone hormone per feddan: It is clear from the data in Table No. (4) That the average consumption of testosterone hormone per feddan for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is approximately 3.244, 1.50, 2.042 grams/acre on average for each of them, respectively.

It is shown from the data in Table No. (4) that the average consumption of testosterone per feddan for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 3.51 million, 3.65 million, and 3.59million per feddan in the average for each of them, respectively.

Average amount of ethyl alcohol per feddan: It is clear from the data in Table No. (4) that the average consumption of ethyl alcohol per acre for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 126.61, 26.48, and 135.90 liters/acre on average for each of them, respectively.

By studying the production efficiency in the three fish hatcheries (concrete, earthen, and net enclosure (Habat) hatcheries), it is clear from Table No. (4) that the average productivity of ethyl alcohol is estimated at about (0.089, 0.087, 0.054) in the average.

Average amount of sodium permanganate disinfectants per feddan: Data from Table No. (4) indicates to that the average consumption of sodium permanganate disinfectants per feddan for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 0.86, 0.96, and 0.96 kilogram per feddan in the average for each of them, respectively.

By studying the production efficiency in the three fish hatcheries (concrete, earthen, and net enclosure (Habat) hatcheries), it is clear from Table No. (4) that the average productivity of sodium permanganate is estimated at about (13.169, 5.687, 7.607) million units of fry in the average.

Average amount of malathion per feddan: As shown from data in Table No. (4), the average consumption of malathion per feddan for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 1.01, 1.12 and 0.92 kg/acre on average for each of them, respectively.

By studying the production efficiency of the three fish hatcheries (concrete, clay, and habat), the data in Table No. (4) indicate that the average productivity of malathion is estimated at about (11.234, 4.891, 7.902) million fry units in the average.

Average amount of fuel and oils per feddan: It is clear from data in Table No. (4) that the average consumption of fuel and oils per acre for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 310.83, 220.54, 327.45 liters/acre on average for each of them, respectively.

By studying the production efficiency in the three fish hatcheries (concrete, clay and habat), it is clear from Table No. (4) that the average productivity of fuel and oils is estimated at about (0.036, 0.024, 0.022) million fry units in the average.

Average amount of electricity per feddan: The data in Table No. (4) also indicate that the average consumption of electricity per feddan for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 420.88, 814.05 and 355.80 kilos/feddan in the average for each of them, respectively.

By studying the production efficiency of the three fish hatcheries (concrete, earthen, and net enclosure (Habat)), it is clear from Table No. (4) that the average electricity production is estimated at about (0.027, 0.006, 0.020) million fry units in the average.

Average amount of vitamins per feddan: It is clear from data in Table No. (4) that the average consumption of vitamins per acre for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat)hatcheries is about 290.05, 540.60, and 336.89 grams per acre on average for each of them, respectively.

By studying the production efficiency in the three fish hatcheries (concrete, earthen, and net enclosure (Habat)), it is clear from Table No.(4) that the average vitamin production is estimated at about (0.039, 0.010, 0.021) million fry units in the average.

Average amount of antibiotics per feddan: Data from Table No. (4) indicates to that the average consumption of antibiotics per acre for the production of fry and fingerlings from concrete, earthen, and net enclosure (Habat)hatcheries is about 831.19, 812.94 and 903 grams per acre on average for each of them, respectively.

By studying the production efficiency of the three fish hatcheries (concrete, earthen, and net enclosure (Habat)), it is clear from Table No. (4) that the average productivity of antibiotics is estimated at about (0.13, 0.006, 0.008) million fry units on average.

Average amount of replacement of mother's stock per feddann: As it is clear from the data in Table No. (4), the average consumption per acre of replacing the mother's stock to produce fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 0.32, 0.38, 0.44 units/acre on average for each of them, respectively.

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Table (4): Production efficiency index for the performance of the three fish hatcheries (concrete, earthen, and net enclosure (Habat) hatcheries) in Kafr El-Sheikh Governorate, 2024 season.

Element		net enclosure (Habat)		earthen		concrete	
	unit	Average consumption per feddan	Average production quantity (million)	Average consumption per feddan	Average production quantity (million)	Average consumption per feddan	Average production quantity (million)
Feed for mothers	ton	1.91	3.833	1.92	2.846	1.91	5.955
Feed for fry	ton	0.58	13.824	0.44	12.360	0.53	19.540
Testosterone hormone	Box/gram	3.51	2.042	3.65	1.50	3.59	3.244
Ethyl Alcohol	liter	126.61	0.054	26.48	0.087	135.90	0.089
Disinfectants Sodium Permanganate	kilogram	0.86	7.607	0.96	5.687	0.96	13.169
Malathion	Kilogram	1.01	7.902	1.12	4.891	0.92	11.234
Fuel & Oils	liter	310.83	0.022	220.54	0.024	327.45	0.036
Electricity	Kilogram	420.88	0.020	814.05	0.006	355.80	0.027
Vitamins	Gram	290.05	0.021	540.60	0.010	336.89	0.039
Antibiotics	Gram	831.19	0.008	812.94	0.006	903	0.013
mothers Replacement	fish	0.32	16.608	0.38	14.107	0.44	35.6
labor	worker	1.12	5.544	0.97	5.628	1.32	10.090
total		1988.87	57.485	2424.05	47.152	2068.71	99.036

Where: *Production efficiency of mothers' feed = Average fry and fingerlings productivity / Average quantity of mothers' feed

*Production efficiency of fry feed = Average fry and fingerlings productivity / Average quantity of fry ration

*Production efficiency of testosterone = Average fry and fingerlings productivity Average quantity of testosterone

*Production efficiency of ethyl alcohol = Average fry and fingerlings productivity / Average amount of ethyl alcohol

*Production efficiency of disinfectants = Average fry and fingerlings productivity / Average quantity of sodium permanganate disinfectants

*Production efficiency of malathion = Average fry and fingerlings productivity / Average quantity of malathion

*Production efficiency of electricity = Average fry and fingerlings productivity Average quantity of electricity

*Production efficiency of vitamins = Average fry and fingerlings productivity / Average quantity of vitamins

*Production efficiency of antibiotics = Average fry and fingerlings productivity / Average quantity of antibiotics

*Production efficiency of parent stock replacement = Average Fry and fingerling productivity / Average replacement quantity of mother herd

*Labor productivity efficiency = Average fry and fingerling productivity / Average number of workers

Source: collected and calculated from the study sample questionnaires for the 2024 season

By studying the production efficiency in the three fish hatcheries (concrete, earthen, and net enclosure (Habat)), the data in Table No. (4) indicate that the average productivity of replacing the mother's stock is estimated at about (35.6, 14.107, 16.608) million fry units on average.

Average number of workers per feddan: It is clear from the data in Table No. (4) that the average consumption of labor per feddan to produce fry and fingerlings from concrete, earthen, and net enclosure (Habat) hatcheries is about 1.12, 0.97, 1.32 workers/acre on average for each of them, respectively.

By studying the production efficiency in the three fish hatcheries (concrete, clay and habat), it is clear from Table No.(4) that the average labor productivity is estimated at about (10.090, 5.628, 5.544) million fry units in the average

Fourth: The economic efficiency index for the performance of the three fish hatcheries (concrete, earthen, and net enclosure (Habat) hatcheries) in Kafr El-Sheikh Governorate, 2024 season.

The economic efficiency of the three fish hatcheries is measured by the relationship between the revenues and costs of fry and fingerlings from the fish hatcheries, where the economic efficiency indicator is measured using the following indicators.

Net income criterion: It is shown from the data in Table No. (5) that the net income achieved by concrete, earthen, and net enclosure (Habat) fish hatcheries amounts to about 955.24, 380.1, 445.28 thousand pounds on average for each of them, respectively, during the season. This indicates the ability of hatchery management to achieve profits from the available resources during the season.

Ratio of Revenues to Variable Costs: It is shown from the data in Table No. (5) that the ratio of revenues to variable costs for concrete, earthen, and net enclosure (Habat) fish hatcheries is approximately 7.45, 3.71, and 3.97 for each of them respectively, indicating the ability of hatcheries to cover variable costs and manage the resources used during the hatching season with economic efficiency.

Benefit cost ratio (profitability indicator): The data in Table No. (5) that the cost return ratio for concrete, earthen, and net enclosure (Habat) fish hatcheries is about 5.50, 2.54, 2.100 for each of them respectively, indicating that the hatchery management is achieving a return from

every pound invested. This indicates the economic efficiency of the concrete fish hatcheries in the study sample and their ability to continue production.

Net return on revenue: It is shown from the data in Table No. (5) that the net return on revenue ratio for concrete, earthen, and net enclosure (Habat) fish hatcheries is approximately 0.72, 0.607, 0.52 for each of them respectively, indicating the ability of fish hatcheries to achieve profits from the resources used during the spawning season, which indicates the efficient use of available resources.

Operating ratio criterion: It is shown from the data in Table No. (5) the operating ratio for concrete, earthen, and net enclosure (Habat) fish hatcheries is about 0.18, 0.392, 0.47 for each of them respectively, indicating the ability of concrete fish hatcheries to achieve profits from the resources used in production during the hatchery season by reducing costs and thus achieving economic efficiency for the hatcheries.

Operating efficiency criterion: Data from Table No (5) that the average annual net income per pound invested for concrete, earthen, and net enclosure (Habat) fish hatcheries is about 4.00, 1.54, and 1.100 on average for each of them respectively. This indicates to the ability of concrete hatchery management to maximize the return from each unit of resource used and thus achieve economic efficiency from the use of available resources.

Break-even price criterion: The break-even price is defined as the price at which the unit costs and revenues of the project are equal, as the management works to rationalize and reduce the unit costs of the project to less than the break-even price for concrete, earthen, and net enclosure (Habat) fish hatcheries, which amounts to about 20.92, 44.81, 55.11 thousand pounds / thousand units of fry and fingerlings for each of them, respectively. This indicates the ability of fish hatchery management to maximize the return on the resources used and achieve economic efficiency.

Net added value criterion: It is shown from the data in Table No. (5) that the net added value achieved by concrete, earthen, and net enclosure (Habat) fish hatcheries amounts to about 145.73, 31.61, 195.25 thousand pounds on average for each of them, respectively. This indicates to the realization of profits from the quantities of fry and fingerlings produced by fish hatcheries and the reduction of risks.

Worker productivity criterion: It is shown from the data in Table No. (5) that the worker productivity from concrete, earthen, and net enclosure (Habat) fish hatcheries in the study sample is about 151.8, 199.65, 110.75 thousand pounds for each of them, respectively. This is in addition to the efficiency of using the available human resource in the hatchery operations.

Wage productivity criterion: Data in Table No. (5) Indicates to that every pound of wages contributes to increasing the value of the quantities produced from concrete, earthen, and net enclosure (Habat) fish hatcheries, while wages productivity is 10.17, 7.76, 12.79.

Table (5) Economic efficiency indicators for the performance of the three fish hatcheries in Kafr El-Sheikh Governorate, 2024 season

Element	net enclosure (Habat)	earthen	concrete
Indicator	The value	The value	The value
Net Income (Thousand Pounds)	445.28	380.1	955.24
Ratio of Revenues to Variable Costs	3.97	3.71	7.45
Benefit cost ratio	2.100	2.54	5.50
Net Return on Revenue (Pounds)	0.52	0.607	0.72
Operation Ratio	0.47	0.392	0.18
Operation Efficiency	1.100	1.54	4.00
Break-even Price (Thousand Pounds/Ton)	55.11	44.81	20.92
Net Added Value (Million Pounds)	195.25	31.61	145.73
Labor Productivity (Thousand Pounds)	110.75	199.65	151.8
wage Productivity (Pounds)	12.79	7.76	10.17

Where:

*Net income = Total revenues – Total costs

* Net value added = Value of production – Value of raw materials (excluding wages)

*Ratio of revenues to variable costs = Total revenues / Total variable costs

* Worker productivity = Total production value / Number of workers

*Benefit cost ratio = Total revenues / Total costs

* Brick productivity = Value of production / Value of wages

*Net return on revenue = Net income / Total revenue Source: Collected and calculated from the study sample questionnaire forms for the 2024 season.

*Operating ratio = Total costs / Total revenue

*Operating efficiency = (Total revenue – Total costs) / Total costs

* Break-even price = Total costs / Total production

Source: collected and calculated from the study sample questionnaires for the 2024 season

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Fifth: The problems facing fish hatcheries in the study sample for the 2024 season.

Table No. (6) shows that the problems and obstacles facing the owners of private fish hatcheries in Kafr El-Sheikh Governorate, which were collected through several personal interviews with about 70 respondents from the owners of fish hatcheries, where several problems were identified and divided into main groups as follows:

1- **Financing and productivity**: It is shown from the data in Table No. (6) That the owners of fish hatcheries in the study sample depend on self-financing, estimated at about 70, representing 100% of the total number of respondents in the study sample. For the labor problem and it was found that high labor wages occupied the first rank, estimated at about 42, representing 60% of the total number of respondents in the study sample, while the problem of the lack of trained labor came in second rank, estimated at about 28, representing 40% of the total number of respondents in the study sample. It is followed by the problem of production requirements, including the problem of feed, and it was found that its high prices occupied the first rank, estimated at about 55, representing 79% of the total number of respondents in the study sample, and its unavailability came in second rank, estimated at about 15, representing 21% of the total number of respondents in the study sample. Then the fertilizer problem, it was found that the high prices of fertilizers ranked first, estimated at about 40, with a percentage of 57% of the total number of respondents in the study sample, and that their unavailability ranked second, estimated at about 30, with a percentage of 43% of the total number of respondents in the study sample. Followed by the problems of seeds, it was found that the increased mortality rate during transportation ranked first, estimated at about 40, with a percentage of 57% of the total number of respondents in the study sample, and the increased mortality rate during hatching came in second place, estimated at about 25, with a percentage of 36%, and the unavailability of seeds ranked third, estimated at about 6, with a percentage of 9% of the total number of respondents in the study sample. The increased mortality rate during rearing came in fourth place, estimated at about 4, with a percentage of 6% of the total number of respondents in the study sample, as well as the problem of oils and fuel, including their high prices and the distance of supply sources from the farm. It was found that the increase in its prices occupied the first

place, estimated at about 48, with a percentage of 73% of the total number of respondents in the study sample, and after the sources of supply from the farm, it came in second place, estimated at about 22, with a percentage of 27% of the total number of respondents in the study sample.

2- **Marketing problems**: It is shown from the data in Table No. (6) That the problem of exploitation by wholesalers and the problem of seasonal production occupy the first place, estimated at about 33, with a percentage of 47%. The high costs of packaging and storage came in second place, estimated at about 20, with a percentage of 29%, and then the distance of the markets from the farm came in third rank, estimated at about 7, with a percentage of 10%.

3- **Regulatory problems**: Data in Table No. (6) indicates to that the laws and decisions of the Ministry of Public Works and Water Resources, which have an impact on the use of Nile water for hatching, rank first, estimated at 70, representing 100%, as they must be used in plant production and then fish farming, followed by the laws of the Lakes Development Authority, which have an impact on the fish hatchery, ranked second, estimated at 70, at a rate of 100%, and the reason is that licenses must be obtained. The problem of water bodies police laws, which have an impact on the fish hatchery as a result of not obtaining a suitable price for the fry, ranked third, estimated at 55, at a rate of 79%, and the reason is chasing cars loaded with unlicensed fry, which was the reason for obtaining a different price for the fry and exploiting the merchants instead of going to the markets where there are many prices. It also became clear that the problem of whether there are obstacles in obtaining licenses to establish a fish hatchery, as it ranks fourth, estimated at 44, at a rate of 63%, and the reason is the high cost of licenses.

4- **Administrative problems**: It is shown from the data in Table No. (6) that the number of specialized respondents ranked first, estimated at about 50, at a rate of 71%, followed by non-specialists, who came in second place, estimated at about 20, at a rate of 29%, then the problem of social insurance, as all fish hatchery owners were not participating in insurance, at a rate of 100%.

5- Environmental problems: It is shown from the data in Table No. (6) that the problem of high temperature occupies the first place, estimated at 41, representing 59%, while the problem of proximity to

industrial wastewater sources came in second place, estimated at 31, representing 44%, followed by the problem of increased water salinity in third place, estimated at 24, representing 34%, and the problem of proximity to sewage sources comes in fourth place, estimated at 22, representing 31%, while the problem of low temperature came in fifth place, estimated at 18, representing 26%, followed by the problem of reused water from the hatchery, which occupies sixth place, estimated at 7, representing 10%.

Table (6) Problems facing fish hatcheries in the study sample for the 2024 season.

The problem	frequencies	relative importance %
Financing and production problems	**-**	**-**
1- Financing	-	-
Self-financing	70	100
Loans	0	%0
2- Labor	-	-
Lack of trained labor	28	40
High labor wages	42	60
2- Production requirements problems	-	-
1- Feed	-	-
Lack of availability	15	%21
High prices	55	%79
2- Fertilizers	-	-
Lack of availability	30	%43
High prices	40	%57
3- fries	-	-
Lack of availability	6	%9
increased mortality rate during transportation	40	%57
Increased mortality rate during rearing	4	%6
Increased mortality rate during hatching	25	%36
4- Fuel and oils	-	-
High prices	48	%69
Far from the sources of supply from the farm	22	%31
1- Marketing problems	-	-
Exploitation of wholesalers	33	%47
Far from the markets from the farm	7	%10
Seasonality of production	33	%47
High costs of packaging and storage	20	%29
2- Regulatory problems	-	-

Do the laws of the water bodies police affect the fish hatchery as a result of not obtaining a suitable price for the fry	55	%79
Do the laws of the Lakes Development Authority affect the fish hatchery	70	%100
Are there obstacles in obtaining licenses to establish a fish hatchery	44	%63
Do the laws and decisions of the Ministry of Public Works and Water Resources have an impact on the use of Nile water	70	%100
3- Problems Administrative	-	-
1- Hatchery Management	-	-
Specialized	50	%71
Non-Specialized	20	%29
2- Social Insurance	-	-
Shared	0	%0
Non-Shared	70	%100
4- Environmental Problems (Regarding Water Source)	-	-
Proximity to Industrial Wastewater Sources	31	%44
Proximity to Sewage Sources	22	%31
Reused Water from the Hatchery	7	%10
High Temperature	41	%59
Low Temperature	18	%26
Increased Water Salinity	24	%34

Source: collected and calculated from the study sample questionnaires for the 2024 season

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الملخص العربي:

يعتمد الانتاج السمكي على انتاج زريعة الأسماك الذي يواجه عجز في تلبية احتياجات مشروعات الإنتاج السمكي بصفة عامة في ظل اتجاه إنتاج زريعة الأسماك للانخفاض، هذا بالإضافة إلي ضعف بعض نظم إنتاج زريعة الأسماك الأكثر انتشارا وضعف كفاءة إنتاج زريعة الأسماك في مصر. كما أستهدف البحث بصفة رئيسية دراسة الجدوى الاقتصادية لإنتاج زريعة الأسماك من مفرخات المياه العذبة بمحافظة كفر الشيخ. هذا قد أعتمد البحث في تحقيق أهدافه على استخدام أساليب الانحدار البسيط والانحدار المتعدد لتقدير حجم الإنتاج المعظم للربح، وتوصلت الدراسة إلى النتائج التالية: تتركز المفرخات السمكية بنسبة نسبة 86.4% في محافظات كفر الشيخ والفيوم وأسوان والشرقية، ويبلغ عدد المفرخات في كل منها حوالي 94 مفرخًا، بواقع 7 مفرخات، و4 مفرخات، و3 مفرخات لكل منها على الترتيب. ومن خلال دراسة أهم عوامل الإنتاج التي لها تأثير كبير على الإنتاج في مفرخات الأسماك في الأحواض الطينية هي عدد الأحواض في المفرخ (×1)، وكمية الكحول (×4)، وكمية الفيتامينات (×5)، وكمية المطهرات (×6)، وكمية الزريعة والعلف للزريعة والأمهات (×8)، حيث بلغت المرونة الكلية 0.87، مما يدل على انخفاض العائد على السعة لهذه العناصر. العوامل الأكثر تأثيرًا في إنتاج الهابات هي: عدد الأحواض في المفرخ (x1)، وكمية الهرمونات (x3)، وكمية الكحول (x4)، وكمية الفيتامينات (x5)، والعلف للزريعة والأمهات (x8)، حيث بلغت المرونة الكلية 0.92، مما يدل على انخفاض العائد على السعة. أما بالنسبة لإنتاج زريعة الأسماك من الأحواض الخرسانية، فقد وجد أن العوامل الأكثر تأثيرًا في الإنتاج هي: عدد الأحواض في المفرخ (x1)، وعدد العاملين في المفرخ (x2)، وكمية الفيتامينات (x5)، والعلف للزريعة والأمهات (x8)، حيث بلغت مرونة الإنتاج 1، مما يدل على ثبات العائد.