J. Agric. Food. Tech., 4(5)1-6, 2014

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ISSN 2090 – 424X
Journal of Agriculture and Food Technology
www.textroad.com

Fish Diseases and Its Economic Effect on Egyptian Fish Farms

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Received: March 6, 2014
Accepted: May 31, 2014

ABSTRACT

This study was carried-out on a random sample from private and governmental sector . Three localities were the area of this study regarding to their importance in farmed fish production in Egypt related to El- behera and Kafr El-Sheikh provinces. Four species of fish used in this study which include, Tilapia ***(Oreochromis niloticus)***, Common carp, Mugil cephalus and Mugil capito.

This study concluded that, the main important economic diseases affecting the Tilapia ***(Oreochromis niloticus)***, carp under Egyptian conditions includes Saprolegnia, Aeromonas, parasitic and the mycotoxins from the previous fish species respectively, and the cycles spread in it this diseases achieved the lower net income level which reached to 65.45 , 12.42, 35.51 and 16.20 LE/1000 fish respectively.

The objectives of this study is to study the incidence of fish diseases among different fish species in Egyptian fish farms and the losses resulted from them.

KEYWORDS: fish diseases, Economic effect, Egyptian fish farms, Tilapia (Oreochromis niloticus), Common carp, Mugil cephalus and Mugil capito.

INTRODUCTION

Egyptian peoples presently eat about twice as much fish as they had 10 years ago. About half of such increase is due to developed supplies from aquaculture, which most of the terms of Tilapia (derived from monosex hatcheries) and mullet (derived from capture fisheries). Consumer Prices are falling either as current or as deflited, while, the average deflited prices of Tilapia declined at about 12.4 % per annum, it was 9 % for mullet, bringing the benefit of price competition to consumers (Megapesca Lda., 2001).

Saad (2002) indicated that mycotoxines caused harmful effects in fish farms via reducing feed effeciency, increasing mortality rate and increased the costs of treatment and decreased returns of increased costs.

Durborow et al. (2003) reported that, fungal diseases considered as the main diseases causing severe economic losses to fish farms especially Saprolegniosis (Winter fungus) and Branchiomycosis.

Ramaiah (2006) indicated that, fish diseases considered as the main cause of reduction of fish production farms and its profitability, this diseases of either bacterial, viral, parasitic and mycotic.

Also, Atallah and El-Banna (2005) and Aly (2013) concluded that, the most important diseases affecting fish under Egyptian conditions were Motile Aeromonas septicemia, Saprolegniasis infection, Aflatoxicosis, Icthyphonus infection, Trichodina and Costiasis infestations and the mixed infection between the Motile Aeromonas septicemia and Saprolegnia. These diseases reduced fish livability, feed consumption and its feed conversion, increasing costs of veterinary management and production costs. The production costs for the previous diseases were 106.53, 175.39, 151.92, 111.62, 167.96, 170.93 and 199.46 LE/100 fish. In the control fish farms the production costs were 168.34 LE/100 fish, while, the returns for the farms for the previous diseases were 201.54, 181.58, 191.37, 273.21, 187.36, 272.75 and 231 LE/100 fish and in the control fish farms it reached to 294.86 LE/100 fish and the net income were 95.01, 6.19, 39.45, 161.59, 19.4, 56.23 and 32.42 LE/100 fish. Moreover, in the control fish farms the net income was 126.52 LE/100 fish, with reduction of fish farm economic and productive efficiency.

Egyptian aquaculture industry has been grown in the last few years; especially that of fresh water fish. According to reports of Agriculture World Journal (2013); Egypt ranked the first in fish farm production in the African and Mediterranean Sea countries. Egyptian fish farm production increased approximately by 45% in the last two years. Fish and fish products are the hope to solve human nutritional problems in Egypt.

The total Egyptian fish production was 220,000 tons in 1980. The Egyptian per capita annual consumption was 4.5 kg. The development plans and the establishment of the General Authority for Fish Resource Development increased production to about 876.000 tons in 2003, i.e. the per capita annual Egyptian consumption reached more than 15.5 kg from domestic production and nearly 16.80 kg with the imported amount of fish. (GAFRD, 2013).

Aly (2013) reported that, during 2000, severe mortalities and morbidities were seen among cultured Nile tilapia *(Oreochromis niloticus)* in several large freshwater fish farms in Egypt. Laboratory studies revealed the presence of Aeromonas hydrophila in 70% of fish examined.

Aquaculture industries are rapidly progressing to fulfill food requirement and provide employment opportunities for growing population. One of the major threatening problems faced by the aquaculture industries is the development of

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bacterial diseases that causes severe financial loss .Fish diseases caused by bacterial, parasites and fungal infection causes severe economic losses to fish industries under Egyptian conditions. (Saad et al., 2014).

So, the objectives of this study was to through the light on the most important fish diseases affecting freshwater fish under Egyptian conditions and their effect on the economic and productive efficiency of fish production farms.

MATERIALS AND METHODS

This study was carried-out on a random samples of (80) fish farms (private and governmental farms) . Three localities were the area of this study regarding to their importance in farmed fish production in Egypt which related to El-behera and Kafr El-Sheikh provinces.

The data on production and financial parameters were collected by using two sources, the available records of these farms (private and governmental farms) as well as by research questionnaire (using scheme) made for the farms did not keep records (Abu El-Enein , 2001).

I. Data processing : The data obtained were divided into :

A. Production resources and production traits that includes the following :

Number of fish per pond, fish species, amount of feed offered, drugs, disinfectants, feed additives, veterinary management, mortality percentage, cause of mortality, marketing age, average marketing weight per fish, total fish population per cycle, time of stocking.

B. Variable costs structure :

Costs of fish purchase (fry and fingerlings), Feed costs, Costs of drugs, Costs of disinfectants, Costs of feed additives, Costs of veterinary visits, Fuel costs, Costs of labour, Costs of transportation and Other variable costs (as fishing costs and conservation of the equipments and ponds).

C. Fixed costs structure :

1. Costs of land, Costs of pond and dikes construction, Costs of nets, boxes and equipments of fishing, Costs of pumping machine.

The annual depreciation costs of assets calculated according to Sankhyan (1983) and El-Telbany and Atallah (2000):

$$\text{Depreciati on rate} = \frac{\text{Value of Asset}}{\text{Age of Asset (year)}}$$

Age of pond = 25 years, Age of a pumping machine = 15 years, Age of dikes = 7 years

D. Variable factors of returns: That Include the price of fish at the end of the cycle.

II. The fish samples collected from the chosen farms under this study were submitted to Dept. of Aquatic Animal Med. Agric. Res. Center Anim., Health Res. Institute. Alexandria laboratory for the following laboratory examinations:

Mycological examination: Isolation and culture of Oomycete fungi including Saprolegnia from cottony-fluffy growth on infected cuticle followed the methods described in (Cerenius et al., 1988) and (Moustafa and Al- Dughaym, 1998).

Bacteriological examination: The isolation of bacteria was achieved from the blood, liver, kidneys and spleen. The isolation was made on Rimler Shotts (R-S) media (Shotts & Rimler, 1973) and nutrient agar.

After incubation for 18-24 hours at 30 ^{o}C the plates were examined for colonies type and growth characteristics. Identification and biochemical characterization of the isolates were carried out according to Popoff (1984).

Parasitological examination: Were done according to (Paperna, 1963). Parasites were collected from skin and gill lesions, fixed in 70% ethyl alcohol and stained with acid carmine mounted in canada balsam. Wet smears were prepared from the lesions and examined under light microscope. Species of parasites were identified according to the keys of Paperna (1980) and Kapata (1985).

Zoospore production: Attempts were made to induce zoospore production by the methods described by Hallett and Dick (1986).

The morphological and biochemical characterization of the bacterial isolates were characterized according to the methods implied by Khalil et al. (2001) as in the following Table.

Table (1) : The morphological and biochemical characters of isolated bacteria from ***Oreochromis niloticus*** .

Test	Result	Test	Result
Solid media :			
Nutrient agar	Round, convex.	-Gelatinase production	+
RS media	Yellow orange	**- Production of acid from :**	
Staining	Gram-ve	Glucose	+
Motility	Motile	Sucrose	+
Production of:		Mannitol	+
Catalase	+*	Sorbitol	-ve**
Oxidase	+	Inositol	-ve
Nitrate reduction	+	0/129 Vibriostate	growth
Arginin dehydrolysis	+	Novobocin	growth
H2S	V***	VP	+
Indol	+	Urease	-ve
Lysine decarboxylase	-ve		
Ornithin decarboxylase	-ve		

*** + = Positive** **** -ve = Negative** ***** v= Variable result.**

III. Statistical analysis:

Data were collected, arranged, summarized and then analyzed using the computer program SPSS/PC+. The analytical design was one way analysis of variance (ANOVA). The analysis was made for detection of the effect of fish diseases on fish production resources, costs parameters, income parameters that all these parameters were calculated for one pond for each / 1000 fish. (SAS, 1997).

RESULTS AND DISCUSSION

I. Clinical examinations:

Mass mortalities were observed in different fish farms under the study. The fish showed severe respiratory manifestations and complete absence of the reflex and moribund fish swim erratically just below the surface of water. Moreover, they showed dark discolouration of the skin, raised scales, redness of the vent, exophthalmia, distended abdomen, haemorrhages, deep ulcer on the skin, severe destruction of the fins especially caudal fin. ***O. niloticus*** showed petechial haemorrhages in the liver, kidney, spleen and intestine, and there was a concomitant accumulation of the ascitic fluid in the abdominal cavity. The characteristic signs of Saprolegniasis were in the form of white to discolored grayish or brownish cotton wall like growth on the external body surface without internal lesion.

This results agreed with those of (Atallah and El-Banna , 2005 and McNulty et al., 2003) where they reported that, fish diseases causes svere mortality in fish farms showed respiratory manifestations with complete absence of the reflex withy severe destruction of the fins.

II. Effect of different diseases on factors affecting economic and productive efficiency among different fish species :

The length of production cycle ranged from 7.88 months to 12.68 months in Tilapia species that exposed to Aeromonus and Carp species in control, respectively.

The livability percentages showed significant differences between fish species and different causes of death and its ranged from 70 % for Carp species that exposed to Mycotoxins to 93.50 % for Mugil Capito in control. These findings are in agreement with those of Atallah and El-Banna (2005) they reported that, the increasing incidence of fish diseases and high mortality reduced livability percentages.

The amount of feed consumed (kg) between species exposed to different causes of death and it ranged from 478.36 to 801.28 kg for 1000 Mugil Cephalus species exposed to Parasitic infection and Carp species exposed to Mycotoxins, respectively. This may be attributed to increase the length of production cycle in Carp than other species and Parasitic infection that reduced feed intake. While, the feed conversion ratio has a significant effect ($P < 0.05$) between fish species exposed to different causes of death and it ranged from 0.40 to 2.16 % for Carp species in control and Tilapia exposed to Mycotoxins, respectively.

The total weight (kg) between species exposed to different causes of death ranged from 230.00 to 1321.05 Kg for each 1000 fish Tilapia species that exposed to Mycotoxins and Carp species in control, respectively. These results may be due to fish diseases which agreed with Jantarotai et al. (1990) and Stoskopf (1993) they recorded that, the fish diseases caused significant drops in growth rates, fish immunity that caused severe economic losses to the fish farms. These results verified what was reported by Samira Rezeka, (1991), Olufemi et al. (1993) and El-Shaboury (1998) as they reported that, the fish diseases cause economical losses to fish farms in the form of mortalities, poor growth rate and lower market value. Also, analogous results mentioned by Faisal et al. (1988) and Shalaby and Ibrahim (1988) they reported that Parasitic diseases especially ectoparasite ones among Tilapia species were most dangerous, that probably causes sever mortalities and Eisa et al. (1989) reported that about 50 % mortality in Tilapia and the result of McNulty et al. (2003) who concluded that, the fish diseases causes high mortality, decreasing livability, total weight and decreasing the productive efficiency of fish farms.

There were significant effects of the species and different causes of death on returns which ranged from 1322.50 to 3281.25 L.E per 1000 fish for Tilapia species that exposed to Mycotoxins and Carp fish in control, respectively.

The net income ranged from 12.42 to 609.67 L.E per 1000 fish for Carp species exposed to Mycotoxins and Mugil Cephalus fish in control, respectively. These results agreed with that obtained by Post (1987) and Soliman et al., (1989) they reported that diseases are the most important limiting factors in aquaculture. They determine the profitability of fish farms. Parallel results were expressed by Atallah et al. (1999) and Khalil et al. (2001) they reported that, fish diseases had significant effects on profitability of fish farms. Most prevalent diseases affecting fish farms in Egypt were Motile Aeromonds Septicemia that declined net profit by 103.95, 173.95 and 83.31 LE/100 fish for the fish ***Oreochromis niloticus***, Common Carp, ***Mugil Cephalus*** and *Mugil Capito*, respectively. Parasitic diseases decreased the profit by 30.45, 7.84, 50.24 and 23.21, while Saprolegnia decreased net profit by 15.38, 4.51, 26.21 and 12.59 LE/100 fish for the same species of fish; respectively.

This study concluded that, the most important economic diseases affecting tilapia *(O.niloticus)* and carp under Egyptian conditions includes Saprolegnia, Mycotoxins, Aeromonas and parasits for the previous fish species respectively, and the cycles spread in it this diseases achieved the lower net income level which reached to 65.45 , 12.42, 35.51 and 16.20 LE/1000 fish respectively.

Table (2) : Effect of Fish Species and Different Causes of Death on Length of Cycle, Livability Feed Consumption, Total Weight and Feed Conversion for each 1000 Fish.

Species	Cause of death	N	Length of cycle (months)	Livability (%)	Amount of feed consumed (kg)	Feed conversion (%)	Total weight (kg)
			Mean ± S.E	Mean ± S.E	Mean ± S.E	Mean ± S.E	Mean ± S.E
Tilapia	Aeromonus	25	7.88 ± 0.38^{i}	78.92 ± 1.23^{j}	485.77 ± 23.58^{ef}	2.08 ± 0.11^{ab}	236.00 ± 6.64^{fgh}
	Saprolegnia	16	8.50 ± 0.50^{ghi}	87.60 ± 0.88^{def}	483.41 ± 14.01^{f}	2.02 ± 0.06^{ab}	240.63 ± 5.04^{fgh}
	Parasitic	14	9.29 ± 0.49^{fgh}	90.71 ± 1.09^{abcd}	509.29 ± 15.97^{ef}	1.90 ± 0.10^{bc}	273.81 ± 10.44^{efgh}
	Mycotoxins	10	8.20 ± 0.44^{ghi}	88.48 ± 1.10^{cde}	489.25 ± 22.59^{ef}	2.16 ± 0.13^{a}	230.00 ± 8.16^{gh}
	Control	80	10.00 ± 0.23^{cdef}	93.08 ± 0.44^{ab}	483.19 ± 8.04^{f}	1.66 ± 0.04^{cd}	298.52 ± 6.57^{ef}
	Total	145	9.28 ± 0.17^{C}	89.49 ± 0.56^{A}	486.60 ± 6.53^{B}	1.83 ± 0.03^{A}	274.24 ± 4.66^{C}
Carp	Aeromonus	19	11.05 ± 0.39^{bcd}	72.89 ± 1.54^{k}	754.10 ± 88.83^{ab}	0.61 ± 0.05^{e}	1202.63 ± 44.34^{c}
	Saprolegnia	10	11.40 ± 0.34^{ab}	82.10 ± 2.49^{hij}	640.61 ± 51.69^{cd}	0.49 ± 0.03^{e}	1300.00 ± 44.72^{ab}
	Parasitic	10	10.80 ± 0.44^{bcde}	85.98 ± 2.54^{efg}	694.00 ± 87.09^{bc}	0.57 ± 0.07^{e}	1215.00 ± 40.86^{c}
	Mycotoxins	2	8.00 ±1.00^{hi}	70.00 ± 5.00^{k}	801.28 ± 32.05^{a}	0.64 ± 0.03^{e}	1250.00 ± 41.01^{bc}
	Control	19	12.68 ± 0.54^{a}	90.20 ± 1.55^{bcd}	521.94 ± 23.78^{ef}	0.40 ± 0.02^{e}	1321.05 ± 44.31^{a}
	Total	60	11.48 ± 0.26^{A}	81.99 ± 1.32^{B}	653.23 ± 35.26^{A}	0.52 ± 0.02^{C}	1260.00 ± 22.82^{A}
Mugil Cephalus	Aeromonus	13	8.92 ± 0.40f^{ghi}	83.11 ± 1.22^{ghi}	489.11 ± 29.38^{ef}	1.76 ± 0.12^{cd}	282.05 ± 11.70^{efgh}
	Saprolegnia	14	10.64 ± 0.55^{bcde}	86.79 ± 1.14^{ef}	514.13 ± 16.28^{ef}	1.88 ± 0.11^{bc}	285.71 ± 18.97^{efgh}
	Parasitic	5	11.00 ± 0.55^{bcd}	92.20 ± 0.80^{ab}	478.36 ± 28.96^{f}	1.72 ± 0.15^{cd}	283.33 ± 20.41^{efgh}
	Mycotoxins	2	9.00 ± 1.00^{fghi}	85.00 ± 5.00^{fgh}	575.81 ± 205.44^{de}	1.91 ± 0.43^{abc}	291.67 ± 41.67^{efg}
	Control	51	11.14 ± 0.31^{bcd}	93.43 ± 0.49^{ab}	534.92 ± 13.27^{ef}	1.54 ± 0.06^{d}	365.03 ± 12.30^{d}
	Total	85	10.66 ± 0.23^{B}	90.49 ± 0.60^{A}	522.13 ± 10.40^{B}	1.65 ± 0.05^{B}	332.74 ± 9.30^{B}
Mugil Capito	Aeromonus	8	9.00 ± 0.57^{fghi}	81.50 ± 2.26^{ij}	511.90 ± 36.66^{ef}	2.06 ± 0.16^{ab}	250.45 ± 9.79^{fgh}
	Saprolegnia	3	11.33 ± 0.67^{bc}	88.33 ± 1.67^{cde}	554.50 ± 16.87^{def}	2.04 ± 0.22^{ab}	277.78 ± 27.78^{efgh}
	Parasitic	4	9.50 ± 0.87^{efg}	91.25 ± 0.75^{abc}	519.86 ± 22.83^{ef}	2.07 ± 0.22^{ab}	258.33 ± 27.64^{efgh}
	Mycotoxins	2	8.00 ± 1.00^{hi}	91.00 ± 1.00^{abc}	463.77 ± 19.32^{f}	2.08 ± 0.14^{ab}	225.00 ± 25.00^{h}
	Control	20	9.90 ± 0.48^{def}	93.50 ± 0.77^{a}	518.18 ± 18.93^{ef}	1.72 ± 0.11^{cd}	316.67 ± 18.65^{de}
	Total	37	9.68 ± 0.32^{C}	90.11 ± 1.02^{A}	517.01 ± 13.15^{B}	1.88 ± 0.08^{A}	287.93 ± 12.01^{C}

Cause of Death: Means within the same column carrying different superscripts (small litters) are significant at ($p \leq 0.05$).
Species: Means within the same column carrying different superscripts (capital litters) are significant at ($p \leq 0.05$).

Table (3) : Effect of Fish Species and Different Causes of Death on Cost Parameter (Fixed, Variable and Total), Price of A Kilogram of Fish, Total Return as well as Net Income for each 1000 Fish.

Species	Cause of death	N	Total cost	Return (L.E)	Net income (L.E)
			Mean ± S.E	Mean ± S.E	Mean ± S.E
Tilapia	Aeromonus	25	1284.96 ± 45.86^{h}	1352.00 ± 46.58^{h}	67.04 ± 31.45^{fg}
	Saprolegnia	16	1300.96 ± 46.85^{h}	1366.41 ± 51.05^{gh}	65.45 ± 24.85^{fg}
	Parasitic	14	1462.46 ± 68.10^{h}	1633.93 ± 70.35^{fgh}	171.47 ± 51.61^{defg}
	Mycotoxins	10	1192.97 ± 74.04^{h}	1322.50 ± 81.65^{h}	129.53 ± 75.21^{efg}
	Control	80	1387.31 ± 29.02^{h}	1718.26 ± 48.19^{efg}	330.94 ± 30.98^{bcd}
	Total	145	1353.99 ± 20.91^{C}	1580.85 ± 32.73^{D}	226.86 ± 21.73^{B}
Carp	Aeromonus	19	2924.98 ± 199.87^{b}	3017.11 ± 194.13^{ab}	92.13 ± 69.23^{fg}
	Saprolegnia	10	2789.85 ± 189.97^{b}	2995.00 ± 169.35^{ab}	205.15 ± 67.48^{cdefg}
	Parasitic	10	2827.21 ± 201.27^{b}	2923.75 ± 168.04^{b}	96.54 ± 51.12^{fg}
	Mycotoxins	2	3293.67 ± 271.44^{a}	2950.66 ± 133.28^{ab}	12.42 ± 115.19^{g}
	Control	19	2635.21 ± 120.60^{b}	3281.25 ± 156.25^{a}	315.45 ± 51.06^{bcde}
	Total	60	2806.69 ± 87.31^{A}	2985.63 ± 83.01^{A}	178.93 ± 32.97^{B}
Mugil Cephalus	Aeromonus	13	2286.60 ± 123.21^{cd}	2322.10 ± 117.63^{cd}	35.51 ± 53.17^{g}
	Saprolegnia	14	2206.56 ± 90.82^{cde}	2355.65 ± 156.09^{cd}	149.10 ± 91.48^{defg}
	Parasitic	5	2058.36 ± 121.32^{cdefg}	2312.50 ± 181.98^{cd}	254.14 ± 88.90^{cdef}
	Mycotoxins	2	1998.27 ± 63.50^{defg}	2385.42 ± 447.92^{c}	387.14 ± 384.42^{bc}
	Control	51	2314.10 ± 69.45^{c}	2923.77 ± 99.63^{b}	609.67 ± 59.64^{a}
	Total	85	2269.71 ± 48.80^{B}	2689.56 ± 74.83^{B}	419.85 ± 47.94^{A}
Mugil Capito	Aeromonus	8	1983.60 ± 175.01^{efg}	2018.30 ± 138.09^{de}	34.70 ± 66.49^{g}
	Saprolegnia	3	1897.05 ± 19.05^{fg}	2069.44 ± 256.94^{cde}	172.40 ± 237.9^{defg}
	Parasitic	4	2107.98 ± 118.81^{cdef}	2204.17 ± 210.76^{cd}	96.18 ± 118.79^{fg}
	Mycotoxins	2	1809.95 ± 102.77^{g}	1793.75 ± 143.75^{ef}	16.20 ± 40.98^{g}
	Control	20	2297.99 ± 106.59^{c}	2754.38 ± 147.47^{b}	456.39 ± 84.65^{ab}
	Total	37	2150.58 ± 74.11^{B}	2428.28 ± 106.70^{C}	277.70 ± 60.85^{B}

Cause of Death: Means within the same column carrying different superscripts (small litters) are significant at ($p \leq 0.05$).
Species: Means within the same column carrying different superscripts (capital litters) are significant at ($p \leq 0.05$).

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