Water Conservation and Management of Fish Farm in Lake Mariout

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ABSTRACT: This research studied water conservation management in fish farm and its impacts on water quality. Mergam fish farm is located in Lake Mariout West of Alexandria. Its area is 14 feddans. The results revealed that mean seasonal water temperature, pH and salinity are in the convenient level for the culture species (*O. niloticus, M. Capito* and *D. Labrax*), while the DO are at minimum level, this value under control by introduction of fresh water from El-Kilo 21 canal the main water source of fish farm all night every day with average exchange greater than 4800 m^3/ day. Mergam's fish farm suffers from high level of ammonia, nitrite, nitrate and BOD as a result of organic residues including uneaten feed containing high percentage of protein 30%, feaces and dead algae which settle to the pond bottom. The excessive organic matters are converted into nutrients; they enable proliferation of high algal level which causes high level of eutrophication. This is problem due to worse management by randomly feeding with high protein percentage.
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1. Introduction

In recent years, water scarcity and animal protein become a main problem in several countries like Egypt, therefore we must conservation water and reducing the gap between production and consumption of animal protein.

In Egypt, aquaculture has become an increasingly important activity as an instantaneous source of fish protein required for the increase population. The total fish production in 1998 was estimated at 546 thousand ton, of which 26% is from aquaculture. Most fish farms practice polyculture where tilapia represents about 38% of the total production. Along with tilapia (*Oreochromis species*), mullets (*Mugil cephalus* and *Mugil capito*) and seabass (*Dicentrachus labrax*) and seabream (*Sparus aurata*) are also stocked [1].

The majority of farmed fish are either in freshwater or brackish water. Most aquaculture activities are generally located in the Northern Nile Delta Region, with fish farms usually found clustered in the areas surrounding the four Delta Lakes (Mariout, Edko, Brouls and Manzala)[2].

Fish farms are maintained by complex physical and chemical factors and by biological interactions which directly depend on water quality. Framing activities can cause important impacts on the environments due to the discharge of waste water into streams, rivers and lakes. Physical and chemical oscillations in fish ponds basically depend on energy input, with special emphasis on the frequency and nature of the nutrient discharge added to the system [3].

Water quality is the first most important limiting and difficult factor in fish farm production to understand predict and manage. Thus, fish farm production has rise to be planned within the context of minimizing environment impact and optimizing resource utilization. The objective of fish farm management is to manage the water quality [4].

In recent years water scarcity is problematic in Egypt. Water availability per capita rate is already one of the lowest in the world. This is suggested for further declines. A major challenge is to close the rapidly increasing gap between the limited water resources and the escalating demand for water from various economic sectors [5].

Therefore, the present study aimed to conservation water which used in fish farms and decreased the impacts of aquaculture on water quality to be suitable to exploit it again especially in agriculture farms, by using environmental parameters to manage fish farm.

2. Materials and Methods

2.1. Study Area:

Fish farm is located at Mergam west of Alexandria, its lies in west south of Lake Mariout. Fish farm total area is 14 feddans, divided into 3 equal ponds; from the first pond one feddan is separate as nursing pond for fries. The water depth in the farm's ponds varies from 1 to 2 m with average depth 1.5 m. as shown in Fig. 1 and 2.

This farm is receives its feeding water from drainage El-kilo 21 and discharge its water in El-Malahate through three drains, the diameter of each one is 8inch. The main water source is agriculture drainage water collected from the cultivated land around south and west of Alexandria.

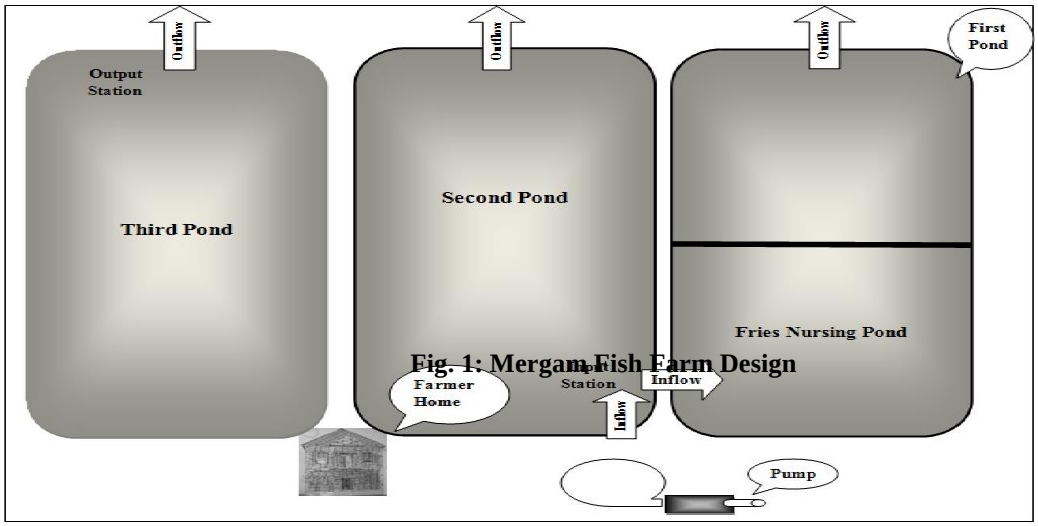

Fig. 1: Mergam Fish Farm Design

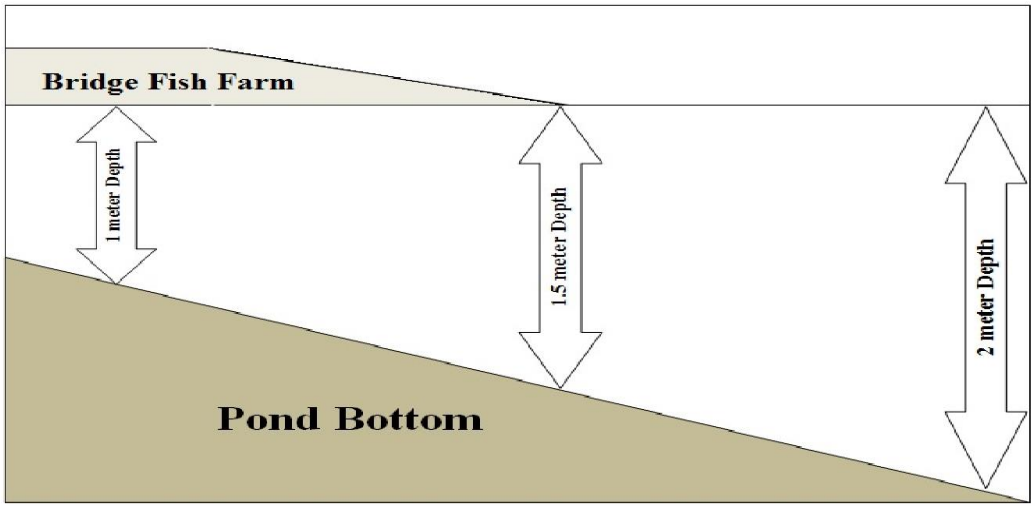

Fig. 2: Mergam Fish Farm vertical Design

2.2. Sampling:

Water sampling was conducted monthly (2016-2017), one day morning at 8 AM o'clock in the each month was select to represent the whole month. Surface water samples were collected in plastic bottles of one and half-liter capacity each at 10 cm below the surface water at two stations. First station is Input take from inflow water (water source from drainage El-kilo 21) while second station is Output take from outflow water (drainage to El-Malahate) representing the different ecological areas of fish farm as shown in Fig. 1.

2.3. Physiochemical and Biological Parameters

2.3.1 Temperature

Surface and depth water temperature was measure by dipping the bucket thermometer, with 0.2°C division, into the upper and depth water layer for a few minutes.

2.3.2. pH

Samples for determination of Hydrogen Ion Concentration (pH) were drowning from the water sampler immediately after sampling by filling a 50 ml wide-mouth polyethylene bottle. pH values were measure immediately using a Lovibond Water Testing, SensoDirect 150 .

2.3.3. Salinity

Samples for determination of Salinity were drowning from the water sampler immediately after sampling by filling a 50 ml wide-mouth polyethylene bottle. Salinity values were measure immediately using a Digital Refractometers for Sea Water Measurements .

2.3.4. Dissolved Oxygen

Sampling for dissolved oxygen (DO) was carrying out as rapidly as possible from sampler in 300 ml BOD bottles. The water sample was allowed to flush 2-3 times the bottle's volume until finally was filled. Without intermediate stopping, fixation of oxygen was carry out by addition of Winkler reagents; 2 ml MnCl2 + 2 ml alkaline iodide solution [6]. We shake the bottles were vigorously for about 1 minute and then precipitate was allowed to settle in a dark place and take to the central lab of NIOF for analysis.

2.3.5. Ammonium

Samples for ammonia was take 35 ml in dark bottle from the water of fish farm. Fixations for ammonium was added first reagent 1 ml of trisodium eitrotili hydroxide cover and shake, add second reagent 1 ml of sodium nitroprusside hydrate + phenol cover and shake and add third reagent 1 ml of sodium hydroxide cover and shake. Final, it store in ice-box and take to the central lab of NIOF for analysis.

2.3.6. Nitrite and Nitrate

We freeze 250 ml water samples immediately without filtration in plastic containers until further analysis for Nitrite and Nitrate by putting in ice-box and take to the central lab of National Institute of Oceanography & Fisheries (NIOF).

2.3.7. Biological Oxygen Demand

Water sample for Biological Oxygen Demand (BOD) was taking in full dark bottle put in ice-box and take to the central lab of NIOF, incubating the BOD bottle for 5 days in the central lab for analysis.

2.4. Fish Farm Management:

The water quality used for fish culture is one of the significant factors affecting fish production to maximum performance. Fish farm water quality must be suitable in terms of temperature, salinity, color, neither acidic nor alkaline, contain enough DO and not be muddy or turbid.

In cases where fish farm problems are encountered, many of parameters set together can serve as indicators of dynamic processes occurring in the pond. So water quality parameters should be monitored to serve as guide for managing a pond, thus that conditions that can adversely affect the growth of fish can be avoided. Manger used pump to inflow water to the farm. The morphometrical parameters and Inflow Pump Water of Mergam farm are shown in Table 1.

Table 1: Morphometrical Parameters and Inflow Pump Water of Fish Farm

Maximum depth (m)	2.00 m.	Quantity pumping water	400 m^3/h
Mean depth (m)	1.50 m.	Duration of pump operation	12 h/day or more
Area (m^2)	58800 m^2	Quantity change water	≥ 4800 m^3/ day
Water volume (m^3)	88200 m^3	Water change rate	≥ 5.44% daily

The source of stocking fry (*D. labrax* and *M. capito*) was collected from estuary of the Nile River Delta and nursed in earthen pond one feddan (30 days). The fingerlings of *D. labrax*, *M. capito* and mono sex *O. niloticus* with mean weight from 40 to 93gm by average length from 10 to 22 cm were reared in the other three earthen ponds.

The rearing period began in March, *D. labrax*, *M. capito* and mono sex *O. niloticus* fingerlings were stocked in the three rearing earthen ponds (13 feddan) at rate 140, 10 and 250 thousand respectively, the feeding rate randomly, twice a day at 10 am and 4 pm for six days/week. The commercial supplementary feed meal was from ALER AQUA Company (30% protein).

3. Result and Discussion

Fish farm management is target to maximise fish production. Thus, successful fish farm management requires an understanding of water quality such as temperature, pH, salinity, DO, ammonia, nitrite, nitrate and BOD. Water quality is directly affects on fish feed efficiency, growth rates, the fish's health and survival [8].

Water temperature is one of the most important physical parameters, which factor affecting ion and phase equilibrium and influencing the rate of biochemical processes which accompany the changes of concentration and content of organic and mineral substances. The suitable water temperature for fish culture is between 24 and 30°C, also the levels of temperature between 28-32°C good for fish culture [8, 9].

The present study revealed that, the mean water temperature rose during the spring to 22 ± 5.03 ˚c; attaining its peak value for water temperature 27 ± 2.65 ˚c in summer. In autumn, it decreases to 21 ± 4.58. While, water temperature decreases to reach its lowest value in winter 16 ± 3.79 ˚c as shown in Table 2.

Table 2: Local and Seasonal variation as well as Seasonal Average of Water Temperature, pH and Salinity Recorded in Two Stations and Mean Value of Fish Farm During 2016-2017

Seasons	Water Tem. Average	pH			Salinity		
		In Put Average	Out Put Average	Fish Farm Mean	In Put Average	Out Put Average	Fish Farm Mean
Spring	22 ± 5.03	7.85 ± 0.21	8.22 ± 0.54	8.04 ± 0.40	6.24 ± 1.75	7.35 ± 0.92	6.80 ± 1.31
Summer	27 ± 2.65	7.73 ± 0.32	8.00 ± 0.10	7.87 ± 0.26	7.83 ± 0.76	7.33 ± 2.08	7.58 ± 1.43
Autumn	21 ± 4.58	7.67 ± 0.50	8.17 ± 0.35	7.92 ± 0.48	4.67 ± 1.53	6.07 ± 1.10	5.37 ± 1.42
Winter	16 ± 3.79	7.63 ± 0.06	7.80 ± 0.46	7.72 ± 0.31	4.00 ± 1.73	4.67 ± 1.53	4.33 ± 1.51

Then, water temperature range is suitable for grows *O. niloticus, M. Capito* and *D. Labrax* ranged between 15-35 °C. Therefore, the present results revealed that the suitability of water temperature for fish culture species in Mergam fish farm. The results are in agreement with [10].

The pH is a result of interaction of numerous substances dissolved in water. Its importance arises from that aquatic organisms are adapted to an average pH value and do not withstand sudden or strong variations. Furthermore; the biological conditions are better when the pH of the surrounding environment is quite constant. Waters ranging in pH from 6.5 to 9.00 are regarded as most suitable for pond fish production. While the largest fish-crops are produced in waters whose are just on the alkaline side of neutrality (i.e. pH ranging from 7.0 to 8.0), which lead to increase fish ponds productivity three times [11, 12].

The present results revealed that the pH mean range between 7.72 ± 0.31 to 8.04 ± 0.40 in winter and spring respectively as minimum and maximum. Also results revealed that the average values of pH in fish farm ranged for input and output stations from the lowest value 7.63 ± 0.06 and 7.80 ± 0.46 respectively during winter season, and reached its highest value during spring 7.85 ± 0.21 and 8.22 ± 0.54 for input and output respectively as shown in Table2. Therefore the present results for Mergam fish farm seem to be much suitable for fish culture and in agreement with the findings [13].

Salinity is a measure of the salt content of sea water and is equivalent to the total amount of dissolved solids in sea water by weight. It plays an important role in the growth of culture organisms through osmoregulations of body minerals from that of the surrounding water. Moreover, salinity is considered a main factor that affects the growth and density fish. Also, they are sensitive to the salt concentration of their waters [10, 14].

The present results revealed that the mean salinity range between 4.34 ± 1.51 to 7.58 ± 1.43 gm/l in winter and summer respectively as minimum and maximum. The average salinity in input and output station investigation fluctuated from a minimum values of 4.00 ± 1.73 and 4.67 ± 1.53 mg/l respectively in winter, to 7.83 ± 0.76 and 7.33 ± 2.08 mg/l in input and output respectively as maximum values in summer as shown in Table 2. Therefore, water salinity of Mergam fish farm is suitable for rearing *O. niloticus, M. Capito* and *D. Labrax* [11, 13].

Fish need oxygen for respiration. The respiratory rate increases with increasing temperature, activity and feeding but decreases with increasing mean weight. Therefore, DO values are the important factors that control the distribution and growth of fish. Fish are always present where DO concentration is high. DO content can be used as an indicator of organic loading, nutrient input and bilogical activity and as an indicator of pollution in the ecosystem. The suitable DO for fish culture is above 5 mg/l but fishes can survive at 4 mg/l [15].

The present results revealed that the mean DO value ranged between 4.10 ± 2.24 mg/l in summer as a minimum to 7.69 ± 2.96 mg/l in winter as a maximum as shown in Table 3, this value under control by introduction of fresh water from El-Kilo 21 canal the main water source of fish farm all night every day with average exchange greater than 4800 m^3/ day as shown in Table 1.

Table 3: Local and Seasonal variation as well as Seasonal Average of DO and BOD Recorded in Two Stations and Mean Value of Fish Farm During 2016-2017

Seasons	DO			BOD		
	In Put Average	Out Put Average	Fish Farm Mean	In Put Average	Out Put Average	Fish Farm Mean
Spring	6.08 ± 1.82	6.23 ± 1.70	6.16 ± 1.58	3.44 ± 1.92	19.54 ± 26.39	13.10 ± 20.44
Summer	4.23 ± 3.46	3.97 ± 0.72	4.10 ± 2.24	58.63 ± 14.38	24.6 ± 9.63	41.62 ± 21.62
Autumn	3.48 ± 0.52	5.46 ± 1.37	4.47 ± 1.42	119.43 ± 49.78	70.51 ± 1.32	94.97 ± 41.45
Winter	7.17 ± 3.58	8.21 ± 2.88	7.69 ± 2.96	88 ± 78.79	248 ± 297.94	168 ± 213.71

The average DO content in the input station fluctuated from 3.48 ± 0.52 and 4.23 ± 3.46 mg/l in autumn and summer respectively as minimum value, while the highest values 7.17 ± 3.58 and 6.08 ± 1.82 mg/l recorded in winter and spring respectively as shown in Table 3. Moreover, The average DO content in the output station fluctuated from 3.97 ± 0.72 and 5.46 ± 1.37 mg/l in summer and autumn respectively as minimum value, while the highest values 8.21 ± 2.88 and 6.23 ± 1.70 mg/l recorded in winter and spring respectively as shown in Table 3, mean that the output DO concentration higher than the input stations. These results may be referring to photosynthesis activities by primary product. Furthermore the mean DO (mg/l) obtained from Mergam fish farm was in the range of 4.10 – 7.69 mg/l. The result agreement with [16]

Ammonia is the waste product of protein metabolism via fish and other aquatic organism's

excretion. The major source of nitrogen compounds in fishpond culture is the protein contained in the feed. Therefore, the rate of ammonia production of fish is proportional to the feeding rate and protein percentage in food. The suitable ammonia level is range from 0.00 to 50µg/l and the desirable range was 0.00 to 25µg/l [17].

Results revealed that, the mean seasonally ammonia in Mergam fish farm fluctuated throughout the year, the lowest value 55.93 ± 33.90 µg/l recorded in spring (began rearing period). It increase progressively to 91.75 ± 44.39 µg/l in summer attaining its highest value 126.35 ± 45.53 µg/l in autumn, but in winter ammonia decreased to 56.75 ± 70.15 µg/l as shown in Table 4.

Table 4: Local and Seasonal variation as well as Seasonal Average of Ammonia, Nitrite and Nitrate (µg/l) Recorded in Two Stations and Mean Value of Fish Farm During 2016-2017

	Ammonia			Nitrite			Nitrate		
	In Put Average	Out Put Average	Fish Farm Mean	In Put Average	Out Put Average	Fish Farm Mean	In Put Average	Out Put Average	Fish Farm Mean
Spring	55.81 ± 33.16	56.05 ± 42.12	55.93 ± 33.90	18.46 ± 12.99	15.96 ± 11.36	17.21 ± 10.99	240.54 ± 319.61	93.56 ± 73.81	167.05 ± 222.53
Summer	95.2 ± 41.25	88.29 ± 56.47	91.75 ± 44.39	28.82 ± 41.13	21.65 ± 30.35	25.24 ± 32.57	99.95 ± 119.69	23.47 ± 12.81	61.71 ± 86.90
Autumn	89.95 ± 13.36	162.75 ± 27.22	126.35 ± 45.53	72.71 ± 38.98	64.77 ± 51.07	68.74 ± 40.87	708.03 ± 674.16	494.81 ± 478.42	601.42 ± 535.71
Winter	45.36 ±46.8	68.13 ± 98.61	56.75 ± 70.15	160.3 ± 81.23	99.11 ± 40.00	129.71 ± 66.35	1269.71 ± 269.71	1006.6 ± 629.40	1138.15 ± 456.43

The average ammonia in input station recorded that lowest value 45.36 ±46.8 µg/l in winter. It increase gradually to 55.81 ± 33.16 µg/l in spring and attained its highest values 95.2 ± 41.25 µg/l in summer, while in autumn it decreased to 89.95 ± 13.36 µg/l as shown in Table 4. Furthermore, result revealed that the ammonia concentration in output station is lowest value 56.05 ± 42.12µg/l in spring. It become to raise progressively to 88.29 ± 56.47µg/l in summer, while it attained highest values 162.75 ± 27.22 µg/l in autumn as shown in Table 4, which do a problem in Mergam fish farm.

The present results revealed that the ammonia levels in output station is significantly higher than that in input station, additionally the mean of its values increased progressively from spring which represents the began rearing period and attaining its highest value in autumn. Therefore, Mergam fish farm suffering from high level of ammonia value.

Furthermore, the results revealed that ammonia percentage to total inorganic nitrogen in the two stations input and output showed that it increased from 17.73% and 33.85% respectively in spring to reach its highest percentage 42.51% and 66.18% respectively in summer. Then it decreased progressively from 10.33% and 22.53% for input and output stations respectively in autumn to lowest percentage for input and output Stations 3.07% and 5.81% respectively in winter as shown in Table 5, these results are agreement with [18, 19].

The present results revealed that the ammonia percentage in the output station significantly higher than the input station and the highest percentage recorded in summer season. The reason for high ammonia value for Mergam fish farm may be due to high level of leftover feed with high protine percentage (30%), faeces and dead plankton with pH suitability. The present results in agreement with Wurts [20].

Table 5: Aqueous Inorganic Nitrogen Percentage in Two Stations of Fish Farm During 2016-2017

	Ammonia %		Nitrite %		Nitrate %	
	Input	Output	Input	Output	Input	Output
Spring	17.73	33.85	5.86	9.64	76.41	56.51
Summer	42.51	66.17	12.87	16.23	44.62	17.60
Autumn	10.33	22.53	8.35	8.97	81.32	68.50
Winter	3.07	5.81	10.87	8.44	86.06	85.75

Nitrite is an intermediate oxidation state between the low oxidant state (ammonia) and the higher oxidant state (nitrate). Nitrite appears in water mainly as a result of biochemical oxidation of ammonia (nitrification) or the reduction of nitrate (denitrification). Nitrite concentration should not exceed 0.2 mg/l in freshwater and 0.125 mg/l in seawater [21].

The present results revealed that the mean lowest Nitrite value 17.21 ± 10.99 µg/l in spring. it raise gradually from 25.24 ± 32.57 µg/l during summer to 68.74 ± 40.87 µg/l in autumn, while it attain its peak value 129.71 ± 66.35 µg/l in winter. Furthermore, the results explained that the nitrite value ranged between 18.46 ± 12.99 and 15.96 ± 11.36 µg/l for the input and output stations respectively as a lowest value in spring. While, its values recorded 160.3 ± 81.23 and 99.11 ± 40.00 µg/l for input and output stations respectively in winter as highest value as shown in Table 4.

The present study revealed that the nitrite percentage to the total inorganic nitrogen not exceeds than 12.87% and 16.23% for input and output stations respectively in summer. In spring lowest percentage ranged between 5.86% and 9.64% for input and output stations respectively. Also, results revealed that the nitrite values increased progressively from spring attaining its highest values in winter as shown in (Table 5), these results are agreement with [18, 19].

Despite the fact that ammonia and nitrite have an effect toxic to the fish, but nitrate is harmless and is produced by the autotrophic Nitrobacter bacteria combining with oxygen and nitrite.

Nitrate considered the most stable compound of inorganic nitrogenous forms. Nitrate is relatively nontoxic to fish and not cause any health hazard; but it become toxic when exceedingly 90 mg/l. The acceptable level of nitrate form ranged between 0 to 100 mg/l [19].

The present results revealed that the values of nitrate in input and output station ranged between 99.95 ± 119.69 and 23.47 ± 12.81 µg/l respectively as a minimum values in summer while maximum value 1269.71±269.71 and 1006.6± 629.40 µg/l respectively in winter. The mean Nitrate of water fish farm registers its lowest value 61.71 ± 86.90 µg/l in summer, then it rose during autumn to 601.42 ± 535.71 µg/l and attaining its peak value 1138.15 ± 456.43 µg/l in winter and it decreased to 167.05 ± 222.53 µg/l in spring as shown in Table 4.

Concerning, the percentage of nitrate to total inorganic nitrogen ranged between 44.62% and 17.59% for input and output respectively in summer as minimum percentage to 86.06% and 85.75% for input and output respectively in winter as maximum percentage. These results revealed that the output percentage less than the input percentage, which explain the high level of eutrophication with high blooming of phytoplankton as shown in Table 5.

the percentage of nitrate to total inorganic nitrogen exceeded 75% this indicates that nitrate is most dominate species of total inorganic nitrogen, which means that the water is well oxygenated due to introduction of fresh water from El-Kilo 21 canal the main water source of fish farm all night every day with average exchange greater than 4800 m^3/ day, these results is agreement with Abbas and Shakeer [19]

BOD is one of the most important bilogical parameters to determine the quality of water. It can be revealed of DO consumed via microorganisms for biodegradation of organic matter such as food particles or sewage. The suitable level of BOD is range from 3.0 to 6.0 mg/l for fish survival [23].

The present study revealed that Mergam fish farm considered definitely poor due to the high value of BOD. The mean BOD seasonally reached its lowest value 13.1 ± 20.66 mg/l in spring season, at the beginning of rearing period. Then it gradually increased to 41.61 ± 21.62 and 94.97 ± 41.35 mg/l in summer and autumn respectively, to reach its highest value 168 ± 213.71 mg/l in winter season, it's the end rearing period as shown in Table 3.

Furthermore, the average variation of BOD value in input and output stations showed the lowest values 3.44 ± 1.92 and 19.54 ± 26.39 mg/l respectively during spring. BOD value becomes to increase progressively form 58.63 ± 14.38 and 24.6 ± 9.63 mg/l in input and output stations respectively in summer to 119.43 ± 49.78 and 70.51 ± 1.32 mg/l in autumn. While the BOD values were 88 ± 78.79 and 248.00 ± 297.94 mg/l at input and output stations respectively in winter. The results revealed that the highest value 248.00 ± 297.94 mg/l were recorded at output station. In winter, the end of rearing season. Moreover, the results revealed that BOD in the output highest than that input value in winter and spring as shown in Table 3.

This problem of high BOD due to biodegradation of organic matter such food particle and sewage. Thus, the manager to overcome this problem is operated water pump 12 hours daily in night with average water rate greater than 5.44% (≥ 4800 m^3/ day) daily to increase the amount of dissolved oxygen in the water. Therefore, it is the main problem because Egypt suffers from lack water problem.

The present results indicated that Mergam fish farm suffering from high eutrophication level resulted from organic residues including uneaten feed containing high percentage of protein 30%, feaces and dead algae which settle to the pond bottom. Therefore, it is lead to creating low level of DO and a high level of BOD, ammonia, nitrite and nitrate. The excessive organic matters are converted into nutrients; they enable proliferation of high algal level which causes high level of eutrophication. Moreover, the results revealed that BOD in the output highest than that input value in winter and spring.

Miss-management risks should be lessened through a holistically-approach aquaculture. Management for sustainable aquaculture is the diffusion of production technology which target to increasing production, decreasing costs, promoting fish survival and ensure the equilibrium of the environment. Also, fish farm management should be collected information and monitoring water quality, Lack of information lead to high risks both on fish farm and environmental impact.

4. Conclusion and Decision Maker Recommendation

Mergam fish farm management is target to decrease the environmental impact and optimal fish production, which is totally dependent on the

physical, chemical and biological qualities of water to most of the extent. Consequently, successful water conservation and management requires an understanding of water.

The results revealed that mean seasonal water temperature, pH and salinity are in the convenient level for the culture species (O. niloticus, M. Capito and D. Labrax), while the DO are at minimum level, this value under control by introduction of fresh water from El-Kilo 21 canal the main water source of fish farm all night every day with average exchange greater than 4800 m3/ day. Mergam's fish farm suffers from high level of ammonia, nitrite, nitrate and BOD as a result of organic residues including uneaten feed containing high percentage of protein 30%, feaces and dead algae which settle to the pond bottom. The excessive organic matters are converted into nutrients; they enable proliferation of high algal level which causes high level of eutrophication. This is problem due to worse management by randomly feeding with high protein percentage. Therefore, to reduce withdrawal periods of inflow water from the source and reduce impacts of fish farm activities on outflow water quality from fish farm the decision maker recommended that:

1. Fish farm manager must be careful preparation of the pond bottom by removing the accumulated organic matter and scraping the bottom pond prior to stocking fries.
2. Manager must be advice using extruded diets. These diets posses' higher stability and digestibility, providing a significant reduction in the amount of nutrient excreted into the rearing pond water.
3. Manager must be avoid over feeding by diet rate must be 5% of its biomass twice a day for 6 days/week.
4. The artificial aeration must be used paddle wheel to rise of Do level and consequently pond production increased.
5. Placing natural submerged substrates like bamboo poles in ponds leads to the adsorption of suspended organic matter on the vertical surfaces.

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