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ENVIRONMENTAL IMPACTS OF POND MANAGEMENTS ON WATER QUALITY, PLANKTON ABUNDANCE AND PRODUCTIONS OF TILAPIA AND MULLET IN EARTHEN PONDS

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Abstract

The present study was conducted in the provinces of Kafr El-Sheikh - Ismailia and Port Said on two farms in each governorate. Four earthen ponds with an area two faddan in each fish farm which irrigated with the main drain was cultivated by Nile tilapia and mullet with an average weight of 2; 30 g for tilapia and mullet, respectively. Water samples were taken once a month to measure water quality parameters and phytoplankton and zooplankton abundances. Fish samples were taken monthly to calculate the growth rates. The obtained results showed that:

There were no significant differences between the two farms in each province in temperature - salinity - conductivity and hardness in each province while there were a significant increase in pH - dissolved oxygen - transparency – total alkalinity - dissolved phosphorus - nitrogen compounds (ammonia – nitrite- nitrates) and chlorophyll a in the farm that depends on organic fertilization.

Significance increase of nitrogen compounds, phytoplankton and zooplankton abundance in fertilized ponds than that in artificial feeding system. Significance increase of nitrogen compounds, phosphorus and phytoplankton and zooplankton abundance in Kafr El-Sheikh fish farm followed by Shader Azzam, Sharkia governate under two the systems. The present study clear that the water quality in Shader Azzam and Kafr El-Sheikh are very heavy considers any relevant biological content is high so we must take this into in fish density and pond management does not represent a danger during the season. Significantly ($P<0.05$) increase in daily growth rate in tilapia than mullet in each fish pond under different pond managements. Also, significantly increase of daily growth rate in feed system ponds than fertilizers system. Significantly increase of total fish production per Fadden on Shader Azzam and after the Kafr el-Sheikh fish ponds under feeding systems and the same trends in fertilizers systems. The study reported that the water quality of the fish farms depends mainly on the applied management system. It also decided that malpractice is the main cause of water pollution problems and degradation of the water quality level. The use of waste in fish pond management as feed or fertilizers depends on many factors, including:

Quality and types of Soil and water; quality and quantity of waste; stocking of fish and feeding habitats; Water temperature; age and the purpose of administration and the purpose of using waste.

INTRODUCTION

Aquaculture is the only from of agriculture that evolved from mainly subsistence food production into on important part of international economy within one human generation. Coincident with/or perhaps caused by its rapid expansion came dramatic changes in the way people viewed the relationship between aquaculture and the environment (Tucker, 2015).

In Egypt freshwater aquaculture is considered to be in conflict with agriculture and is confined to areas not suitable for agriculture, and to the use of drainage water. It is also noteworthy that the quality and salinity level of the drainage water is declining as efforts to reuse the drainage water for multiple irrigation cycles are underway. This situation undermines the sustainability of existing farms (EL-Gayar, 2003). Water is the most vital requirement for a successful aquaculture venture, thus, its quality is very important. Evaluations of water quality parameters are necessary to enhance the performance of an assessment operation and develop better water resources management and plan (Ali *et al*., 2009). Water quality includes all physical, chemical and biological factors that influence the beneficial use of water. There are many water quality variables in pond fish culture. All other things being equal, a pond with good water quality will produce more and healthier fish than a pond with poor quality.

Fertilizers are applied for fish ponds to increase plant nutrients contraction and to stimulate natural fish growth and ultimately to increase fish production. Availability of natural food in pond water reduces fish demand for artificial feeds, leading to reduce production costs and improve farm income. Chicken manure has been used extensively as organic fertilizers in fish farms for increasing natural food web and consequently reducing production costs. Chemical fertilizers are highly soluble and release nutrients that can cause eutrophication of natural waters. Water is a major component and physiological necessity of all living aquatic species. An adequate volume of high quality water is necessary to initially fill holding and culture units at aquaculture facilities, and to replace water that evaporates, seeps, or is intentionally discharged from them (Boyd and McNevin, 2015).

The present study aimed to assess the impact of some of the environmental conditions and pond management system on water quality, phytoplankton, and zooplankton and fish production.

MATRIALS AND METHODS

The study was conducted in Kafr El-Sheikh; Ismailia and Port Said governorates, two fish farms located in each governorate. The two fish farms in Kafr El-Sheikh irrigated from agriculture drainage water beside deep ground water wells and water from El-Burullus Lake, in Ismailia irrigated from Ismailia Canal and in Port Said irrigated from Hadous drain, Ramsise drain, Baher El Bakar drains and Manzala Lake. Each fish farm in each governorate applied two different management systems, all fish farms were cultured by tilapia and mulet. First fish farm received artificial feed 25% protein as 3% of total weight of fish twice daily, five days/week only and second one used organic and mineral fertilizers system and in last month uses ponds received artificial feed 25% protein as 2% of fish total weight twice daily, five days/ week. The fertilized fish farm used (50kg chicken manure+4kg urea+10kg triple superphosphate/feddan /week) during first four months and in the last month using 50kg break pasta/ feddan/ daily five days /week in each governorate. Each fish farm system had four replicates, two faddan for each pond surface area. All ponds had 1.25 m as an average water depth. The experimental period was 150days. The feed fish farm Kafr El-Sheik (KF) and fertilizer fish farm in Kafr El-Sheikh governorates located between drain 7 and drain 8. The feed fish farm (TF) and fertilizer fish farm (TM) in Ismailia governorates located in El Tal El Kabeer. The feed fish farm (PF) and fertilizer fish farm (PM) in Port Said governorates located in Shader Azam.

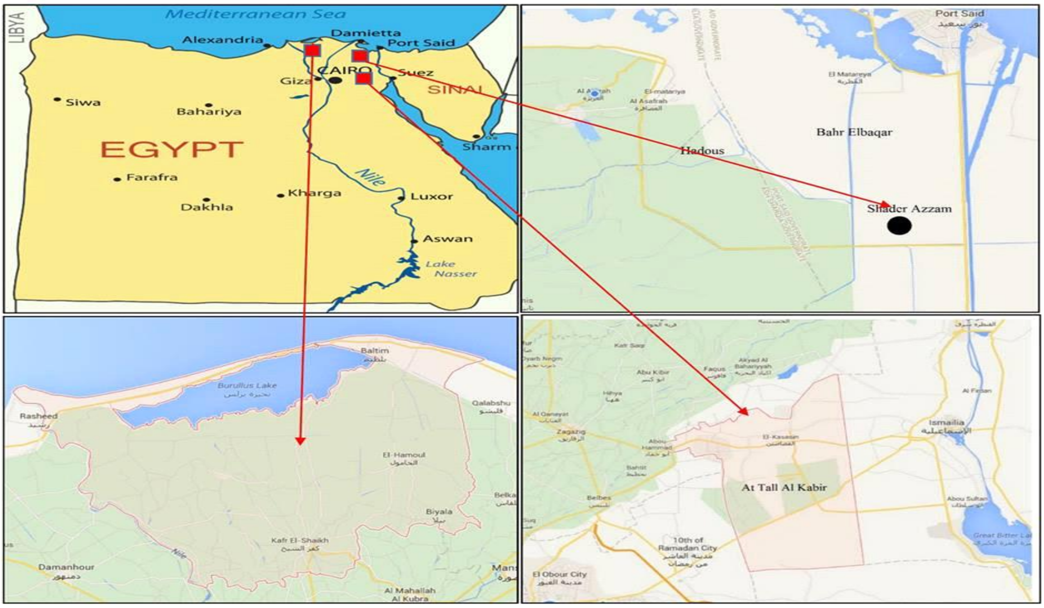

Fig.1. A map showing different fish farms in Kafr El-Sheikh; El Tal El Kabeer in Ismailia and Shader Azam in Port Said governorates.

Samples:

Water temperature °C, dissolved oxygen (DO) mg/l, pH, salinity, electrical conductivity, were measured in earthen ponds using water quality device multi parameters (YSI 5200); total ammonia NH_4 and secchi disck (SD) as a field measurements. Water samples were taken monthly from each pond for the same system and analyzed for water quality (physical, chemical and biological of water). Water samples were taken with a vertical water sampler from three spots in the ponds in a plastic container according to Boyd (1990). Then one liter were taken for water quality analysis, and put in a plastic bottles and kept in ice box until transferred to (CLAR) for lab analysis during 24 hours. Total alkalinity (mg/l), total hardness, nitrite (mg/l), nitrate (mg/l), orthophosphate (mg/l) and chlorophyll "a" (µg/l) content were determined according to (APHA, 2000).

Quantitative and qualitative estimation of phytoplankton and zooplankton standing crops were performed monthly for all ponds during the experimental period. Phytoplankton standing crop was estimated by sedimentation method described in APHA (2000). Zooplankton representative samples were collected by filtering 30 liters of water through zooplankton net (40µm), the concentrated samples were preserved in 4 % formalin solution.

Statistical analyses:

Two-way ANOVA was used to evaluate the significant difference of the concentration of different items studied with respect to fish farms and pond managements. A probability at level of 0.05 or less was considered significant. Standard errors were also estimated. All statistics were run on the computer, using the SAS programme (SAS, 2000).

RESULTS AND DISSCISIONS

Water is one of the most essential constituents of the human environment. The resource generates development in socio-economical issues crucial to the society in general and more specifically for industries, agricultural activities and for the public use. Water quality refers to the physical, chemical and biological characteristics of water in relation to the existence of life and especially human activity. The quality of water is predetermined by the intended uses and each of these uses affects, more or less, its quality.

Average all means of water quality parameters presented in Tables (1), where water temperature ranged from 27.6 to 27.5, 27.8 to 27.6, 27.2 and 27.2 °C for KM; KF; TM; TF; PM and PF fish farm pond respectively. Water temperature values in the different fish farms were closely followed air temperature. This range of temperature is suitable for survival and growth of tilapia and mullet. Water temperatures in different fish farms ponds were not significantly ($P<0.05$) differ between the two fish pond managements in the same month but were significantly ($P<0.05$) differ in the same fish farm managements among different months. The obtained data revealed that the water temperature was differed time to time. The water temperature depends on air temperature during different months.

The pH lies in the alkaline side indicating well-buffered conditions. It showed remarkable difference at different fish farms ponds with values ranged between 8.8 to 8.5, 8.8 to 8.6; 8.4 and 8.1 for KM; KF; TM; TF; PM and PF fish farms respectively. Variations in pH values coincided mainly with differences in photosynthetic activities. The lowest pH values appeared in Shader Azam fish farms under the two pond management systems (Table, 1).

The pH values were significantly increased ($P<0.05$) in fertilized fish ponds than that feed fish ponds. These results may be due to increased phytoplankton in fertilizer fish ponds led to increased photosynthetic. This variation could be explained by the photosynthetic uptake of CO_2 and bicarbonate that substituted hydroxyl ions. Water pond pH and CO_2 concentration are affected by respiration and photosynthesis. Carbon dioxide is may build up in water as a result of respiration by aquatic animals and bacteria. In poorly buffered waters, this can cause a drop in pH below 7.0 that can inhibit nitrification. Aeration can drive of CO_2, and in that process the pH is increased. Adequate alkalinity will ensure stable pH and provide carbon for nitrifying bacteria (Stephen, 2010).

The average values of dissolved oxygen ranged from 5.1 to 4.8; 5.6 to 4.8; 4.8 and 4.2 mg/l for KM; KF; TM; TF; PM and PF fish farms ponds respectively. The DO values were significantly increased ($P<0.05$) in fertilized fish ponds than that in feed fish ponds during experimental period. The dissolved oxygen values were gradually decreased with increasing fish size then fish production per unit area. These results may be due to increased fish consumption of oxygen with increasing size of fish and increasing of water temperature. Concentration of dissolved oxygen in the water depends on the temperature and the proliferation of air where increasing solubility of oxygen in water down the temperature in the sense that there is an inverse relationship between temperature and solubility of oxygen in the water as well as on the process of photosynthesis by phytoplankton in the water (Shaker *et al.*, 2013). These results are in agreement with those obtained by Ayub and Boyd (1994) and Boyd and Tucker (1998) & Shaker *et al.* (2009a,b) who reported that the dissolved of oxygen from air to water decreased with increasing temperature.

The SD readings were higher in feed fish ponds in each fish farm indicating the low abundance of plankton in these ponds compared to the fertilizer fish ponds. These results are in agreement with those obtained by Shaker, (2008).

The pH, temperature and dissolved oxygen were the most influencing parameters in fish ponds, where their values in all ponds although fluctuated from time to time, they stayed within the acceptable and favorable levels required for growth, survival and wellbeing of the tested fish species.

From the presented data in Tables (1), show the average values of nitrogen compounds (NH_4, NH_3, NO_2 and NO_3) in ponds in each fish farm.

Ammonia is the major end product in the breakdown of proteins in fish. Fish digest the protein in their feed and excrete ammonia through their gills and in their feces. The amount of ammonia excreted by fish varies with the amount of feed put into the pond or culture system, increasing as feeding rates increase. Ammonia also enters the pond from bacterial decomposition of organic matter such as uneaten feed or dead algae and aquatic plants.

The NH_4 and NH_3 concentrations were significantly ($P<0.05$) increased in fertilizer fish ponds than that feed fish ponds in each fish farms. The average values of NH_3 ranged from 1.33 to 1.04; 0.98 to 0.78 and 1.07 to 1.18 mg/l for KM; KF; TM; TF; PM and PF fish farm pond respectively. The average values of NH_4 ranged from 2.3 to 1.9; 1.9 to 1.6 and 2.8 to 2.4 mg/l for KM; KF; TM; TF; PM and PF fish farm pond respectively. The average values of NO_2 were 0.53 to 0.37; 0.21 to 0.09 and 0.67 to 0.48 mg/l for KM; KF; TM; TF; PM and PF fish farm pond respectively, whereas the average values of NO_3 were 1.13;

0.88; 0.86; 0.67; and 1.32 to 1.05 mg/l for KM; KF; TM; TF; PM and PF fish farms ponds respectively (Table 1). The highest values of nitrogen compound recorded in Shader Azam fish farm and the lowest values recorded in El Tal El Kabeer fish farm. The NH_4; NH_3; NO_2 and NO_3 were significantly ($P<0.05$) increased in fertilized fish ponds than in feed fish ponds during all months in each fish farms. From the above results the nitrogen compound values were significantly ($P<0.05$) increase with increase experimental period. These results may be due to increased fish waste, residuals of artificial feed and organic fertilized led to increase of organic compounds and then increase the decomposition process. These results are in agreement with those obtained by (Shaker *et al.*, 2015).

Ammonia can be converted to nitrite (NO_2) and nitrate (NO_3) by bacteria, and then used by aquatic plants and phytoplankton. Nitrate and ammonia are the most common forms of nitrogen in aquatic systems. Nitrate predominates in unpolluted waters. Nitrogen can be an important factor controlling algal growth when other nutrients, such as phosphate, are abundant. If phosphate is not abundant it may limit algal growth rather than nitrogen.

The main source of ammonia nitrogen in the water of feed-base aquaculture ponds is nitrogenous wastes from protein and metabolism by aquatic animals and degradation of uneaten feed and feces by microorganisms. Ammonia nitrogen also is introduced to ponds in nitrogen fertilizer such as ammonium sulfate, ammonium phosphate, urea that hydrolyzes into ammonia nitrogen, and in runoff from watershed (Piyajit, 2014).

The average of salinity, electrical conductivity, TDS and total hardness in water were represented in Tables (1). Salinity, EC, TDS and total hardness had a directl relatiships with evaporation rate of water. Also Changes in salinity, conductivity, total soluble salt and total hardness of water depends on:

Inlet water salinity; air temperature; soil salinity; mineral fertilizers and soil amendments and evaporation rate

Phosphorus is very important for plant growth including algal growth in water. Total phosphorus, orthophosphate and chlorophyll “a” presented in Tables (1) . There are several ways that phosphorus enters the water body and one of them is by organic manure decomposition. Organic manure in ponds decomposes and releases phosphorus which stimulates the growth of planktons and increase nutrient availability, leading to improve water quality and fish growth (Sevilleja *et al.,* 2001). Chlorophyll “a” abundance in aquatic environment is correlated to the presence of phosphorus a limiting element of biological productivity.

The average values of total phosphorus 1.35; 1.03; 0.88; 0.7; 1.64 and 1.33mg/l for KM; KF; TM; TF; PM and PF fish farms ponds respectively (Table 1), and orthophosphate were 0.0.43; 0.31; 0. 27; 0.19; 0.48 and 0.37mg/l for the same fish farm respectively. The average values of chlorophyll “a” were 98.24; 63.19; 68.11; 33.17; 81.18 and 57.88µg/l for the same fish farm respectively. The highest values of total phosphorus, orthophosphate and chlorophyll “a” recorded in Shader Azam fish farm. The average values of total phosphorus, orthophosphate and chlorophyll “a” were significantly ($P<0.05$) increase in Shader Azam fish farm than that in others fish farm. The average values of total phosphorus, orthophosphate and chlorophyll “a” were significantly ($P<0.05$) increased in fertilized fish farm than in feed fish farms. These finding may be due to the deposition of organic fertilizer with increasing water temperature.

The chlorophyll a has been used to indicate the presence level of nutrient and physiological status of phytoplankton (Othman *et al.,* 2001).The presence of chlorophyll “a”, a principal pigment in all green plants in an aquatic environment indicates the amount of phytoplankton and monitoring its abundance in aquatic environment is a direct way of knowing phytoplankton growth in fish ponds. (Arrignon 1998).

Chlorophyll “a” is in a direct relation to phytoplankton as increases in nutrient abundance which lead to increase zooplankton production which in turn, reduces the phytoplankton biomass through grazing and as such chlorophyll "a" is reduced (Ekpenyong, 2000).

Dissolved oxygen is important to the health of aquatic ecosystems and a key indicator in determining water quality. Uncontrolled phytoplankton growth (high chlorophyll-a) can be a serious problem for the farmers as it takes more oxygen out of the water during the night than what remains in solution from daytime photosynthesis.

Moreover, phytoplankton die offs can increase bacterial decomposition and the reduction in normal oxygen production can lead to oxygen depletions, high ammonia levels, and stressed or dead fish (Kunlasak *et al,* 2013).

Water is a major component and physiological necessity of all living things; in addition, aquatic species live in water. An adequate volume of high quality water is necessary to initially fill holding and culture units at aquaculture facilities, and to replace water that evaporates, seeps, or is intentionally discharged from them (Boyd and McNevin, 2015).

Table 1. Average all means of water quality in Kafer El-Sheik , El Tal El Kabeer and Shader Azam fish farm under fertilizer and feed management.

Items Fish farms	System	Temp. ° C	pH	DO mg/l	SD cm	NH_4 mg/l	NH_3 mg/l	NO_2 mg/l	NO_3 mg/l
Kafer El-Sheik	Fertilizer (KM)	27.6±0.4[a]	8.8±0.2[a]	5.1±0.3[b]	10.5±1.5[c]	2.3±0.12[b]	1.33±0.11[a]	0.53±0.02[b]	1.13±0.03[b]
	Feed (KF)	27.5±0.2[a]	8.5±0.3[b]	4.8±0.4[c]	14±2.0[b]	1.9±0.15[c]	1.04±0.1[b]	0.37±0.02[c]	0.88±0.03[c]
El Tal El Kabeer	Fertilizer (TM)	27.8±0.4[a]	8.8±0.3[a]	5.6±0.4[a]	14.8±1.2[b]	1.9±0.14[c]	0.98±0.1[c]	0.21±0.02[d]	0.86±0.04[c]
	Feed (TF)	27.6±0.4[a]	8.6±0.4[b]	4.8±0.3[c]	22.2±1.3[a]	1.6±13[d]	0.78±0.05[d]	0.09±0.01[e]	0.67±0.04[d]
Shader Azam	Fertilizer (PM)	27.2±0.8[a]	8.4±0.5[b]	4.8±0.4[c]	11.5±1.5[c]	2.8±0.17[a]	1.47±0.12[a]	0.67±0.03[a]	1.32±0.12[a]
	Feed (PF)	27.2±0.6[a]	8.1±0.4[c]	4.2±0.2[d]	15.5±1.5[b]	2.4±0.17[b]	1.18±0.12[b]	0.48±0.02[b]	1.05±0.06[b]

Letters (a to e) show vertical differences among fish farms under different managements. Data shown with different letters are statistically different at $P < 0.05$ level

Table (1 continue).

Items Fish farms	System	Sali. g/l	EC mS/Cm	TDS mg/l	Total alka. mg/l	Total hard.mg/l	Total Phos. mg/l	Ortho phos. mg/l	Chlo."a" µg/l
Kafer El-Sheik	Fertilizer (KM)	3.1±0.1^{a}	5.5±0.1^{b}	3.2±0.1^{b}	334±22^{a}	852±14^{b}	1.35±0.05^{b}	0.43±0.02^{a}	98.24±5.6^{a}
	Feed (KF)	3.2±0.1^{a}	5.6±0.1^{b}	3.3±0.1^{b}	302±14^{ab}	844±15^{b}	1.03±0.04^{c}	0.31±0.02^{b}	63.19±4.7^{c}
El Tal El Kabeer	Fertilizer (TM)	1.9±0.1^{b}	4.8±0.1^{b}	2.0±0.1^{c}	292±12^{b}	782±14^{c}	0.88±0.03^{b}	0.27±0.01^{c}	68.11±5.3^{c}
	Feed (TF)	2.1±0.1^{b}	5.1±0.1^{b}	2.3±0.1^{c}	266±12^{c}	788±16^{c}	0.71±0.02^{d}	0.19±0.01^{d}	33.17±2.1^{e}
Shader Azam	Fertilizer (PM)	3.7±0.1^{a}	6.2±0.2^{a}	3.9±0.2^{a}	322±18^{a}	1144±24^{a}	1.64±0.07^{a}	0.48±0.01^{a}	81.18±4.7^{b}
	Feed (PF)	3.8±0.1^{a}	6.5±0.2^{a}	4.0±0.2^{a}	288±16^{b}	1240±22^{a}	1.33±0.06^{b}	0.37±0.01^{b}	57.88±3.8^{d}

Letters (a to e) show vertical differences among fish farms under different managements. Data shown with different letters are statistically different at $P < 0.05$ level

Average numbers of phytoplankton and zooplankton are presented in Tables (2&3) . Phytoplankton growth depends on the availability of nutrients in the water, especially nitrogen and phosphorus. From the obtained results, we find that the phytoplankton is divided into four main groups namely Chlorophyta; Bacillarophyta; Cyanophyta and Euglina. Also, zooplankton divided to four groups Cladocera; Copepoda; Ostracoda and Rotifra. From the average numbers data of phytoplankton in Table (2), chlorophyta were significantly increase ($P<0.05$) in each fish farm. Also, fertilized fish ponds had significantly increase ($P<0.05$) than feed fish ponds during experimental period. The fertilized fish ponds in Kafer El-Sheik had significantly increase ($P<0.05$) than others fish farms. Chlorophyta numbers had this direction, Kafr El-Sheikh followed by Shader Azzam then El Tal El Kabeer. The same trend was observed in Bacillarophyta. The Cyanophyta and Euglina numbers had significantly increase ($P<0.05$) in Kafer El-Sheik and Shader Azzam fish farms. These results indicated that an increase of water pollutants in these fish ponds. These results are in agreement with those obtained by Shaker, 2008, who reported that the Cyanophyta and Euglina numbers recorded a significantly increase ($P<0.05$) with increasing organic and inorganic pollutants in water. The natural fish productivity of water ponds is determined by plankton and benthos quantity, which serve as food for different fish species. The growth of the fish species depends on the availability of the main biogenic elements, such as nitrogen and phosphorus. The controlled regulation and addition of mineral fertilizers can increase the natural productivity of water ponds (Abbas, 2001; Chumchal and Drenner, 2004, 2005; Wang *et al.*, 2008). Thus, fertilizer application is one of the most often employed enhancement activities in fish farming practice (Culver *et al.*, 2003; Dasgupta *et al*., 2008).

Increased nutrient richness stimulates the growth of planktonic algae and thereby reduces water clarity and shades the benthic vegetation. All algal variables responded to changes in total nitrogen; salinity and available phosphorus. Planktonic populations have long been used as ecological indicators (Lindo, 1991; Webber & Webber, 1998).

Table 2. Average number of phytoplankton ($x10^6$org/l) in Kafer El-Sheik, El Tal El Kabeer and Shader Azam fish farm under fertilizer and feed anagement.

	Managements.	Clorophyta	Bacilarophyta	Cyanophyta	Euglina	Total
Kafer El-Sheik	Fertilizer (KM)	8.88± 0.062^a	6.11± 0.064^a	3.77± 0.023^a	3.11± 0.013^b	21.87± 0.123^a
	Feed (KF)	5.97± 0.035^c	3.77± 0.015^c	3.04± 0.022^b	2.47± 0.013^c	15.25± 0.111^c
El Tal El Kabeer	Fertilizer (TM)	5.14± 0.033^c	5.12± 0.017^b	2.87± 0.012^b	1.89± 0.011^d	15.02± 0.112^c
	Feed (TF)	3.99± 0.024^e	3.88± 0.017^c	2.33± 0.014^d	1.37± 0.011^e	11.57± 0.0423^e
Shader Azam	Fertilizer (PM)	6.99± 0.055^b	3.98± 0.019^c	3.12± 0.011^a	3.89± 0.014^a	17.98± 0.142^b
	Feed (PF)	4.58± 0.023^d	3.04± 0.013^d	2.74± 0.013^c	3.17± 0.014^b	13.53± 0.106^d

Letters (a toe) show vertical differences among fish farms under different managements. Data shown with different letters are statistically different at $P < 0.05$ level

The average numbers of Chlorophyta; Bacillarophyta; Cyanophyta and Euglina in fertilized fish farm ponds were (8.88; 5.14 and 6.99 $x10^6$org/L); (6.11, 5.12 and 3.98 $x10^6$org/L); (3.77, 2.87 and 3.12 $x10^6$org/L) and (3.11, 1.89 and 3.89 $x10^6$org/L) for Chlorophyta; Bacillarophyta; Cyanophyta and Euglina in Kafr El-Sheikh , El Tal El Kabeer and Shader Azzam respectively. while, in feed fish ponds were (5.97; 3.99 and 4.58 $x10^6$org/L), (3.77; 3.88 and 3.04 $x10^6$org/L)$^;$ (3.04; 2.33 and 2.74 $x10^6$org/L) and (2.47; 1.37 and 3.17 $x10^6$org/L) for the same algae division (Table, 2). The average numbers of copepod were $3.52x10^4$org/l, $4.55x10^4$org/l and $4.39x10^4$org/l in fertilized farms while it was $2.93x10^4$org/l, $4.13x10^4$org/l, 3 and $3.77x10^4$org/l in Kafr El Sheikh, El Tal El-Kabber and Shader Azzam respectively. The cladocera average numbers were $3.11x10^4$org/l, $4.05x10^4$org/l and $3.47x10^4$org/l in fertilized farms but it was 2.77x10^4org/l, 3.63x10^4org/l, and 2.71x10^4org/l in feed farms in Kafr El Sheikh, El-Tal El-Kabber and Shader Azzam respectively. While the average number of rotifers was 5.88x10^4org/l, 4.11x10^4org/l and 2.49x10^4org/l in fertilized farms fish, and it was 4.21x10^4org/l, 3.32x10^4org/l and 2.02x10^4org/l in feed in Kafr El Sheikh, El Tal El-Kabber and Shader Azzam respectively, finally the average numbers of ostracoda was 1.79 x10^4org/l, 1.57 x10^4org/l and 1.89 x10^4org/l in fertilized farms while it was 1.31 x10^4org/l, 1.23 x10^4org/l and 1.35 x10^4org/l in feed farms in Kafr El Sheikh, El Tal El-Kabber and Shader Azzam respectively (Table 3). The quality and distribution of zooplankton depend on the phytoplankton biomass and water temperature. When water temperature is lower then the zooplankton will be lower.

Table 3. Average number of zooplankton (org/lx10^4) in Kafer El-Sheik , El Tal El Kabeer and Shader Azam fish farm under fertilizer and feed management.

	Managements.	Copepoda	Cladocera	Rotifera	Ostracoda	Total
Kafer El-Sheik	**Fertilizer (KM)**	3.52± 0.011[b]	3.11± 0.023[c]	5.88± 0.051[a]	1.79± 0.015[a]	14.3± 0.104[a]
	Feed (KF)	2.93± 0.012[c]	2.77± 0.021[a]	4.21± 0.043[b]	1.31± 0.013[b]	11.22± 0.044[c]
El Tal El Kabeer	**Fertilizer (TM)**	4.55± 0.014[a]	4.05± 0.023[a]	4.11± 0.035[b]	1.57± 0.012[b]	14.28± 0.121[a]
	Feed (TF)	4.13± 0.022[a]	3.63± 0.023[b]	3.32± 0.023[c]	1.23± 0.01[c]	12.31± 0.043[b]
Shader Azam	**Fertilizer (PM)**	4.39± 0.022[a]	3.47± 0.016[b]	2.49± 0.015[d]	1.89± 0.011[a]	12.24± 0.051[b]
	Feed (PF)	3.77± 0.023[b]	2.71± 0.015[d]	2.02± 0.011[e]	1.35± 0.01[b]	9.85± 0.023[a]

Letters (a to e) show vertical differences among fish farms under different managements. Data shown with different letters are statistically different at $P < 0.05$ level

According to Bwala and Omoregie (2009), the diversity of zooplankton is not only dependent on feeding on phytoplankton alone but they substitute by feeding other available feed like bacteria which give room to phytoplankton reproduction and unlike in a situation when zooplankton are dependent on only phytoplankton alone they then tend to reduce the number of phytoplankton species in ponds. Many studies have shown that the combined use of inorganic and organic fertilizers is effective in productivity improvement in earthen ponds (Afzal *et al.*, 2007and Jha *et al.*, 2008). Moreover, the combined use of inorganic and organic fertilizers is effective in maintaining phytoplankton and zooplankton population in rearing ponds (Afzal *et al.*, 2007).

The abandance of zooplankton is low in aquatic environment with very low nutrient or organic matter content as observed in each feed fish farm ponds.

The presented data in Table (4), showed the growth performance of Nile tilapia and mullet in different fish farms under different pond managements during the experiment period. The initial weight and initial number of tilapia and mullet were not significantly ($P<0.05$) differ in same fish species among three fish farms under different pond managements. Survival rate of tilapia recorded a significantly increase ($P<0.05$) than of mullet. The survival rate of tilapia in Kafer El-Sheik fish farm under feed management had significantly ($P<0.05$) increased than other tilapia in different fish farm under different pond management. The survival rate of mullet in Shader Azam fish farm under feed management had significantly ($P<0.05$) increased than other mullet in different fish farm under different pond management. These results are in agreement with those obtained by Shaker, (2008), who reported that the survival rate of fish depends on pond management. The author found the survival rate of tilapia significantly increased in feed only pond management than the other managements. The final weight of tilapia fertilizers fish ponds were 185; 175 and 200g for KM; TM and SM respectively, in feed ponds managements were 250; 250 and 285 for KF; TF and SF respectively. The daily gain of tilapia were 1.65 and 1.22g for feed and fertilizer fish farms respectively, mullet were 1.2 and 1.13 and catfish were 5.63 and 4.97g for the same fish farm respectively. These results indicated that the daily gain of Tilapia had significantly increase ($P<0.05$) than mullet. These results are good in agreement with those obtained by Yang Yi *et al.*, (2003); Shaker and Abd El Aal, (2006) and Shaker, (2008), who reported that the daily gain and SGR of catfish was higher than daily gain tilapia, silver carp, common carp and mullet.

Organic and inorganic fertilizations can produce high plankton abundance to be capable of supporting fish growth (Jha *et al.,* 2008). Fertilizers, fresh feed or both are manipulated in fish ponds to increase production. Organic fertilizers have been widely used in tilapia, common carp and mullet ponds, especially in Asia (Edwards *et al*., 1994).

Table 4. Growth performance of tilapia and mullet in different fish farms as affected by different water sources and pond management.

Locations	Kafer El-Sheik				El Tal El Kabeer				Shader Azam			
Management	Fertilizer (KM)		Feed (KF)		Fertilizer (TM)		Feed (TF)		Fertilizer (PM)		Feed (PF)	
Items	Tilapia	Mullet	Tilapia	Mullet	Tilapia	Mullet	Tilapia	Mullet	Tilapia	Mullet	Tilapia	Mullet
Initial Weight (g)	2 ± 0.1^{a}	30 ± 1.5^{A}	2 ± 0.1^{a}	30 ± 2.0^{A}	2 ± 0.1^{a}	30 ± 1.5^{A}	2 ± 0.1^{a}	30 ± 2.0^{A}	2 ± 0.1^{a}	30 ± 1.5^{A}	2 ± 0.1^{a}	30 ± 2.0^{A}
Initial Number	16000 ±100^{a}	4000 ±30^{A}	16000 ±100^{b}	4000 ±25^{A}	16000 ±100^{a}	4000 ±25^{A}	16000 ±100b	4000 ±25^{A}	16000 ±100^{a}	4000 ±30^{A}	16000 ±100 b	4000 ±30^{A}
Total Initial Weight (g)	32000 ±200^{a}	12000 ±500^{A}	32000 ±00^{a}	12000 ±500^{A}	32000 ±200^{a}	12000 ±500^{A}	32000 ±200^{a}	12000 ±500^{A}	32000 ±200^{a}	12000 ±500^{A}	32000 ±200^{a}	12000 ±500^{A}
Average final Weight (g)	185 ± 15^{d}	200± 12^{C}	250 ± 25^{b}	210 ± 15^{C}	175± 25^{d}	185 ± 25^{D}	250 ± 25^{b}	205 ± 25^{C}	200± 25^{c}	230± 25^{B}	285± 25^{a}	250± 25^{A}
Survival Rate %	93.2 ±3.5^{b}	87.5 ±2.5^{B}	98.22 ±1.2^{a}	86.5 ±2^{B}	94.5 ±1.5^{b}	90.0 ±2^{A}	95.5 ±1.5^{b}	90.0 ±2^{A}	95.0 ±1^{b}	90.0 ±3^{A}	95.0 ±2^{b}	91.5 ±1.5^{A}
Final Number	14912 ±120^{d}	3500 ±45^{B}	15715 ±120^{a}	3460 ±50^{B}	15120 ±110^{b}	3600 ±52^{A}	15280 ±123^{b}	3600 ±22^{A}	15280 ±114^{b}	3600 ±28^{A}	15280 ±144^{b}	3660 ±32^{A}
T. Prod./Kg /Fed.	3458.7 ±102^{e}		4693.2 ±136^{b}		3312 ±92^{e}		4558 ±126^{c}		3884 ±110^{d}		5255 ±172^{a}	

Letters (a to e) show horizontal differences among same fish species in different fish farms under different managements. Data shown with different letters are statistically different at $P < 0.05$ level.

The total fish production of each fish farm were 3458.7 kg/faddan; 4693.2 kg/faddan; 3312 kg/faddan; 4558 kg/faddan; 3884 kg/faddan and 5255 kg/faddan for KM; KF; TM; TF, PM and PF respectively as shown in Table 4. These results clear that the total fish production/ feddan in feed fish farms were significantly increase ($P<0.05$) than fertilizer fish farms. These results indicated that the fertilizer system were not suitable for different fish species during whole period but artificial feed offers fish needs during different stages of fish life. Overall note that the cost of fish production in fertilizer system was less than artificial feeding. We can conclude that the fertilization fish farm ponds need added doses of artificial feed during last two months in the last stages of life to improve fish production.

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الآثار البيئية لإدارة الأحواض الترابيه السمكية على نوعية المياه ونموالبلانكتون وانتاجية البلطي والبوري

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أجريت الدراسة فى محافظات كفر الشيخ – الاسماعيلية – بورسعيد فى مزرعتين بكل محافظة. استخدم فى الدراسة عدد 4 حوض ترابى مساحه كل منها 2 فدان. استمرتالدراسه لمدة 150 يوما .تم استخدام نوعين من الادارة(التسميد والتغذية) واستخدم حوضين لكل مزرعه من المزارع الثلاث وتم استزراها بأصبعيات من أسماك البلطى النيلى والبورى بمتوسط وزن اولى 2؛ 30 جم على الترتيب. تم أخذ عينات مياه مرة شهريا لقياس جودة المياه ونموات الفيتو بلانكتون والزوبلانكتون وعينات من الاسماك لحساب معدلات النمو. وكانت اهم النتائج المتحصل عليها:

- لاتوجد فروق معنويه بين النظامين فى كل محافظة فى درجه الحرارة – الملوحة – التوصيل الكهربى و العسر الكلى فى حين ان هناك زيادة معنوية فى الاس الهيدروجينى – الاكسجين الذائب – قراءة قرص الشفافية – القلوية الكلية – الفوسفور الذائب – المركبات النيتروجينية (الامونيا – النتريت– النترات) والكلوروفيل أ فى المزرعة التى تعتمد على التسميد العضوى.
- زيادة المركبات النيتروجينية تحت نظام التسميد عنها فى نظام التغذية الصناعية.
- زيادة معنوية فى نموات الفيتوبلانكتون والزوبلانكتون فى أحواض النظام التسميدى عن نظام التغذية الصناعية.
- زيادة الهائمات النباتية والحيوانية فى مزرعة كفر الشيخ يليها– شادر عزام –واخير الأسماعيليه التل الكبير تحت النظام السمادى.
- تعتبر مياه مزرعة كفر الشيخ وشادر عزام من المياه الثقيلة أى ذات محتوى بيولوجى مرتفع لذا يجب مراعاة ذلك من حيث كثافة الاسماك والادارة حتى لاتمثل خطورة على حياة الاسماك خلال الموسم.
- زيادة معنوية لمعدل النمو اليومى البلطى عن البورى فى نظامى الادارة.

- كانت الزيادة فى معدل النمو اليومى للاسماك فى المزرعتين لكل محافظة البلطى يتبعها البورى.
- زيادة معدل النمو اليومى ومعدل النمو التخصصى لجميع الاسماك فى نظام التغذية الصناعية عنها فى التسميد.
- زيادة معنوية فى اجمالى الانتاج للفدان فى نظام التغذية الصناعية عنها فى التسميد.
- سجل اعلى انتاجية للفدن فى مزرعه شادر عزام وبعدها كفر الشيخ والتل الكبير تحت نظام التغذية الصناعية وفى نفس الاتجاة كان تحت نظام التسميد.

اوضحت الدراسة الى ان خواص جودة المياه فى المزارع السمكية تعتمد اساسا على نظام ادارة المزرعة.