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RESPONSE OF PHYTOPLANKTON AND ZOOPLANKTON COMMUNITIES TO DIFFERENT WATER SUPPLIES IN AQUACULTURE PONDS

Mona H. Ahmed[1]; Gibreel M. Sharaf[2]
and Nadia N. Abd El-Hamed[3]

[1] *Central Lab .for Aquaculture Research, Agricultural Research Center, Ministry of Agriculture, Egypt.*

[3] *Faculty of Science Suez Canal University.*

[2] *Labor University, Kafr El-Sheikh, Egypt.*

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Abstract

This study was conducted to investigate the impact of two different aquaculture systems on plankton organisms. The first farm is a private fish farm located in Kafr El-Sheikh governorate and the second is located in Central Laboratory for Aquaculture Research in Abbassa, Sharkia governorate. Water samples were collected monthly from the two farms from June to December to measure physico-chemical parameters and plankton composition. The results showed that the most studied water quality parameters were within the permissible range for fish culture at the two farms, phytoplankton groups showed dominance of diatoms and green algae compared with blue green algae and euglenoids. At Kafr El-Sheikh July samples showed the least densities of phytoplankton, and the numbers reached their maximum values in October. However at Abbassa the phytoplankton densities were remarkably low compared to Kafr El-Sheikh; pond water where their numbers showed minimum values in November and maximum values in October. Concerning of zooplankton, rotifers were the dominant species *Brachionus sp., Keratella sp.* and *Filinia sp.* comprised more than 82.63% of rotifers species at the two farms. Kafr El-Sheikh pond water rich with rotifers species than Abbassa whereas cladocera group was the dominant in Abbassa pond fish farm which represented by *Cerodaphnia sp, Moina sp.* and *Bosmina sp*.

INTRODUCTION

Aquaculture is considered one of the largest sectors for fish production in Egypt, where it represents 65% of the total fish yield and 99% of that production is done by the private sector (FAO, 2010). Nile tilapia is considered the most important fish species in Egypt, it occupies more than 70% of the Egyptian fish production (Ishak *et al.,* 1985). Planktivorous fish like tilapia have a major influence on the structure of the whole plankton where they modify the density and size structure of communities (Carpenter *et al*., 1985).

Physical factors such as climate (i.e. temperature, wind, precipitation, and solar radiation) are also important determinants of water quality in lakes and all critically affect the lake's hydrologic and chemical characteristics, and indirectly affect the composition of the biological community (Najafpour *et al.*, 2008). Also, water quality may be affected by the source of the water, rate of flow, nutrients and algae. Other factors like sewage and agricultural runoffs, various hazardous chemicals and natural contaminants (animal feces) reach the natural sources of water and also pollute the ground water by seeping (Hamill and Verburg, 2010).

Problems of sewage pollution of inland waters have become a point of local concern (Abdel-Moneim *et al*., 2012). Egyptian drains receive large quantities of partially untreated domestic and industrial wastewater and other human activities, which in turn ultimately discharge into River Nile, canals, lakes, or seas (El-Sheikh *et al*., 2010). The disposal of the untreated sewage may be harmful concerning its possible hygienic and aesthetical effects and its impact on fauna and flora in the aquatic environment (Bahnasawy *et al.,* 2009).

Phytoplankton and zooplankton are considered the main natural food for fish culture especially during the early stages of their lives. The carrying capacity and production of fish ponds could be increased by the fertilization that encourages growth of phytoplankton and in turn zooplankton that is required as natural food for fish (Seymour, 1980).

Zooplankton plays an important role in the biological cycling of carbon and other elements in the ocean. Seasonal zooplankton dynamics and the mechanisms driving their variability are highly susceptible to changes of environmental variables, especially in shallow, semi-enclosed bays with heavily populated shores where increased anthropogenic nutrient input severely affects marine communities (Marcus, 2004).

The zooplankton plays a significant role in determining the quality of the ecosystem (Uriarte and Villate, 2004) and also,used as bioindicators of environmental quality are commonly found among copepod species (Caulleaud *et al.*, 2009). Zooplankton abundance and diversity distribution are directly and indirectly influenced by natural environmental variables and by nutrients (Albania *et al.*, 2009).

The aim of this study is to evaluate the plankton communities in two different aquaculture systems and to find their relationships with different water quality parameters.

MATERIAL AND METHODS

Experimental design.

This study was carried out at two fish farms in two governorates one in Kafr El Sheikh and the other in El Sharkia at (ClAR). In each governorate three fish farms were selected which have the same management, feeding, source of irrigation, fish density. All fish farms are polycultured with fingerlings (tilapia, silver carp and Mullet), and fertilized in thefirst three months then the fish feed by artificial feed of 27% protein.

The first fish farm is a private fish farm, in Kafr El-Shiekh governorate. It is provided with water through El-Gharbia main drain (Ketshenar). Which has drainage water (El-Shinnawy, 2002) and this drain is considered the main source for irrigation to many fish farms in Kafr El-Sheikh governorate.

The second fish farm is in El Sharkia governorate, Abbassa fish farms which belongs to the Central Laboratory for Aquaculture Research (CLAR), Abbassa, Abou-Hammad, that is receives water from El-Wady drain, which collected agricultural waste water from surrounding, lands.

The samples of water quality, phytoplankton, and zooplankton were collected monthly from June to December.

Physico-chemical water parameters.

Water quality measurements were taken outdoor in the field, temperature and dissolved oxygen (DO) using Yellow Spring Instrument (YSI model 57) oxygen meter. pH values using pH meter (model Corning 345). Water visibility was measured by using a Secchi disk (SD) in field. Five liters of water were collected from signed sites in each pond, mixed and transferred to the laboratory for of total alkalinity and total hardness which were determined by titration as $CaCO_3$ (APHA, 1985). While total ammonia (NH_4-N+NH_3-N) Nitrite (NO_2-N), Nitrate (NO_3-N), orthophosphate (PO_4-p), chlorophyll-content (µg/l) were measured by a spectrophotometer. All methods are described in Boyd and Tucker (1992).

Phytoplankton sampling was carried out at a subsurface during the morning (until 12 AM) using a motorized pump and 500 ml water sample is preserved in lugol's solution, at a ratio of 0.3 ml to 100 ml sample (APHA, 1985). Then water was siphoned after sedimentation and the remained 50 ml was examined. Phytoplankton cells were identified to four divisions: Green algae (Chlorophyceae), Blue-green algae (Cyanophyceae), Diatoms (Bacillariophyceae), and Euglena (Dinophyceae). Phytoplankton cells were counted microscopically in a special counting chamber using binuclear microscope.

For zooplankton analysis, samples were collected from each water body on a monthly basis. About 100 liter of water is filtered by passing water through plankton net made up of bottling silk cloth having mesh size of 40 micrometer. Samples were then washed into wide mouth botels and were preserved by adding 4% formaldehyde solution. Analysis was done by putting 1 ml of the preserved sample on a Sedgwick- Rafter cell and studying it under inverted microscope for qualitative analysis, the keys given in Tonapy (1980) and APH (1998) were utilized and the results were expressed in number per liter.

Statistical comparisons.

One-way ANOVA and Duncan multiple range test were used to evaluate the significant difference of the concentration of different items with respect to months. Significant differences are stated at $P<0.05$. Correlation coefficients between the different parameters were computed. Data were statistically analyzed according to Bailey (1981).

RESULTS AND DISCUSSION

The monthly average temperature varied from 15 to 32.2ºC in Kafr El-Sheikh ponds and from 14.6 to 32.1ºC in Abbassa area (Table 1& 2). Maximum temperature was recorded in July and June and minimum values were recorded in December, these usually are the average water temperature at these times of the year of exposed water ponds. Temperature readings during the present study fell within the optimum range for fish culture (Meske, 1985 and Boyd, 1998). There were significant variations at both Kafr El-Sheikh and Abbassa ponds this agree with the results obtained by Saeed, 2013.

The average values of pH ranged from 8.6 in July to 9.5 in November at Kafr El-Sheikh ponds and from 7.7 in June to 9.4 in December at Abbassa ponds (Table 1& 2). Tilapia can survive in pH ranging from 5 to 10 but they do best in a pH range from 6 to 9 (Popma and Masser, 1999). All readings in the present study were on the alkaline side of the pH scale and within the optimum range for tilapia culture (Boyd, 1998). The variations of pH were significant ($p<0.05$) (Table 1&2). During the day as a result of photosynthesis, phytoplankton removes CO_2 from the water which will decrease the hydrogen ion concentration and as a result increase pH of the water this results hand with hand Boyd (1998). The pH is interdependent with other water quality parameters, such as carbon dioxide, alkalinity, and hardness. It can be toxic in itself at a certain level, and also known to influence the toxicity as well of hydrogen sulfide, cyanides, heavy metals, and ammonia (Klontz, 1993).

Table 1. The monthly average values of water quality parameters at Kafr El-Sheikh farms.

Month Item	Temp. °C	pH	SD (Cm)	DO (mg/L)	T. alkalinity (mg/L)	T. hardness (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	NH_4-N (mg/L)	PO_4 (mg/L)	Chlorophyll a (µg/L)
Jun	29.6 ±1.2[a]	9.0 ±0.4[a]	20.0 ±0.9[a]	5.8 ±0.1[b]	319.8 ±14.2[b]	690.4 ±54.2[b]	0.154 ±0.01[c]	1.480 ±0.05[b]	0.224 ±0.02[f]	0.957 ±0.04[b]	133.3±17.2[a]
Jul	32.2 ±1.6[a]	8.6 ±0.1[b]	17.2 ±0.6[b]	5.0 ±0.3[c]	337.6 ±18.7[b]	768.6 ±47.2[ab]	0.171 ±0.02[b]	1.070 ±0.03[d]	0.530 ±0.04[e]	0.962 ±0.05[b]	131.7 ±9.5[a]
Aug	31.7 ±0.9[a]	9.1 ±0.3[a]	19.0 ±0.4[a]	5.1 ±0.4[c]	296.6 ±8.3[c]	742.0 ±45.8[ab]	0.186 ±0.03[a]	1.038 ±0.06[d]	0.783±0.03[c]	0.876 ±0.07[c]	146.7 ±8.6[a]
Sep	27.3 ±0.8[b]	9.3 ±0.1[a]	16.0 ±0.9[b]	5.1 ±0.3[c]	357.2 ±32.9[ab]	436.0 ±24.7[c]	0.136 ±0.02[d]	1.214 ±0.04[c]	0.799 ±0.06[c]	0.842±0.04[c]	100.0 ±5.2[b]
Oct	23.1 ±0.7[c]	9.3 ±0.3[a]	17.0 ±0.7[b]	4.8 ±0.3[c]	348.8 ±25.7[ab]	422.0 ±27.9[c]	0.174 ±0.02[b]	1.075 ±0.06[d]	0.697 ±0.05[d]	0.852 ±0.07[c]	103.3 ±6.7[b]
Nov	17.8 ±0.3[d]	9.5 ±0.2[a]	13.5 ±0.5[c]	7.1 ±0.2[a]	387.4 ±27.8[a]	796.0 ±39.6[a]	0.113 ±0.03[f]	2.064 ±0.05[a]	0.978 ±0.09[b]	0.930 ±0.09[b]	92.3 ±3.5[b]
Dec	15.0 ±0.6[e]	9.4 ±0.3[a]	11.4 ±1.2[d]	5.7 ±0.4[b]	403.8 ±36.8[a]	871.6 ±52.1[a]	0.125 ±0.01[e]	2.042 ±0.04[a]	1.108 ±0.08[a]	1.140 ±1.03[a]	83.3 ±5.4[c]

[a-f] Means have the same later in the same column for the same parameter in different months are not significant ($P>0.05$).

Table 2. The monthly average values of water quality parameters at Abbassa farms.

Month Item	Temp. ^{O}C	pH	SD (Cm)	DO (mg/L)	T. alkalinity (mg/L)	T. hardness (mg/L)	NO_2-N (mg/L)	NO_3-N (mg/L)	NH_4-N (mg/L)	PO_4 (mg/L)	Chlorophyll a (μg/L)
Jun	32.1±0.9^{a}	7.7±0.3^{b}	23.4±1.2^{a}	6.6±0.2^{a}	316.8±17^{b}	224.0±15.2^{b}	0.109±0.02^{b}	1.360±0.028^{b}	0.098±0.008^{e}	0.750±0.03^{c}	90.3±1.2^{b}
Jul	30.6±1.2^{a}	7.9±0.2^{b}	16.2±0.7^{b}	6.7±0.2^{a}	314.2±15^{b}	207.8±17.5^{c}	0.096±0.01^{c}	1.500±0.010^{a}	0.083±0.008^{e}	0.778±0.04^{b}	98.3±3.6^{a}
Aug	29.7±1.4^{a}	8.9±0.2^{a}	17.1±0.5^{b}	6.2±0.3^{a}	356.4±19^{ab}	273.2±21.2^{b}	0.109±0.01^{b}	1.140±0.019^{c}	0.098±0.007^{e}	0.790±0.07^{b}	100±2.5^{a}
Sep	26.4±0.8^{b}	9.1±0.4^{a}	14.4±0.7^{c}	5.0±0.3^{c}	336.0±21^{ab}	338.0±24.3^{a}	0.084±0.02^{c}	1.220±0.093^{b}	0.640±0.005^{b}	0.761±0.06^{c}	96.7±3.6^{a}
Oct	21.6±0.6^{c}	9.2±0.4^{a}	13.0±0.5^{d}	5.8±0.2^{b}	360.8±18^{a}	261.8±17.8^{b}	0.242±0.01^{a}	0.867±0.062^{e}	0.162±0.003^{d}	0.670±0.04^{d}	89.7±4.2^{b}
Nov	17.3±0.3^{d}	9.2±0.3^{a}	15.5±0.6^{c}	5.2±0.3^{c}	369.0±19^{a}	205.0±21.1^{c}	0.107±0.01^{b}	1.058±0.025^{d}	0.181±0.004^{c}	0.803±0.03^{b}	88.3±5.1^{b}
Dec	14.6±0.3^{e}	9.4±0.3^{a}	20.4±1.9^{a}	6.1±0.3^{b}	319.0±17^{b}	336.0±24.7^{a}	0.116±0.01^{b}	1.138±0.065^{c}	0.842±0.009^{a}	0.896±0.04^{a}	61.66±5.8^{c}

$^{a-d}$ Means have the same later in the same column for the same parameter in different months are not significant (P>0.05).

Transparency (reading of Secchi disc depth, SD) varied between 11.4 cm in December to 20 cm in June at Kafr El-Sheikh ponds (Table 1) and from 13 cm in October to 23.4 cm in June in Abbassa (Table 2). High transparency values were observed in the warm months at both farms, while low values were found during the cold months in Kafr El-Sheikh only, while in Abbassa transparency increased to some extent in December. Transparency values varied significantly ($p<0.05$) among months. It showed a positive correlation with temperature and a negative correlation with pH in Kafr El-Sheikh. High densities of plankton usually have a negative effect on water transparency (Boyd, 1998); In the present study only transparency was negatively correlated with euglenoids only which constituted about 17% of total phytoplankton in Kafr El-Sheikh (Table 3).

Average values of dissolved oxygen ranged from 4.8 mg/l in October to 7.1mg/l in November at Kafr El-Sheikh and from 5 mg/l in September to 6.7 mg/l in July in Abbassa pond Variations in dissolved oxygen among months were significant ($P<0.05$) at both farms (Table 1&2). Table (3) shows a moderate negative correlation between temperature and dissolved oxygen at Kafr El-Sheikh farm. Dissolved oxygen is usually positively correlated with pH, as phytoplankton photosynthesizes, when released oxygen during photosynthesis and take up CO_2 which will increase the pH values as stated above. Tilapia has a low oxygen demand and can survive at low oxygen levels (Siddiqui *et al.,* 1989). The oxygen levels measured during the present study fall within the optimum levels for cultured fish and higher than 5 mg/l which was reported by Boyd (1998) as the minimum desirable dissolved oxygen level in fish ponds.

Total alkalinity is the sum of carbonate Co_3 and bicarbonate HCO3 at Kafr El-Sheikh ranged from 296.6 mg/l in August to 403.8mg/l in December while in Abbassa it ranged from 314.2 in July to 369 mg/l in November. Fluctuations in alkalinity readings were significant among months (Table 1& 2). This might be due to the high rate of Co_3 production which causes high rate of biological activities in ponds these results similar to the results obtained by Saeed (2013). Total hardness values ranged from 422 mg/l in October to 871.6 mg/l in December at Kafr El-Sheikh, while at Abbassa it was from 205 mg/l in November to 336 mg/l in December (Table 2). Total hardness variations between months were significantly at the two farms (Table 2). Boyd (1998) stated that in most waters the values of total alkalinity and total hardness are approximately equal, the present study showed a higher hardness values at Kafr El-Sheikh ponds compared to alkalinity. As mentioned above, alkalinity is a good indicator of pH level in the system Lawson (1995). EPA (1986) the values of hardness measured at Kafr El-Sheikh makes it very hard water. Total alkalinity correlated positively with pH and dissolved oxygen and negatively with temperature and transparency at Kafr El-Sheikh (Table 3) while hardness showed only positive correlation with dissolved oxygen. Generally total hardness was greater in concentration than total alkalinity. These common phenomena in aquaculture ponds (above 0.2 g/L) are acceptable according to Boyd and Tucker, 1998.

Nitrite (NO_2-N) values at Kafr El-Sheikh ponds ranged from 0.113 mg/l in November to 0.186 mg/l in August, while at Abbassa values were from 0.084 in September to 0.242 mg/l in October (Table 1&2). The differences in nitrite readings were found significant between months in both farms (Table 2). Nitrate (NO_3-N) at Kafr El-Sheikh ranged from 1.038 mg/l in August to 2.064 mg/l in November, while at Abbassa it varied from 0.867 mg/l in October to 1.5mg/l in July (Table 2). Total Ammonia in Kafr El-Sheikh varied from 0.224 mg/l in June to 1.108 mg/l in December (Table 1) and at Abbassa ranged from 0.083 mg/l in July to 0.842 mg/l in December. The differences in total Ammonia were significant among months in both farms. High ammonia levels can arise from overfeeding, protein-rich feed, excess feed decays to liberate toxic ammonia gas, in conjunction with the fish's excreted ammonia accumulate to dangerously high levels under certain conditions (Lawson, 1995). Fortunately, ammonia concentrations are partially buffered by conversion to nontoxic nitrate (NO_3-N) ion by nitrifying bacteria. Values of NO_2 and NO_3 in this study are not very critical, as these will not pose any harm to the species cultured, if not present in a very high concentration this agree with (Lawson, 1995). NO_2-N was found negatively correlated with NO_3-N and NH_3, while NO_3-N was positively correlated to NH_3 at Kafr El-Sheikh (Table 3).

Table 3. The correlation between different parameters at kafr El-Sheikh farm.

	green	blue	diatoms	Euglena	T.t phyto	*T. rotifers*	T.copepod	Temp	pH
Green	1.00								
blue	0.83	1.00							
diatoms	0.46	0.61	1.00						
Euglena	0.24	0.65	0.74	1.00					
tot phyto	0.87	0.89	0.82	0.62	1.00				
tot rotifers	0.06	-0.09	0.25	-0.34	0.09	1.00			
T.copepod	-0.48	0.01	-0.07	0.36	-0.27	-0.26	1.00		
temp	-0.12	-0.28	-0.38	-0.62	-0.33	0.70	-0.30	1.00	
pH	0.49	0.44	0.61	0.49	0.64	-0.36	-0.10	-0.83	1.00
SD	-0.09	-0.37	-0.32	-0.69	-0.30	0.75	-0.50	0.89	-0.70
DO	-0.38	-0.51	-0.05	-0.04	-0.28	-0.33	0.00	-0.58	0.50
T.alk	0.12	0.30	0.13	0.54	0.21	-0.86	0.37	-0.91	0.69
T.H.	-0.86	-0.54	-0.09	0.17	-0.56	-0.13	0.70	-0.24	-0.12
NO2	0.03	0.08	0.10	-0.09	0.05	0.59	-0.20	0.75	-0.67
NO3	-0.33	-0.24	0.02	0.23	-0.18	-0.54	0.41	-0.83	0.60
NH3	0.28	0.54	0.71	0.80	0.60	-0.37	0.35	-0.74	0.78
O.P.	-0.59	-0.18	-0.17	0.30	-0.40	-0.47	0.91	-0.52	0.03
Chlol a	-0.45	-0.07	-0.08	0.39	-0.26	-0.59	0.85	-0.69	0.24

SD	DO	T. alka	T.H.	NO2	NO3	NH3	O.P.	Chlo a
1.00								
-0.46	1.00							
-0.95	0.51	1.00						
-0.34	0.50	0.22	1.00					
0.76	-0.79	-0.84	-0.27	1.00				
-0.75	0.86	0.79	0.58	-0.88	1.00			
-0.86	0.30	0.69	0.24	-0.51	0.52	1.00		
-0.58	0.30	0.55	0.76	-0.43	0.67	0.30	1.00	
-0.73	0.40	0.71	0.68	-0.58	0.78	0.43	0.97	1.00

Orthophosphate (OP) values fluctuated at Kafr El-Sheikh ponds from 0.842 mg/l in September to 1.14 mg/l in December and at Abbassa ponds from 0.67 mg/l in October to 0.896 mg/l in December. Significant differences were noticed at both farms (Table 1&2). Negative correlations were found between OP and temperature and transparency at Kafr El-Sheikh (Table 3), and between OP and NO_2-N at Abbassa ponds. Positive correlations were found between OP and total alkalinity, total hardness and NO_3-N at Kafr El-Sheikh and between OP and total ammonia at Abbassa (Table 4). A lack of OP with a concentration of below 0.010 mg/l is considered as oligotrophic, while concentrations between 0.010 and 0.020mg/l are indicative of mesotrophy, and concentrations exceeding 0.02 mg/l are considered eutrophic (Muller and Helsel, 1999). So, high phosphate values measured during the present study put the studies farms within the eutrophic range. To flourish in a fish pond, phytoplankton needs inorganic salts like nitrate, phosphate and silicate in addition to solar energy and once a phytoplankton community is established in the fish pond, numbers of herbivorous zooplankton will consequently increase which are the main food items for fish larvae and planktivorous fish. Dense phytoplankton blooms and large amounts of unconsumed artificial food and fish excreta will lead to the deterioration of any water body and will therefore affect the food chain and the fish cultured.

Chlorophyll-a measured at each farm during the present study, it ranged at Kafr El-Sheikh from 146.7 µg/l in August to 83.3 µg/l in December while at Abbassa it varied from 100 µg/l in Aug. to 61.66 µg/l in December. Significant variations were found in chlorophyll-a between months in the both farms (Table 1&2). Positive relationships were found between months, an increase in chlorophyll-a was observed during June, July and August when nutrients were mostly available and temperature increased, while a decrease in the concentration of this pigment was found during the cold months. This month's pattern of chlorophyll-a has been already observed by Aguirre *et al.* (2011) and Gil *et al.* (2011). The increase in chlorophyll-a during the warm months is correlated with the increase in the phytoplankton growth that favored by high concentrations of nutrients and optimum temperature and light conditions. This increase in primary productivity in these months followed by an increase in zooplankton grazing during August. these results were in agreement with Torres *et al.* (2009) and Florencia *et al*. (2014). Positive correlation were found between chlorophyll-a and total alkalinity, total hardness, NO_3-N and OP at Kafr El-Sheikh, and between chlorophyll-a and pH and total Ammonia in Abbassa ponds while negative correlations were found between chlorophyll-a, transparency and NO_2-N at Kafr El-Sheikh (table 3) and between chlorophyll-a and temperature and transparency at Abbassa ponds (Table 4).

At Kafr El-Sheikh ponds densities of total phytoplankton groups (Table 5) showed dominance of diatoms (40.8%) and green algae (35%) over blue algae and euglenoids (7% and 17.1% respectively). This agrees with Padmavathi and Prasad (2009); Hussein (2009) and Ponce Palafox (2010) who observed that dominance of diatoms and green algae over all other phytoplankton groups were recorded. Elhigazi *et al.* (1995) recorded that, bacillariophyceae dominated in the fishless ponds, while in the presence of the Nile tilapia, green algae overgrown diatoms. Sondergaard *et al.* (1990) found that, the removal of about 50% of planktivorous fish was found to be altering the plankton community towards an increase in large-sized diatoms in Lake Sobygird (Denmark). The highest density of diatoms was in August (48494x10^3 cells/l) while the lowest one was in June (23431 x10^3 cells/l) at Kafr El Sheikh while it was 6698 x10^3 cells/l in Novomber and 30543 x10^3 cells/l in Aug.at Abbassa. Green algae ranged from 12400x10^3 cells/l in June to 65207 x10^3 cells/l in September in Kafr El Sheikh while it was from 12209 x10^3 cells/l in July to 43204 x10^3 cells/l I September in Abbassa. In Kafr El Sheikh blue green algae ranged from 3083.7x10^3 cells/l in June to 7757.8 x10^3 cells/l at October while it ranged from 3384x10^3 in July to 5134 x10^3 cells/l in October in Abbassa. On the other hand euglenoids ranged from 10856x10^3 cells/l in June to 19344.6x10^3 cells/l in December at Kafr El Sheikh and 5937x10^3 cells/l in

September to 11819x10^3 cells/l in October at Abbassa table (5&6). June showed the least densities of total phytoplankton (49770 x10^3 cells/l) and the numbers reached a maximum in October (128598.6 x10^3 cells/l) at Kafr El-Sheikh ponds.

Table 4. The correlation between different parameters at Abbassa farm.

	green	blue	diatoms	Euglena	T.t phyto	*T. rotifers*	T.copepod	Temp	pH
Green	1.00								
Blue	0.67	1.00							
diatoms	-0.45	-0.49	1.00						
Euglena	-0.25	0.17	0.61	1.00					
tot phyto	0.61	0.38	0.41	0.43	1.00				
tot rotifers	-0.29	0.28	-0.25	0.37	-0.36	1.00			
T. copepod	0.16	0.26	-0.43	-0.01	-0.15	-0.04	1.00		
Temp	0.08	-0.10	0.28	0.00	0.27	0.09	-0.95	1.00	
pH	0.29	0.22	-0.12	-0.11	0.18	-0.53	0.75	-0.79	1.00
SD	-0.47	-0.37	0.28	0.39	-0.18	0.61	-0.19	0.19	-0.48
DO	-0.73	-0.63	0.70	0.45	-0.13	0.26	-0.62	0.51	-0.71
T.alk	0.21	0.54	-0.21	-0.13	0.05	-0.19	0.22	-0.33	0.60
T.H.	0.48	-0.06	0.15	0.00	0.56	-0.59	0.42	-0.32	0.61
NO2	0.15	0.52	0.26	0.61	0.50	-0.10	0.20	-0.21	0.29
NO3	-0.36	-0.55	0.06	-0.31	-0.40	-0.11	-0.44	0.39	-0.60
NH3	0.30	-0.14	-0.15	-0.13	0.14	-0.34	0.70	-0.58	0.57
O.P.	-0.43	-0.68	-0.02	-0.31	-0.54	-0.08	0.35	-0.43	0.22
Chl- a	0.17	-0.13	-0.31	-0.44	-0.17	-0.59	0.59	-0.58	0.53

SD	DO	T. alka	T.H.	NO2	NO3	NH3	O.P.	Chlo a
1.00								
0.58	1.00							
-0.63	-0.59	1.00						
-0.05	-0.39	-0.13	1.00					
-0.49	-0.09	0.42	-0.02	1.00				
-0.10	0.53	-0.48	-0.44	-0.19	1.00			
0.08	-0.42	-0.28	0.86	-0.20	-0.31	1.00		
0.45	0.06	-0.33	0.32	-0.69	0.00	0.58	1.00	
-0.63	-0.42	0.06	0.34	0.14	0.30	0.52	0.23	1.00

At Kafr El-Sheikh ponds variations of densities of phytoplankton groups were significant among months for green algae, diatoms and euglenoids ($P<0.05$) Table (5) while blue green algae showed non-significant variations ($p>0.05$). Negative relationships were found between green algae and total hardness while blue algae showed negative correlations with total hardness and a positive correlation with total ammonia, diatoms showed a positive correlation with pH and total ammonia while, euglenoids showed a negative correlations with transparency and a positive correlation with total alkalinity and total Ammonia (Table 3). Water temperature, light and nutrients have been reported as the most effective factors on increase of algae (Sen and Sonmez, 2006).

At Abbassa ponds the phytoplankton densities were remarkably low compared to Kafr El-Sheikh (Table 5) but they showed a similar trend to Kafr El-Sheikh with dominance of green algae and diatoms (38.9 and 37.2% respectively) while euglenoids and blue green algae showed low densities (16% and 7.9 % respectively).

Table 5. Total monthly average numbers (x10^3 cells/l) of phytoplankton orders at Kafr El-Sheikh fish farm

Order / Month	Green	Blue	Diatom	Euglena	T. phytoplankton
Jun	12400±611[d]	3083±367[d]	23431±1012[c]	10856±1113[d]	49770
Jul	3720±167[e]	5082±389[b]	8707±1574[d]	12254±546[c]	29764
Aug	21027±2134[b]	5590±379[b]	48494±2749[a]	12987±621[c]	88098
Sep	65207±3215[a]	7261±421[a]	35936±1184[b]	8904±589[e]	117308
Oct	60236±2195[a]	7757±109[a]	43272±3836[a]	17331±1352[a]	128598

Nov	17024±897[c]	4519±276[c]	33965±3153[b]	14061±979[b]	69569
Dec	16087±788[c]	6679±87[b]	34511±2146[b]	19344±1121[a]	76623

[a-e]Means have the same later in the same column for the same parameter in different months are not significantly different (P>0.05).

Table 6. Total monthly average numbers (x10^3 cells/l) of phytoplankton orders at Abbassa fish farms.

Order / Month	Green	Blue	Diatom	Euglena	T. phytoplankton
Jun	18405±832[c]	4530±132[b]	21452±153c	11361±133a	55732
Jul	12209±265[e]	3384±96[d]	21179±132[c]	6955±729[d]	43543
Aug	16305±351[d]	3752±87[c]	30543±165[a]	8219±118[c]	58667
Sep	43204±786[a]	4852±98[b]	11256±185[d]	5937±409[d]	64953
Oct	25154±489[b]	5134±125[a]	24571±124[b]	11819±133[a]	66576
Nov	18378±762[c]	4732±102[b]	6698±069[e]	6266±678[d]	35843
Dec	12576±322[e]	3478±92[d]	24476±122[b]	9727±089[b]	50043

[a-d] Means have the same later in the same column for the same parameter in different months are not significantly different (P>0.05).

The presence of humic substances has been shown to stimulate photosynthesis and growth in the green algae (Koukal *et al.,* 2003). In contrast to cyanobacteria and euglenophyta, chlorophytes and diatoms appeared to be stimulated by N and P rather than Fe (De Wever *et al.,* 2008).

At Abbassa differences in densities of phytoplankton among months were significant in green algae, diatoms and euglenoids ($p<0.05$) but blue algae showed non-significant differences ($p>0.05$) Table (6). Green algae showed a negative correlation while blue algae showed positive correlations with total alkalinity and NO_2-N, and negative correlations with dissolved oxygen, NO_3-N and OP, Diatoms correlated positively with dissolved oxygen, while euglenoids correlated positively with NO_2-N (Table 4).

The present data indicates that rotifera is the dominant group followed by copepoda and cladocera, this occurred together with higher values of dissolved oxygen and green algae this is hand with hand with Paula *et al*.

(2010). This community composition of zooplankton was not in conformity with observations of EL-Serafy and AL-Zahaby (1991), where they pointed out that copepoda predominated all the other groups. However, the present data are in agreement with those of Abdel-Hakim *et al*. (2000)

Three rotifers; *Brachionus sp, Keratella sp. and Filinia sp.* comprised 82.63% of total rotifers at Kafr El-Sheikh ponds Table (7) while at Abbassa these constituted 84.4% of total rotifers, the other six species of rotifers were numerically insignificant. In general, Kafr El-Sheikh is richer with rotifers than Abbassa. At Kafr El-Sheikh *Brachionus* ranged from 14 org./l in December to 164 org./l in August *Keratella* varied form 13 org./l in December to 133 org./l in August, whereas *Filinia* ranged from 7 org./l in December to 29 org./l in August. Densities of rotifers were higher in summer than in winter at Kafr El-Sheikh ponds, total rotifers showed two peaks in June and August (235.4 org./l and 376 org./l, respectively) while minimum densities were reached in December (48 org./l).

Variations in rotifer densities among months were significant ($P<0.05$) for *Brachionus sp.* and Keratella at Kafr El-Sheikh ponds Table (7) at Abbassa differences were non-significant ($p>0.05$) Table (8). Total rotifers at Kafr El-Sheikh showed positive correlations with temperature, and transparency Table (3) and negative correlations with total alkalinity, and chlorophyll-a. While in Abbassa, total rotifers showed negative relationships with pH, total hardness and Chlorophyll-a (Table 4). Total copepods (adults and nauplii), ostracods and cladocerans comprised the minor groups found during the study where their densities were numerically insignificant compared to rotifers. The numbers of copepods ranged from 5 org./l to 49 org./l at Kafr El-Sheikh and from 7 org./l to 72 org./l at Abbassa (Tables 9&10). Ostracods ranged from 1 org./l to 11 org./l at Kafr El-Sheikh and from 2-14 org./l at Abbassa while total cladoceran ranged from 1-12 org./l at Kafr El-Sheikh pond and from 3-80 org,/l at Abbassa. Most variations in densities of these minor groups were non-significant ($p>0.05$) among months in the two areas it is noticed that copepods *cyclop sp.* were dominant during months of November, December and January. The copepod Cyclops and its larvae would be adapted to conditions of low temperatures this coordinate with Lovrich (1999) and Florencia *et al.* (2014). Green algae dominant were probably favored by high concentration of dissolved oxygen, this as well as the lower densities of cladocea and copepod Train *et al*. (2005). Susceptibituty of green algae to zooplankton predation is well discussed in the literature of Padisak *et al*. (2009) who explaining decreasing of cladocera at the same time increasing of rotifer increase predation of zooplankton on small size of phytoplankton species (<40µm). Rotifer community indicated a strong monthly influence showing higher abundance in warm months and the inverse pattern in cold months. This may be due to the high temperature coupled with increasing daylight hours would produce development in primary production as a consequence the rotifer and plankton abundance this results agree with data obtained by (Mafalda *et al.,* 2007).

Table 7. The monthly average of rotifer species number (org./L) at Kafr El-Sheikh fish farm.

Months Species	*Brachionus Sp.*	*Keratella Sp.*	*Filinia Sp.*	*Polyarthra Sp.*	*Lecane Sp.*	*Notholca Sp.*	*Euchlanus Sp.*	*Asplancha Sp.*	*Hexarthra Sp.*	Total rotifers
Jun	67±1.3[b]	93.0±2.3[b]	28.0±1.3[a]	5.0±0.4[c]	9±0.3[b]	8±0.6[a]	5.4±0.4[b]	6±0.2[a]	14±0.6[a]	235.4
July	28±0.9[c]	33.0±1.7[d]	10.0±0.3[c]	2.0±0.1[e]	7±0.6[c]	6±0.2[b]	3.1±0.1[d]	0	9±0.3[b]	98
Aug.	164±2.3[a]	133±3.5[a]	29.0±1.2[a]	22±0.8[a]	12±0.4[a]	6±0.2[b]	10.0±0.5[a]	0	0	376
Step	74±1.6[b]	75.0±1.2[c]	16-0±0.6[b]	10.4±0.3[b]	6±0.4[c]	3±0.1[c]	3.1±0.1[d]	0	0	187.4
Oct.	32±1.1[c]	38.8±4.2[d]	15.6±0.7[b]	6.0±0.3[c]	7±0.5[c]	2±0.1[d]	4.4±0.2[c]	0	0	105.8
Nov.	19±0.7[d]	25.0±0.9[e]	10.0±0.4[c]	5.0±0.4[c]	4±0.1[d]	3±0.1[c]	1.1±0.1[f]	0	1±0.1[c]	68
Dec.	14±0.6[e]	13.0±0.4[f]	7.00±0.2[d]	3.0±0.1[d]	2±0.1[e]	7±0.5[a]	2.1±0.1[e]	0	0	48

[a-e] Means have the same later in the same column for the same organism in different months are not significantly different (P>0.05).

Table 8. The monthly average of rotifer species number (org./L) at Abbassa farm.

Abbasa	*Brachionus sp.*	*Keratella sp.*	*Filinia sp.*	*Polyarthra sp.*	*Lecane sp.*	*Notholca sp.*	*Euchlanus Sp.*	*Asplancha sp.*	*Hexarthra Sp.*	Total rotifers
Jun	10.4±0.7[a]	13±0.6[a]	6.4±0.2[a]	2±0.1[a]	3.6±0.2[a]	0	2.6±0.2[a]	0	0	38
July	04.1±0.4[c]	06±0.b[d]	0	1±0.1[b]	0	0	0		0	11
Aug.	0	02±0.2[d]	0	0	0	0	0	0	0	2
Step	0	03±0.2[c]	0	0	0	0	0	0	0	3
Oct.	03.2±0.5[c]	06±0.4[b]	1±0.1[c]	1±0.1[b]	0	0	0	0	0	11
Nov.	06.1±0.3[b]	12±1.5[a]	2±0.1[b]	1±0.1[b]	02.0±0.1[b]	0	0	0	1	24
Dec.	02.0±0.1[d]	08±1.6[b]	0	1±0.1[b]	0	0	0	0	0	11

[a-d] Means have the same later in the same column for the same organism in different months are not significantly different (P>0.05).

Table 9. The monthly average of copepod, ostracoda and cladocera species numbers (org./L) at Kafr El-Sheikh fish farm.

	Order Copepod			**Order Cladocera**					**Ostracoda**
Months Species	**Copepoda**	***Naupl ii***	**T. copepod**	***Daphnisoma sp.***	***Ceriodaphnia sp.***	***Moina sp.***	***Bosmina sp.***	**T. .cladocerans**	**Ostracoda**
Jun	10 ± 0.4^{b}	06 ± 0.6^{d}	16	0	0	0	0	0	0
July	08 ± 0.2^{c}	19 ± 1.9^{a}	27	0	0	0	0	0	0
Aug.	04 ± 0.1^{d}	15 ± 0.9^{b}	19	0	0	0	0	0	1 ± 0.1^{c}
Step	01 ± 0.1^{e}	10 ± 0.9^{c}	11	2 ± 0.1^{b}	4 ± 0.1^{b}	1 ± 0.1^{b}	0	7	11 ± 0.8^{a}
Oct.	0	05 ± 0.5^{d}	5	4 ± 0.2^{a}	5 ± 0.2^{a}	2 ± 0.1^{a}	1 ± 0.1^{a}	12	3 ± 0.1^{b}
Nov.	01 ± 0.1^{e}	09 ± 0.8^{c}	10	0	0	0	0	0	0
Dec.	27 ± 0.4^{a}	22 ± 1.9^{a}	49	0	1 ± 0.1^{c}	0	0	1	0

[a-d] Means have the same later in the same column for the same organism in different months are not significantly different (P>0.05).

Table 10. the monthly average copepoda, ostracoda and cladocera species numbers (org./L) at Abbassa farm.

	Order Copepod			Order Cladocera								Ostracoda
Abbasa	**Copepoda**	***Nauplii***	**T. copepod**	***Daphnia sp.***	***Ceriodaphnia Sp***	***Moina sp.***	***Bosmina sp.***	***Chydorus sp.***	***Sida sp.***	***Daphnisoma sp.***	**T. cladocera**	**Ostracoda**
Jun	9±0.4[d]	6±0.5[b]	15	0	7.2±0.4[c]	8±0.7[b]	2±0.1[c]	0	0	10±1.5[b]	27	2±0.1[c]
July	5±0.4[e]	7±0.6[b]	12	0	3.1±0.2[d]	0	0	0	0	0	3	0
Aug.	6±0.7[e]	1±0.1[c]	7	0	3.1±0.2[d]	0	0	0	0	0	3	14±0.8[a]
Step	37±1.7[b]	7±0.2[b]	44	1.1±0.1[c]	10.1±2.4[b]	5±0.5[c]	1±0.1[d]	2±0.2[b]	0	5±0.2[c]	24	2±0.1[c]
Oct.	22±1.3[c]	26±1.2[a]	8	2.5±0.2[b]	15.2±2.8[b]	2±0.2[d]	2±0.1[c]	1±0.1[c]	1.0±0.1[b]	8.8±0.4[b]	32.3	0
Nov.	35±3.6[b]	25±1.7[a]	60	4.5±0.3[a]	33.75±5.7[a]	4.2±0.4[c]	6±0.5[b]	2.4±0.2[b]	2.4±0.2[a]	24.4±2.5[a]	77.65	2±0.1[c]
Dec.	42±4.6[a]	30±3.8[a]	72	3.1±0.4[b]	25.2±3.5[a]	11±1.1[a]	8±0.9[a]	6±0.3[a]	0	27.6±3.7[a]	80	4±0.2[b]

[a-c] Means have the same later in the same column for the same organism in different months are not significantly different (P>0.05).

Planktivorous fish are known to be size-selective predators that prey selectively on largest zooplankton (Zaret, 1980). The present data are concurrent with this observation since the small rotifers and the nauplius larvae of copepods were the most dominant in fishponds. Microzooplankton (rotifers, nauplius larvae, ciliates, and heterotrophic flagellates) develops better when predatory pressure by zooplankton crustaceans is reduced (Richardson *et al.*, 1990). Carpenter and Kitchell (1993) and Brett and Goldman (1996) found that removing large and more conspicuous zooplankton, leave back small crustaceans and small rotifers. Diana *et al. (*1991*)* tested the trophic cascade hypothesis in aquaculture ponds containing tilapia at different densities. They detected that fish predations affect not only the prey, but also lower trophic levels. They found that zooplankton densities, particularly small zooplankton were reduced in ponds without fish. Total copepods occurrence has been widely associated with non-polluted area this may be the reason of its occurrence in Abbassa sites than Kafr El Sheikh this agree with Albamia *et al.*, 2009.

CONCLUSION

From this study it is concluded that changes in regions and in turn water quality parameters may alter the density and structure of plankton communities.

REFERENCE

Abdel-Hakim, N.F.; M.N. Bakeer and M.A. Soltan, 2000. Effect of two manuring systems on water quality and plankton communities in fishponds. Conference of Social and Agricultural Development of Sinai, El-Arish -North Sinai, Egypt, 147-158

Abdel-Moneim, A.M.; M.A. Al-Kahtani and O.M. Elmenshawy, 2012. Histopathological biomarkers in gills and liver of Oreochromis niloticus from polluted wetland environments, Saudi Arabia. Chemosphere, 88: 1028-1035.

Aguirre, G.E.; F.L. Capitanio; G.A. Lovrich and G.B. Esnal, 2011. Seasonal variability of metazooplankton in coastal sub-Antarctic waters (*Beagle Channel*). Marine Biology Research, 3: 1-13.

Albania, A.; F. Villate and I. Uriarte, 2009. Zooplankton communities in two contrasting Basque estuaries (1999–2001): reporting changes associated with ecosystem health. Journal of Plankton Research, 31(7): 739–752.

APHA (American Public Health Association), 1998. Standard methods for the examination of water and wastewater. In: Greenberg, A.E., Clesceri, L.S., Eaton, A.D. (Eds.), APHA, WEF and AWWA, 20th, Washington DC, USA, pp: 1193.

APHA, (American Public Health Association) 1985. Standard Methods for the Examination of Water and Wastewater. 16th ed. Washington, D.C. 1268 pp.

Bahnasawy, M.H.; A.A. Khidr and N.A. Dheina, 2009. Seasonal variations of heavy metals concentrations in mullet, Mugil cephalus and Liza ramada (Mugilidae) from Lake Manzala, Egypt. Egyptian Journal of Aquatic Biology and Fisheries, 13 (2): 81-100.

Bailey, N.T., 1981. Statistical Methods in Biology. 2nd ed. (Biological Science Texts).

Boyd, C.E. 1998. Water quality for pond Aquaculture. Research and development series. International centre for aquaculture and aquatic environment, Alabama Agriculture Experiment Station, Auburn University, Alabama.

Boyd, C.E. and C.S. Tucker, 1998. Pond Aquaculture Water Quality Management. Kluwer Academic Publishers, Boston, MA. pp. 541-575.

Boyed, C.E. and C.S. Tucker, 1992. Water quality and pond soil analysis for aquaculture. Alabama Agriculture Expermint Station. Auburn Univ., 183, pp.

Brett, M.T. and C.R. Goldman, 1996. A meta-analysis of the freshwater trophic cascade. Proc. Acad. Sci. USA, 93: 7723-7726

Carpenter, S.R.; J. F.Kitchell, and J.R. Hodgson, 1985. Cascading trophic interactions and lake productivity. Bio Science, 35: 634-639.

Carpenter, S.R. and E.D.S. Kitchell, 1993. The trophic cascade in lakes. Cambridge studies in ecology. Cambridge University Press, 358pp.Lazzaro, X., 1987. A review of planktivorous fishes: their evolution, feeding behavior, selectivities, and impacts. Hydrobiologia, 146: 97-167.

Caulleaud, K.; J. Forget-Leray; L. Peluhet; K. LeMenach; S. Souissi, and H. Budzinski, 2009. Tidal influence on the distribution of hydrophobic organic contaminants in the Seine Estuary and biomarker responses on the copepod Eurytemora affinis. Environmental Pollution, 157(1): 64–71.

DE Wever, A.; K. Muylaert; D. Langlet; L. Alleman; J. Descy; L. Andre; C. Cocquyt and W. Vyverman, 2008. Differential response of phytoplankton to additions of nitrogen, phosphorus and iron in Lake Tanganyika. Freshwater Biology, 53: 264–277.

Diana, J.S.; D.J. Dettweiler and C.K. Lin, 1991. Effect of Nile tilapia (Oreochromis niloticus) on the ecosystem of aquaculture ponds, and its significance to the trophic cascade hyphothesis. Can. J. Fish. Aquat. Sci, 48: 183-190.

Elhigazi, F.A.R.; S.A. Haider and P. Larsson, 1995. Interactions between Nile tilpia (*Oreochromsis niloticus*) and cladocerans in ponds (Khartoum, Sudan): Hydrobiologia, 307: 263-272.

El-Serafy, S.S. and S.A. AL-Zahaby, 1991. Plankton in the tradition and improved technique of fish culture, Egypt.J.Appl. Sci., 6 (10): 429-440.

El-Sheikh, M.A.; H. I.Saleh; D.E. El-Quosy and A.A. Mahmoud, 2010. Improving water quality in polluted drains with free water surface constructed Wetlands. Ecological Engineering, 36: 1478-1484.

El-Shinnawy, I.A., 2002. Al-Burullus, wetlands, Hydrological study. EEAA, Medwet Coast, Egypt, pp. 52.

EPA., 1996. Method 3050B. Test Methods for Evaluating soil, sludges and Solid Waste. Laboratory manual physical/chemical methods. Office of Solid Waste and Emergency Response, Washington, DC.

FAO., 2010. National Aquaculture Sector Overview. Egypt. Fact Sheets. In: FAO Fisheries and Aquaculture Department (online). Rome

Florencia, B.; M.S. Dutto; A.A. Berasategui; G. Kopprio, and M.S. Hoffmeyer, 2014. Mesozooplankton assemblages and their relationship with environmental variables: a study case in a disturbed bay (Beagle Channel, Argentina). Environ Monit Assess., 186: 8629–8647.

Gil, M.; A.I. Torres; O. Amin, and J.L. Esteves, 2011. Assessment of recent sediment influence in an urban polluted subantarctic coastal ecosystem. Beagle Channel (Southern Argentina). Marine Pollution Bulletin, 62 (1): 201–207.

Hamill, K.D. and P. Verburg, 2010. Lake water quality in New Zealand 2010: Review of monitoring and reporting. Ministry for the Environment. Available online: http://www.

Hussein, M.S. 2009. Comparative effects of fertilization and supplementary feed with rice bran on growth performance, water quality parameters and economic returns of the fish under polyculture ponds. J. Product. & Dev., 15(3): 251-277.

Ishak, M.M.; A. Sayes and K. Tallaat, 1985. Tilapia fisheries in Lake Borollus (Egypt). Kuwait. Bull. Mar. ScL, 6: 225-242.

Klontz, G.W., 1993. Epidemiology. In: Stoskopf, M.K. (ed.) Fish Medicine. W.B. Saunders, Philadelphia, US. pp. 210-213.

Koukal B.; C. Gueguen; M. Pardos and J. Dominik, 2003. Influence of humic substances on the toxic effects of cadmium and zinc to the green alga Pseudokirchneriella subcapitata. Chemosphere, 53: 953-961.

Lawson, T.B., 1995. Fundamentals of Aquacultural Engineering. New York: Chapman and Hall.

Lovrich, G.A., 1999. Seasonality of larvae of Brachyura and Anomura (*Crustacea Decapoda*) in the Beagle Channel, Argentina. Scientia Marina, 63 (1): 347–354.

Mafalda, J.P.; J. Pérez de Rubín and C. Sampaio de Souza, 2007. Mesozooplankton composition and distribution in relation to oceanographic conditions in theGulf of Cádiz, Spain. Revista UDO Agricola, 7 (1): 274–284.

Marcus N., 2004. An overview of the impacts of eutrophication and chemical pollutants on copepods of the coastal zone, Zool. Stud., 43 (2): 211–217.

Meske, C., 1985. Fish Aquaculture. Pergamon Press, Oxford. Mueller, D.K. and D. Helsel, R., 1999. Nutrients in the Nation's Waters-Too Much of a Good Thing. U.S. Geological Survey Circular 1136. National Water-Quality Assessment Program. http://water.usgs.gov/nawqa/circ-1136.

Mueller, D.K. and D.R. Helsel, 1999. Nutrients in the Nation's Waters--Too Much of a Good Thing? U.S. Geological Survey Circular 1136. National Water-Quality Assessment Program. http://water.usgs.gov/nawqa/circ-1136.html.

Najafpour, S.; A.F. Alkarkhi; M.O. Kadir and G.D. Najafpour, 2008. Evaluation of spatial and temporal variation in river water quality. Int. J. Environ. Res., 2 (4): 349-358.

Padisa,´k.J.; L.C. Crossetti and L. Naselli-Flores, 2009. Use and misuse in the application of the phytoplankton functional classification: a critical review with updates. Hydrobiologia, 621: 1-19.

Padmavathi, P. and K.D. Prasad, 2009. Studies on the influence of plankton on fish production of carp culture ponds of Krishna district, Andhra Pradesh, India. Ecology Environment and Conservation, 15: 473-479.

Paula, A.; F. Borges; S. Train; J.D. Dias and C.C. Bonecker, 2010. Effects of fish farming on plankton structure in a Brazilian tropical reservoir. Hydrobiologia, 649: 279–291

Ponce Palafox, J.T., 2010. The effect of chemical and organic fertilization on phytoplankton and fish production in carp (*Cyprinidae*) polyculture system.

Popma, T. and M. Masser, 1999. Tilapia, life history and biology. Southern Regional Aquaculture Center (SRAC) Publication, No. 283.

Richardson, W.B.; S.A. Wickham and S.T. Threlkeld, 1990. Foodweb response to the experimental manipulation of a bentivore {Cypinus carpio), zooplankton (Menidia heryllina) and benthic insects. Arch. Hydrobiol, 119: 143-165.

Saeed, M.S., 2013. assessment of inorganic pollutants in water and sediments in abbassa and maruit fish farm, EGYPT. Abbassa Int. J. Aqua., 6 (1): 19-39.

Sen, B. and F. Sonmez, 2006. A Study on the algae in fish ponds and their seasonal variations. Int. J. of Sci. & Tech., 1 (1): 25-33.

Seymour, E.A., 1980. The effects and control of algal blooms in fish ponds. Aquaculture, 19: 55–74.

Siddiqui, A.Q.; M.S. Howlader and A.B. Adam, 1989. Culture of Nile tilapia, *Oreochromis niloticus* (L.), at three stocking densities in outdoor concrete tanks using drainage water. Aquacult. Fish. Manag., 20: 49-57.

Sondergaard, M.; E. Jeppesen; P. Kristensen and O. Sortkjaer, 1990. Interaction between sediment and water in shallow and hypertrophic lake: a study on phytoplankton collapses in Lake Sobygard. Denmark. Hydrobiologia, 191: 129 - 138.

Tonapi, G.T., 1980. Freshwater Animals of India: An Ecological Approach. Oxford and IBH Publishing Co., New Delhi, India. 341 pp.

Torres, A.I.; M.N. Gil; O. Amin and J.L. Esteves, 2009. Environmental characterization of a eutrophicated semienclosed system: nutrient budget (Encerrada Bay, Tierra del Fuego Island, Patagonia, Argentina). Water, Air, and Soil Pollution, 204(1–4): 259–270.

Train, S.; S. Jati; L.C. Rodrigues and B.M. Pivato, 2005. Distribuic¸a˜o Espacial e Temporal do Fitopla^ncton em Tre^s Reservato´rios da Bacia do Rio Parana´. In Rodrigues, L.; S. M. Thomaz; A. A. Agostinho, and L. C. Gomes (eds), Biocenoses em Reservato´rios: Padro˜es Espaciais e Temporais. Sa˜o Carlos, Rima, 73-85.

Uriarte, I and F. Villate, 2004. Effects of pollution on zooplankton abundance and distribution in two estuaries of the Basque coast (Bay of Biscay). Marine Pollution Bulletin, 49 (3): 220–228.

Zaret, T.M., 1980. Predation and fresh water communities. New Haven and London, Yale Univ. Press, 187.

استجابة الهائمات النباتيه والحيوانية لمصادر مختلفة من المياة فى احواض الاستزراع السمكى

منى حامد احمد[1] ، جبريل محمود شرف[2] ،
نادية نظمى عبد الحميد[3]

[1] المعمل المركزى لبحوث الثروه السمكيه بالعباسه، وزارة الزراعة، مركز البحوث الزراعية، مصر.
[2] كلية العلوم, جامعة قناة السويس.
[3] الجامعة العمالية فرع كفرالشيخ.

الملخص العربى

اقيمت الدراسة للمقارنه بين كثافة البلانكتون ومصادر المياه وتم اختيار مزرعتين الاولى مزرعة خاصة بكفر الشيخ والثانيه بالمعمل المركزى لبحوث الثروة السمكية بالعباسه ابو حماد شرقية وكانتا تدار بنفس ظروف الاداره حيث تم تجميع العينات خلال شهور من يونيه الى ديسمبر واوضحت النتائج ان الخواص الكيميائيه للمياه فى المزرعتيين تقع فى الحدود المسموح بها للاستزراع السمكى وايضا اوضحت النتائج ان الهائمات النباتية فى كفر الشيخ اعلى منها فى العباسة وسادت الدياتوم والطحالب الخضراء فى المزرعتين بينما الهائمات الحيوانية التى تمثلت فى اربع مجموعات وظهرت مجموعة العجليات بصورة سائدة ومثلت 82.63% فى المزرعتين حيث سادت هذه المجموعه فى مزرعة كفر الشيخ .وكانت الاجناس السائدة منها البراكنيوس والكيراتيلا والفيلنيا. بينما سادت مجموعة متفرعات القرن فى مزرعة العباسة حيث كانت الاجناس السائدة منها السيرودفنيا والموينا والبوزمينا.