MACROBENTHOS ABUNDANCE AND COMMUNITY STRUCTURE IN RELATION TO SOME ENVIRONMENTAL VARIABLES IN EL- KANATER El-KHAIRIA FISH FARM, EGYPT.

Journal

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ABSTRACT

The community structure of macrobenthic invertebrates in relation to some physicochemical variables were investigated in El-Kanatair Fish Farm (NIOF). Some physico-chemical conditions (Water temperature, pH, Dissolved Oxygen, Electrical conductivity, Ammonia, Ortho-Phosphate and Sediment type) were estimated. A total of 21 macrobenthic species belong to Arthropoda (11 species), Annelida (6 species), and Mollusca (4 species) were identified. Annelida dominated the other macrobenthic groups at ponds, drain & feeder channel contributing about 45.7, 62.8 & 72.8% of total macrobenthos density. *Limnodrilus huffmeisteri* and *Branchiura sowerbyi* were the most dominant annelid. Eleven arthropod species dominated mainly by Chironomid larvae were identified. The participation of Mollusca in macrobenthos of the fish ponds density was small, (0.3%), while it formed a considerable portion in its biomasses (31.8%). Shannon diversity index reached maximum of 1.4 at the feeder channel, while the lowest , 0.79 was recorded at Pond 1 Cluster analysis of macrobenthos diversity measures indicate two groups, fish ponds and the drain & feeder channel. The highest similarity (73%) was recorded within the 2 nd group, (drain & feeder channel).

Key word: Fish farm, physicochemical variables, macrobenthos community structure.

INTRODUCTION

Fish production through aquaculture is realized in a wide variety of culture systems, from extensive seasonal ponds to intensive concrete raceways or floating cages (Van Dam *et al* 2002). Production in extensive pond systems is based on the natural productivity of the pond and solar energy. In semi-intensive systems, organic and chemical fertilizers and supplemental feeds are added whereas intensive systems are based predominantly on high-quality complete feeds. Only 5–15% of the nitrogen added to the ponds as fertilizer is harvested as fish biomass (Edwards, 1993). Extensive culture is defined as management highly dependant on the natural food web and physical conditions of the natural environment, this system is carried out in earthen ponds.

The benthic macro-invertebrates play an important role in the transformation of the organic matter sediment on the bottom to its own flesh and subsequently contribute the basic nutrition for fish. Lentic Fish biomass and yield are strongly correlated with macrobenthos biomass and production (Eggers *et al.*, 1978) and Wissmar & Wetzel, 1987). The macrobenthos community has often been used as a sensitive indicator for environmental monitoring of organically polluted areas (reviewed by Pearson and Rosenberg, 1978). Assessments using macrobenthos as a bio-indicator have also been conducted at fish farms in Finland (Lauren-Maatta *et al.*, 1991), Scotland (Brown *et al.*, 1987), North America (Findlay *et al.*, 1995), Australia (Ritz *et al.*, 1989), China (Wu *et al.*, 1994), and Japan (Yokoyama, 2002). These studies showed that a reduction in species richness and/or species diversity; a decrease in the number of large-sized species and the appearance of dense populations of the opportunistic small species complex (Oligocheata), which often results in an increase in total macrofaunal abundance, are typical effects of mariculture farming on the macrobenthos.

There is a relatively little information on macrobenthos in fish Ponds. Bedeer (1989) surveyed the bottom fauna through his ecological studies on Ismaelia Pond. Abdel-Gawad (1993) found that, in EL Serow fish farm, the macrobenthic invertebrates comprised 36.6% Oligochaeta, 1.1% Polychaeta, 30.2 % Crustacea and 32% Insecta. Fishar and AbdEl-Regal (1998) studied the macrobenthic invertebrates in relation to sediment properties in fish ponds at El-

Fayoum Govemorate (Egypt), they reported that, the benthos community was represented by four groups (Annelida, Crustacea, Insecta and Mollusca). They added that, nature of the bottom sediment, soil salinity, and its organic matter content, besides the number of rearing stocked fishes were the most important factors affecting the composition and distribution of benthic community. El-Shabrawy and Gohar (2006) listed a total of 23 macrobenthic species belong to Arthropoda (7 species), Annelida (8 species), and Mollusca (8 species) in some fish farms at El-Fayum Province. The data showed two density peaks of 6960 and 6720 org.m^{-2} at Pond 1 in February and El-Wadi Drain in November. Arthropoda dominated the other macrobenthic groups at Ponds 1, 2, 3 & El-Wadi Drain and came next Annelida at Pond 4 and Dair El-Berka Drain. Corophium orientale (Amphipoda) and Chironomid larvae (Diptra) were the dominant taxa.

This study sets out to assess the abundance and community structure of macrobenthic invertebrates in El-Kanater El-Khayria Fish farm (National Institute of Oceanography and Fisheries (NIOF, Cairo, Egypt) in relation to some environmental conditions.

MATERIALS AND METHODS

Site description:

The study was carried out at the freshwater fish farm (Research Station belongs to National Institute of Oceanography and Fisheries) at El-Kanater El-Khayria. The farm consists of 7 earthen ponds, 10 Concrete ponds, Feeder (supply) and the drain channels.

Sampling program:

The sampling program was carried out during fish farm's season (June 2003 till December 2003). Samples were collected from the earthen ponds, drain and the feeder channel. Water, sediment and macrobenthos were monthly collected.

Physico-chemical variables:

Water temperature, dissolved oxygen (DO), pH values and Electrical Conductivity were measured using the Hydro-lab measurement; model (Multi 340i / SET). The water depth of each pond was measured by using graduated rod. Exchangeable ammonia concentrations were determined by indophenol's colorimetric methods according to Bremner and Shaw (1955). Available phosphorus was determined after extraction in hot 0.5 M NaOH according to

Hartikainen (1979) and Krausse *et al.* (1983).The organic matter contents were determined by oxidation with potassium dichromate under acidic conditions (Jackson *et al.*, 1984). The sediment samples were subjected to mechanical analysis according to the method mentioned by Folk (1968).

Macrobenthos samples:

Benthic samples were collected from the surveyed ponds, feeder and drain. The samples were sieved by hand sieve of 0.4 mm mesh diameter, and then washed with lake water to remove mud or other fine particles. The organisms retained in t he sieve were preserved in 10% neutral formalin solution. In the laboratory, the samples were rewashed with tap water to remove any silt remains. Sorting of the specimens was carried out by taking successive small sub-samples and examining them under stereoscopic microscope at 40X. The bottom organisms were sorted into main groups. Each group was examined and sorted into genera or species. Both of the number and wet weight of each species were measured after retaining the organism on filter paper for 3 minutes before weighting. All mollscan species have been weighted with shell. The references used for identification of the collected species are Brinkhurst (1971), Brown (1980), Ruffo (1982), Habashy (1993) and Ibrahim *et al.* (1999).

Statistical analyses

Shannon-Winner diversity, species richness, evenness and similarity index. Correlations between some environmental variables and the zooplankton and benthos assemblages were calculated using Primer (Vs5) program.

RESULTS AND DISCUSSION

1- Results:

Physico-chemical Variables:
Water Temperature

The water temperature ranged between 31.8°C in ponds 7, 2 during August, September, respectively and 17.4°C in pond 3 during December, with a mean average value of 27.8°C. The temperature at the feeder was slightly lower than the corresponding values of the ponds and drain with a mean value of 26.5°C (Table, 1).

Water transparency

In the fish ponds, the Secchidisc depth ranged between 95cm in pond 4 during June and 19cm in ponds 3 & 1, during October & November respectively, with a mean average value of 40.4cm. The highest value of water transparency in the drain (90cm) was recorded during October, while the lowest value of 46cm was recorded during December, with a mean average value of 67.3 cm. The feeder channel is more or less similar to that of the ponds, the transparency varied from 51cm during November to 29cm in July, with an average value of 44cm (Table, 1).

Electrical conductivity:

As shown in Table (1), the conductivity reading in ponds ranged between 466µS/cm in pond 1 during November and 315µS/cm in pond 3 during September. The conductivity in the drain reached its maximum value of 430µS/cm during August, while the minimum value of 326µS/cm was detected during October, with an average value of 372 µS/cm. The conductivity in the feeder channel reached its maximum value (438µS/cm) during November, while the minimum value of 315µS/cm was during June, with an average value of 363 µS/cm.

pH:

The pH values of the selected localities were always on the alkaline side. It ranged between 9.17 in pond 1 during June and 6.55 in pond 1during October with a mean average value of 7.95. pH value of the drain channel were fluctuated between 8.73 during June and 7.89 during both July & August. The variation of the pH values at the feeder channel was very narrow, ranged between 8.28 in June and 7.82 in July (Table, 1).

Dissolved Oxygen (DO):

The dissolved oxygen concentration in the studied ponds was ranged between 7.7mg/l in pond 5 during July and 2.5mg/l in pond 4 during August with a mean average value of 4mg/l. The dissolved oxygen in drain and feeder channels were more or less similar to the earthen ponds, the highest values were 6.9 mg/ & 6.7 mg/l during October and the lowest values were 3.7 mg/l & 2.6 mg/l both during June, with an average values of 5.5 mg/l & 5.2 mg/l respectively (Table, 1).

Ammonia:

As shown in Table (1), the concentration of ammonia in the ponds reached its highest value of 576μg/l in pond 4 during August, while the lowest value of 38μg/l was recorded in pond 5 during June, with a mean average value of 138.9μg/l. Ammonia in the drain reached its maximum value of 306μg/l during December, while the minimum value 122μg/l during June, with an average value of 203μg/l. The ammonia in the feeder channel reached its maximum value of 396μg/l during August, while the minimum value of 201μg/l was recorded during October, with an average value of 284μg/l.

Table (1): Some physical and chemical variables of the water of studied fish farm.

Variables		Pond-1	Pond-2	Pond-3	Pond-4	Pond-5	Pond-6	Pond-7	Avr.	Drain	Feeder channel
W. Temperature (^0C)	Max.	31.5	31.8	31.5	31	31.4	30.6	31.8	31.4	32.2	31
	Mini.	18.8	18.6	17.4	22.8	19.5	19.2	19	19.3	18.9	16.3
	Avr.	28	27.9	27.5	28.3	27.8	27.2	27.7	27.8	27.9	26.5
W.Transparency (cm)	Max.	51	51	52	95	61	42	51	57.6	90	51
	Mini.	19	22	19	40	25	30	39	27.7	46	29
	Avr.	31.7	36.9	35	58.1	37.9	37.3	46	40.4	67.3	44
E conductivity (μS/cm)	Max.	466	449	443	437	425	432	432	440.6	430	438
	Mini.	322	323	315	326	322	320	320	321.1	326	315
	Avr.	395.7	369.4	367.4	395.6	359.6	365.6	377.4	375.8	371.9	363.4
pH	Max	9.17	8.28	8.76	8.39	8.68	8.33	8.62	8.6	8.7	8.3
	Mini.	6.55	7.58	7.78	7.5	7.81	7.61	7.44	7.5	7.9	7.8
	Avr.	7.9	8	8.1	7.9	8.1	7.9	7.8	8	8.2	8.1
Dissolved oxygen (mg/l)	Max.	6.53	6.17	6.95	5.09	7.65	6.81	6.22	6.5	6.9	6.7
	Mini.	3.33	2.66	3.28	2.49	3.24	2.64	3.32	3	3.7	2.6
	Avr.	5.4	4.8	5.2	3.8	5.5	4.8	4.6	4.9	5.5	5.2
Ammonia (μg/l)	Max.	399	468	252	576	246	196	185	331.7	306	396
	Mini.	110.9	72	80.2	90	38.3	63	71	75.1	122	201
	Avr.	158.1	169.6	127.1	177.5	105.1	120.9	113.9	138.9	202.7	284
Orthophosphate (μg/l)	Max.	200	135	114	105	106	121	139	131.4	135	943
	Mini.	99	64	72	66	64	55	59	68.6	52	56
	Avr.	147.1	95.9	100.2	90	81.6	83.8	90.1	98.4	94.8	242.6

Ortho-Phosphate:

The concentration of Ortho-Phosphate concentration in the ponds ranged between 200µg/l in pond 1 during July, and 55µg/l in pond 6 during December, with a mean average value of 98.4µg/l. The monthly average of Ortho-Phosphate concentration in the drain and feeder channel were maximum (135 and943µg/l) during September & August, while the minimum average values of 52µg/l and 56µg/l were recorded during December & October respectively (Table, 1).

Mechanical analysis:

The bottom of ponds in the farm consists of mud (clay and silt), sand with gravel and few of broken shells in a proportion varying from one pond to the other. Sand and mud are abundant in the farm's bottom except in pond 4 where sand with gravel is dominant. Sand represented 71.9 % of the bottom, while mud and gravel represented 17.9 % and 10.2 % of the bottom, (Fig. 1). The bottom of the drain and the feeder channels were homogenous, known as the gravelly sandy mud type; Mud represented 55.3% & 46.9%, while sand and gravel represented 43.7%, 44.5% and 1%, 8.6% of the bottom respectively.

Organic matter:

As shown in Fig. (2), the organic matter in the ponds reached its highest percentage (32.7 %) in pond 1 during November, while the lowest percentage (1.1%) was recorded in pond 5 during November 2003, with a mean average value of (5.7%). The amount of Organic matter was higher in the drain and feeder than the corresponding values in the ponds with an overall average of 8 and 12.5 %, respectively.

Macrobenthos:

Macrobenthos abundance showed a regional variation (Fig. 3). Pond-7 and pond-2 maintained the highest density of 1451 and 1549 org. m^{-2}, weighted 24.1 and 19.8 g fresh wt. m^{-2}, respectively. On the other hand, the lowest abundance of 880 org. m^{-2}, weighted 0.81 g fresh wt. m^{-2} was recorded at pond-6. The population density of macrobenthos was obviously higher at the drain and feeder (avr. 1495 & 2040 org. m^{-2}, weighted 20.9 and 24.9 g fresh wt.m^{-2}, respectively) than the ponds (avr. 1018 org. m^{-2}, weighted 8.8 g fresh wt.m^{-2}) (Fig., 4).

A total of 21 macrobenthic species belong to Arthropoda (11 species), Annelida (6 species), and Mollusca (4 species) were identified (Table 2). Annelida dominated the other macrobenthic groups at ponds, drain & feeder contributing about 45.7, 62.8 & 72.8% of total macrobenthos density (Fig., 3). Six Annelida species dominated mainly by *Limnodrilus huffmeisteri* and *Branchiura sowerbyi* were identified. *Limnodrilus huffmeisteri* was an ubiquitous species, perennially occurred with a highest peak of 4720 org.m^{-2} at pond-7 in June (Fig, 5).

Eleven arthropod species dominated mainly by Chironomid larvae were identified. Chironomid larvae were predominant in the sediments of Ponds, drain & feeder. It shows a maximal density of 6906 org.m^{-2} weighed 2.08 g fresh wt.m^{-2} in Pond 2 during June, while it was totally missed from macrobenthos hauls during September and October (Fig., 6).

The participation of Mollusca in macrobenthos of the fish ponds density was small, (0.3%), while it formed a considerable portion in its biomasses (31.8%). Mollusca was represented by 4species, dominated by *Melanoides tuberculata,* which was common in Pond 4 and totally vanished at the other sites (Table 2).

Species richness and other diversity indices

The highest species and richness values of 17 and 1.8 were recorded at the fish ponds followed by the feeder channel (9 and 0.83). Ponds 2 and 6 had the lowest species number (5 species) and richness (0.4 and 0.6). Shannon diversity index reached maximum of 1.4 at the feeder channel, while the lowest, 0.79 was recorded at Pond 1 (Table, 2). Cluster analysis of macrobenthos diversity measures indicates two groups, fish ponds and the drain & feeder channel (Fig. 7). The highest similarity (73%) was recorded within the 2 nd group, (drain & feeder channel)

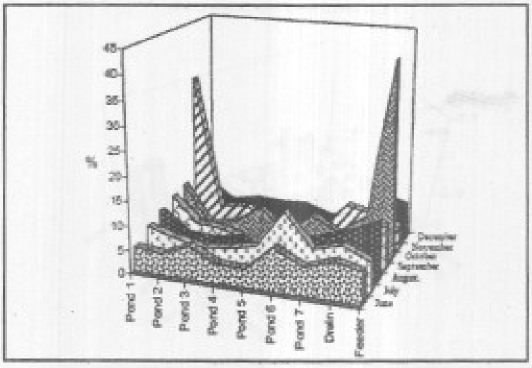

Figure 1: Percentages of the fish ponds, drain and feeder channel's soil components in the Fish Farm

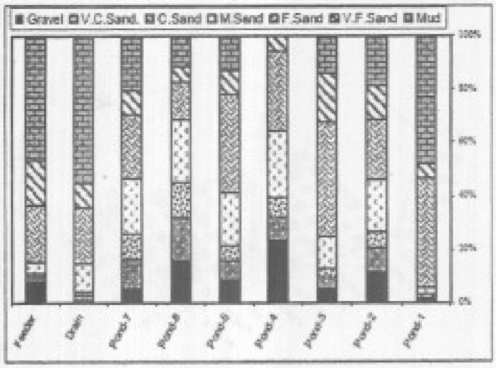

Figure 2: Soil organic mater percentages for the fishponds, drain and feeder channel in the Fish Farm

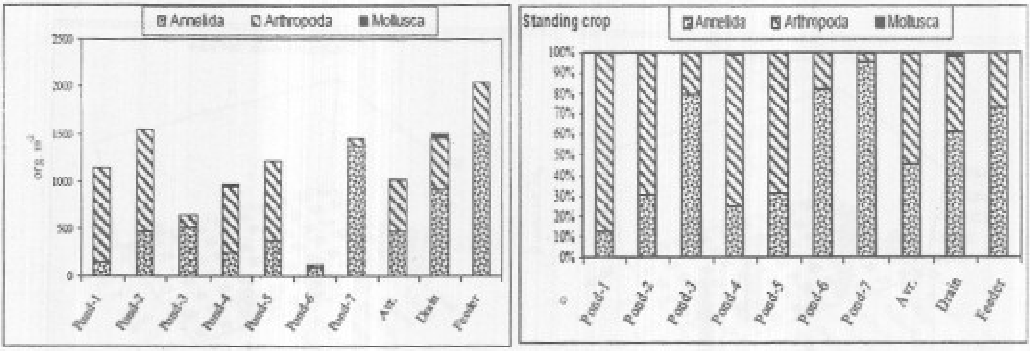

Figure 3: The standing crop of the different macrobenthic groups and its percentage composition to total macrobenthic density at the studied fish farm.

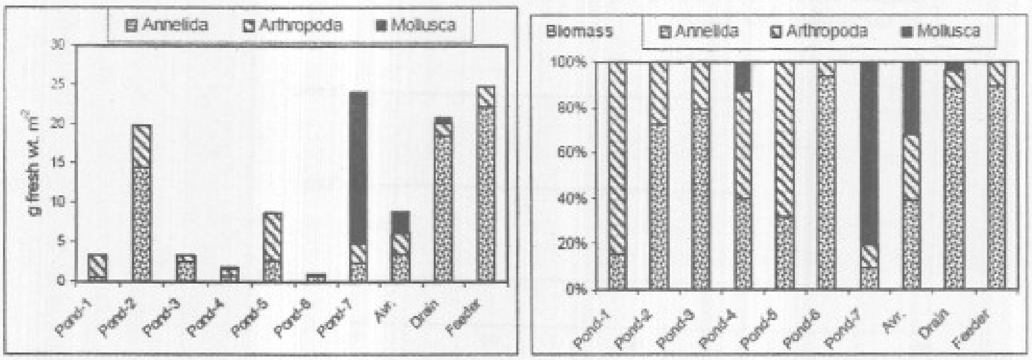

Figure 4: The biomass of the different macrobenthic groups and its percentage composition to total macrobenthic density at the studied fish farm.

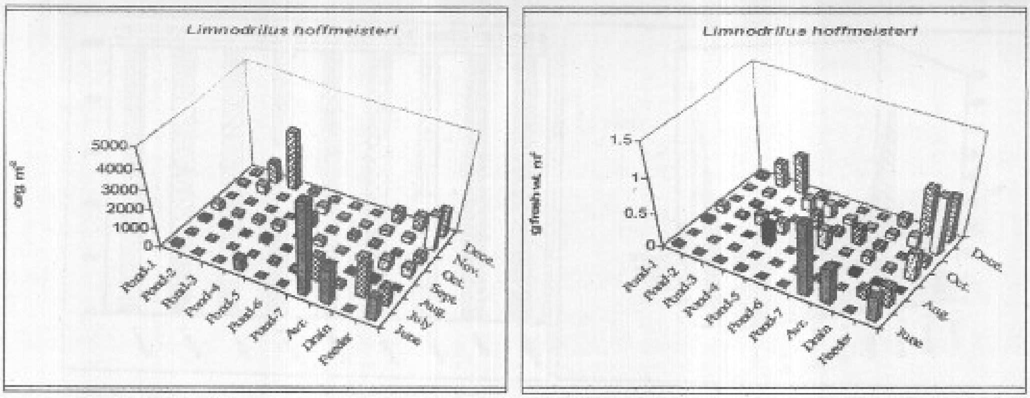

Figure 5: The standing crop and biomass of *Limnodrilus huffmeisteri* in the studied fish farm.

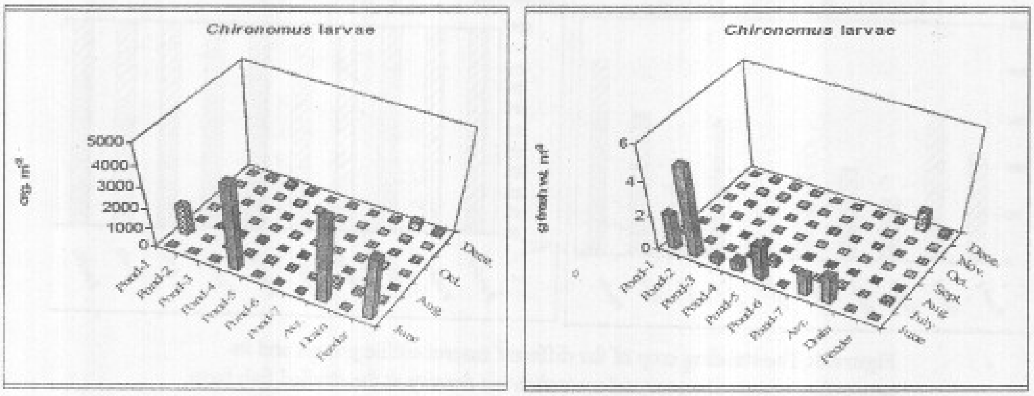

Figure 6: The standing crop and biomass of *Chironomus* larvae in the studied fish farm.

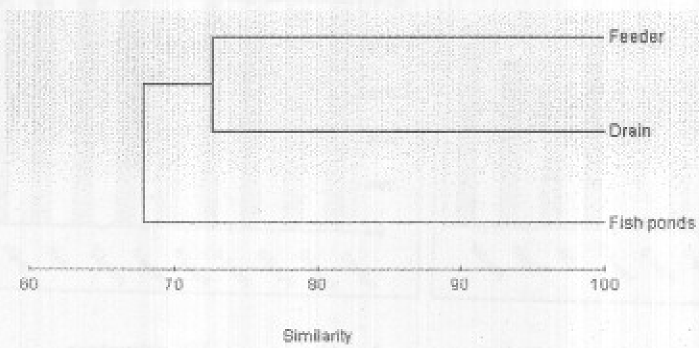

Figure 7: Cluster analysis of the studied ponds, drain and feeding channel according to macrobenthos data.

Table (2): Standing crop of the different macrobenthic species (Org.m^{-2})

	Pond-1	Pond-2	Pond-3	Pond-4	Pond-5	Pond-6	Pond-7	Avr.	Drain	Feeder channel
Annelida										
Limnodrilus hoffmeisteri	131	291	463	223	257	86	1060	362	587	909
Limnodrilus udekemianus	0	0	17	11	6	6	0	6	0	0
Helobdella conifera	6	6	6	0	29	0	57	15	0	23
Glossiphonia paludosa	0	0	0	0	11	6	234	36	0	246
Salifa sp.	0	0	0	0	0	0	6	1	0	0
Branchiura sowerbyi	11	183	34	6	80	6	6	47	331	309
Subtotal	**149**	**480**	**520**	**240**	**383**	**103**	**1383**	**465**	**918**	**1486**
Arthropoda										
Chironomus Larvae	920	1034	114	663	823	23	34	516	520	503
Chironomus Pupa	69	34	17	11	11	0	6	21	23	11
Dytiscidae larva	11	0	0	0	0	0	0	2	0	0
Nymph of *Panthemis* sp.	0	0	0	0	0	0	0	0	0	17
Micronecta sp.	0	0	0	6	0	0	6	2	0	0
Semiaquatic Archnida	0	0	0	0	0	0	0	0	0	6
Ephydra sp.	6	0	0	0	0	0	0	1	0	17
Muscidae larvae	0	0	0	0	6	0	0	1	0	0
Ischnura sp.	0	0	0	6	0	0	0	1	0	0
Cypraides torosa	0	0	0	29	0	0	0	4	0	0
Cardina nilotica	0	0	0	0	0	0	17	2	0	0
Subtotal	**1006**	**1069**	**131**	**714**	**840**	**23**	**63**	**549**	**543**	**554**
Mollusca										
Bulinus truncatus	0	0	0	6	0	0	0	1	23	0
Melanoides tuberculata	0	0	0	16	0	0	0	1	0	0
Mutela rostrata	0	0	0	0	0	0	6	1	0	0
Mutela sp.	0	0	0	0	0	0	0	0	11	0
Subtotal	0	0	0	22	0	0	6	3	34	0
Total	1154	1549	651	976	1223	126	1451	1018	1495	2040
No of Zoop. sp.	9	5	6	9	8	5	10	17	6	9
Richness	0.88	0.43	0.59	0.91	0.78	0.59	1.08	1.83	0.54	0.83
Evenness	0.36	0.58	0.52	0.42	0.45	0.62	0.6	0.42	0.69	0.65
Diversity index	0.79	0.94	0.93	0.93	0.93	0.99	1.38	1.22	1.25	1.42

2- Discussion:

The availability type and succession patterns of potential live food, as influenced by environmental factors, are an important determinant of growth and production, and thus the success of a fish culture. In artificial ponds, benthic macroinvertebrates usually reach high densities a few months after filling and can become an important source of food for benthic feeding fish. Although some studies reported the temporal structural changes of the benthic invertebrate assemblage in newly created ponds (Barnes, 1983; Layton & Voshell, 1991; Christman & Voshell, 1993). The structure of macrobenthos assemblage is complex and seems to be strongly influenced by site specific processes and condition, as well as by interspecific interactions (Lui *et al.*, 2002).

Dissolved oxygen concentration is one of the critical factors affecting processes and conditions at the bottom soil–water interface. Diffusion of oxygen to the pond bottom is slow and insufficient. Wind and mechanically driven water currents mix the water column and bring some oxygen to the bottom layers, yet, in most cases, insufficient amounts to oxygenate the bottom soil. The mixing of water at the soil–water interface and across the flocculent layer is very limited. Oxygen does not penetrate deeper than 1 mm in stagnant intensive and semi-intensive fishpond bottom soil cores (Meijer and Avnimelech, 1999). Mixing and resuspension of bottom soil expose the organic particles to the oxygenated water and may induce aerobic processes. Pond bottom soil mixing can be done by aerators (Boyd, 1998), by towing chains above the bottom (Pullin, 1987) or by aquatic organisms (bioturbation) (Blackburn *et al.*, 1988; Scheffer, 1997; Riise and Roos, 1997; Avnimelech *et al.*, 1999). A possible benefit from pond stirring was observed in tilapia ponds where approximately 2.5 higher yields were obtained for stirred pond as compare with unstirred ponds (Costa-Pierce and Pullin, 1989). Several species could be used to induce bioturbation, the best known is the common carp (Cyprinus carpio), a benthic feeder that stir the bottom soil (Costa-Pierce and Pullin, 1989).

In ponds systems, the increase or decrease of organic matter in the sediments is the difference between the rate of in situ produced and allochtonous material that reaches the bottom before being mineralized, and the rate of organic matter mineralization in the sediment. The rate of sedimentation (deposition) of particulate matter is determined by the particle size, shape, density with respect to water density, and water viscosity (Jørgensen, 1989). The organic content and type of sediments are known to have pronounced effects on the spatial distribution and community composition of benthos. Organic mater in sediments is though to provide food for deposit feeding and detrivorous macrobenthos. There is usually a higher species abundance and biomass in organically rich environments than in organically poor environments (Taylor, 1993). Vivier and Cyrus

(1999) reported that, higher benthic densities were recoded in mud than in fine sand, owing to high organic content of mud. This agrees the present result, the high organic matter content of the drain and feeder are concurrently with high macrobenthos density. The same trend was observed in some of EL-Fayum fish farm that reported by EL-Shabrawy and Gohar (2006). A positive correlation was established between organic carbon and chironomid biomass. These associations are supported by the results of experiments conducted with larvae of the chironomid (*Nilodorum brevibucca*), which showed that the choice of settling site was influenced by substrate texture and particle size, organic detritus being favored while coarse sand was avoided. Associations between chironomid larvae and organic matter and particle size have also been demonstrated by Wene (1940) and similar relationships between a number of benthic organisms and substrate have been reviewed by Cummins and Lauf (1969).

The distribution of benthic macroinvertebrates results from the balance of a variety of requirements for organisms. Many references have confirmed that substrate-type is a useful and convenient predictor of the abundance, biomass and diversity of benthic macroinvertebrates. Winnel & Jude (1984) stated that bottom dweller invertebrate avoid coarse sediment, which could cause injury to their soft integument due to abrasion. Wiley (1981) mentioned that Chironomid are active borrowers, prefers and actively seek, soft sediment which are conductive to borrow activity. McLachlan & McLachlan (1971) found adverse affect of coarse sand sediment on Chironomidae. Maccall and tavesz (1982) stated that fresh water muddy bottom is dominated by tubificid oligocheata. El-Shabrawy and Abd El-Regal (1999) found a negative correlation (r =-0.75) between coarse sand and benthos, *Limnodrilus* and Chironomus larvae were abundant at area with clay and loem sediment in lake Nasser. The particle size may favor some organisms but can not be entirely responsible for their distribution. Some other factors associated with the substrate such as sediment consistency and chemistry should also be taken in consideration.

Aquatic macrophytes are an important habitat for aquatic macroinvertebrates. In plant beds, benthic invertebrates are generally more numerous and more diverse than in open water. Diehl and Kornijow (1998) showed the increase in epiphytic macroinvertebrates with increasing macrophyte densities, and how this is paralleled by an increase in fish biomass. This agrees the present study; macrobenthic invertebrate was highly diverse in the fish ponds (17 species) than the drain and feeder (6 & 9 Species) owing to presence of macrophytes.

Annelida represented by *Limnodrilus huffmeisteri*, *Limnodrilus udekemianus*, *Helobdella conifera*, *Glossiphonia paludosa*, *Salifa* sp. and *Branchiura sowerbyi* was considered the dominant benthic group in El-Kanater fish farm. The same conclusion was observed in ElSerw fish farm (Abdel-Gawad, 1993). *Limnodrilus hoffmeisteri* was one of the dominant Annelida species (86.2% of total Annelida density) in El-Kanater Fish farm. Oligochaetes are facultative species that are successful in wide variety of habitats and thus the modification of the environment with time did not appreciably affect them (Paterson and Fernando, 1970). In the present study, *Limnodrilus hoffmeisteri* was positively correlated with temperature (r= 0.6), transparency (r= 0.18) and pH (r= 0.66). On the other hand, it was negatively correlated with the other studied abiotic parameters. *Limnodrilus hoffmeisteri* a cosmopolitan species occurring in a wide variety of surface water habitats. Both *Limnodrilus hoffmeisteri* and *Tubifex tubifex* can be indicators of organic pollution and low levels of dissolved oxygen (Chapman and Brinkhurst, 1984; Lauritsen *et al.*, 1985 and Brinkhurst and Gelder, 2001), when they reach very high abundance (Brinkhurst, 1975 and 1996). However, each of these species also has been associated with clean water benthic assemblages (Brinkhurst, 1974). Qi Sang (1987) mentioned that *Limnodrilus hoffmeisteri* is dominant and favored in organic polluted water, and it is known by its ability to tolerate low oxygen levels. Verdonschot (1987) stated that this species has a positive relation with pH, nitrate and bicarbonate.

In the present study, *Chironomus* larvae were dominant, in all studied ponds. This may be due to the presence of macrophytes as a food. In addition, There is a strong positive correlation (r= 0.71) between these larvae and pH. Diaz *et al.*, (1998) stated that fresh water communities were dominated by Asiatic clam (*Corbicula fluminalis*), tubificid oligochaete of genus Limnodrilus and the chironomid insect larva (*Coelotanypus scapularis*). Roback (1980) claimed that, chironomus larvae are known to inhabit littoral zone of both oligotrophic and eutrophic lakes. This is mainly due to the presence of food and macrophytes for protection and high dissolved oxygen.

Results of the present study showed that, Mollusca in the fish farm were rarely recorded. This agreed with Abdel-Gawad (1993). She found that, molluscs were represented by empty shells and most of them were of rare occurrence in EL-Serow fish farm (NIOF). This indicates the unsuitability of farms environments for molluscan life.

The present study recommends a further analysis of the benthic assemblage to understand the contribution of these benthic fauna to the ecology and production of the earthen pond fisheries. Also, more detailed work is urgently needed to determine the effects of these phenomenons on the survival of the aquatic fauna and fishes.

REFERENCES

Abdel-Gawad, S. S. E. (1993). Studies on macrobenthic invertebrate in ElSerw fish farm region. M. Sc. Thesis Fac. Sic. El-Mansoura Univ. 203 pp.

Avnimelech, Y., Kochva, M., Hargreaves, J.A. (1999). Sedimentation and resuspension in earthen fish ponds. J. World Aquacult. Soc. 30, 401–409.

Barnes, L. E. (1983). The colonization of ball-clay ponds by macroinvertebrates and macrophytes. Freshwater Biology 13, 561–578.

Bedeer, A. (1989). Ecological studies in Pond Ismaelia in El-Minia province. M. Sc. Thesis, Fac. Sci. El-Minia Univ., 214pp.

Blackburn, T. H., Lund, B. A. and Krom, M. D. (1988). C and N mineralization in the sediments of earthen marine fish pond. Mar. Ecol., Prog. Ser. 44, 221– 227.

Boyd, C. E. (1998). Pond water aeration systems. Aquac. Eng. 18, 9–40.

Bremner, J. M. and Shaw, K. (1955). Determination of ammonia and nitrate in soil. J Agric. Sci., 46.320 - 328.

Brinkhurst, R.O., (1971). A guide for the identification of British aquatic oligachaeta. Freshwater Biological Association. Scientific, Pub. No. 22. 55pp.

Brinkhurst, R. O. (1974). The Benthos of Lakes. MacMillan, London, 190 pp.

Brinkhurst, R. O. (1975). The Benthos of Lakes. St Martin's Press, New York.

Brinkhurst, R. O. (1996). On the role of tubificid oligochaetes in relation to fish disease with special reference to the myxozoa. Annu. Rev. Fish Dis. 6, 29–40.

Brinkhurst, R. O. and Gelder, S. R. (2001). Annelida: Oligochaeta, including Branchiobdellidae, in Thorp, J.H. and Covich, A.P., (eds.), Ecology and Classification of North American Freshwater Invertebrates, Second Edition: San Diego, CA, Academic Press, p. 431-463.

Brown, D. S. (1980). Fresh water snails of Africa and their medical importance. London, Taylor and Francis, 487 pp.

Brown, J. R., Gowen, R. J., and McLusky, D. S. (1987). The effect of salmon farming on the benthos of a Scottish sea loch. Journal of Experimental Marine Biology and Ecology 109, 39–51.

Chapman, P. M. and Brinkhurst, R. O. (1984). Lethal and sublethal tolerances of aquatic oligochaetes with reference to their use as a biotic index of pollution: Hydrobiologia, 115, 139-144.

Christman V. D. & Voshell, Jr. J. R. (1993). Changes in the benthic macroinvertebrate community in 2 years of colonization of new experimental pond. Int. Rev. gesamt. Hydrobiol. 78, 481–491.

Costa-Pierce, B. A., Pullin, R. S. V. (1989). Stirring ponds as a possible means of increasing aquaculture production. Aquabyte 2, 5 – 7.

Cummins, K. W., and Lauff, G. H. (1969). The influence of substrate particle size on the microdistribution of stream macrobenthos. Hydrobiologia 34, 145-181.

Diaz, P., Guerrero, M. C., Alcorlo, P., Baltanas, A., Florin, M. and Montes, C. (1998). Anthropogenic perturbations to the trophic structure in a permanent hypersaline shallow lake: La Salada de Chiprana (North-Eastern Spain). International Journal of Salt Lake Research, 7, 187-210.

Diehl, S. & Kornijow, R. (1998). The Influence of submerged macrophytes on trophic interactions among fish and macroinvertebrates.24-46 In: the role submerged macrophytes in

Lakes (Eds) E. Jeppesen, M. Sőndergaard, and M.Christoffersen, Sbringer-Verbg, Newyork,Tokyo.

Edwards, P. (1993). Environmental issues in integrated agriculture aquaculture and wastewater fed fish culture systems. In: Pullin, R.S.V., Rosenthal, H. and Maclean, J.L. (eds.), Environment and Aquaculture in Developing Countries. ICLARM Conf. Proc., 31, pp.139–170.

Eggers, D. M., Bartoo, N. W., Rickard, N. A., Nelson, R. E., Wissmar, R. C., Burgner, R. L. and Devol, A. H. (1978). The Lake Washington ecosystem: the perspective from the fish community production and for age base. J. Fish. Res. Board Can. 35(5), 1553-1571.

El-Shabrawy, G. M. & Abd El-Regal, R. (1999). Benthic fauna and sediment of Lake Nasser I – Main channel and its littoral area. Bulletin of the Faculty of Sciences of Zagazig University 21, 193 – 215.

El-Shabrawy, G. M. and Gohar, M. (2006). Influence of organic matter, nutrients and type of sediment on macrobenthos structure in some fish farms at EL-Fayum, Egypt. Egyptian Journal of aquatic research. Egypt. 32 (2), 239-253.

Findlay, R. H., Watling, L.and Mayer, L.M. (1995). Environmental impact of salmon net-pen culture on marine benthic communities in Maine: a case study. Estuaries 18, 145–179.

Fishar, M. R. A. and. AbdEl-Regal, R. M. (1998). Macrobenthic Invertebrate in relation to sediment properties in some fish farm Egy. J. Aquat. Biol. & fish 2,87-100

Folk, R. L. (1968). Petrology of sedimentary rock, Hemphill Pub. Co., Austin, Texas, 170pp.

Habashy, M. M. (1993). Taxonomical and ecological studies of aquatic insect in rearing and nursing Ponds fish form. M.Sc. Thesis Fac. Sci., Ain Shams Univ., 173pp.

Hartikainen, H. (1979). Phosphorus and its reactions in terrestrial soils and lake sediments. J. Scient. Agric. Soc. Finl., 53, 16 - 26.

Ibrahim, A., Bishai, H. and Khalil, M. (1999). Fresh eater Molluscs of Egypt publication of National Bio. Unit. (10).

Jackson, J. F. C., Nevissi, A. E. and Dervalle, F. B. (1984). Soil Chem. Analysis, Prentice Hall inc. Engle Works Cliffs, New Jersey, 498 pp.

Jørgensen, E. (1989). Sedimentation. In: Jørgensen, S.E., Gromiec, M.J. (Eds.), Mathematical Sub-models in Water Quality Systems. Developments in Environmenal modeling. Elsevier, Amesterdam. 14,109-124.

Krausse, G. L. Schelske, C. L. and Davis, C. O. (1983). Comparison of three wet alkaline methods of digestion of biogenic silica. Freshwat. Biol., 13, 73 - 81.

Lauren-Maatta, C., M. Granlid, S. Henriksson, and V. Koivisto. (1991). Effects of fish farming on the macrobenthos of different bottom types. In: T. Ma¨kinen (ed.), Marine Aquaculture and Environment. Nordic Council of Ministers, Copenhagen, Denmark. pp, 57–83.

Lauritsen, D. D., Mozley, S. C. & White, D. S., (1985). Distribution of oligochaetes in Lake Michigan and comments on their use as indices of pollution: Journal of Great Lakes Research, Vol. 11. 67-76.

Layton R.J. and Voshell J.R. (1991). Colonization of new experimental ponds by benthic macroinvertebrates. Environ. Entomol. 201, 10-17

Lui, T. H., Lee, S. Y. and Sadovy, Y. (2002). Macrobenthos of a tidal impoundment at the Mai Po Marshes Nature Reserve, Hong Kong. Hydrobiologia. 468, 193-212.

McCall, P. L. & Tevesz, M. J. S (1982). The effects of benthos on physical properties of freshwater sediments. In P. L. McCall & M. J. S. Tevesz (eds), Animal-Sediment Relations. Plenum Press, New York: 105–176.

McLachlan, A. J. & McLachlan, S. H. (1971). Benthic fauna and sediments in the newly created lake Kariba(central Africa) Ecology 52, 800-809.

Meijer, L. E., Avnimelech, Y. (1999). On the use of micro-electrodes in fish pond sediments. Aquacult. Eng. 21, 71– 83.

Pearson, T. H., Rosenberg, R., (1978). Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanogr. Mar. Biol. Ann. Rev. 16, 229– 311.

Pullin, R. S. V. (1987). General discussion on detritus and microbial ecology in aquaculture. In: Moriarty, D.J.W., Pullin, R.S.V. (Eds.), Detritus and Microbial Ecology in Aquaculture. ICLARM Conference Proceedings 14, International Center for Living Aquatic Resources Management, Manila, Philippines, pp. 368–381.

Qi Sang (1987). Some biological aspects of aquatic oligochaetes in the lower Pearl River (China). Hydrobiologia, Vol. 155. 199 – 208.

Riise, J. C. and Roos, N. (1997). Benthic metabolism and the effects of bioturbation in a fertilised polyculture fish pond in northeast Thailand. Aquaculture 150, 45– 62.

Ritz, D. A., Lewis, M. E. and Shen, M. (1989). Response to organic enrichment of infaunal macrobenthic communities under salmonid seacages. Marine Biology 103, 211–214.

Roback, S. S. (1980). The immature Chironomids of eastern. United State IV TonyPondina, Procladini . Proc. Acad. Nat. Sci. Philadelphia. 132, 1-63.

Ruffo, M. (1982). The amphipoda of the Mediterranean. Mem. De l'Inst. Oceano., Monaco. Part I: Gammaridae

Scheffer, M. (1997). Ecology of Shallow Lakes. Kluwer Academic Publishing. 384 pp.

Stumm, W. and Morgan, J. J. (1981). Aquatic chemistry. An introduction emphasizing chemical equilibria in natural waters. 2nd Ed. John Wiley and Sons N. Y. 780.

Taylor, J. D. (1993). Regional variation in the structure of tropical benthic communities: relation to regimes of nutrirnt input. In Morton. B. (ed). The marin biology of the south China sea. Hong kong Univ. press, Hong kong: 337-356.

Van Dam, A. A., Beveridge, M. C. M., Azim, E. A., Verdegem, M. J. C. (2002). The potential of fish production based on periphyton. Reviews in Fish Biology and Fisheries 12,1–3.

Verdonschot, P. F. M. (1987). Aquatic oligochaetes in ditches. Hydrobiologia, 155, 283 – 292.

Vivier, L. and Cyrus, D. (1999). The zoobenthic fauna of Nhlabane coastal lake system. Kwazulu Natal, Suoth Africa, 20years after construction of a barrage. Water. S. A. 25(4), 533-542.

Wene, G. (1940). The soil as an ecological factor in the abundance of aquatic chironomid larvae. Ohio J. Sci. 110, 193-199.

Wiley, M. J., (1981). An analysis of some factors influencing the successful penetration of sediment by Chironomid larvae Oikos 36, 296-302.

Winnel, M. H. and Jude, D. J. (1984). Benthic community structure and composition among rocky habitats in the great lakes and Keuka lake, New York. J. great Lakes Res. 13,3-17

Wissmar R. C. and Wetzel, R. G. (1987). Analysis of five North American ecosystem. IV: Consumer community structure and production. Verh. Inst. Ver. Limnol. 20, 587-597.

Wu, R. S., Lam, S. K. S., MacKay, D., Lau, T. C., and Yam, V. (1994). Impact of marine fish farming on water quality and bottom sediment: a case study in the sub-tropical environment. Marine Environmental Research 38, 115–145.

Yokoyama, H. (2002). Impact of fish and pearl farming on the benthic environments in Gokasho Bay: evaluation from seasonal fluctuations of the macrobenthos. Fisheries Science 68, 258–268.

تراكيب مجتمع حيوانات القاع الكبيرة وعلاقتها ببعض المتغيرات البيئية بمحطة بحوث الأسماك بالقناطر الخيرية"مصر"

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تلعب حيوانات القاع دورا هاما فى السلسلة الغذائية لأى مسطح مائي. فمن المعروف أن الأسماك تعتمد إعتماد مباشر أو غير مباشر فى غذائها على هذه الكائنات و دراسة هذه الكائنات ضرورية في زيادة إنتاج الاسماك ومدى انتاجية آى مزرعة سمكية تعتمد بشكل أو بأخر على كمية حيوانات القاع الموجودة بها ولهذا تلعب حيوانات القاع دورا كبيرا في زيادة إنتاجية المزارع السمكية .

استهدفت هذه الدراسة إلقاء الضوء على كثافة وأنتشار و تراكيب حيوانات القاع اللافقارية وعلاقتها ببعض التغيرات الفزيقية والكميائية فى مزرعة الأسماك التابعة للمعهد القومى لعلوم البحار والمصايد بالقناطر الخيرية تم دراسة الخواص الفزيقية والكيماوية للمزرعة عن طريق تحديد كل من درجة حرارة الماء و الهواء وشفافية الماء وتركيز أيون الهيدروجين والأوكسجين الذائب و التوصيلية الكهربية و تركيز النيتريت و الأمونيا والأورثوفوسفات بالإضافة الى تحديد بعض خواص التربة للأحواض موضع الدراسة.

أوضحت الدراسة أن قاع الأحواض متجانس تقريبا مع بعض الاختلافات عنها فى قاع المغذى و المصرف و هو مغطى بطبقة من الرمل و الطين و الحصى.

أوضحت الدراسة أنه هناك ثلاث مجموعات رئيسية كونت مجتمع حيوانات القاع فى المزرعة وهى:(الديدان الحلقيه و مفصليات الارجل و الرخويات). وكانت أكثرهم شيوعا وعددا هى مجموعة الديدان الحلقيه و مثلت حوالى ٥٧,٤٣٪ و ٧٠,١٢٪ و ٧٢,٨٣٪ من حيوانات القاع فى الأحواض و المصرف والمغذى على التوالى، وكان *Limnodrilus huffmeisteri* هو السائد من حيوانات هذه المجموعه.أما *Chironomus* larvae فهو السائد من مجموعة مفصليات الارجل كما جاء في هذه الدراسه.

و توصى الدراسة الحالية بالأتي:

- إنتاج غذاء طبيعي لتغذية الأسماك جنبا إلى جنب مع التغذية الصناعية.
- وجوب التحليل الدوري لجودة المياه في المزارع السمكية.