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BENTHIC COMMUNITIES IN THE RIVER NILE, EGYPT III- MEIOFAUNA AT HELWAN REGION

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ABSTRACT

The present work is the third in a series titled "Benthic communities in the River Nile, Egypt". The first dealt with aquatic stages of Insecta (Ramadan *et al.*, 1998) and the second dealt with Mollusca (Ramadan *et al.*, 2000). The present work is the first to deal quantitatively with the ecology of the Egyptian Nile Meiofauna. It is hoped to be a contribution to the data base necessary for the development of the resources of the River Nile.

Monthly samples were collected from the eastern and western sides of five stations in the Nile at Helwan region (Industrial area, 30 km. South Cairo) from June 1997 to May 1998. The average standing crop of meiofauna in the whole investigated area during the period of study was 27.3 organisms/10 cm^2 weighing 5.06 mg. fresh weight/10 cm^2. Nematoda was the dominant group, contributing about 66.3% of the total population density (P. D.) followed by Ostracoda (32.1%). Regarding biomass, Ostracoda occupied the first position contributing 55.5 % of the total biomass of Meiofauna, followed by Nematoda (42.9%). Summer and autumn represented the most productive seasons. The temporal average biomass followed the same trend of population density (P. D.)with some deviation. Nature of the sediment was the primary factor affecting the meiofaunal abundance. A highly significant negative correlation was revealed between the total number of macrobenthos and meiobenthos in the sampled area. Similarily, a negative correlation was observed between the ostracod *Chlamydotheca unispinosa* Baird, 1862 and the macrobenthic gastropod *Valvata nilotica* Jickeli, 1874. The scarce occurence of harpacticoid copepods makes the Nematoda/ Copepoda ratio reaches its maximum value indicateing heavy polluted area.

INTRODUCTION

The study of meiofauna is a late component of benthic research, despite the fact that meiobenthic animals have been known since the early days of microscopy. While the terms macrofauna and microfauna have been long established, it was not until 1942 that "meiofauna" was used by Mare to define an assemblage of mobile or hapto-sessile benthic invertebrates (meiobenthos), distinguished from macrofauna by their small size, but larger than microfauna (a term now restricted to Protozoa) (Giere, 1993).

Meiobenthic species are a good indication of water quality changes, because they have a short life cycle, a fast metabolism and quick reaction to changes in their environment and they are also more specialized regarding their food sources (Lodge *et al*.,1988). Meiofauna in fresh water comprises different groups in relation to various types of freshwater biotopes.

The meiobenthos have been little investigated in comparison with macrobenthic fauna (Pennak, 1988; Moore & Betta, 1989). In the Egyptian fresh water, very little is known about the meiofauna. The present work is the first to deal quantitatively with this important topic in the River Nile. It aimed to provide the data base necessary for the development of the River Nile resources.

MATERIAL AND METHODS

Study area :

Helwan region lies about 30km south Cairo. At this region there are many factories which discharge their wastes in the Nile water leading to a continuous change in water quality. In the investigated area, monthly samples (from June 1997 to May 1998) were collected from each side {East (E) and West (W)} of Nile stream at five stations (Fig. 1) representing different environmental conditions according to their distance and position from the discharging point of Iron and Steal Factories (Table 1). Besides, during the priod of study, the colour of both water and sediment at the locality 2E was red during the whole period of study. Samples were collected from the middle of the river stream (the main channel) during the first two months but no fauna was recorded.

Meiofauna sampling:

Meiofauna samples were collected by Ekman grab. An area of 0.0033 m^2 from the upper sediment's surface of each locality was investigated.

Treatment of samples:

Samples were stained with Rose Bengal (1gm /L) and were preserved in 4% formalin solution. In laboratory, samples were washed with water and passed through two sieves, the upper one with 500 µm mesh size (captured the macrofauna) and the lower one with a mesh opening of 55µm. Sediments retained on the lower sieve were diluted with water to 100 ml and few drops of Rose Bengal and formalin were added to them. From each sample, three subsamples (1ml each) were examined separately under a dissecting microscope. Sorted animals were identified as much as possible to species level. Indiveduals of species were counted and the average total density was expressed in number of organisms /10 cm^2. Mean individual fresh weight of each species was determined by means of mettler microbalance (accuracy 0.1mg). More than twenty specimens of every taxon were randomly picked out and weighed. The weight of one organism was calculated and the average total weight was expressed in mg fresh wt /10 cm^2.

RESULTS

Species Composition:

Free living Nematoda and Ostracoda were the main groups of meiofauna in the area investigated. Numerically, they were represented by 66.3% and 32.1% of the total number of meiofauna in the area respectively. Very few individuals of harpacticoid copepods appeared in the area (only on three occasions and in a condition difficult to be identified). Concerning biomass, Ostracoda occupied the first position contributing 55.5% of the total biomass of meiofauna in the area, followed by Nematoda (42.9% of the biomass of meiofauna). Ostracods were mainly represented by three species namely *Cyprideis torosa* (Jones, 1850), *Chlamydotheca unispinosa* Baired, 1862 and *Cypretta bilicis* Furtos, 1936 , all of them belong to family Cyprididae and affiliated to order Podocopa.

Spatial and temporal distribution of total meiofauna:

The population density (P.D.) and biomass of total meiofauna in the sampled localities are given in Table 2. The average P. D. and biomass of total meiofauna in the whole area during the whole period of study were 27.3 organisms /10 cm^2 and 5.06 mg/10cm^2 respectively. Three peaks were recorded in the area, the highest one (40.2 organisms /10 cm^2) was observed in 1E, the second and third ones (37.47 and 35.19 organisms /10cm^2) were observed in 2E and 5E respectively (Fig. 2). In the other localities, the average P.D. of meiofauna during the whole period of study fluctuated between 29.32 organisms /10cm^2 and 12.79 organisms /10 cm^2 (Table 2). Concerning biomass, the maximum values (8.01, 6.73, 6.42 and 6.25 mg /10cm^2) were estimated in 5W, 2E, 5E and 3E respectively, while the lowest biomass (2.15 mg /10cm^2) was recorded in 4W (Fig. 2).

Regarding temporal distribution of meiofauna, summer and early autumn were the most productive seasons, showing peaks during July and September (Fig. 3). A slight decrease was recorded during winter months. The minimum values were recorded during November, February and April. The temporal average biomass for the whole area followed the same trend of P.D. with some deviations. Two biomass peaks (9.37 and 9.49 mg /10cm^2) were respectively observed in June and July 1997 (Fig. 7).

Spatial and temporal distribution of the recorded taxa:

A. Nematoda

Table 3 shows the monthly P.D. and biomass of nematodes in each sampled locality. The average P.D. and biomass of Nematoda for the whole area during the whole period of study were 18.08 organisms /10cm^2 and 2.17 mg fresh wt / 10cm^2 respectively. The average standing crop fluctuated between 38.4 organisms /10cm^2 in 1E and 8.23 organisms /10cm^2 in 3W weighing 4.16 mg /10cm^2 and 0.99 mg /10cm^2 respectively.

Concerning the temporal distribution of average nematode's crop in the whole area of investigation, two peaks were observed. The higher one (41.22 organisms /10cm^2 weighing 4.95 mg /10cm^2) appeared in September and the lower one (31.84 organisms /10cm^2 weighing 3.82 mg /10cm^2) appeared in July (Fig. 5). The minimum values of P.D. and biomass were estimated in November (Fig. 5).

B. Ostracoda

The average P.D. and biomass for the whole area during the whole period of study were 8.74 organisms /10cm^2 and 2.81 mg /10cm^2 respectively (Table 4). The localities 2E, 2W, 5E and 5W were the most favorable grounds for ostracods in the area where P.D. fluctuated between 10.97 and 18.43 organisms /10cm^2 and the biomass ranged from 1.79 and 6.71 mg /10cm^2 (Table 4 and Fig. 6). The localities 1W, 3W and 4W were approximately similar in average P.D. for the whole period of study (Fig. 6). The minimum value of Ostracoda was estimated in 1E where 1.83 organisms /10 cm^2 weighing 0.66 mg /10cm^2 were calculated (Table 4 and Fig. 6).

As regards temporal variation, a high peak (23.12 organisms /10 cm^2 weighing 8.16 mg /10 cm^2) appeared during June (Fig. 7), while in the other months, P. D. ranged from 13.40 to 2.01 organisms /10 cm^2 (Table 4) and biomass trend followed the same trend of P. D (Fig. 7).

B.1. *Cyprideis torosa* (Jones, 1850)

Numerically, *Cyprideis torosa* was the most dominant ostracod species in the area, having an average standing crop, in the whole area of study during the whole period of investigation, of 3.9 organisms /10 cm^2 weighing 0.47 mg /10 cm^2 (Table 5). This species constituted about 42 % and 17 % of P. D. and biomass of total ostracods respectively. Table 5 shows that 2 W was the flourishing locality for *C. torosa* where 8.23 organisms /10 cm^2 weighing 1.0 mg /10 cm^2 represented the standing crop.

Two peaks, each of 8.04 organisms /10cm^2 weighing 0.97 mg /10cm^2 were estimated during June and October (Table 6).

B.2. *Chlamydotheca unispinosa* Baird, 1862

According to weight, *Chlamydotheca unispinosa* occupied the first position, but in order of P. D. it was next to *Cyprideis torosa. C. unispinosa* constituted about 46 % and 78 % of the total P. D. and biomass of ostracods in the area, respectively. Although the difference between P. D. of *Cyprideis torosa* and *C. unispinosa* was not high, the biomass of *Chlamydotheca unispinosa* constituted more than 4 times the biomass of *Cyprideis torosa.* Table 7 shows that 5W and 3E are the most productive localities in the area, where 9.22 and 6.4 organisms of one organism /10 cm^2 weighing about 0.5 mg /10 cm^2 was recorded in each locality.

Table 8 shows that for the whole area, two peaks occurred, the highest one (11.06 organisms /10 cm^2 ,weighing 6.61 mg /10 cm^2) was in June and the next one (8.38 organisms /10 cm^2 weighing 5.03 mg /10 cm^2) was in July.

B.3. *Cypretta bilicis* Furtos, 1936

Few individuals of *Cypretta bilicis* were recorded in the area during the period of study with an average of one organism /10 cm^2 weighing 0.14 mg /10 cm^2. This species constituted about 12 % and 5.0 % of the total P. D. and biomass of Ostracoda in the area respectively. It was totally absent from 1E, 1W, 3E, 3W and 4E during the whole period of study. In the other localities, P. D. fluctuated between 0.84 and 3.53 organisms /10 cm^2 and the biomass ranged from 0.12 to 0.47 mg /10 cm^2 (Table 9).

Regarding the monthly variation, *Cypretta bilicis* has disappeared totally from the whole area during September and October 1997 and from January to April 1998. The persistence of *C. bilicis* in the whole area was confined to June, July, August, November and December 1997 with few individuals (Table 10).

C. Harpacticoid copepods

Only three organisms of harpacticoid copepods were captured in the area of study during the whole period of investigation. (in 3E during April and in 5E during January and May).

DISCUSSION

Compared with Qarun Lake (Fishar, 2000), the benthic meiofauna in the Nile River at Helwan region is very poor This may be attributed to the impact of the industrial and domestic discharges in the area. Gray (1981) related the decline in benthic meiofauna density and diversity to the impact of several types of pollution. As well, the interaction between meiofauna and macrofauna seems to influence the distribution of meiofauna. Giere (1993) indicated that macrobenthos organisms decrease the number of meiobenthos through mechanical disturbance of sediment. A high significant negative correlation ($r= -0.28$, $P<0.01$) was revealed between the total number of macrobenthos and meiobenthos in the sampled area (unpublished data). This agrees with Fishar (1999) working in Manzala Lake. Moreover, Gee (1989) reviewed the importance of fish as predators on meiofauna taxa. As the abundance of meiofauna might increase, its role in the small food web becomes more important. So its weak representation in the area may be due to its predation by fish.

In the present study, meiofauna showed its P. D. peaks during July and September. This agrees with the results of Rudnick *et al.* (1985) who recorded high meiofaunal densities in some coastal marine ecosystems during summer. Fishar (1999 & 2000) recorded the highest level of meiofauna abundance during June and July and attributed that to the rapid rise in water temperature which was accompanied by abundant food supply.

As far as the available literature, no studies have been so far carried out on the freshwater benthic nematodes in Egypt, while they are are only numerous on the soil and phytoparasitic nematodes (Heiba, 1991). Though they are of considerable ecological importance. They were poorly investigated, partly due to problems of identification. The increase in numbers of nematodes will increase bioturbation (Gullen, 1973), nutrient remineralization (Warwick and Price, 1978; Platt and Warwick, 1980) and sustain bacterial growth (Gerlach, 1978). In the present study, Nematoda dominated the meiofauna and were distributed in all sampling localities. This high abundance of nematodes agrees with the finding of Giere (1993) and Smol *et al.* (1994) who stated that nematodes usually dominated all meiofauna samples occurring in each substrate and sediment and in all climatic zones.

Numerically, Ostracoda ranked the second position of total meiofauna in the area after Nematoda. They showed the highest P. D. during June and July. Smol *et al.* (1994) stated that the abundance peak of Ostracoda was noted either in spring, summer or autumn and their minimum P. D. was always observed in winter. The grain size of sediment is a primary factor affecting the abundance and species composition of meiofauna organisms. Martens and Tudorancea (1991) and Fishar (2000) concluded that ostracods in Zwai Lake and Qarun lake, respectively, were the most abundant inhabitants in medium coarse sand. This disagrees with the present findings where a highly significant weak negative correlation ($r = -0.1198$, $P < 0.01$) was revealed between Ostracoda and percentage of sand grain in the bottom sediment.

Three species of Ostracoda (*Cyprideis torosa, Chlamydotheca unispinosa* and *Cypretta bilicis*) were recorded in the area. The first one was the most abundant. In Egypt, its record dates back to El Shebrawy (1996) in the second lake of Wadi El Rayan and Fishar (2000) in Qarun Lake. That proves that *C. torosa* is extremely euryhaliine species. Samaan (1977) recorded *Cyprideis littoralis* in Edku Lake. All the previous studies recorded the highest P. D. of *Cyprideis* during summer and autumn. This is in support with the present results, where the highest P. D. was noticed in June and October. In the present study *C. torosa* showed the highest population density in the localities 2W and 2E where the lowest current flow was recorded. This agrees with the behavior of this species in Wadi El Rayan lakes where it disappeared from the localities with high water velocity (El Shebrawy, 1993). According to biomass, the second species (*Chlamydotheca unispinosa*) ranked the first position before *Cyprideis torosa*. This is atributed to the heavier individuals of *C. unispinosa* compared with those of *C. torosa*. Fishar (1995) recorded *C. unispinosa* in Nasser Lake and found an interspecific relationship between this species and the gastropod mollusc *Valvata nilotica* Jickeli, 1874. In the present study, this relation is clear where stations 5 and 3 showed the lowest P. D. of *V. nilotica* (unpublished data) while they contained the highest P. D. of *C. unispinosa*. Also the temporal distribution of standing crop indicates that June and July were the flourishing time for *C. unispinosa*, while no *V. nilotica* was recorded during these months (unpublished data). In brief, there is a negative correlation ($r= -0.336$, $P<0.05$) between *C. unispinosa* and *V. nilotica* (unpublished data). The ostracod prefers the snail's faeces and may attack the snail's body to get its food. Such relation agrees with Janz (1992) who found a negative relation between the ostracod *Cypria ophthalm* and the gastropod *Gyralus crista*. The third species of Ostracoda (*Cypretta bilicis*) was recorded in the area with few scattered specimens during the present study. It was previously recorded from Meinofia and Gharbyia canals (Heiba, 1991).

Very few individuals of harpacticoid copepods were captured during spring and winter months. This agrees with Khalifa (2000) who found that planktonic Copepoda was few if compared with Rotifera or Cladocera in the same area during the same period of study. This may be attributed to heavy pollution in Helwan region. Smol *et al*. (1994) stated that Nematoda/Copepoda ratio (N/C) as a monitor of pollution has to be used with precaution. Within the unpolluted Oosterschold River the N/C ratio exhibited an important variation and reached peak values, which according to Raffaelli and Mason (1981) are charachteristic for polluted situation. In the present study, the scarce occurrence (nearly absence) of harpacticoid copepods makes the N/C ratio reaches its maximum value, indicating heavy polluted area.

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Table (1): Area investigated and average physicochemical variables in the sampled localities { St.= Station, Loc.= Locality, E.= eastern side of the station, W.= western side of the station, W.D.= Water depth (cm.), T.S.= Type of sediments, M.S = Muddy sand, S.M.= Sandy mud, C.S.= Current speed (cm/ sec.), Tr.= Transparency (Cm.), T.= Temperature (C^0),Con.= Conductivity (Mohs/cm),DO_2= Dissolved Oxygen (mg./l)}.

St.	1 1km. upstream of discharging point of Iron and Steal Factories.		2 1 km. northern to St. 1. In front of discharging point.		3 3.5 km. northern to St.1. Under El Marazeek Bridge.		4 5 km. Northern to St. 1. At Helwan Cement Factory.		5 10 km. northern to St. 1. At Farouk Corner.		Average
Loc.	E	W	E	W	E	W	E	W	E	W	
W.D	334.2	204.6	160.4	241.3	163.3	230	238.3	310.4	187.5	267.9	
T. S	M.S.	M.S.	S.M.	S.M.	M.S.	M.S.	M.S.	M.S.	M.S.	M.S.	
C. S.	1.37		1.14		1.32		1.26		1.38		1.29
Tr.	73.3	67.8	55.8	81.3	61.0	70.3	71.8	69.3	75.2	69.5	69.53
T.	23.4	23.5	23.6	23.6	23.8	23.6	23.14	23.07	23.11	23.06	23.56
Con.	353.3	337.3	508.3	388.0	357.0	349.3	368.5	349.5	357.0	348.0	371.7
PH	8.09	8.21	8.05	8.09	8.09	8.16	8.03	8.18	8.18	8.3	8.16
$D.O_2$	8.37		7.35		8.49		8.04		8.32		8.11

Table (2) : Monthly population density (P.D.= organisms/10cm^2) and biomass (Bio= mg./10cm^2) of total meiofauna in the area investigated (St.= Station, Loc.= Locality, E = eastern side, W = western side, n.c.= not collected, Av.= Average).

St.		1				2				3				4				5				Av.	
Loc.		E		W		E		W		E		W		E		W		E		W			
Month		P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.	P.D.	Bio.
1997	Jun	0	0	10.05	1.12	50.27	15.89	0	0	20.11	7.24	20.11	2.41	70.37	13.3	20.11	2.42	40.21	9.85	100.5	41.42	33.18	9.37
	Jul.	30.16	8.44	70.37	8.44	n.c	n.c	n.c.	n.c	n.c.	n.c.	n.c.	n.c	50.27	10.86	0	0	50.27	10.86	70.37	18.31	45.24	9.49
	Aug.	50.27	6.03	30.16	3.62	0	0	10.05	1.21	20.11	2.41	20.11	2.41	10.05	1.21	10.05	1.41	60.32	12.06	30.16	3.62	24.13	3.4
	Sep.	211.1	25.33	70.37	13.27	40.21	14.49	30.16	3.62	10.05	1.21	10.05	1.21	30.16	8.44	20.11	7.24	40.21	4.83	40.21	4.83	50.27	8.45
	Oct.	70.37	8.45	0	0	10.05	1.21	30.16	3.62	60.32	16.9	10.05	1.21	20.11	2.42	10.05	1.21	40.21	9.65	10.05	1.21	26.14	4.59
	Nov.	10.05	1.21	0	0	10.05	1.21	0	0	10.05	6.03	10.05	1.21	0	0	40.21	4.83	20.11	7.44	20.11	7.24	12.06	2.92
	Dec.	0	0	0	0	70.37	13.27	60.32	19.71	20.11	2.41	40.21	14.48	50.27	6.04	20.11	1.41	40.21	9.65	10.05	1.21	31.17	6.82
1998	Jan	70.37	8.44	30.16	18.1	120.6	14.48	50.27	6.03	0	0	20.11	2.41	10.05	1.21	0	0	30.16	1.61	10.05	1.21	34.18	5.35
	Feb.	0	0	0	0	10.05	1.21	10.05	1.21	110.6	18.1	0	0	0	0	0	0	10.05	1.21	0	0	14.07	2.17
	Mar.	n.c.	n.c	n.c.	n.c.	50.27	6.04	30.16	3.62	20.11	2.41	10.05	6.03	80.43	9.65	50.27	6.03	10.05	1.21	0	0	31.42	4.37
	Apr.	0	0	10.05	1.21	20.11	2.41	10.05	1.21	30.16	6.03	0	0	30.16	3.62	10.05	1.21	0	0	0	0	11.06	1.57
	May	0	0	0	0	30.16	3.82	40.21	3.62	10.05	6.03	0	0	0	0	0	0	80.43	8.64	60.32	17.1	22.12	3.92
Av.		40.21	5.26	20.11	4.16	37.47	6.73	24.68	3.99	28.33	6.25	12.79	2.85	29.32	4.73	15.08	2.15	35.19	6.42	29.32	8.01	27.25	5.06

Table (3): Monthly population density (P.D.= organisms/10cm2) and biomass (Bio.= mg./10cm2) of Nematoda in the area investigated (E = eastern side, W = western side).

Station		1				2				3				4				5				Average	
Location		E		W		E		W		E		W		E		W		E		W			
Month		P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.
1997	Jun.	0	0	10.05	1.21	0	0	0	0	10.05	1.21	20.11	2.41	30.16	3.62	10.05	1.21	20.11	2.41	0	0	10.05	1.21
	Jul.	20.11	2.41	70.37	8.44	n.c.	n.c.	n.c.	n.c.	n.c	n.c.	n.c.	n.c.	40.21	4.83	0	0	30.16	3.62	30.16	3.62	31.84	3.82
	Aug.	50.27	6.03	20.11	2.41	0	0	10.05	1.21	20.11	2.41	20.11	2.41	10.05	1.21	0	0	30.16	3.62	30.16	3.62	19.1	2.29
	Sep	211.1	25.33	60.32	7.24	10.05	1.21	30.16	3.62	10.05	1.21	10.05	1.21	0	0	10.05	1.21	30.16	3.62	40.21	4.83	41.22	4.95
	Oct	60.32	7.24	0	0	0	0	0	0	40.21	4.83	0	0	10.05	1.21	10.05	1.21	30.16	3.62	0	0	15.08	1.81
	Nov.	10.05	1.21	0	0	0	0	0	0	0	0	0	0	0	0	30.16	3.62	0	0	0	0	4.02	0.48
	Dec	0	0	0	0	60.32	7.24	0	0	20.11	2.41	20.11	2.41	40.21	4.83	10.05	1.21	20.11	2.41	10.05	1.21	18.1	2.17
1998	Jan.	70.37	8.44	0	0	110.6	13.27	30.27	6.03	0	0	20.11	2.41	10.05	1.21	0	0	0	0	0	0	26.14	3.14
	Feb.	0	0	0	0	10.05	1.21	10.05	1.21	90.48	10.86	0	0	0	0	0	0	10.05	1.21	0	0	12.06	1.45
	Mar.	n.c.	n.c.	n.c.	n.c.	40.21	4.83	0	0	20.11	2.41	0	0	80.43	9.65	50.27	6.03	0	0	0	0	23.88	2.87
	Apr.	0	0	10.05	1.21	20.11	2.41	10.05	1.21	0	0	0	0	30.16	3.62	0	0	0	0	0	0	7.04	0.84
	May	0	0	0	0	20.11	2.41	30.16	3.62	0	0	0	0	0	0	0	0	70.37	8.44	20.11	2.41	14.04	1.68
Average		38.39	4.16	15.54	1.86	24.68	2.96	12.79	1.53	19.19	2.3	8.23	0.99	20.94	2.51	10.05	1.21	20.11	2.41	10.89	1.31	18.08	2.17

Table (4): Monthly population density (P.D.= organisms/10cm2) and biomass (Bio.= mg./10cm2) of Ostracoda in the area investigated (E = eastern side, W = western side, n.c.= not collected).

	St.	1				2				3				4				5				Average	
	Loc.	E		W		E		W		E		W		E		W		E		W			
	Mo.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.	P.D.	Biom.
1997	Jun.	0	0	10.05	1.21	0	0	0	0	10.05	1.21	20.11	2.41	30.16	3.62	10.05	1.21	20.11	2.41	0	0	10.05	1.21
	Jul.	20.11	2.41	70.37	8.44	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	40.21	4.83	0	0	30.16	3.62	30.16	3.62	31.84	3.82
	Aug.	50.27	6.03	20.11	2.41	0	0	10.05	1.21	20.11	2.41	20.11	2.41	10.05	1.21	0	0	30.16	3.62	30.16	3.62	19.1	2.29
	Sep.	211.12	25.33	60.32	7.24	10.05	1.21	30.16	3.62	10.05	1.21	10.05	1.21	0	0	10.05	1.21	30.16	3.62	40.21	4.83	41.22	4.95
	Oct.	60.32	7.24	0	0	0	0	0	0	40.21	4.83	0	0	10.05	1.21	10.05	1.21	30.16	3.62	0	0	15.08	1.81
	Nov.	10.05	1.21	0	0	0	0	0	0	0	0	0	0	0	0	30.16	3.62	0	0	0	0	4.02	0.48
	Dec.	0	0	0	0	60.32	7.24	0	0	20.11	2.41	20.11	2.41	40.21	4.83	10.05	1.21	20.11	2.41	10.05	1.21	18.1	2.17
1998	Jan.	70.37	8.44	0	0	110.59	13.27	50.27	6.03	0	0	20.11	2.41	10.05	1.21	0	0	0	0	0	0	26.14	3.14
	Feb.	0	0	0	0	10.05	1.21	10.05	1.21	90.48	10.86	0	0	0	0	0	0	10.05	1.21	0	0	12.06	1.45
	Mar.	n.c.	n.c.	n.c.	n.c.	40.21	4.83	0	0	20.11	2.41	0	0	80.43	9.65	50.27	6.03	0	0	0	0	23.88	2.87
	Apr.	0	0	10.05	1.21	20.11	2.41	10.05	1.21	0	0	0	0	30.16	3.62	0	0	0	0	0	0	7.04	0.84
	May	0	0	0	0	20.11	2.41	30.16	3.62	0	0	0	0	0	0	0	0	70.37	8.44	20.11	2.41	14.04	1.68
Average		38.39	4.16	15.54	1.86	24.68	2.96	12.79	1.53	19.19	2.3	8.23	0.99	20.94	2.51	10.05	1.21	20.11	2.41	10.89	1.31	18.08	2.17

Table (5): Average population density (P.D.= organisms/ $10cm^2$) and biomass (Bio. = mg/$10cm^2$) of *Cyprideis torosa* in the sampled localities during the whole period of study (St. = station, Loc. = locality, E = eastern side, W = western side).

St.	Loc.	P.D.	Bio.
1	E	0.91	0.11
	W	0.91	0.11
2	E	6.40	0.77
	W	8.23	0.99
3	E	0.91	0.11
	W	1.83	0.22
4	E	5.87	0.70
	W	2.51	0.30
5	E	5.86	0.71
	W	5.86	0.71
Average		3.39	0.47

Table (6): Monthly population density (P.D.=organisms/10 cm^2) and biomass (Bio.= mg/$10cm^2$) of *Cyprideis torosa* in the whole area of investigation from June 1997 to May 1998.

Mon.	P.D.	Bio.
Jun.	8.04	0.97
Jul.	3.35	0.40
Aug.	3.02	0.36
Sep.	4.02	0.48
Oct.	8.04	0.97
Nov.	4.02	0.48
Dec.	5.03	0.60
Jan.	3.02	0.36
Feb.	1.01	0.12
Mar.	6.28	0.76
Apr.	1.08	0.13
May	1.08	0.13

Table (7): Average population density (P.D.= organisms /$10cm^2$) and biomass (Bio.= mg/$10cm^2$) of *Chlamydotheca unispinosa* in the sampled localities during the whole period of study (E = eastern side, W = western side).

St.	Loc.	P.D.	Bio.
1	E	0.91	0.55
	W	3.67	2.20
2	E	4.57	2.74
	W	0.91	0.55
3	E	6.40	3.84
	W	2.74	1.64
4	E	2.51	1.51
	W	0.84	0.50
5	E	5.03	3.02
	W	9.22	5.53
Average		3.68	2.21

Table (8): Monthly population density (P.D.= organisms /$10cm^2$) and biomass (mg/$10cm^2$) of *Chlamydotheca unispinosa* in the whole area of investigation from June 1997 to May 1998.

Mo.	P.D.	Bio.
Jun.	11.06	6.61
Jul.	8.38	5.03
Aug.	1.01	0.61
Sep.	5.03	3.02
Oct.	3.02	1.81
Nov.	3.02	1.81
Dec.	4.02	2.41
Jan.	3.02	1.81
Feb.	1.01	0.61
Mar.	1.26	0.76
Apr.	1.01	0.61
May	3.02	1.81

Table (9): Average population density (P.D.= organisms/$10cm^2$) and biomass (Bio.= mg/$10cm^2$) of *Cypretta bilicis* in the sampled localities during the whole period of study (E = eastern side, W = western side)

St.	Loc.	P.D.	Bio.
1	E	0.00	0.00
	W	0.00	0.00
2	E	1.83	0.26
	W	1.83	0.26
3	E	0.00	0.00
	W	0.00	0.00
4	E	0.00	0.00
	W	0.84	0.12
5	E	1.68	0.24
	W	3.53	0.47
Average		0.95	0.14

Table (10): Monthly population density (P.D.= organisms/$10cm^2$) and biomass (Bio.= mg/$10cm^2$) of *Cypretta bilicis* in the whole area of investigation from June 1997 to May 1998.

Mon.	P.D.	Bio.
Jun.	4.02	0.56
Jul.	1.68	0.24
Aug.	1.01	0.14
Sep.	0.00	0.00
Oct.	0.00	0.00
Nov.	1.01	0.14
Dec.	2.01	0.28
Jan.	0.00	0.00
Feb.	0.00	0.00
Mar.	0.00	0.00
Apr.	0.00	0.00
May	2.01	0.28

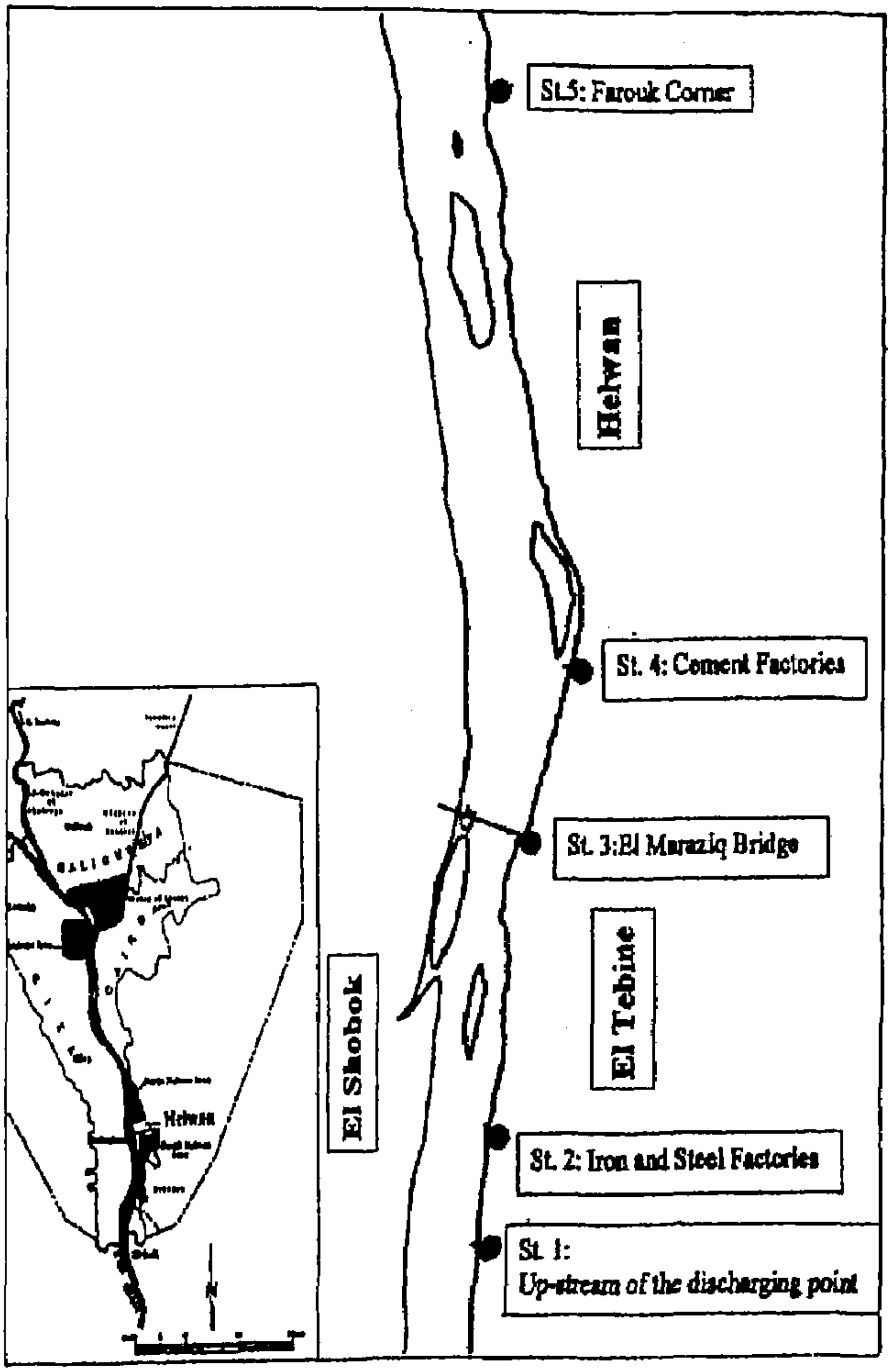

Figure 1: Schematic map showing the position of Helwan region and sampling stations.

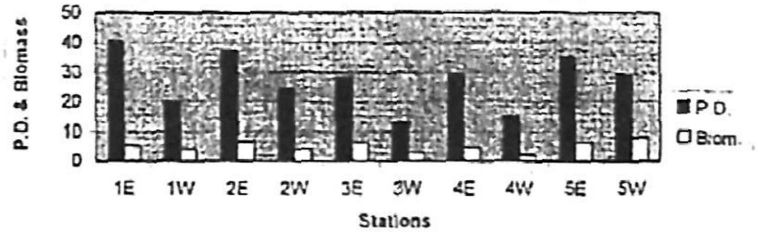

Fig. (2): Average population density (P.D.= Organism/10 cm2) and biomass (Biom.= mg./10 cm2) of total meiofauna during the whole period of study.

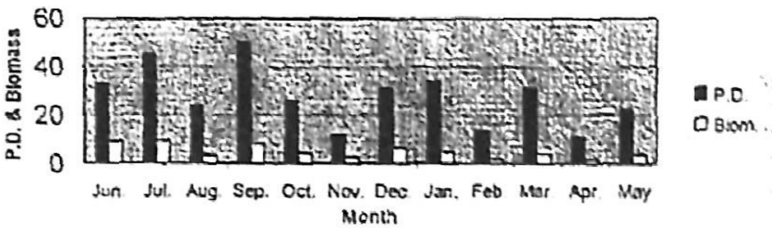

Fig. (3): Average monthly population density (organism/10 cm2) and biomass (mg./ 10cm2) of total meiofauna in the whole area of investigation

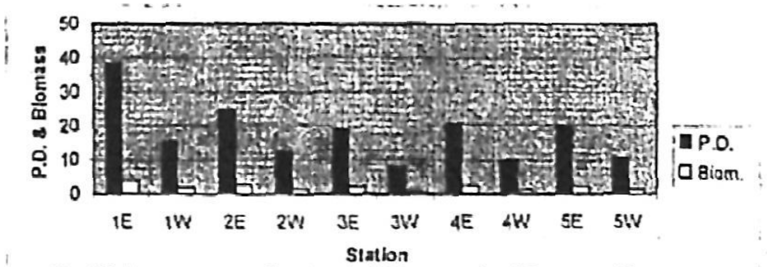

Fig. (4): Average population density (P.D.= organism/10 cm2) and biomass (Biom.= mg./10 cm2) of total Nematoda during the whole period of study.

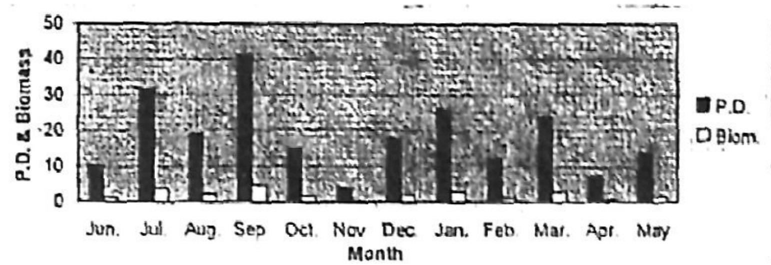

Fig. (5): Average monthly population density (organism/10 cm2) and biomass (mg./10 cm2) of total Nematoda in the whole area of investigation

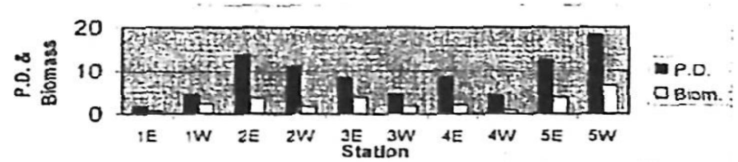

Fig. (6): Average population density (P.D.= organism / 10 cm2) and biomass (Biom.= mg./ 10 cm2) of total Ostracoda during the whole period of study.

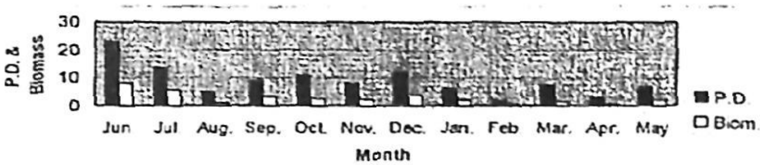

Fig. (7): Average monthly population density (organism/10 cm2) and biomass (mg./10cm2) of toal Ostracoda in the whole area of investigation.