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Meiobenthic Aquatic Annelids Community in River Tigris Baghdad province / Iraq

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Abstract:

A number of 3649 individuals of meiobenthic aquatic annelids worms were sorted from 40 samples of the aquatic plant *Ceratophyllm demersum L.* collected monthly from four different sites across River Tigris in Baghdad province during a period from February /2017 until December /2017. The sorted worms were identified to 16 species, 10 of them represented Subfamily Naidinae (58%), including *Chaetogaster diastrophus, Paranais litoralis, Stylaria lacustris, S. fossularis, Ophidonais serpentina, , Nais simplex, Nais variabilis, Allonais inaequalis, , Dero (Dero) digitata, Dero (Aulophorus) furcata, Slavina appendiculata* and *Stephensoniana trivandrana* . Two species of pristininae *Pristina longiseta, and P. aequiseta,* also identified and recorded a percentage of 6%, in addition to two species of family Aeolosomatidae, *Aeolosoma variegatum*, and *A.hemprichi* with a percentage of 36%. The result revealed that *Aeolosoma variegatum* was the most abundant species and recorded 1209 individuals with a percentage of 33.13%, followed by *Stylaria lacustris* and *Cheatogaster diastrophus* , which they recorded a total individuals number of 621 and 569 with a percentages of 17.01& 15.59% respectively, while the lowest percentage of individual number was recorded by *Allonais inaequalis* (0.71%). The highest individual numbers were recorded in July and August of 526 & 644 respectively. Site No.2 recorded the highest species richness (16 species) and highest individuals' number of 1127. The study was also included measure of the physicochemical parameters such as air temperature, water temperature, biochemical oxygen demand (BOD),PH, salinity, electrical conductivity (EC), ,turbidity, total suspended substance

(TSS) and total dissolved substance (TDS). The result showed that the air temperature were (9.5-47) C°, water temperature (8.67-31.16)C° , BOD (0.46-4.7) mg/l,PH (7.941-8.125), salinity (0.2-0.4), EC (562-1043) ms/cm, ,Turbidity (6.92-215)NUT,TSS (1-94) mg/l and TDS(359-807)mg/l.

Keywords;Meiobenthic, Aquatic Annelids, River Tigris, Naidinae, pristininae, Aeolosomatidae..

Introduction

Meiobenthos are tiny benthic invertebrates that exist in both marine and fresh water environments. They are bigger than microfauna but lesser than macrofauna, They are organisms that can pass during a 1 mm mesh but will be retained by a 45 μm mesh, but the accurate dimensions will vary from researcher to researcher [1]. Freshwater meiofauna communities are usually dominated by rotifers, harpacticoid and cyclopoid copepods, young chironomids, naidid and enchytraeid oligochaetes, and nematodes [2&3]. Among freshwater Annelid worms, Naidid and Enchytraeid worms (class Clitellata , subclass Oligochaeta) in addition to Family Aelosomatid worms were considederd as Meiobenthos since they are difficult to detect in the samples by the necked eye. Naidid worm previously represent the family Naididae , but Since 2008 the classification of aquatic oligochaetes has been changed. International Commission of Zoological Nomenculture (ICZN) blended the two previous families Tubificidae and Naididae into one family, family Naididae, comprised the subfamily Naidinae; subfamily Tubificinae and subfamily Pristininae [4]. The later subfamily regarded by [5] as a genus of family Naididae comprising 23 species, and as two separate genera by [6], *Pristina* with proboscis comprises 21 spp. and *pristinella* without proboscis with 7 spp. , while [7] *omitted* genus *Pristina* from family Naididae as recommended by [8], Species of Family Aeolosomatidae, may be handled as an independent class, Aphanononeura [5], which are comparatively very minute and translucent, illustrate by the occurrence of hair chaetae in both dorsal and ventral bundles, ciliated prostomium and the existence of coloured epidermal glands. Enchytraeids are semiaquatic worms, common in marginal aquatic habitats as marshes, small streams, springs, and interstitial waters along the margins of streams, and they are found occasionally in the sediments of lakes and rivers as well. [8] .

During the last decade a huge increase interest in the meiofauna around the world were noted, which often dominates benthic animal communities in terms of numbers and species richness and play roles in community and ecosystem [1&3]. Studies on meiobenthos were initiated in 2008 within the scope of studies on factors influencing the productivity, trophic relations, and feeding spectra [3]. Researches on aquatic meiobenthos annelids are depended on its significant role in aquatic ecosystem, due to their importance in aquatic food chains; their impact on sediment structure; and their potential to reduce sludge volumes in sewage treatment systems; in addition to their role as intermediate host for several fish parasites (9). Some of them like naidid species act as bioindicator for various type of pollution and they are used for pollution monitoring and assessment [5]. In Iraq, most of studies deals with the identification, and focus on the abundance of family Naididae as benthos invertebrate [10&11] refer to this family in Euphrates River , [12,13&14] in Tigris River. The present study comes to add a new scope on the relation between the species richness of meiobenthic aquatic oligochaetes and the environmental variables in River Tigris, within Baghdad City.

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Material and Methods

Four sites on the Tigris River within the city of Baghdad were selected to conduct the present study including (S1), upstream , Near Al – Muthana Bridge, (S2), Near Al-Sarafiya Bridge, (S3), Near Al-Shuhada'a Bridge, the two lastsites represented the midstream, while the last site (S4), downstream, at Al-Dora, near Al-Dora power station (plate 1).

Plate (1): Sampling sites across Tigris River, Baghdad City (www.googleearth.com)

Samples of aquatic plant *Ceratophyllm demersum L.* collected monthly from each study sites during a period from February /2017 to December /2017 between 9 am until 12 pm by hand digger, and placed in a plastic container, with a little amount of river water, then transferred to the laboratory where they are placed into four aquaria of (40X20X20 cm) and left for about 7-10 days to allow the worms to settle down. Air pump is used to ventilate water in each aquarium. The settled sediment on the floor of aquarium is collected carefully by fine dropper and transferred to a clean petri dish that contain little amount of tap water. The worms were sorted carefully under simple microscope, finally, preserved according to [15]. For identification, permanent slides were prepared as mentioned in [15], then the samples were examined under compound microscope and the specimens were identified to species level according to [5, 7 &15]. Water samples were collected in a clean polyethylene bottles that prewashed with distilled water. Before filling those with water samples they were rinsed several times with the river water before filled them with water samples. Samples were analyzed for chemical and physical properties immediately after collection according to [16].

The statistical analysis system program (SAS) was used to reflect the differences of parameter among the sites, least significant difference –LSD test (ANOVA) was used to significant compare between means [17]. Some ecological indices had been used such as Jaccard index- to determine the similarity among the sites, depending on the equation noted in [18], Species richness index (D) was calculated depending on (19),Shannon –Weiner diversity as mentioned in [18]also, the species uniformity index (E) has been detected based on [20].

Results and Discussion

Table (1) shows the maximum and minimum values of the physic-chemical parameters for all study sites with the average of each parameter. The result revealed that there are no significant differences between the study sites in all measured physical and chemical parameters except for the BOD which recorded a significant differences, but for all site this parameter recorded acceptable values ranging between 0.47- 4.7 mg/l and that values was conform what mention in (21). Figure (1) show that 58% of the total identified worm were represented Subfamily Naidinae (F. Naididae) ; 36% referring to family Aeolosomatidae (Aphanononeura : polychaeta), while only 6% were belong to subfamily pristininae (F. Naididae) .

Table (3) illustrates the identified species, the number of individuals of each species in all sites during study period and their occurrence frequencies. A number of 3649 individuals of meiobenthic aquatic annelids worms were sorted and identified as 16 species. According to this table, it is obvious that *Aeolosoma variegatum* was recorded the higher individual number in all sites and reveal a percentage of 77.5% frequency, followed by *Stylaria lacustris* that recorded 569 individuals with occurrence frequency reached to 72.5%, while both *Paranais litoralis* and *Stephensoniana trivandrana* demonstrated the lowest number which were 3 and 14 respectively with occurrence frequency 5% for each one. *P. litoralis* was previously recorded in Iraq by (22) in Iraqi southern marshes; in Euphrates River by (23) and by (24) in Al-Dalmage lake, but it found to be rare species in Tigris river, not noticed by (13, 14 & 25)in Tigris river. Concerning the sites, S2 is the wealthy one with the total of 1127 individuals, represented 16 species. Followed by S4 with total number 705 and 15 species, while S1 and S3 recorded 828 and 989 individuals respectively and they had only 14 species.

This result may attribute to the difference in BOD between the sites. The species richness, Shanon-weiner diversity index (H), and Species uniformity index (E) were recorded very close values in all sites (table 2). Jaccard index shows great similarities between the sites with its values range between 87.5 – 100 % similarities (table 4). Figure (2) shows the number of total worms sorted monthly for the period from February 2017 until December2017.

The highest total worms were sorted in both July and August where the lowest occurred during. Table (3) shows the number of individuals for each species sorted in each month. According to this table ,It was clear that some species was available in all study months such as *S. lacustris* and *O. serpentine*, while *D. (Aulophorus) furcata* and *S,trivandrana* were recorded in a short period of 2-3 months only, the other species were fluctuated between months. The highest species richness values were recorded its highest values of 4.272 and 4.043 in July and August respectively (table 3).

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Table 1. maximum and minimum values ((Max-Min) and (average ±STDV) for the physic-chemical parameters of water in each study site during study period

Parameters	Study sites				LSD
	S1	S2	S3	S4	Value
Air temperature (C°)	16.3-7.7 29.613±7.918 a	16.5-38.03 28.959 ±8.652 a	12.47-47.76 29.381±10.813 a	9.5-45 30.515±9.979 a	3.72 NS
Water temperature (C°)	11.07-30.8 24.039±5.702 a	11.3-30.36 24.05 ±n 6.201 a	10.4-29.66 23.436n±6.016 a	8.67-31.16 24.323±6.598 a	2.94 NS
BOD Mg/l	0.58-4.1 1.826±1.158 ab	0.46-4.7 1.551±1.338 b	0.47-4.5 1.879±1.284 ab	0.88-4-4 2.408±1.119 a	0.643 *
PH	8.125-7.464 7.723±0.233 a	7.941-7.442 7.7009±0.156 a	7.672-7.261 7.522±0.142 a	7.851-7.108 7.6284±0.23 a	0.893 NS
Salinity	0.2-0.5 0.32±0.091 a	0.2-0.4 0.34±0.084 a	0.2-0.4 0.34±0.084 a	0.2-0.4 0.33±0.082 a	0.102 NS
Turbidity (NUT)	12.6-185 64.9±66.13 a	6.92-209 65.634±75.94 a	9.53-174 59.509±62.27 a	13.4-215 70.24±79.84 a	29.78 NS
EC (ms/cm)	562-1043 810.3±147.54 a	587-1040 843.1±142.16 a	587-1038 845.7±145.61 a	586-1040 820.7±130.20 a	183.06 NS
TDS (mg/l)	364-706 535.1±141.54 a	377-775 553.6±121.20 a	359-687 544.7±106.73 a	346-672 518.3±99.76 a	82.17 NS
TSS (mg/l)	2-94 24±27.816 a	6-77 17.8±22.641 a	3-85 19.9±26.065 a	7-82 20±24.66 a	9.27 NS
* (P<0.05), NS: Non-Significant.					

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Table 2. **The number of individuals of meiobenthic aquatic annelids species in all study sites during the study period, with their percentages and frequencies.**

species	Study sites				total	Percentage %	Frequency %
	S1	S2	S3	S4			
Aeolosoma variegatum	163	359	511	176	**1209**	33.13	77.5
A.hemprichi	30	12	20	30	**92**	2.52	25
Chaetogaster diastrophus	189	273	40	67	**569**	15.59	52.5
Stylaria lacustris	113	230	150	128	**621**	17.01	72.5
S. fossularis	22	24	32	56	**134**	3.67	30
Dero (Dero) digitata	45	24	15	89	**173**	4.74	42.5
Dero(Aulophorus) furcata	0	35	2	10	**47**	1.28	12.5
Slavina appendiculata	20	9	5	8	**42**	1.15	20
Paranais litoralis	0	1	0	2	**3**	0.08	5
Nais simplex	49	31	9	15	**104**	2.85	35
Nais variabilis	26	15	12	12	**65**	1.78	27.5
Allonais inaequalis	2	7	15	2	**26**	0.71	2.4
Ophidonais serpentina	59	69	147	62	**337**	9.23	70
Stephensoniana trivandrana	12	2	0	0	**14**	0.38	5
Pristina longiseta	54	20	21	44	**139**	3.80	45
p.aequiseta	44	16	10	4	**74**	2.02	27.5
Total individual number	**828**	**1127**	**989**	**705**	**3649**		
No. of species	**14**	**16**	**14**	**15**	**16**		
Species richness	**4.463**	**4.915**	**4.341**	**4.916**			
Shanon-weiner diversity index(H)	**0.069**	**0.060**	**0.060**	**0.081**			
Species uniformity index (E)	**0.026**	**0.022**	**0.020**	**0.030**			

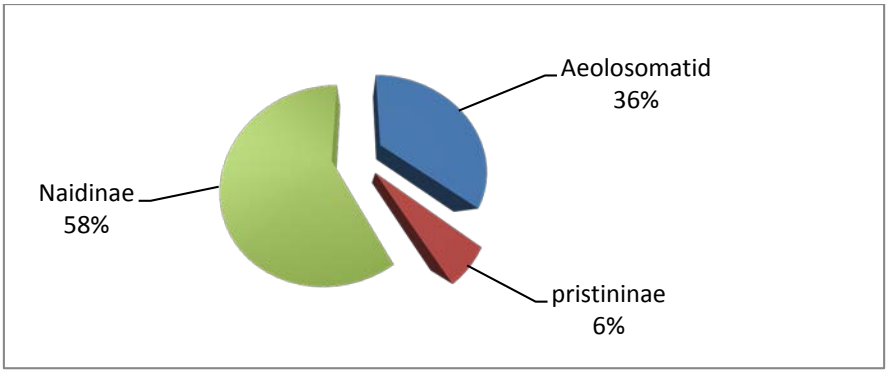

Fig.1 percentage of sorted worms

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Table 3. The number of individuals for each meiobenthic aquatic annelids species and the number of species recorded in each month for a period from Feb. to Nov. 2017

species	2017										total
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
Aeolosoma variegatum	0	0	176	217	196	158	158	210	60	34	**1209**
A.hemprichi	0	0	54	19	19	0	0	0	0	0	**92**
Chaetogaster diastrophus	0	0	100	61	50	92	238	0	28	0	**569**
Stylaria lacustris	191	23	75	13	13	29	30	35	27	185	**621**
S. fossularis	12	71	0	0	0	18	0	0	0	33	**134**
Dero (Dero) digitata	2	2	0	0	22	61	58	5	5	18	**173**
Dero(Aulophorus) furcata	0	0	0	0	0	22	25	0	0	0	**47**
Slavina appendiculata	5	0	0	0	0	5	5	9	0	18	**42**
Paranais litoralis	0	1	0	0	0	0	2	0	0	0	**3**
Nais simplex	1	6	2	0	0	35	35	7	8	10	**104**
Nais variabilis	0	37	0	0	0	10	5	8	0	5	**65**
Allonais inaequalis	0	2	0	0	0	0	0	5	7	12	**26**
Ophidonais serpentina	118	12	22	11	11	43	43	15	22	40	**337**
Stephensoniana trivandrana	0	0	0	0	0	0	2	12	0	0	**14**
Pristina longiseta	0	11	1	0	0	38	33	26	10	20	**139**
p.aequiseta	0	34	0	0	0	15	10	13	2	0	**74**
Total	**329**	**199**	**430**	**321**	**311**	**526**	**644**	**345**	**169**	**375**	**3649**
Number of species	**6**	**10**	**7**	**5**	**6**	**12**	**12**	**11**	**9**	**10**	
Species richness	**1.986**	**3.915**	**2.279**	**1.596**	**2.006**	**4.043**	**4.272**	**3.94**	**3.5911**	**3.497**	
Shanon-weiner diversity index(H)	**0.072**	**0.15**	**0.066**	**0.066**	**0.075**	**0.087**	**0.078**	**0.11**	**0.156**	**0.098**	
Species .uniformity index (E)	**0.023**	**0.065**	**0.034**	**0.041**	**0.042**	**0.035**	**0.03**	**0.046**	**0.071**	**0.043**	

Table 4. Jaccard index values

Sites	1	2	3	4
4	81.25	93.75	93.3	
3	100	87.5		
2	87.5			

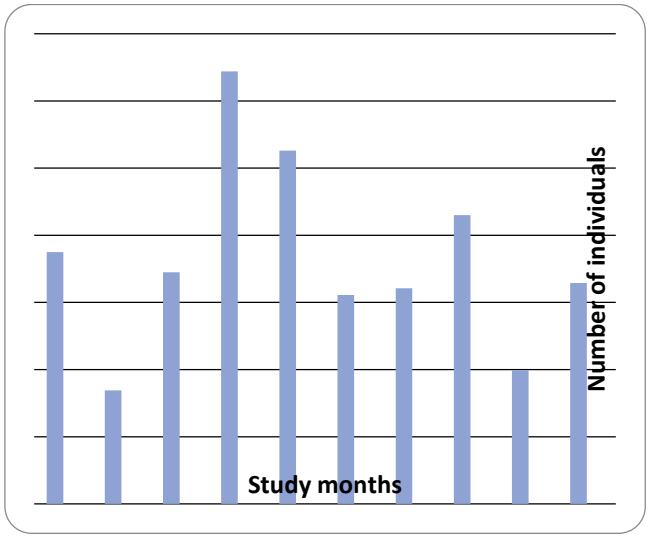

Fig.2 Number of individuals of meiobenthic aquatic oligochaeta sorted in different study months

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