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BENTHIC FAUNA OF ROSETTA NILE BRANCH (EGYPT)

BY

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ABSTRACT

The benthic fauna of Rosetta Nile Branch (Egypt) was estimated seasonally for two successive years between May, 1987 and February, 1989. The community consisted of members of the phyla Annelida (10 species), Arthropoda (8 species) and Mollusca (7 species). Their annual averages amounted to 2,657 org/m^2 during the first year increased to 4,225 org/m^2 in the second one. The total biomass of benthos was high whenever molluscs appeared in abundance due to their big size. Their annual averages were 104.8 and 70.95 g, fresh wt/m^2 for the two successive years respectively. The most dominant species comprised Chaetogaster limnaei and Chironomus larvae. Besides, other species appeared frequently such as Branchiura sowerbyi, Tubifex tubifex, Nais sp. and Bellamya unicolor. Most of the recorded species are muddy bottom dwellers which can tolerate low oxygen content and are widespread in inland waters of Egypt and Nile System.

The benthic fauna showed marked variations in species composition and distribution between the different Nile localities. The highest annual averages were recorded at the littoral infront of Kafr El-Zyat City during the first year (average 8517 org/m^2) mainly due to Chironomus larvae and at the mid-stream site near to El-Khairya Barrage in the second year (average 9,779 org/m^2) as produced by Chaetogaster limnaei. They showed also wide fluctuations from one season to the other, but the higher values were usually observed in summer and autumn.

Results indicate that Rosetta Nile Branch sustained high standing stock of benthos which is attributed to the high fertility of the Nile water.

INTRODUCTION

The Rosetta Nile Branch extends north of El-Khairiya Barrage for about 236 Km along the western boundary of the Nile Delta (Egypt) and it opens finally into Rosetta Estuary through the gates of Edfina Barrage (Fig. 1). It varies in width from 250 to 800 meters with an average of 500 meters. The widest parts lie opposite to Kafr El-Zayat and Dessuk Cities. The branch represents a shallow water stream with a depth fluctuating between 4.5 and 6.0 meters in the midstream.

The bottom sediments range from sandy-silt in the first half of its course to silty-clay in the northern part (Draz, 1983). Since the erection of the High Dam in 1965 most of the flood water has been retained in front of the dam and only small amounts are constantly discharged into Resetta Branch to cover the needs of irrigation as well as industrial and human activities. However, during the period extending from December to February of the following year, the gates of El-Khairiya and Edfina Barrages are opened and excessive amounts of fresh Nile water flow through Rosetta Branch and are discharged into Rosetta Estuary.

Very few investigations were carried out dealing with the spatial and seasonal distribution of benthic fauna in Nile River and these were confined to the works of El-Duweini and Ghabbour (1962), Ishak ***et al.*** (1979) and Iskaros (1988).

The aim of the present work is to carry-out quantitative and qualitative estudies of bottom fauna in the Rosetta Nile Branch in relation to the prevailing physico-chemical conditions, such as water temperature, dissolved oxygen, cholorosity, total alkalinity and pH values.

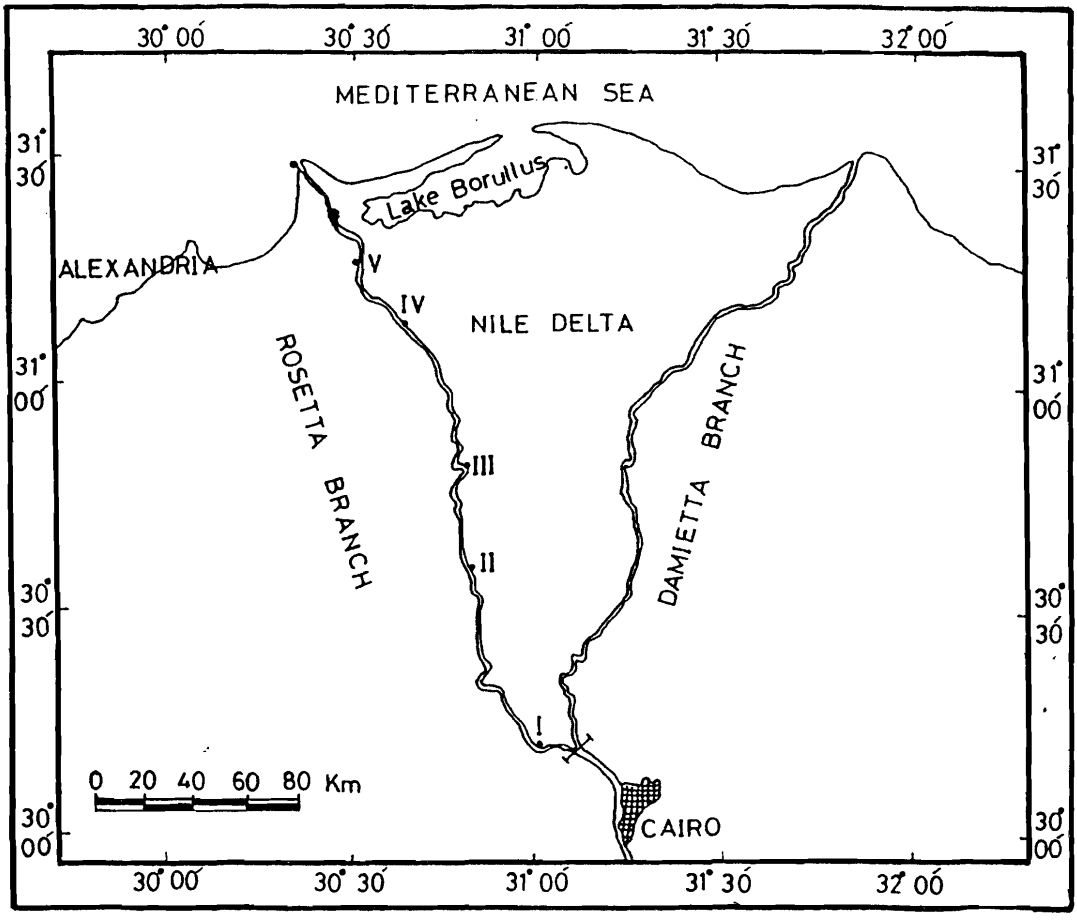

Fig.1 The Nile Delta. Position of stations.
I Al-Kanater El-Khairiya II El-Khatatba, III Kafr El-Zayat, IV Dessuq V Edfina

MATERIAL AND METHODS

Five stations were selected as representing the different habitats along the course of the Rosetta Nile Branch. Each station comprised littoral and midstream sites (Fig. 1).

Station I represents the beginning of the Rosetta Nile Branch at a distance of about 1 Km north to El-Khairiya Barrage. The width of the branch is about 500m and with an average water depth of 4.5 meters in the midstream. Its bottom is sandy-silt. The current in this area is more swift as produced by rushing of water from the gates of the Barrage.

Station II is located beside El-Khatatba City, about 95 Km north to El-Khairiya Barrage. The average depth is about 6.0 meters and width about 400 meters. Its bottom is sandy-silt.

Station III is situated beside Kafr El-Zayat City at a distance of about 160 Km north of El-Khairiya Barrage. The Nile in this area reaches 800 meters in width and it possesses wide margins with drifting patches of the floating plants ***Eichhornia crassipes***. Its average depth is about 5 meters and the bottom sediments is clayey-silt. This area receives some industrial wastes from oil and soap factories.

Station IV lies in front of Dessuq City at a distance of about 270 Km north to El-Khairiya Barrage. Its water is contaminated with some sewage effluents discharged from Dessuq City. The width of the Nile there is about 700 meters and its depth reaches 4.5 meters where the bottom is mostly silty-clay, containing some plant remains.

Station V is located just in front of Edfina Barrage. The Nile in this area appeares more or less stagnant during periods when the gates of the Barrage are closed. Its average water depth is about 6 meters and its width is 250 meters. The surface sediment is silty-clay.

Sampling of bottom fauna was performed seasonally for two year cycle between, May, 1987 and February, 1989. The months representing the four seasons are: May (spring), August (summer), October (autumn) and February

(winter). Two dredges were hauled from each site using Ekman bottom sampler and representing a total area equivalent to 0.04 m2 of the upper layer of bottom deposits. The hauled samples were washed in the field using a small hand net of bolting silk with 23 mesh/cm and the benthic fauna was preserved in 10 % formalin solution. Sorting of fauna was carried out in the laboratory and each group was counted and weighed separetly after being left for five minutes on a filter paper to eleminate the external residual water. The different bottom animals were calculated as their total numbers and fresh weights per square meter. The biomass of molluscs were determined as their flesh weights.

For identification of the different species the following works were consulted Muttkowski (1918), Eggleton (1935), Pennak (1953), Mundie (1955), Edmondson (1959) and Morris *et al.* (1980).

RESULTS

Some environmental parameters such as, tranparency water temperature, PH values, chlorosity, total alkalinity, dissolved oxygen and phytoplankton abundance are considered.

Community Composition

The benthic fauna of Rosetta Nile Branch included three main phyla with six classes namely; Annelida (Oligochaeta & Hirudinea), Arthropoda (Insecta & Crustacea) and Mollusca (Gastropoda & Pelecypoda). Oligochaeta contributed numerically the most dominant group during the second year of investigation. They formed about 31.14 % and 85.6 % of the total benthos during the two successive years (averages 803 & 3620 organisms m^{-2} respectively). On the other hand, arthropods ranked as the most important component in the first year. They constituted 55.2 % and 10.8 % of the total benthos during the two successive years (averages 1467 & 457 organisms m^{-2} respectively). Molluscs formed only 12.67 % and 3.3 % by number of the total benthos during the two successive years with annual averages of 335 and 139 organisms m^{-2}. The recorded species and their numerical annual averages are given in table (1).

Distribution and seasonal variations of the total fauna

The average annual counts of the total benthos at the littoral stations amounted to3,974 organisms m^{-2} during the first year, decreased to 1,788

rganisms m^{-2} in the second one. This is in contrast to its distribution in the nidstream sites where it appeared low throughout the first year with an average 1344 organisms m^{-2} but it increased to 6,660 organisms m^{-2} in the second one.

Chironomus larvae were the main component of benthos at the littoral sites during the first year and contributed 64.7 % of their total counts (average 2570 arvae/m^2), followed by the oligochaete ***Chaetogaster limnaei*** (12.9 % & 511 rganisms m^{-2}). This was reversed in the second year when ***Chironomus*** arvae and ***Chaetogaster limnaei*** contributed respectively 16.4 % and 43.8 % of he total fauna (averages 293 larvae /m^2 & 783 oligochaete/m^2). On the other and, the midstream sites were dominated by ***Chaetogaster limnaei*** which ormed 33.5% and 76.8 % of the total benthos during the two successive years averages 451 & 5112 organisms m^{-2} respectively). Besides, other species appeared more frequent particularly ***Tubifex tubifex, Nais sp. Bellamya unicolor*** and ***Chironomus*** larvae during the first year and ***Branchiura owerbyi, Tubifex tubifex***, ***Nais sp***. and ***Chironomus*** larvae in the second one Table 1).

Generally, the highest counts of benthos were observed at both sites of station III and less so at station V during the first year, mainly due to the increased numbers of ***Chironomus*** larvae. In the second year, the midstream sites, harboured higher counts of benthos particularly at station I, being mostly oligochaetes (Table 1 & Fig. 2A). The annual averages of the total benthos for he whole branch amounted to 2,657 and 4,225 organisms m^{-2} during the two successive years.

The total benthos biomass was generally high whenever molluscs appeared in abundance due to their big size. Thus, the highest biomass was recorded at both sites of station III and less so at station V during the two years, coinciding with the increased numbers of molluscs, in particular ***Bellamya unicolor*** (Table & Fig. 2B). The annual average biomass of the total benthos amounted to 24.75 and 93.17g fresh wt/m^2 at the littorals during the two successive years, decreased respectively to 84.94 and 48.94g fresh wt/m^2 in the midstream sites. The annual average biomass for the whole branch reached 104.75 and 70.96 g fresh wt/m^2 during the two successive years.

Seasonally, stations I and II showed wide fluctuations in benthos counts from one season to the other. The highest density appeared in autumn and summer of

Table (1) : Average numbers of the different species of benthos (organisms m^{-2}) and their frequency percentages to the total fauna recorded in the whole littoral and the whole midstream of Rosetta Branch during each of the two successive years of study.

Species	First year May, 1987 - Feb., 1988						Second year May, 1988 - Feb., 1989					
	Littoral		Mid-stream		Total averages		Littoral		Mid-stream		Total averages	
	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%
Oligochaeta												
Branchiura sowerbyi	41	1.03	70	5.2	55	2.14	130	7.3	226	3.4	178	4.2
Tubifex tubifex	176	4.4	119	8.9	147	5.5	35	2.0	201	3.0	118	2.8
Chaetogaster limnaei	511	12.9	451	33.5	481	18.1	783	43.8	5112	76.8	2947	69.7
Nais sp.	143	3.6	96	7.2	119	4.5	374	20.9	379	5.7	377	8.9
Hirudinea												
Glossosiphonia complanata	73	1.8	7	0.5	40	1.5	6	0.3	8	0.1	7	0.2
Helobdella stagnalis	24	0.6	2	0.15	13	0.5	1		5	0.1	3	0.1
Insecta												
Chironomus larvae	2570	64.7	284	21.4	1427	53.7	293	16.4	555	8.3	424	10.0
Chironomus pupae	66	1.66	10	0.17	38	1.4	13	0.7	46	0.7	30	0.7
Ohiogomphus sp.	-	-	-	-	-	-	-	-	4	0.1	2	0.1
Plathemis sp.	-	-	-	-	-	-	-	-	1	-	1	
Crustacea												
Cardinea nilotica	1	0.02	4	0.30	2	0.07	-	-	-	-	-	-
Gastropoda												
Bellamya unicolor	219	5.5	169	12.6	194	7.3	146	8.2	81	1.2	114	2.7
Melanoides tuberculata	10	0.3	-	-	5	0.2	-	-	-	-	-	-
Cleopatra bulimoides	87	2.1	16	1.2	52	2.02	-	-	-	-	-	-
Bulinus truncatus	10	0.3	-	-	5	0.2						
Biomphalaria alexandrina	-	-	4	0.30	2	0.07						
Bivalvia												
Anodonta implicata	17	0.4	-	-	8	0.3	2	0.1	1	0.01	1	0.02
Corbicula consobrina	26	0.6	112	8.61	69	2.6	7	0.4	40	0.6	23	0.6
T o t a l	3974	%	1344	100	2657	%	1788	%	6660	%	4225	%

Table (2): Aaverage biomasses of the different species of benthos (g/m^2) and their frequency percentages to the total fauna recorded in Rosetta Branch during each of the two successive years of study.

Species	First year May, 1987 - Feb. 1988						Second year May, 1988 - Feb. 1989					
	Littoral		Mid-stream		Total averages		Littoral		Mid-stream		Total averages	
	g/m2	%	g/m2	%	g/m2	%	g/m2	%	g/m2	%	gm2	%
Oligochaeta												
Branchiura sowerbyi	**0.22**	**0.18**	**0.58**	**0.68**	**0.40**	**0.4**	**0.78**	**0.84**	**1.544**	3.2	1.2	1.7
Tubifex tubifex	0.11	0.09	0.02	0.02	0.10	0.1	0.024	0.02	0.06	0.12	0.04	0.06
Chaetogaster limnaei	0.11	0.09	0.33	0.39	0.22	0.2	0.352	0.38	0.876	1.80	0.614	0.86
Nais sp.	0.08	0.06	0.08	0.09	0.08	0.1	0.071	0.08	0.082	0.17	0.076	0.11
Hirudinea												
Glossosiphonia complanata	0.35	0.28	0.03	0.03	0.19	0.18	0.036	0.04	0.09	0.18	0.063	0.09
Helobdella stagnalis	0.27	0.22	0.002	0.0	0.14	0.13	0.02	0.02	0.076	0.15	0.05	0.07
Insecta												
Chironomus larvae	1.776	1.42	0.276	0.32	1.03	0.98	1.01	1.08	0.51	1.04	0.76	1.07
Chironomus pupae	0.18	0.14	0.048	0.06	0.12	0.11	0.03	0.03	0.054	0.11	0.04	0.06
Ohiogomphus sp.	0.0	-	0.0	-	-	-	0.0	-	0.17	0.35	0.08	0.11
Plathemis sp.	0.0	-	0.0	-	-	-	0.0	-	0.032	0.06	0.02	0.03
Crustacea												
Cardinea nilotica	0.004	0.003	0.016	0.02	0.01	0.01	0.0	-	0.01	0.02	0.005	0.01
Gastropoda												
Bellamya unicolor	93.45	74.9	60.032	70.7	76.74	73.8	89.59	96.1	43.8	89.8	66.7	93.94
Melanoides tuberculata	0.9	-	0.0	-	0.072	0.07	-	-	-	-	-	-
Cleopatra bulimoides	3.15	2.52	0.754	0.89	1.95	1.87	-	-	-	-	-	-
Bulinus truncatus	0.3	0.17	0.0	-	0.103	0.10	-	-	-	-	-	-
Biomphalaria alexandrina	-	-	0.05	0.06	0.03	0.03	-	-	-	-	-	-
Bivalvia												
Corbicula consobrina	12.272	9.84	22.726	26.75	17.50	16.8	0.08	0.08	0.494	1.01	0.29	0.4
Anodonta implicata	12.432	9.97	0.0	0.0	6.22	6.0	1.17	1.25	0.958	1.96	1.06	1.5
T o t a l	124.75	100%	84.94	100	104.75	100	93.17	100	48.76	100	70.96	100

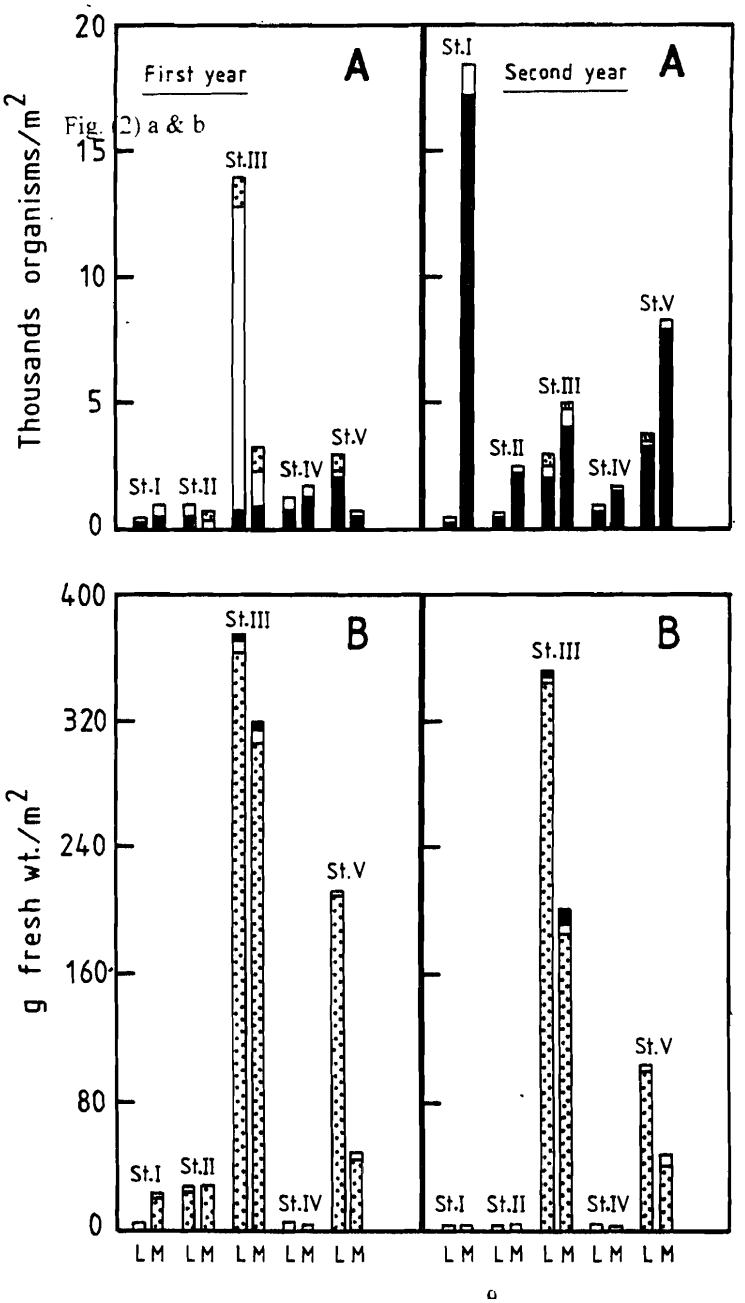

Fig. (2) : Average counts (A) and biomass (B) of the different phyla of benthos recorded at each of the Littoral (L) and Midstream (M) sites of the different stations during each of the two successive years.

Annelida Arthropoda Mollusca

1987 at the littorals of the two stations respectively and in summer, 1988 in the midstream sites of both stations. They attained their maximum persistence at station III during summer, 1987 and spring, 1988 at the littoral and midstream sites respectively. The littorals of stations IV and V harboured also high density of benthos during spring and summer of 1988 respectively, while their midstream sites sustained the highest records in winter and summer of 1988 respectively (Table 3).

The seasonal variations of the total benthos biomass generally followed their total counts except of the records of the midstream sites at stations II, III and V in autumn and of stations IV and V during winter, 1988 and summer, 1987 respectively.

Distribution and seasonal variations of important species :

1- *Oligochaeta*

a- Chaetogaster limnaei **K. Von Bear**

Chaetogaster limnaei was numerically the most dominant oligochaete species in the Nile water. It averaged 481 organisms m^{-2} in the first year, and increased to 2,947 organisms m^{-2} during the second one. However, being small in size, its annual average biomass amounted only 0.22 and 0.61 g fresh wt/m^2 during the two successive years.

The species appeared more frequent in the midstream site of station IV and at the littoral of station V during the first year (averages 1323 & 1579 organisms m^{-2} respectively). It increased sharply to an average of 16,380 organisms m^{-2} in the midstream site of station I in the second year and this may be attributed to its transportation from the Upper Nile into the area by the swift water current prevailing winter (Fig. 3).

Seasonally, ***Ch. Limnaei*** was recorded all the year round, attaining highest counts of 14,230 organisms m^{-2} in the midstream sites during summer, 1988 (Fig 4). On the other hand, its highest biomass was observed in the same sites during winter and summer, 1988 (averages 1.15 & 1.05 g fresh wt/m^2 respectively) and winter, 1989 (average 1.75 g fresh wt/m^2).

Table (3): Seasonal variations in the number (organisms m^{-2}) and biomass (g/m^2) of the total bottom fauna recorded at each of the littoral (L.) and midstream (M) sites of the different stations.

	I				*II*				*III*				*IV*				*V*			
Stations	L		M		L		M		L		M		L		M		L		M	
Seasons	*No/m2*	*g/m²*	*No/m2*	*g/m²*	*No/m2*	*g/m²*	*No/m2*	*g/m²*	*No/m2*	*g/m²*	*No/m2*	*g/m²*	No/m2	*g/m²*	No/m2	*g/m²*	No/m2	*g/m²*	No/m2	*g/m²*
First year																				
Spring, 87	487	0.33	1950	32.17	-	-	-	-	1159	179.7	2285	222.3	521	0.402	-	-	1647	257.64	1680	0.68
Summer	-	-	1108	64.13	2907	110.71	-	-	47794	556.4	723	0.66	2739	1.21	-	-	3644	467.02	-	-
Autumn	2168	8,74	-	-	991	2.30	3092	118.4	2437	245.9	1597	66.1	689	0.51	1210	0.87	2705	59.56	907	192.42
Winter, 88	-	-	673	0.14	-	-	-	-	4973	524.24	6282	399.6	958	18.85	5359	6.6	3696	61.69	-	-
Seasonal averages	1328	9.1	933	96.4	975	28.3	773	29.6	14,09	376.6	2722	321	1227	5.24	1642	1.9	2923	211.5	647	48.3
Second year																				
Spring, 88	790	0.59	387	0.10	-	-	-	-	3276	6.06	7157	16.3	3612	3.05	4704	0.2	2840	25.87	4738	76.3
Summer	-	-	67,532	4.32	2285	1.64	4989	10.4	1916	470.4	2050	519.12	824	0.61	2587	1.14	6367	107.65	5275	78.2
Autumn	-	-	-	-	940	2.37	840	0.76	3695	844.3	1326	183.3	-	-	152	0.17	454	260.31	5309	15.32
Winter, 89	504	0.08	6586	5.59	168	0.08	4032	1.14	2890	90.43	4436	54.8	68	-	-	5158	49.72	11,138	11,138	8.24
annual averages	324	0.17	28626	2.5	848	1.07	2465	3.1	2944	352.8	3742	193.4	1126	0.94	1861	0.4	3705	110.9	6615	44.5

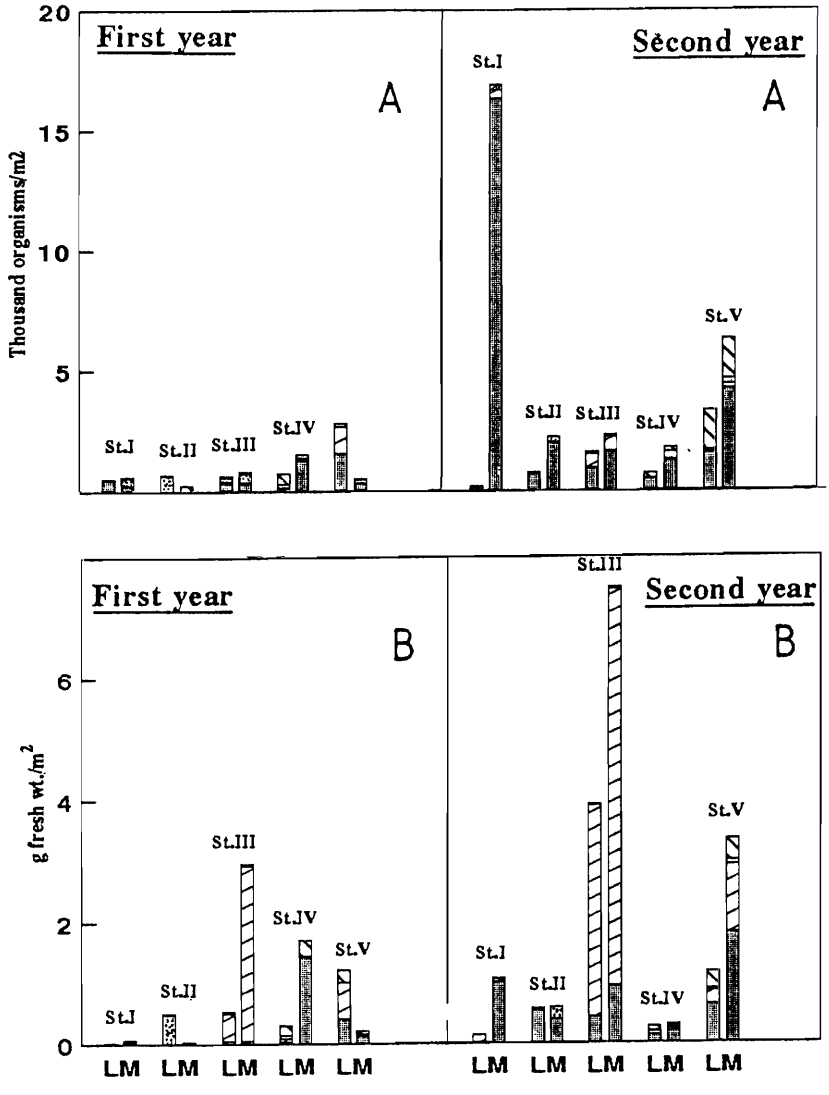

Fig. (3) : Average counts (A) and biomass (B) of the different species of Oligochaeta recorded at each of the Littoral (L) and Mid-stream (M) sites of the different stations during each of the two successive years.

Chaetogaster limnaei *Branchiura sowerbyi* *Tubifex tubifex* *Nais sp.*

Table (4): Aaverages of the number (organisms m^{-2}) and biomass (g/m^2) of ***Chironomus*** larvae and Pupae recorded at the littoral (L) and mid-stream (M) sites in each station of Rosetta Nile Branch during each of the two successive years.

	First year (87-1988)								***Second year (88-1989)***							
	***Chironomus* l.**				**Pupae**				***Chironomus* l.**				**Pupae**			
	Littoral		**Midstream**		**L**		**M**		**L**		**M**		**L**		**M**	
Station	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**
I	164	0.09	273	0.35	0	0.0	4	0.02	126	0.02	1558	0.54	0	0.0	113	0.03
II	231	0.09	155	0.13	0	0.0	4	0.01	55	0.02	46	0.01	0	0.0	0	0.0
III	11,777	7.80	869	0.75	332	0.90	42	0.19	723	3.90	928	1.60	66	0.16	118	0.24
IV	491	0.73	96	0.13	0	0.0	4	0.02	416	0.66	63	0.07	0	0.0	0	0.0
V	189	0.17	25	0.02	0	0.0	0	0.0	143	0.44	180	0.32	0	0.0	0	0.0
Station average	2570	1.8	284	0.28	66	0.18	10	0.05	292	1.01	555	0.51	13	0.032	46	0.054

Table (5): Seasonal variations of the average numbers (organisms m^{-2}) and biomass (g/m^2) of ***Chironomus*** larvae and Pupae recorded at the whole littoral (L) and whole midstream sites (M) of Rosetta Nile Branch during the two successive years.

	First year (87-1988)								***Second year (88-1989)***							
	***Chironomus* l.**				**Pupae**				***Chironomus* l.**				**Pupae**			
	Littoral		**Midstream**		**L**		**M**		**L**		**M**		**L**		**M**	
Station	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**	**No/m²**	**g/m²**
Spring	97	0.07	134	0.26	0	0.0	3	0.01	685	1.26	736	0.75	13	0.03	0	0.0
Summer	8786	5.51	121	0.05	259	0.69	0	0.0	98	0.09	121	0.12	3	0.01	3	0.02
Autumn	400	0.33	148	0.12	7	0.03	3	0.01	168	2.02	24	0.13	0	0.0	0	0.0
Winter	998	1.21	732	0.67	0	0.0	37	0.17	218	0.66	1341	1.03	37	0.1	182	0.19

Chaetogaster limnaei is an omnivorous species (Streit, 1977), previously recorded as the most dominant bottom dweller in Lake Burollus (Aboul Ezz, 1984).

b- *Tubifex tubifex* Muller

The species was frequently recorded in the Nile stations and it attained annual averages of 147 and 118 organisms m^{-2} with 0.06 and 0.10 g fresh wt/m^2 during the two successive years. It appeared more abundant in the midstream site of station I and the littoral of station III during the first year (averages 323 & 621 organisms m^{-2} respectively) and in the midstream site of station IV in the second year (average 332 organisms m^{-2}).

Tubifex tubifex was recorded throughout the whole investigation period except in winter, 1989 (Fig. 4). It appeared more frequent in the midstream sites during spring, 1988 (average 326 organisms m^{-2}) and at the littorals in summer, 1987 (632 organisms m^{-2}).

The species usually prefers calm water with no strong currents that may wash out the bottom silt (Dumincka, 1987). It is considered as a typical species for polysabrobic zones (Dumincka, 1985).

C - *Nais* sp.

Nais sp was frequently recorded in the investigated area with annual averages of 119 & 377 organisms m^{-2} and 0.08 & 0.076g fresh wt/m^2 during the two successive years. Its maximum persistence appeared in the midstream of station II and at the littoral of station IV during the first year (averages 231 & 445 organisms m^{-2} respectively) as well as in the two sites of station V in the second one (average 1651 organisms m^{-2} for both sites). The species occurred during the different seasons, showing its maximum persistence in summer, 1988.

d - *Branchiura sowerbyi* Bedd

Branchiura sowerbyi appeared infrequently at the littorals of stations III, IV and V and midstream site of station III during the first year, while it occurred at all stations in the second one. Its annual averages amounted to 55 & 178 organisms m^{-2} and 0.40 & 1.2 g fresh wt/m^2 during the two successive years.

Branchiura sowerbyi was recorded at most littoral sites throughout the whole investigation period, showing relatively higher counts in spring, summer and autumn (118, 155 and 198 organisms m^{-2} respectively). In the mid stream sites the species occurred during the four seasons of 1988 with highest density in summer which harboured an average of 402 organisms m^{-2} and it persisted in low counts during winter, 1989.

Branchiura sowerbyi is a cosmopolitan species (Brinkhurst & Jamieson, 1971), previously recorded from the Nile River and its connected canals (El-Duweini & Ghabbour, 1962) and in Lake Nasser (Iskaros, 1993). It is regarded as the most important oligochaete species at the littoral of Aswan Reservoir and in the Nile water at Aswan City (Iskaros, 1988).

2 - Hirudinea

a - *Glossosiphonia complanata* Linn.

The species appeared infrequently during the first year at both sites of station III and at the littorals of stations II and V with an annual average of 40 organisms m^{-2} and 0.19g fresh wt/m^2. Its distribution in the second year was confined at both sites of station III and V and its average values decreased to 7 organisms m^{-2} and 0.063 g fresh wt/m^2.

The species was recorded throughout the whole investigation period except in winter, being more abundant at the littorals during summer, 1987 (average 282 organisms m^{-2}). It favours both stagnant and running water systems (Millanby, 1977).

B- *Helobdella stagnalis* Linn.

The species appeared rarely at both sites of station V in spring, 1988 and at the littoral of station III during summer, 1987. Its annual averages amounted to 13 and 3 organisms m^{-2} and 0.14 & 0.05 g fresh wt/m^2 for the two successive years.

3 - Insecta

Insecta formed numerically the major component of benthos during the first year and contributed 55.1 % of their total counts and 1.1% of their weights

(averages 1465 organisms m^{-2} and 1.15 g fresh wt/m^2). However, these values decreased to 10.8 % and 1.3 % respectively in the second year (averages 457 organisms m^{-2} and 0.9 g fresh wt/m^2). The recorded forms were mostly ***Chironomus*** larvae and their pupae, beside scattered specimens of nymphs of Odonata.

***a - Chironomus* larvae :**

Chironomus larvae represented the main constituent of Insecta in the investigated area. They appeared at all stations, showing maximum persistence at both sites of station III during the two years and in the midstream site of station I in the second year (table 4). Their annual averages reached 1427 larvae/m^2 and 1.03 g fresh wt/m^2 during the first year and 424 larvae/m^2 with 0.76 g fresh wt/m^2 in the second one.

Seasonally, they appeared throughout most seasons, being more abundant in summer, 1987 at the littorals and in winter, 1989 at the midstream sites (Table 5).

Chironomus larvae usually inhabit the littoral zones of both oligotrophic and eutrophic lakes (Mundie, 1955) and are considered as a good indicator of water pollution (Rivosecchi ***et al.***, 1976). They may be found in moderately contaminated water but their growth is slightly retarded (Wentsel, ***et al.***, 1977). They were previously recorded in Aswan Reservoir and Nile River (Iskaros, 1988), in the polluted Lake Mariut (Samaan & Aleem, 1972), in Lake Burollus (Aboul Ezz, 1984) and Lake Edku (Samaan, 1977).

b - Pupae of Chironomids

Their distribution was confined to the littoral of station III, coinciding with the increased numbers of ***Chironomus*** larvae there. Few pupae were also observed in the mid stream sites of stations I, II, III and IV during the first year and at station I in the second one.

Pupae of Chironomids appeared during one season or the other, being more abundant in summer, 1987 and winter, 1989. Their annual averages amounted to 38 pupae/m^2 with 0.12 g fresh wt/m^2 in the first year, decreased to 30 pupae/m^2 and 0.04g fresh wt/m^2 in the second one.

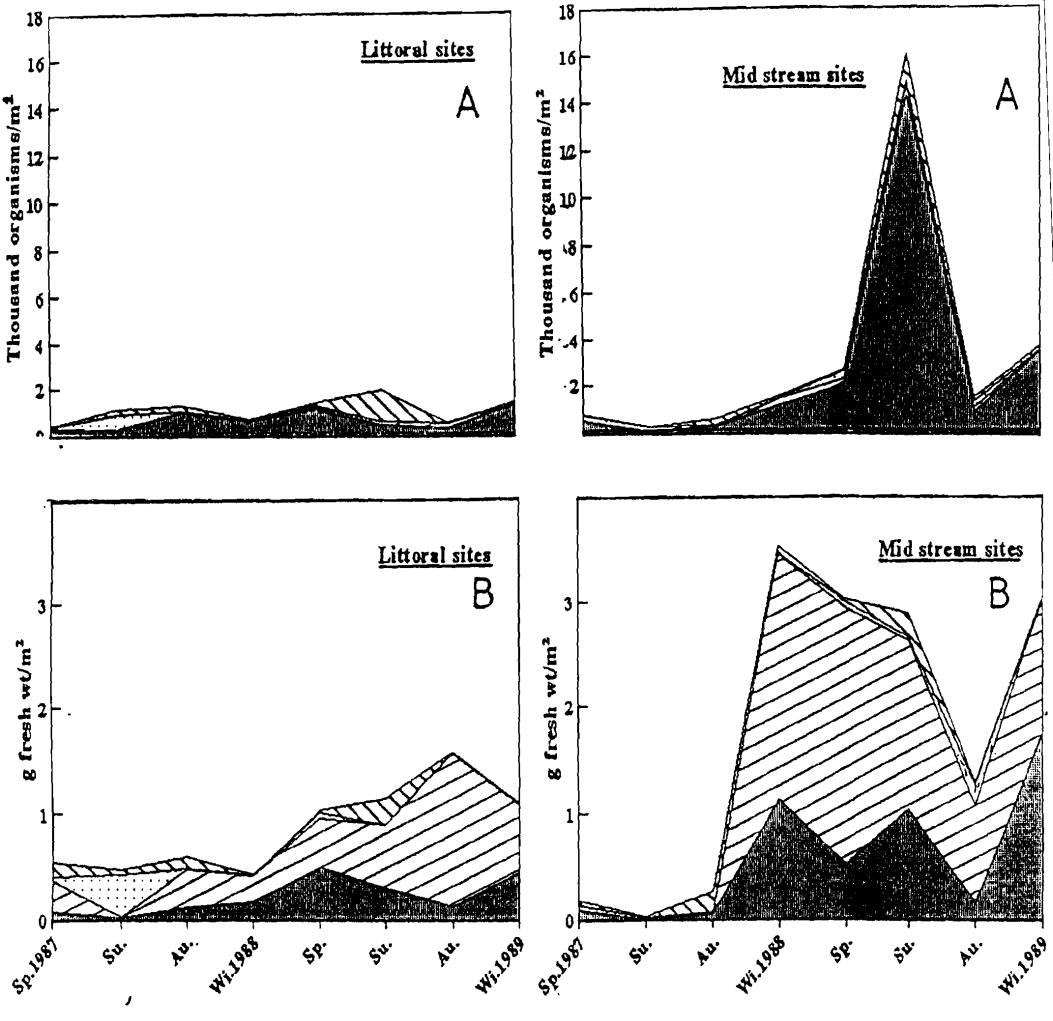

Fig. (4) : Seasonal variations in the average number (A) and biomass (B) of the different species of Oligochaeta recorded at each of the whole Littoral and the whole Midstream of Rosetta branch (average of stations I-V) during the period May, 1987 - February, 1989.

Chaetogaster limnaei *Branchiura sowerbyi* *Tubifex tubifex* *Nais sp.*

Fig. (5)

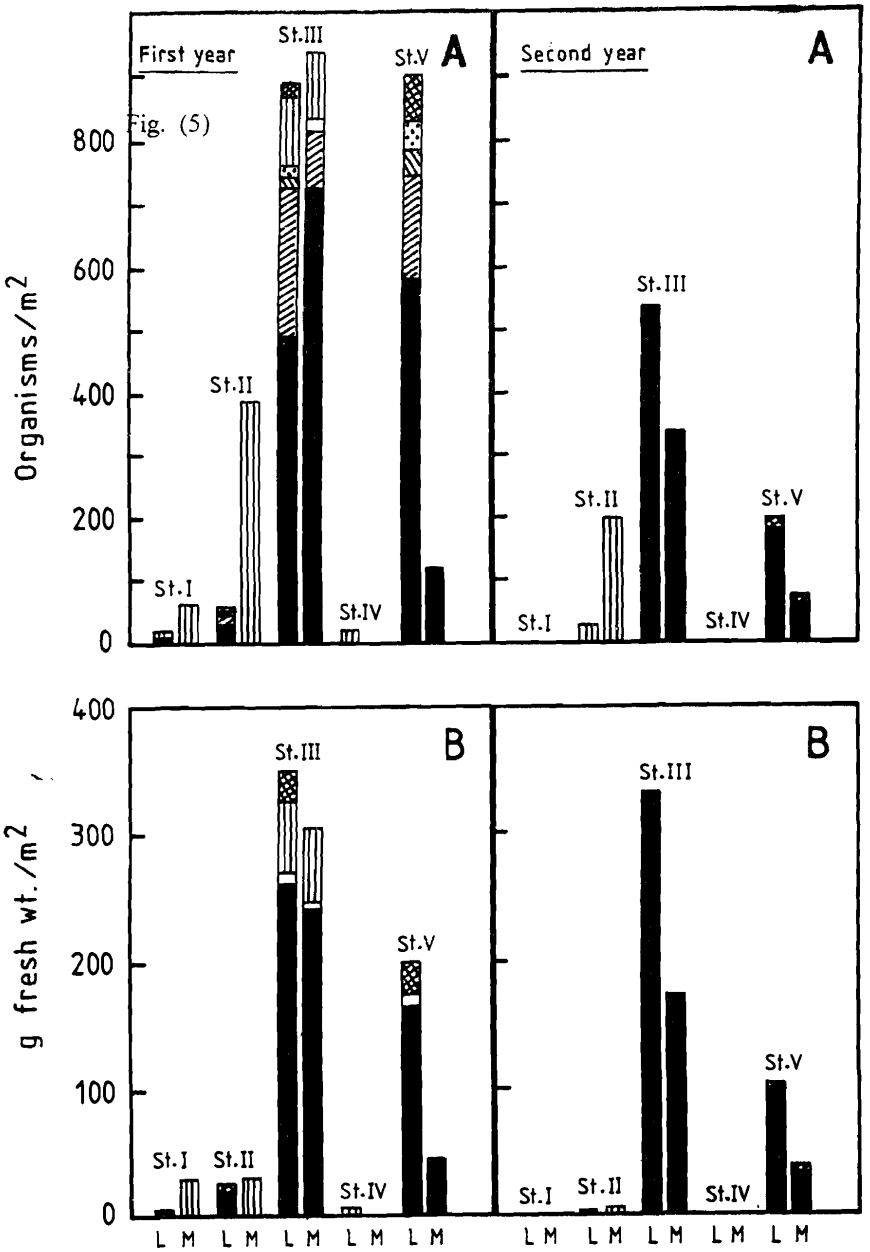

Fig. (5) : Average counts (A) and biomass (B) of the different species of Mollusca recorded at each of the Littoral (L) and Midstream (M) sites of the different stations during each of the two successive years.

Bellamya unicolor
Biomphalaria alexandrina
Anodonta implicata
Cleopatra bulmoides
Melanoides tuberculata
Bulinus truncatus
Corbicula consobrina

Pupae of Chironomidae were also previously recorded at the littorals of Aswan Reservoir and in the Nile River (Iskaros, 1988).

c - Nymphs of Odonata

Nymphs of the family Gomphidae (***Ophiogomphus sp.***) were observed once in the midstream site of station I during winter, 1989 with 84 nymphs/m^2 and 0.67g fresh wt/m^2 and that of the family Libellulidae (***Plathemis sp.***) In the midstream site of station III during summer, 1988 (17 nymphs/m^2 and 0.65 g fresh wt/m^2). They were also previously recorded at the littorals of Aswan Reservoir and in the Nile River (Iskaros, 1988).

4 - Crustacea

Cardinea nilotica **Roux**

The Nile shrimp ***Cardinea nilotica*** was rarely recorded at the littoral of station III during autumn, 1987 and in the midstream site of the same station in summer of the two years.

The species is a tychoplanktonic form, previously recorded among the littoral vegetation of Lake Nasser (Entz, 1976).

5- Gastropoda

a - *Bellamya unicolor* Olivier

Bellamya unicolor appeared as the most dominant gastropod in Rosetta Branch and it averaged 194 and 114 organisms m^{-2} during the two successive years. Its biomass was also high and attained annual averages of 76.74 and 66.69 g fresh wt/m^2 respectively.

The maximum persistence of the species was recorded at both sites of stations III and V in both years. Otherwise, it appeared rare at the littorals of stations I and II during the first year and was missed from the other stations in the second one (Fig. 5). The species was observed during most seasons, showing higher counts in summer and/or autumn (Fig. 6).

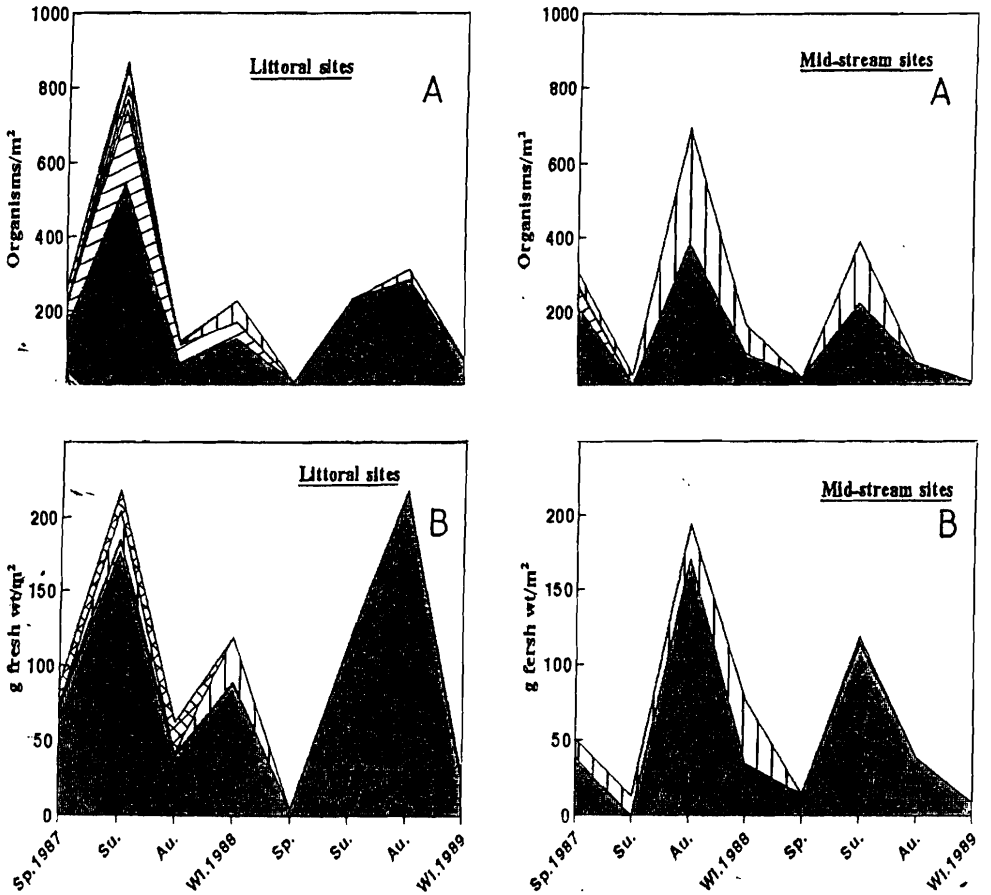

Fig. (6) : Seasonal variations in the average number (A) and biomass (B) of the different species of Mollusca recorded at each of the whole Littorals and whole Mid- stream sites of Rosetta Nile Branch (average of stations I-V) during the period May, 1987 - February, 1989.

Bellamya unicolor was previously recorded at Aswan Reservoir (Iskaros, 1988), also in the Nile system including Lake Victoria, Lake Kioga and Lake Albert (Rzoska, 1976 & Brown, 1980). It usually survives in clear slowly flowing waters (Brown ***et al.***, 1984).

b - *Cleopatra bulimoides* Olivier

Cleopatra bulimoides appeared only at the littorals of stations II, III & V and in the midstream site of station V during the first year, being more frequent in summer. Its annual average amonted to 52 organisms m^{-2} and 1.95 g fresh wt/m^2.

The species was previously encountered among the bottom fauna of Aswan Reservoir (Iskaros, 1988). It is widely distributed in most inland waters of Africa, particularly in Egypt (Brown, 1980). It usually survives in riverine localities and slowly flowing clear water (Brown ***et al.***, 1984).

c - Melanoides tuberculata **Muller**

Melanoides tuberculata appeared once at the littorals of stations III and V during summer, 1987 with 50 and 134 organisms m^{-2} and 0.072 & 2.8 g fresh wt/m^2 respectively.

It is regarded as euryhaline species, previously observed in Aswan Reservoir (Iskaros, 1988), as well as in the Egyptian Delta Lakes (Samaan, 1977; Guerguess, 1979 & Aboul Ezz, 1984). The species can afford partial pollution (Samaan & Aleem, 1972).

d - *Bulinus truncatus* Audouin

The distribution of ***B. truncatus*** was also confined to the littorals of stations III and V during the first year of investigation with annual averages of 9 & 42 organisms m^{-2} and 0.01 & 1.02 g fresh wt/m^2 for the two stations respectively. It appeared mainly in summer, 1987 (average 30 organisms m^{-2}) and was rare during spring, 1987 and winter, 1988 (averages 7 & 3 organisms m^{-2} respectively).

The species was previously recorded in the Nile River and at the littorals of Lake Nasser and Aswan Reservoir (Iskaros, 1988) and in Lake Manzalah (Guerguess, 1979).

e - *Biomphalaria alexandrina* Ehr.

Biomphalaria alexandrina appeared once in the midstream site of station III during spring, 1987 with 34 organisms m^{-2} and 1.02 g fresh wt/m^2.

The species was also previously recorded at the littorals of Aswan Reservoir (Iskaros, 1988) and is regarded as a common gastropod in the Nile River (Dawood & Chu, 1973). It inhabits slowly flowing irrigation canals (Dazo ***et al.***, 1966) and the Nile Delta Lakes around the outlets of the fresh water drains (Brown, 1980). It is usually found among aquatic vegitation in the Sudan (Williams & Hunter, 1968).

6 - Pelecypoda

a- *Corbicula consobrina* Cailliaud

Corbicula consobrina formed the main bivalve inhabiting Rosetta Nile Branch. Its annual averages amounted to 69 organisms m^{-2} and 17.5 g fresh wt/m^2 in the first year, decreased to 23 organisms m^{-2} and 0.28 g flesh wt/m^2 in the second one.

The species appeared at all littoral sites except that of station V as well as in the midstream sites of stations I, II and III during the first year. Its distribution in the second year was confined to both sites of station II. The highest counts of ***C. consobrina*** was in winter, 1988 at the littorals and in autumn, 1987in the midstream sites. Similarly, Leveque (1973) recorded heavy reproduction of the species during the cold season in Lake Chad.

The species is regarded as an important mollusc in Lake Burollus (Aboul Ezz, 1984), Lake Menzalah (Guerguess, 1979) and Lake Edku (Samaan, 1977).

b - *Anodonta implicata* Say

The species was recorded at the littorals of stations II, III and V during the first year of investigation, being numerically more frequent at station V in spring, 1987 while its highest biomass of 26 g flesh wt/m^2 was recorded at station III in autumn, 1987. During the second year, its distribution was confined to the midstream site of station V in summer, 1988 and at the littoral of the same station in winter, 1989. Its annual averages amounted to 8 and 2 organisms m^{-2} with 6.22 & 1.06 g fresh wt/m^2 during the two successive years.

DISCUSSION

The Rosetta Nile Branch lies in a warm temperate zone where the average monthly air temperature fluctuates between 13°C in winter (January & February) and 30°C during summer (July & August). According to its shallowness the temperature of the Nile water usually follows that of the air and its average values ranged between 14 and 30°C during winter and summer respectively in the present investigation.

The peaks of the total counts of benthic fauna in Rosetta Branch appeared mostly during summer (29.2°C) and autumn (24.8°C). Similarly, Sitaramaiah (1966) found that the oligachaete population increases with the increase of water temperature. In the present investigation ***Chaetogaster limnaei*** appeared all the year round but attained its highest density in summer, 1988. Also, the distribution of ***Nais*** sp. and ***Tubifex tubifex*** were mostly confined to the summer. El- Duweini and Ghabbour (1962) postulated that the seasonal variations of water temperature is not a determining factor in the distribution of oligochaetes. Pennak (1953) considered that although temperature is not usually a limiting factor for the growth of oligochaetes, yet it often determines their relative abundance.

The ***Chironomus*** larvae which represent the second dominant benthic constituent in Rosetta Branch showed also their highest density during summer as well as in winter. Iskaros (1993) found high counts of these larvae in Lake Nasser during winter and early spring. This indicates that other factors beside temperature variations affect their seasonal distribution.

The highest occurrence of pelecypods was also in summer and autumn, while gastropods were completely absent in summer, 1987 at the midstream sites. Brown (1980) attributed the decline of gastropods in summer to their high mortality as a result of low oxygen content.

The concentration of dissolved oxygen is one of the most important factors controlling aquatic life. Train (1979) mentioned that the amount of dissolved oxygen required for healthy growth of fresh water biota must be over 5 mg O_2/l. This is mostly the case in Rosetta Branch except during summer when lower oxygen content down to 1.1 ml O_2/l was frequently observed in the near bottom

layer (Soliman, 1994). The two main benthic components in Rosetta Branch namely; Oligochaetes and ***Chironormus*** larvae can tolerate low oxygen content (Brinkhurst & Jamieson, 1971). This is emphasized by their maximum abundance during summer, coinciding with the minimum oxygen concentration.

The nature of bottom sediment has a selective influence on the quality of benthos (Welch, 1952). Its texture in the investigated area ranges from sandy-silt to silty-clay. Most of the recorded species favour silty-clay substrates. Thus the growth of ***Tubifex tubifex*** is favoured on muddy bottoms (Dumnicka, 1985) while ***Branchiura sowerbyi*** appears more abundant in clayey silt bottom (Naidu, 1965). Wirth and Stone (1968) mentioned that most chironomids breed on muddy bottom. For molluscs, the distribution of ***Melanoides tuberculata, Bellamya unicolor*** and ***Cleopatra bulmoides*** was confined to sand-silt-clay substrates in Lake Nasser while ***Bulinus truncatus*** and ***Biomphalaria alexandrina*** usually inhabits areas with aquatic plant belts (Iskaros, 1988).

Results of the present investigation indicate that the Rosetta Nile Branch represents a highly eutrophic running water system. This is attributed to the fact that it harbours a high standing crop of both phytoplankton (average 7,104,150 units/l) and zooplankton populations (average 639,180 organisms m^{-2}) (Soliman, 1994). These inturn form the basic food supply for benthos particularly in the form of detritus. Thus, the average annual biomass of bottom fauna in Resetta Branch amounted to 87.9 g fresh wt./m^2 during the present investigation. This value is much higher than those previously recorded for the Egyptian Delta lakes which fluctuated between 9.9 and 76.5 g fresh wt./m^2 (Samaan & Aleem, 1972; Samaan, 1977; Aboul Ezz, 1984; Samaan et al, 1989). It is also higher than the records of benthos in Lake Nasser and Aswan Reservoir which averaged 7.5 and 20.4 g fresh wt./m^2 respectively (Iskaros, 1988).

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