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ORIGINAL ARTICLES

Temporal And Spatial Variability Of Macrofauna In A Microtidal Estuary (Sefid-Rood River Estuary, South Of Caspian Sea)

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ABSTRACT

Temporal and spatial trents were examined in benthic macroinvertebrate and physical – chemical data collected for 2 years at five sites along the sefid-rood river estuary, south of Caspian sea. Results of the investigation of chemical and physical shown that of temprature was 16.50 and salinity surface 1.84ppt, salinity deep 2.21 ppt, DO 8.23 (ppm).Sediments compositions were fine sand34.14%, sand and coarse22.96%, medium sand15.5% and organic matter .896%. During this study 10 taxa benthic collected and *chironomidae*. was dominant Group in the estuary. Other group were *Lumbriculidea, Tubificidae, Gastropoda, Spharidae, Gammaridae, Nereidae, Archenidae, Ephemeroptera, Pelecoptera. Th*ere are temporal variability between individuals and biomass macroinvertebrates in the estuary.

Key word: Estuary, Macroinvertebrate, Caspian Sea, Sefid-rood River, Sediment

Introduction

Temporal and spatial variations of macrozoobenthos species and communities structure is controlled by environmental factors such as water quality (Hellawell 1986), sediment grain size (Tolkamp 1980), sedminet characteristics (Peeters & Gardeniers 1998) and biological factors.The analysis of macrobenthos species is important for monitoring program (Weisberg *et al*.1997) and macrozoobenthic communities are key components in the functioning of estuarine systems. Benthic organisms produce considerable changes in physical and chemical conditions (Day *et al*. 1989). A large number of studies on the structure and dynamics of estuarine and coastal benthic assemblages have been conducted world wide (Desmond *et al*., 2002). Benthic communities vary considerably according to environmental conditions and the majority of the species have highly aggregated small – scale distribution patterns induced especially by substrate type, sediment composition, salinity, food availability and predation (Mclusk & Elliottzool 2004). Contaminants in the sediment may have also a marked influence on the stracture of benthic communities. Some studies have been focused on the functional characterization of benthic assemblages rather species composition outlining that this approach is useful when interpreting estuarine gradients and assessing ecosystem functioning (Weston 1990). Both abiotic and biotic factors areas play a role in shaping the organization of communities and in the distribution and abundance of species (Angermeier & Winston 1998). Abiotic factors are often regarded to determine patterns in the distribution and abundance of species over broad scales, while the relative importance of biotic factors (Levin 1992). The enclosed Caspian sea is the world's largest brackish water body, comprising nearly 40% of the earth's continental surface water (Dumont 1998), with a surface area of about 38000 km (the northern area 25%, middle 30% and southern area 39%) and volume of approximately 78000km^3 . About 130rivers of various size drain into the sea with an annual freshwater inflow of about 300km^3 . the main input is from the Volga River in Russia, while rivers from Iran contribute an inflow of only 4-5% (CEP2002). Sefid – rood river is the largest and longest river in southern of Caspian sea watershed. There is not tide in Caspian sea and input the sea water in the rivers with wind and waves. The main goal of the present study was identification of macro zoobenthos and their temporal and special variability with environment conditions along the estuary.

Materials And Methods

Sefid – rood estuary is located at the mouth of the sefid – rood river on the south – west of Caspian sea in the north of Iran (Fig.1)

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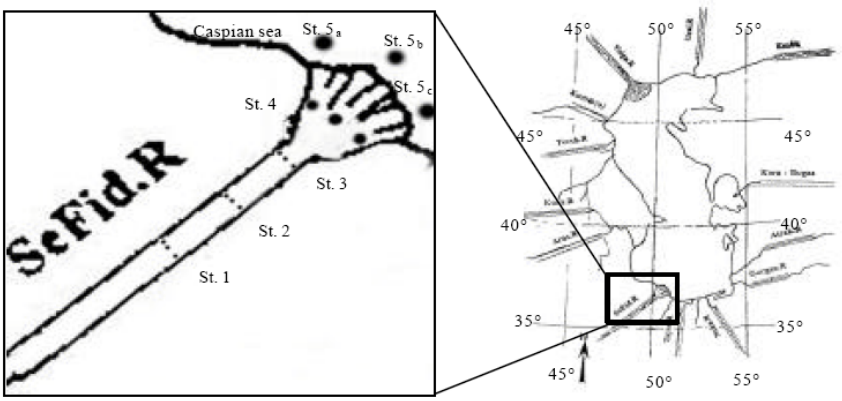

Fig. 1: Sampling area at the Sefid Rood River estuary(South Caspian Sea) with 5 sample stations

It is a shallow and microtidal estuary caused by the mominance of freshwater riverine in with 3276 ha. area and it is an important habitat fishes. Sampling surveys were carried out regular monthly from 2008 until 2010 in the five sites. During this period, 540 sites were sampled. Sampling surveys and data analysis collected with Ekman grab ($0.33m^2$) and one for sediment charcterisation. In order to characterize the macrofaunal assemblages, sediment samples were sieved through a 500 μm mesh sieve and the individuals retained in the sieve preserved in 4% buffered formaldehyde. Macrobenthos were identified to the lowest possible taxonomic level , counted and wet weighted . The granulometric analysis was performed by dry sieving using the detailed description given by its Gaudencio *et al*. (1991). Characterized by percentage of silt anc clay (<63 μm), very fine sand (63 – 125 μm), fine sand (125 – 250 μm), medium sand (250 – 500 μm), coarse sand (500-1000 μm), very coarse sand (1000-2000 μm), gravel (>2000 μm) and by the median of grain size diameter. Total organic matter (TOM) of the sediment was obtained by loss on ignition. Temperature, Oxygen, PH and depth were measured in the field. water samples (0.5L) were taken and brought into the laboratory for further analysis of the water quality variables. Statistical one way ANOVA were used to test the existence of significant difference between sites and sampling data.

Results:

The physical and chemical parameters are presented in Table 1. The water temperature was higher in summer and ranged between 10.7 and 26.8^{o}C. salinity values varied significantly from upstream to river mouth, with the highest value recorded in station 5 and the lowest in station 1. The dissolved oxygen values varied between 5.1mg/L and 10.1 mg/L and the PH values between 8 and 8.3.

Table 1: Physical and Chemical parameters of water in the sefid-rood river estuary at stations.

Station	T ^{o}C	$S_{s(ppt)}$	$S_{D(ppt)}$	pH	D_m	D_O
1	16/5±6/68	102±0.32	1.06±0.36	8.1	1.6	9.5
2	16/5±6/07	1.17±0.38	1.31±0.6	8.13	1.13	8.7
3	15.9±7.37	1.3±0.53	1.5±0.73	8.15	0.9	8.3
4	16.61±6/02	1.9±0.95	2.1±1.09	8.22	1.34	8.1
5	16.54±5.96	3.83±1.59	8.1±4.02	8.29	1.53	7.8
MEAN	16.5±6.12	1.64±0.8	2.61±2.12	8.19	1.3	8.23

Temperature (T^{o}C) ,Salinity (Ss=surface , S_D=Depth),dissolved oxygen (D_o=mg/l),PH , D(water Depth)

The station located in the river mouth (station 4,5)contained abundant fine matter and the other station , located upstream , contained coarser sediment with a preponderance of sands and gravels . organic matter in the sediment ranged from 0.6 % (station 4) to 45% (station 2)(Table 2)

Table 2: Percentage of sediments compositions the sefid-rood river estuary at stations.

Station	TOM(%)	S+CC(%)	VFS(%)	FSC(%)	MSC(%)	SC(%)	VCS(%)	G(%)
1	0.9	24.64	7.36	12.06	8.22	0.04	0.88	0.2
2	1.45	34.34	18.11	41.88	21.11	0.39	0.65	0.1
3	0.84	13.97	17.7	29.18	11.94	0.13	0.54	0.1
4	0.6	23.42	19.71	39.88	13.24	2.76	0.96	0.5
5	0.68	18.47	9.12	47.7	23.03	2.81	0.2	0.5

TOM=Total organic matter, S+C=silt+clay, VFC=very fine sand, FS=fine sand, MS=medium sand, CS=coarse sand, VCS=very coatse sand, G=gravel

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Table 3: Macroinvertebrads groups identification in the sefid-rood river estuary and their quantity and biomass during season and station ind/m^2

groups	Spring	Summer	Autumn	winter	St.1	St.2	St.3	St.4	St.5
Chironomidea	41 25/7	159 17/5	14 2.97	6 0.74	29 5.38	52 19.23	21 3.42	98 15.88	25 3.54
Lunbriculidea	1 10/03	25 2.65	43 9.02	18 2.85	2 0.23	2 0.3	1 0.17	32 4.79	50 3.48
Tubificidae	1 27/1	52 13.5	5 0.9	7 0.93	4 0.44	2 0.21	2 0.2	56 7.85	1 0.11
Gastropoda	8 35/7	18 84.39	1 0.1	1 0.8	8 83.03	8 12.96	4 1.19	7 50.96	1 0.7
Spharium	6 10.6	83 170.14	14 253.34	1 1	3 100.8	52 264.34	13 89.3	34 155.67	1 0.3
Ephemeroptera	5 1/77	8 0.8	-	-	4 1.32	2 0.42	3 0.91	2 0.56	2 0.4
Gammaridea	7 2.18	73 70.75	6 2.2	5 0.88	1 0.9	-	1 0.53	-	86 43.37
Archenidae	1 0.1	2 0.8	-	-	-	1 0.1	-	-	-
Nereidae	-	1 0.21	1 0.15	-	-	-	-	1 0.11	3 0.39
Pelecoptera	-	-	1 5.11	-	1 0.11	-	-	-	-
Average	14 22.64	84 99.93	19 54.42	7 1.28	51/21	119/33	45/26	232/21	159/7

Discussion:

Estuaries are the main transition zones or ecotones between the riverine and marine habitats. They are geomorphologically very dynamic and ephemeral systems, influenced both by sea and land changes, forming a complex mixture of many different habitat types. An estuary generally harbours less species than either the freshwater river above the tidal limit or the trualy marine habitat outside the estuary. Estuaries support many important ecosystem functions: biogeochemical cycling and movement of nutrients, purification of water, mitigation of flood, biological production (nursery grounds for several commercial fish species) etc (Meire *et al*., 1998). It is clear that the hydrological, geomorphological and biogeochemical changes in the estuary had important consequences for the biodiversity. Bad water quality severelly impacted benthic invertebrates and fish. Diversity in estuaries is lowest in the brackish part, due to the large variation of salinity .In the brackish part, less macrobenthic species were indeed found than in the marine part (ysebaert *et al*, 2003). In contrast, the freshwater part harboured less species than the brackish part, as the benthic community was almost exclusively restricted to oligochaetes (seys *et al*, 1999). The sefid-rood estuary is one of the most important estuaries along the southern Caspian sea for migration bony and sturgeon fishes. Macrobenthic communities in the sefid-rood river estuary were numerically domined by surface deposite-feeders, while in the adjacent coastal shelf surface deposite-feeders and filter feeders were almost exually represented. Besides salinity sediment composition has also been pointed out as a major factor inducing spatial heterogeneity of benthic invertebrates. These relationship between spatial distribution patterns and environmental factors, being partially hard to distinguish between natural and anthropogenic included changes. Hydrodynamic conditions (Davould 1990), sediment composition (Gaston 1987) and especially, mud content of the sediment have been pointed out as key factors in the structuring of benthic communities but particular combinations. of these factors may produce a pattern difficult to interpret or may be masked by other factors such as biological interactions or pollutants.Ten benthos taxa were found and identified in the sefid- rood river estuary. The average density from all sites was 153 ind/m^2 and biomass was ……g/m^2.The lowest density and number of benthos found was at site no 3 and in winter .There was poor organic matter in the sediment and the soil type is mainly sand which not quite suitable for the growth of benthos The highest number of benthos found was at site 4 and 5 which is the mouth river and the estuary of the river. There were no significant different in temperature at the sites but there are a significant difference during seasons. There are a high density of macroinvertebrates in summer with increasing temperature chironomidea is dominate group in the estuary other organisms in very less. Although measurements over larger spatial scales have also shown relationships between environmental factors and

benthic macro invertebrate assemblages using an enclosed sampler to concurrently collect benthic macroinvertebrates and measure environmental factors at the sample scale provides additional meaningful insights into the explanations for the ecological condition of estuaries.

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