DIVERSITY, DISTRIBUTION AND ABUNDANCE OF BENTHOS IN MOURI RIVER, KHULNA, BANGLADESH

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ABSTRACT

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Abundances and distribution of macrobenthic organisms were studied in the Mouri river during January-March 2005. Twenty (20) different species were identified in the present investigation. Polychaeta dominated all over the river and represented by *Nemalycastis indica, Nephthys oligobranchia, Dasybranchus caducus* and *Nereis lamellose*. The population of Oligochaeta was represented by *Nais simplex, Stylaria fossularis* and *Limnodrilus hoffmeisteri.* Insecta population was represented by a single species *Chironomus javanus*. Bivalvea population represented by *Lamellidens marginalis* and *Lamellidens jenkinsianus.* Gastropoda dominated by *Bellamya bengalensis, Pila globosa, Lymnea acuminate, Indoplanorbis exustus* and *Thiara granifera*. Abundance of Oligochaeta is concentrated at station I, II and III. Organic pollution indicator *Limnodrilus hoffmeisteri* fairly dominated at station I, II and III. The maximum abundance of macrobenthic organisms recorded from station VI and minimum at the station I which was 630 and 1040 indv. m^{-2} sediment respectively. Shannon-Wiener index indicates the maximum pollution in the station I (1.20 ± 0.23) and minimum in the station VI (1.49 ± 0.753).

Keywords: Aquatic community, diversification, pollution level

INTRODUCTION

Benthos is the organism that inhabit in bottom of lakes, ponds and river stream. Macro benthos play as an important role in aquatic community consist of involved in mineralization, promoted and mixing of sediments and flux of oxygen into sediments, cycling of organic matter (Lind, 1979) and in effort to assess the quality of inland water (Milbrink, 1983). The amount of nutrients release by the sediments will depend on the mineralizing capacity of the benthic community (Newrkla and Gunatilaka, 1982). Abundance and distribution of macro benthos has affected by various physical and chemical condition of the water body such as depth, current of the water organic contents of the sediments, contaminations of bed sediments environment, toxicity of sediments and rapid sedimentation have appear to causes shifts towards lower abundances of macro benthic species (Pearson, 1970).

The present investigation has used a quantitative index (S-W index) of pollution, which enables comparison of pollution loads of different sections of Mouri river. The benthic marco-invertebrates appear to be intimately related with the changing environment by causing and effective pathways. The alterations produced in the physical and chemical status of the riverine ecosystem become recognizable through elasticity of the community structure of the organisms expressible numerically as an index (Wilhm and Dorris, 1966). Thus, benthic macro-invertebrates make ideal subject for such studies and hence have often been used for biological assessment of water quality. Obviously then, pollution of an aquatic water body, being a form of ecological stress-condition, will result in reduction in diversity to benthic community to an extent depending upon the degree of stress; in other words as a measure of severity of pollution. The corollary of the above truism is that low species diversity of macro- invertebrates in a river stretch is indicative of pollution, not merely a state of pollution but the frequency of occurrence of resident species, as a quantitative measure of the intensity of pollution (Mishra, 1996).

In the view of above discussion, the major objectives of the present investigation were fixed to measure the abundance and distribution of different macro benthos in the river and establish Shannon-Wiener Index for the benthic organisms to determine the pollution level of the river.

MATERIALS AND METHOD

The six working stations were established with more or less similar distances (approximately 1.5 km) and near the drainage openings to the river. Investigation site was the Mouri river (Figure 1), flowing at the North West side of the Khulna city, which separate the Domuria upzella from Khulna. The river is about 9.5 Km long and run through various agricultural lands and by side of the main city and finally falls into the Shibsa river near Badamtala which starting fused point is in Rayermohal. The six working stations by name were: Station I: *Rayer Mohal*, Station II: "*Boyra*", Station III: "*Gollamari*", Station IV: "*Nirala*", Station V: "*Nirala-west*", Station VI: *"Labonchara*".

From the above six station samples were collected in the month January to March 2005 at regular fortnightly intervals; six successive days were used to collect sample from six different stations.

For each station sampling started at 8 A.M continue up to 4 PM to complete the collection and measuring the primary productivity. After collection of sample it was bring to the Biology laboratory of Fisheries and Marine Resource Technology discipline, Khulna University, Khulna. Species identification and quantitative analysis of phytoplankton was done in the same laboratory at same day.

Triplicate benthos samples were collected from six stations during the period of January -March, 2005 by using a grab sampler. The mud content was removed *in-situ* by using a set of sceiv. The benthos samples were preserved in a 250 ml plastic container with 10% neutralized formalin and habitat water solution further laboratory study. Collected samples were transferred to an empty tray, classified by groups and counted. The abundance of macro invertebrates in a square meter area was calculated following Jhingran *et al.* (1989) as follows:

$$N = \frac{n}{ah}$$

Where,

N= Number of macro-invertebrates in 1 square meter; n= number of macro-invertebrates per sample; a = area used and h=number of hauls taken.

The data gathered from monthly samples were pooled to furnish the value of S-W Index. The Shannon-Wiener Index of species diversity (H) is defined as (Wilhm and Dorris, 1966):

$$\overline{H} = -\sum_{i=1}^{s} \left(\frac{ni}{N}\right) \log 2 \left(\frac{ni}{N}\right)$$

Where,

S = number of species in a sample; N= total number of individual sin the sample; ni= number of individuals in each species; i.e. N= $\sum$ ni.

For identification of collected benthos work of Wilhm and Dorris (1966), Wilhm (1967), Pearson (1970) and Osborne *et al.* (1976) were used.

Figure 1. Location of working area (Source Banglapedia, ASB, 2003)

RESULTS AND DISCUSSION

20 species under 16 families were identified (Table 1). These belong to Oligochaeta, Polychaeta, Insecta, Bivalvea and Gastropoda. The organisms were Oligochaeta: *Nais simplex, Stylaria fossularis* and *Limnodrilus hoffmeisteri.* Polychaeta*: Namanereis quadraticeps, Nereis lamellose, Nephthys oligobranchia* and *Dasybranchus caducus.* Insecta*: Chironomus javanus.* Bivalvea*: Lamellidens jenkinsianus, Lamellidens marginalis* and *Novaculina gangetica.* Gastropoda*: Bellamya crassa, Bellamya bengalensis, Thiara granifera, Cerithium tenellum, Septaria lineate, Lymnea acuminate, Pila globosa, Indoplanorbis exustus* and *Littoraria scabra*.

Table 1: The species wise distribution of different macro benthos in the Mouri river

Class	Family	Species	Station					
			I	II	III	IV	V	VI
Oligochaeta	Naididac	*Nais simplex*	+	+	+	-	+	-
	Tubificidae	*Stylaria fossularis*	+	+	+	+	-	-
	Tubificidae	*Limnodrilus hoffmeisteri*	+	+	+	-	-	-
Polychaeta	Nereidae	*Namanereis quadraticeps*	+	+	+	+	-	+
	Nereidae	*Nereis lamellosa*	-	+	+	+	+	+
	Nephthydidae	*Nephthys oligobranchia*	+	+	+	+	+	+
	Capitellidae	*Dasybranchus caducus*	+	+	+	+	+	+
Insecta	Chironomidae	*Chironomus javanus*	+	+	+	+	+	+
Bivalvea	Unionidae	*Lamellidens jenkinsianus*	+	+	+	+	+	+
	Unionidae	*Lamellidens marginalis*	+	-	+	+	+	-
	Solecurtidae	*Novaculina gangetica*	+	+	+	+	+	+
Gastropoda	Viviparidae	*Bellamya crassa*	+	-	-	+	+	+
	Viviparidae	*Bellamya bengalensis*	+	+	+	+	+	+
	Thiaridae	*Thiara granifera*	+	+	+	+	+	+
	Cerithiidae	*Cerithium tenellum*	-	+	+	+	+	+
	Neritidae	*Septaria lineata*	+	+	+	+	+	+
	Lymnaeidae	*Lymnea acuminata*	+	-	-	+	+	+
	Pilidae	*Pila globosa*	-	-	-	+	+	+
	Planorbidae	*Indoplanorbis exustus*	+	-	-	+	+	+
	Littorinidae	*Littoraria scabra*	-	-	-	+	+	+
Total		20	16	14	15	18	17	16

Benthos Abundance: Macrobenthos abundance varied between 630 and 1040 indv. m^{-2} in the present study. The maximum abundance 1040 indv. m^{-2} was recorded from station-V and the minimum 630 indv. m^2 in station-I (Table 2). In India Mishra (1996) recorded the average density of macro benthic organisms in the polluted portion of Ganga river was 119-4053 indv. m^{-2} which supported the result of present investigation.

Table 2. Abundance of benthos (indv/m^2) in different stations

	Station					
	I	II	III	IV	V	VI
Range	630-640	645-655	812-980	856-890	650-1040	975-996
Mean	640±10	655±10	895±84	870±17.70	980±51.69	985±10.56

Maximum abundance of Oligochaeta was 340 indv. m^{-2} recorded in station-I (Rayer mohal) and minimum 250 indv. m^{-2} in station VI (Nirala) (Table 3). Mishra (1996) recorded the average density of Oligochaeta in the polluted portion of Ganga river; India was 150-1845 indv. m^{-2} which supported the result of present investigation. Oligochaeta is considerate as an indicator of organic pollution, the higher number represent the maximum pollution (Pearson, 1970). Comparatively higher abundance of Oligochaeta was found in station I station II and station III in the Mouri river.

Polychaeta showed it maximum density 305 indv. m^{-2} at station II and III (Boyra) and minimum 125 indv. m^{-2} at station-I (Rayer mohal) (Table 3). Mishra (1996) recorded the density of Polychaeta 50-585 indviduals/m^2 in the polluted portion of Ganga river, India which supported the result of present investigation.

The maximum abundance of Insecta was 219 indv. m^{-2} recorded at station IV (Gollamari) and minimum 70 indv. m^{-2} at station I (Rayer mohal) (Table 3). Average ranged density of Insecta in the polluted portion of Ganga river India was 100-1250 indv. m^{-2} (Mishra, 1996) which was much higher than the result of present investigation.

Maximum abundance of Bivalvea 150 indv. m^{-2} was found at station VI (Niralla) in and minimum 10 indv. m^{-2} at station III (Gollamari) (Table 3). Average ranged density of Bivalvea in the polluted portion of Ganga river; India was 50-125 indv. m^{-2} (Mishra, 1996) which was much similar with the result of present investigation.

Gastropoda in the present study found in ranged from 36 to 120 indv m^{-2}.Maximum concentration 120 indv. m^{-2} was recorded at station VI and minimum 36 indv. m^{-2} at station II (Table 3). Present investigation result was much less than the findings of Mishra (1996), who recorded the average ranged density of Gastropoda in the polluted portion of Ganga river, India was 60-250 indv. m^{-2}.

Table 3. Distribution of macrobanthos organism (ind/m^2) at different station

	Station					
	I	II	III	IV	V	VI
Oligochaeta	340	286	325	250	260	250
Polychaeta	125	185	250	305	280	305
Insecta	70	90	179	219	190	160
Bivalvea	45	55	10	55	145	150
Gastropoda	60	36	55	40	105	120

Shannon-Wiener index*:* The Shannon-Wiener (S-W) indices of diversity (H) of the benthic macro-nvertebrates, were 1.20 ± 0.23 in station I; 1.24 ± 0.453 in Station II; 1.247 ± 0.543 in station III; 1.464 ± 0.782 in station IV; 1.47 ± 0.985 in station V and 1.49 ± 0.753 in station VI.

It is apparent from Figure 2 that the any stations did not show very trenchant differences in the mean values of diversity index amongst each other. Although the mean species diversity value of station III and I is much lower compared to those of other four stations which indicating high pollution in station III and I. Lowe value of S-W index indicate the higher level of pollution (Wilhm and Dorris, 1966).

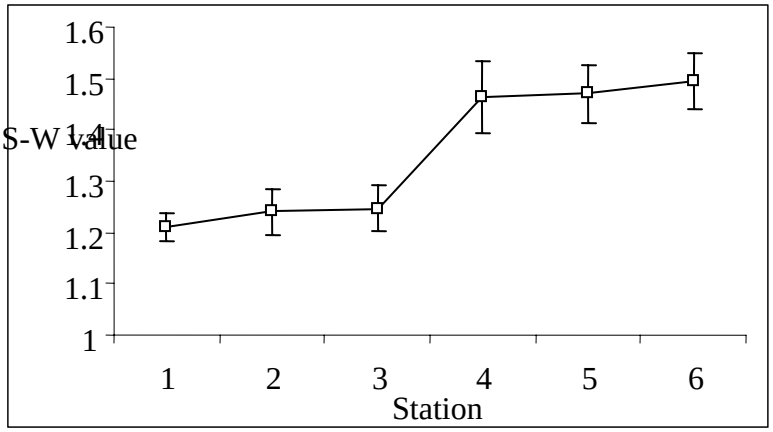

Figure 2. Shannon-Wiener Indices at different station of Mouri River.

Shannon-Wiener Index is a sensitive indicator of pollution and its values do not fluctuate very widely. Shannon-Wiener index of diversity in the present study has shown a variation range 1.052 ± 0.782 to 1.374 ± 0.543. Johnson and Brinkhurst (1971) observed the values ranging form 1.00 to 3.66 in their study, Mackey *et al.* (1973) reported that in their study the Shannon-Wiener index ranged from 1.3 to 2.5 from 50 polluted streams.

Osborne *et al*. (1976) observed values ranging from a minimum of 0.14 to a maximum of 2.69 whereas Godfrey (1978) found the value ranging from 1.938 to 5.34. The investigation is supported by the above findings. Ransom and Derris (1972) made a similar observation in their work on Keystone reservoir in the U.S.A. The somewhat lower values of the index of diversity during the investigation can be attributed to the residual effect of the pollutants' settled at the bottom which come from different domestic sources, municipal wastes disposal, agricultural wastes and industrial wastes discharge to the river. According to Wilhm and Dorris (1966) species diversity (S-W) index (H) value ranged from >3 indicates clean water, 1.00 to 3.00 indicates moderately and <1.00 indicates heavily polluted condition of water.

Exposed to progressively increasing amount of domestic discharge and urban runoff, the benthos of station III and I was found to be less and less able to support a diverse and stable macrobenthic community.

The maximum impact of pollution in Mouri river is felt at station I and III since in between the stations I and III, enough geographical distance is not available for stream's self-purification and pollution abatement. Thus, station III and I are the most affected area of this river.

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