15

Impact of Coalmining and Washing Practices on Macro Benthic Community

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Introduction

In the simplest words the organisms living on the bottom of the water bodies are termed as benthos. The benthic fauna occupying a very important place in tropic dynamics and production of a water body, become an important aspect of limnological investigations. However, a perusal of literature relieves that among the limnological attributes the least studied component, so far the Indian scenario is concerned, is macrobenthic community.

The macrobenthic community of an aquatic ecosystem, be it lotic or lentic, like other communities has a series of attributes that do not reside in its individual species components and have meaning only with reference to the community level of integration such as species diversity, growth form and structure, dominance, relative abundance, tropic structure. One of these attributes or many of these or all, depending upon situation, may be changed with the changing ecology of the water body concerned. In fact the present view of the nature of community lies closer to Gleason's individualistic view than to Clements's superorganismic interpretation. Species are

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distributed individualistically according to their own genetic characteristics. Populations of most of the species tend to change gradually along the environmental gradients. Most species are not in obligatory association with other species which suggests that associations are formed with many combinations of species and vary continuously in space and time. Hence a study on macro benthic community composition and dynamics of different populations of the community becomes a reliable source to provide the picture of environmental gradients and influence of changing ecology of the concerned water body.

Furthermore, apart from the normal ecological condition, in polluted systems, natural changes induced by pollution — the benthic biota provide a method for assessment of pollution; biological examinations have been stressed to provide a more accurate picture than the physico-chemical examinations (Hirsch 1958, Hynes 1960, 1964a, 1964b, 1965, Sarkar and Krishnamoorthy 1977, Singh 1988 Sinha *et al* 1989). In aquatic systems, the macrobenthic invertebrate community is most often investigated due to absence of mobility and sensitivity towards physico-chemical stress. Several workers have pointed out that benthic organisms provide a valuable indicator of past and present water quality conditions and prove to be the most useful in assessment of pollution (Hynes 1965, Hussainy and Abdulappa 1967, Rama Rao *et al* 1978, Sinha 1988) because of their life-cycle length, central position in food chain and ease of sorting and preservation (Mackenthum 1966, Cairns and Dickson 1971, Brinkhurst 1970, 1972). Thus in pollution impact analysis the pollution ecology of the macro benthic community becomes a very important and readily available biological tool. But in studying water pollution, the lack of data or clear picture on just the normal ecology of macrobenthic organisms — let alone their pollution ecology and the extent to which individuals or species of community or communities *per se* indicate degree of pollution — is disheartening and may lead to ambiguity in drawing conclusions. And as pointed out by Hart (1974) it is foolish to try to understand abnormal conditions without knowing first what is normal. This is why while preparing the present write up of assessing pollutional impacts of coal mine drainage and allied effluents by macrobenthic fauna a concise normal ecology of the benthos from the same area under similar environmental conditions has been dealt with to provide a clear pollutional impact.

Normal Spectrum

The study carried out on normal (unpolluted) water body for one year reveals that the macrobenthic community is composed of some forty eight species, the maximum being insects and minimum being from molluscs while the oligochaets occupied the intermediate position from species richness viewpoint. The abundance of different populations of the community and co-existence of the member of species are well expressed by the data presented in Table 15.1. A hierarchy of mechanisms responsible for the distribution and abundance of organisms exists within any community (Brown 1981, Reynoldson 1981). Ultimately organisms in aquatic biotopes are limited to specific ranges of physical environments by their physiological tolerances to ranges of temperature, water chemistry (Fiance 1978, Vannote and Sweeney 1980). Within a suitable range of these physical limitations, organisms may be restricted to particular ranges of current velocities, substrata types or food availability within which they can successfully procure food resources (Harrod 1965, Edington 1968, Carlsson *et al* 1977, Malas and Wallace 1977). In addition, predation interspecific competition and many types of other stresses and disturbances posed by pollution further restrict the distribution and abundance of individuals within otherwise suitable microhabitats.

Though the details of normal ecology of different components of the community recorded during the investigation is out of scope of the present article and space limitation is another binding yet some important points on gross level have been listed below.

Insects

In an aquatic ecosystem, if not otherwise or specifically stressed, it would be the insects to dominate the macrobenthic fauna both qualitatively and quantitatively. During the present study five orders of insects have been represented by their different families.

Ephemeroptera : The ephemeropteral nymphs are found in all kinds of water bodies with variation in habitat like soft mud bottom, under rocks, sand gravel, bottom vegetation etc. They are perhaps the prime grazer in the aquatic food web. Most are algal feeders, some are scavengers, feeding both on algae and vegetational detritus. They are not very sensitive to chemical and physical stress, *Baetis* sp. being very tolerant form.

Table 15.1 : The Community Composition Organisms/m² and Seasonal Changes in Different Population of a Macro Benthic Community of Unpolluted Water Body. (— = Absent and + = Less than 10)

1	2	3	4	5	6	7
	Jul.	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
OLIGOCHAETA						
f. TUBIFICIDAE						
Branchiura sowerblyi	576	934	128	230	64	154
Branchiodrilus horlensis	154	-	27	90	26	-
Tubifex tubifex	230	102	38	51	12	-
Auledrilus americanus	25	-	12	-	-	-
Limnodrilus undekemianus	128	115	102	218	38	64
Limnodrilus angustipenis	-	-	-	33	12	141
Limnodrilus claparedianus	28	-	-	-	-	-
Potanothrix vejdovski	-	-	-	+	+	-
f. AEOLOSOMATIDAE						
Aeolosoma sp.	141	39	37	-	27	108
f. NAIDIDAE						
Dero pectinata	154	-	90	128	-	-
Dero sp.	230	154	77	-	38	72
Chaetogaster sp.	167	139	-	38	-	27
Pristina sp.	-	-	-	-	-	-
Bratislavia bilongata	+	-	-	-	+	+
INSECTA, O. EPHEMEROPTERA						
f. EPHEMERIDAE						
Ephemerella sp. (nymph)	18	36	-	27	-	-
f. BAETIDAE						
Baetis (nymph)	-	15	-	-	-	-
f. CAENIDAE						
Caenis (nymph)	-	32	-	15	18	-

1	2	3	4	5	6	7
	Jul.	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
O. ODONATA						
f. *Zygopteran* nymph	51	26	26	52	-	38
f. *Anisopteran* nymph	39	-	63	-	52	52
O. TRICHOPTERA						
f. HYDROPSYCHIDAE						
Hydropsyche sp. (Larva)	-	15	-	-	-	-
f. RHACOPHILIDAE						
Rhacophila sp.	12	-	27	-	-	-
O. COLEOPTERA						
f.. HYDROPHILIDAE						
Berosus sp. (Larva)	27	-	54	-	29	90
f. GYRINIDAE						
Gyrinus sp. (Larva + Adult)	-	-	22	-	-	28
Dineutus sp. (Larva + Adult)	-	15	-	29	-	-
O. DIPTERA						
f. TRIPULIDAE						
Limnophila sp. (Larva)	-	-	-	-	27	54
Helius sp. (Larva)	-	-	-	-	+	+
Elliptera	-	-	-	-	-	±
f. CULIEIDAE						
Chaoborus sp.	-	-	-	-	+	+
f. TABANIDAE						
Tabanus sp.	-	-	-	-	+	-
f. DIXIDAE						
Dixa sp.	-	-	-	-	+	+
f. SIMULIDAE						
Simulium sp.	-	-	-	-	-	-