Mahasagar-Bulletin of the National Institute of Oceanography, *14*(1), 1981, 79-81.

# A NOTE ON THE HETEROTROPHIC BACTERIAL POPULATION IN INTERTIDAL SEDIMENTS OF THE KARNAFULI ESTUARY

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ABSTRACT

Populations of bacteria in the intertidal sediments of the Karnafuli estuary were studied. Bacterial counts per gram of dry sediments varied from $2.103 \times 10^6$ to $6.612 \times 10^6$ and $2.016 \times 10^6$ to $4.420 \times 10^6$ in the nutrient-agar-medium and ZoBell medium-2216 respectively. Organic carbon, nitrogen content and salinity of the sediments were found to have much effect on the distribution of bacteria.

Microbial populations in the estuarine habitat vary widely. Although the estuarine sediments are in contact with the saline water they form a separate biocoenosis (Wood, 1965).

Karnafuli estuary can be considered as a typical estuary (Mahmood, Khan and Ahmed, 1976). Some works on the bacterial activity in the sediments of other parts of the world (Oppenheimer, 1960), bacterial population in the Canadian lake sediments (Tsernoglou and Anthony, 1971) and bacterial population in water of the Bay of Bengal off the coast of Bangladesh (Hakim and Mahmood, 1977) have been carried out earlier. However, no work has yet been done on bacterial population in the sediments of any estuarine environment of Bangladesh.

Sediment samples were collected in the month of November, 1979 from the intertidal areas of four stations (Fig. 1) of the Karnafuli estuary by hand coring with sterile glass tubes. The samples were transferred to sterile flasks and carried to the laboratory.

Bacterial population was determined by the method of plate count using nutrient-agar-medium and ZoBell medium-2216 (Jannasch and Jones, 1959). pH of the samples was measured using a pH meter. Salinity of the samples was determined by the specific electrical conductivity method (USDA Salinity Lab. Staff, 1954). Total organic carbon and nitrogen contents were estimated by the methods outlined by Jackson (1958).

The results are shown in the Table I. Bacterial count per gram of dry sediments varied from $2.103 \times 10^6$ to $6.612 \times 10^6$ in the nutrient agar medium and from $2.016 \times 10^6$ to $4.420 \times 10^6$ in the ZoBell medium-2216. Wood (1953) reported by plate count, that bacterial population per gram of mud in the continental shelf off Port Hacking varied from $1 \times 10^5$ to $3 \times 10^6$ and that per ml estuarine mud in the oyster-growing regions of Botany Bay it ranged from $8 \times 10^4$ to $2.5 \times 10^7$. ZoBell (1959)

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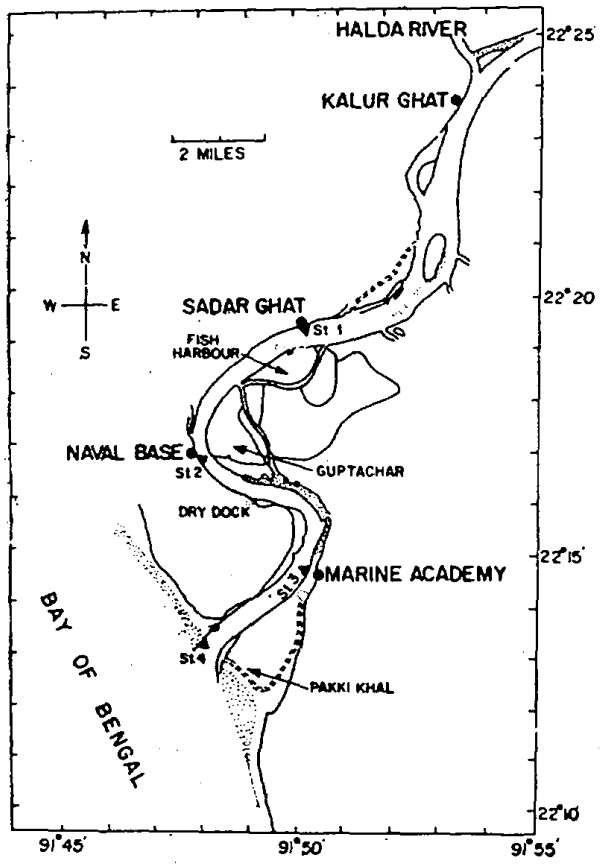


*Fig. 1.* Location of stations.

mentioned that in recently deposited marine sediments the bacterial population varied from $10^5$ to $10^8$ per gram of wet material.

The type of the sampled sediments varied from clay to silt. Sediments were nearly neutral to slightly alkaline in nature. Salinity of the samples ranged from 0.85 to 12.45‰. The maximum salinity was observed at the station 4 and the salinity decreased gradually towards the station 1. Similar observation in case of the salinity of water samples of the Karnafuli estuary was reported by Mahmood, Khan and Ahmed (1976).

Total organic carbon and nitrogen contents of the collected samples ranged from 0.7 to 12.7% and from 0.37 to 2.07% respectively. Dale (1974) reported the total organic carbon and total nitrogen in the sediments of an intertidal basin at the southeast end of Petpeswick Inlet (Nova Scotia) to vary from 0.1 to 16.8% and from

*Table I.* Bacterial population and physico-chemical features of sediments of the Karnafuli estuary.

| Station No. & Place | Sample No. | Sampling depth (cm) | Type of sediments | Physical analysis of sediments | | Chemical analysis of sediments | | Bacterial count per gram of dry sediments | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | pH | Salinity (‰) | Total Org. C (%) | Total N (%) | Nutrient agar medium ($\times 10^6$) | ZoBell medium-2216 ($\times 10^6$) |
| 1 Sadarghat | 1 | 0 | Clay | 7·2 | 1·11 | 12·7 | 2·07 | 6·612 | 3·727 |
| | 2 | 2 | Clay | 7·1 | 1·55 | 11·2 | 1·75 | 6·521 | 3·410 |
| | 3 | 3 | Clayey | 6.9 | 0·98 | 9·3 | 1·47 | 5·913 | 3.126 |
| | 4 | 5 | Clay | 6·8 | 0·85 | 8·2 | 1·23 | 5·621 | 2.016 |
| 2 Naval base | 5 | 0 | Clay | 7·3 | 5·60 | 5·8 | 1·19 | 4.519 | 3.932 |
| | 6 | 2 | Clay | 7·2 | 4.07 | 5·3 | 1·12 | 4·433 | 3·621 |
| | 7 | 3 | Clay | 7·1 | 3.81 | 5·0 | 0.96 | 4·127 | 3·502 |
| | 8 | 5 | Silty clay | 7·1 | 2·77 | 4·6 | 0·91 | 3·152 | 3·332 |
| 3 Marine Academy | 9 | 0 | Clay | 7·4 | 8·51 | 3·9 | 0·93 | 4.327 | 4·102 |
| | 10 | 2 | Clay | 7·4 | 8·01 | 3·1 | 0.88 | 4·059 | 3·915 |
| | 11 | 3 | Silty clay | 7·2 | 7·95 | 2·4 | 0·76 | 3·921 | 3.812 |
| | 12 | 5 | Clayey silt | 7.2 | 6·07 | 1·9 | 0·67 | 3·131 | 3·617 |
| 4 Estuary | 13 | 0 | Clay | 7.5 | 12·45 | 2·2 | 0·68 | 3·339 | 4·420 |
| | 14 | 2 | Silty clay | 7·5 | 12·01 | 1·3 | 0·59 | 2·450 | 4·295 |
| | 15 | 3 | Clayey silt | 7·4 | 11.67 | 0·9 | 0·53 | 2·237 | 4·105 |
| | 16 | 5 | Silt | 7·2 | 10·78 | 0·7 | 0·37 | 2.103 | 3·903 |

0·01 to 1·67% respectively. In our present study sampling station 4 was adjoining the Bay of Bengal and station 1 was relatively far away from the Bay of Bengal. Organic carbon and nitrogen contents gradually decreased from station 1 to station 4 and similar was the case with the bacterial counts in the nutrient-agar-medium but the reverse was true with the plate count in the ZoBell medium-2216.

These observations showed that heterotrophic organisms were more abundant in the station 1 and these organisms were gradually dominated by the halotolerant organisms towards the station 4 because of the increase in salinity. It could also be assumed that the halotolerant organisms preferred the constituents of ZoBell medium-2216 containing sea water and ferric phosphate in which they could grow well.

The number of viable bacteria and also the organic content of the marine sediments have been reported to decrease with the core depth or with the increase in the age of deposits (ZoBell and Anderson, 1936; Anderson, 1940). In this study viable count of bacteria in both media decreased with the core depth and so did the organic carbon and nitrogen contents at all the sampling stations.

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