

Benthic Studies in the Environs of a Sewage outfall Panjim, Goa

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DOMESTIC wastes including sewage contain a large number of substances which can be toxic to aquatic life and cause health hazards. Their effect on the environment is seldom noticed until occurrence of some calamity. Environs of a sewage outfall in the Mandovi estuary near Panjim, Goa have been studied from August to October 1974 for distribution and abundance of benthos and bacteria.

Collections were made from five fixed stations : 1) At the outfall 2) about 150 m. away from the discharge point in the direction of the outflow, 3) and 4) about 150 m. on either side of the station, and 5) on the opposite bank of the estuary (Fig. 1). A Van Veen grab of 0.4 m² area was used for benthic collections and the environmental parameters were observed along with each collection. For bacteriological examination, a part of each group sample was processed in the laboratory. The most probable number (MPN) was determined referring to McCready's Table. Collections were made once in a fortnight and the results of five such collections are discussed here. The environmental parameters and their range of variations are given in Table I.

Table : I. Environmental parameters at different stations.

| Stations | Depth m. | Salinity ‰ | | Oxygen-ml/L | | Substratum |
|----------|-------------|------------|------|-------------|------|--|
| | | Min-Maxm. | Mean | Min-Maxm. | Mean | |
| 1 | 0.5 | 25.6-27.8 | 27.4 | 3.62-4.80 | 4.14 | Loose sand |
| 2 | 2.0 | 26.4-30.1 | 29.2 | 3.25-4.51 | 3.96 | Muddy sand |
| 3 | 2.2 | 26.4-30.2 | 29.2 | 3.82-4.76 | 4.28 | Fine sand |
| 4 | 2.0 | 26.5-31.0 | 30.1 | 3.96-4.89 | 4.31 | Fine sand |
| 5 | 4.5 | 27.2-32.1 | 31.0 | 3.52-4.65 | 4.06 | Fine sand with detritus and shell fragments. |

Environment

Both salinity and oxygen values show fluctuations. Variations are predominantly due to the influence of tide and freshwater influx which make this environment complex. Earlier investigations showed that this area is in euhaline zone of the estuary and is also rich in organic carbon. So, any heterogeneity in benthic populations at different stations may be due to variations in the substratum, depth, hydrological differences in the environment and may also be due to the effect of sewage.

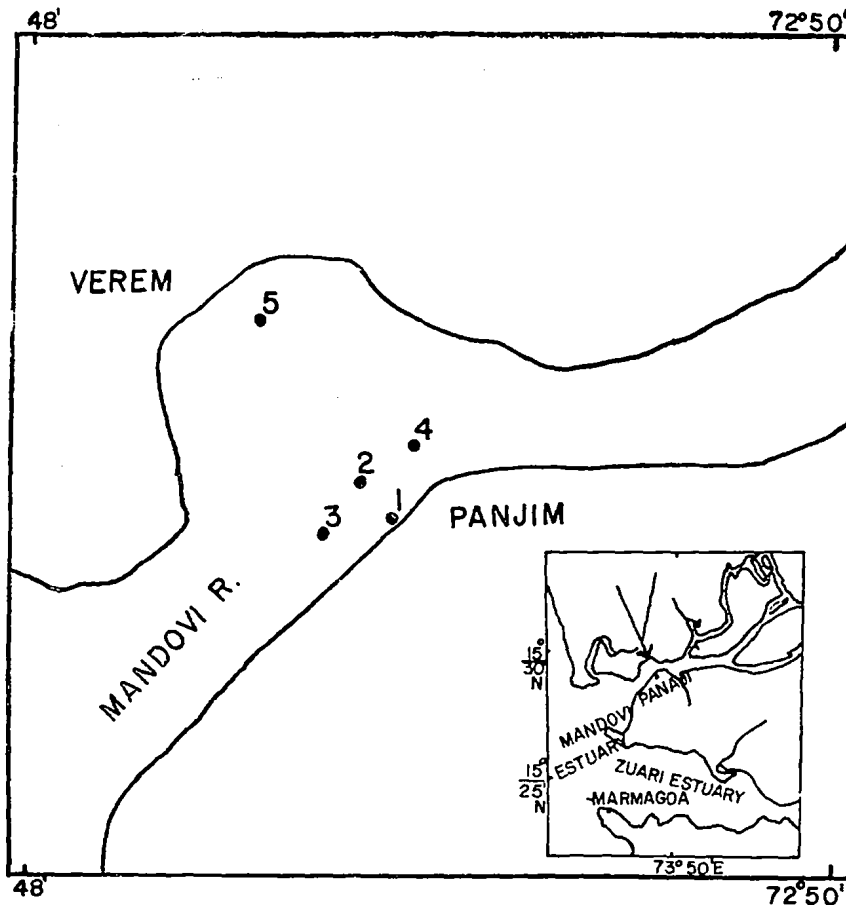
Benthos

Benthic populations are structured communities with numerous connecting links. Disruption of these communities by external stresses like pollution can affect the entire aquatic food-web. The general picture of benthic population in this area is given in Table 2.

Table II. Relative abundance of benthos among different stations (Average of five collections in %m²)

| Species | Stations | | | | |
|--------------|----------|----|----|----|----------|
| | 1 | 2 | 3 | 4 | 5 |
| Glyceridae | — | 24 | — | — | 51 |
| Polynoidae | — | — | — | — | 100 |
| Nematode | 68 | 32 | — | — | — |
| Nemertem sp | 30 | 50 | — | — | — |
| Gammaridae | — | 21 | 13 | 13 | 53 |
| Mole crab | 100 | — | — | — | — |
| Grapsus sp | — | 17 | 17 | 33 | 33 |
| Leucosia sp | — | — | — | — | 100 |
| Gelasiums sp | — | — | — | — | 100 |
| Gastropod | — | — | 20 | 40 | 40 |
| Glams | — | — | — | — | Abundant |

In general, benthic populations were scarce in the outfall region. The greater number of species and the larger number of individuals per species at the station No. 5 indicates a healthy environment. The mole crabs recorded from the discharge point were found on the exposed bottoms in the vicinity of the outfall. It appears that the solid wastes and debris brought by the drainage is deposited near station No. 2. The general species composition is comparable at stations 1 and 2. The other stations are conspicuous by the absence of these forms. In the outfall region the environment appears to have been modified and Nematodes and Nemertean species are dominant. The absence of these two groups at stations 3 and 4 and the presence of crabs and gastropods in these stations suggest that these stations are much less influenced by the waste disposal and the disposed wastes get diluted before reaching these stations. Hence the influence of the outfall upon the benthic population is seen for a very short distance. However, the distribution of nematodes and nemerteians at stations 1 and 2 is significant. The former along with other organisms is re-



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ported to be pollution indicators. If the presence of nematodes indicate polluted waters, nemerteians which are also found in the same habitat may be considered as possible pollution indicators. But further investigations are necessary to group the faunal elements into regressive, transgressive and indicator species because the distribution and abundance of marine benthos is influenced by a number of environmental factors.

Bacteria

The presence of pathogenic bacteria, viruses and resistant stages of parasites make domestic wastes a potential hazard to human health. Both the coliforms and total bacterial counts were observed at all the five stations. The mean population counts and their range of variation are given in Table III.

Table-III. Total counts of coliform bacteria at different stations (Per gramme wet wt. of the substratum)

| Stations | Total bacteria 10 ⁵ /gm | | | Coliform bacteria 10 ³ /gm | | |
|----------|------------------------------------|-------|------|---------------------------------------|--------|------|
| | Min. | Max. | Mean | Min. | Max. | Mean |
| 1 | 1.10 | 280.0 | 59.9 | 4.5 | 1100.0 | 24.9 |
| 2 | 0.61 | 125.2 | 36.5 | 7.0 | 140.0 | 44.4 |
| 3 | 0.61 | 156.0 | 44.0 | Nil | 75.0 | 22.4 |
| 4 | 2.0 | 21.9 | 7.7 | 2.5 | 150.0 | 39.4 |
| 5 | Nil | 8.6 | 3.0 | 2.5 | 150.0 | 54.8 |

The population counts varied widely at different collections. The wider range may be due to the observations being made at different phases of the tide and also due to the differences in the amounts of sewage fall

From the beaches of Goa, Gore recorded bacterial populations in the order of 1×10^3 to 28×10^5 Compared to these figures, counts upto 280×10^5 recorded from the outfall point is high enough to be significant. In polluted waters, Persoone and de Parvw round the number of coliforms from 40 000 to 24,000/ml. In the present study at different stations observed, the bacteria were present in sufficiently large numbers and indicate unhealthy conditions.

A part of sewage and domestic waste is being emptied into the Mandovi estuary through this nalla. This has resulted in the increase of bacterial populations and changes in the benthic community. Some times near the opening of the canal fishing boats land their catches and wash the fish near the outfall region. It is desirable that sewage and townwaste should be treated as far as possible.

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