

OCCURRENCE AND DISTRIBUTION OF BACTERIAL INDICATORS OF FAECAL POLLUTION IN THE TIDAL WATERS OF A MUDDY COAST

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ABSTRACT

Population of bacterial indicators of faecal pollution at three coastal port stations viz. Old Port, New Port and Gogha Port of Bhavnagar were enumerated every month for two years. Old Port was found to be more polluted than the other two ports. It showed a higher population of total coliform, faecal coliform and faecal streptococci that increased during the monsoon and postmonsoon months. The tidal waters during most part of the year showed a wide variation of faecal index.

INTRODUCTION

OCCURRENCE of bacterial indicators of faecal pollution like faecal coliform and other enteric bacteria in coastal waters is a public health hazard. These organisms especially faecal coliform get ingested into the body of filter feeding organisms, bottom dwelling fishes, prawns, bivalves, etc. rendering them potential carriers and making them unfit for human consumption. Geldrich (1974) reported that occurrence of coliform in water signifies the potential presence of other enteric pathogens in the same environment.

Ecological studies on faecal indicator bacteria have been carried out in a number of water bodies (Carney *et al.*, 1975; Sayler, 1975; Goyal *et al.*, 1977; Gore *et al.*, 1979; Raveendran *et al.*, 1978; Pradeep and Lakshmanperumalsamy *et al.*, 1986; Venkateswaran and Natarajan, 1987). Studies on faecal pollution of Bhavnagar Coastal waters is an untouched area and hence merits a detailed investigation. In this paper, based on data collected during February 1987 to January 1989, quantitative occurrence of indicator bacteria like total coliform, faecal coliform and faecal streptococci in tidal water is presented.

MATERIALS AND METHODS

The study area covered the following three port stations of Bhavnagar Coast, spread over 20 kms, located at 21°45'N and 72°14'E. Old Port, an abandoned port having pure mud flats which are directly influenced by land drainage, sewage discharges and heavy land runoff during monsoon; New Port, an active port station situated 6 kms away from Old Port and Gogha Port, situated 20 kms away with rocky, sandy, muddy narrow coastal area.

High tide water samples were collected at monthly intervals for two years (February 1987 to January 1989) from four sites of each of the three stations. These were taken in sterilized screw capped bottles to the laboratory in ice boxes. The isolation and enumeration of total coliform, faecal coliform and faecal streptococci were made by the method suggested by Rand *et al.*, (1975). FC/FS (Faecal coliform/Faecal streptococci) ratio which gives a quantitative pollution index was calculated for all the samples as suggested by Finstein (1972). A ratio greater than 4.0 indicates pollution of human origin, while a ratio of less than 0.6 indicates pollution originated from animal wastes (Geldrich, 1974).

RESULTS AND DISCUSSION

Monthly variations of coliform, faecal coliform and faecal streptococci data are given

in Fig. 1. At all three stations the highest total coliform populations occurred in the monsoon and postmonsoon seasons (August-January) and the minimum population in March-May (i.e.

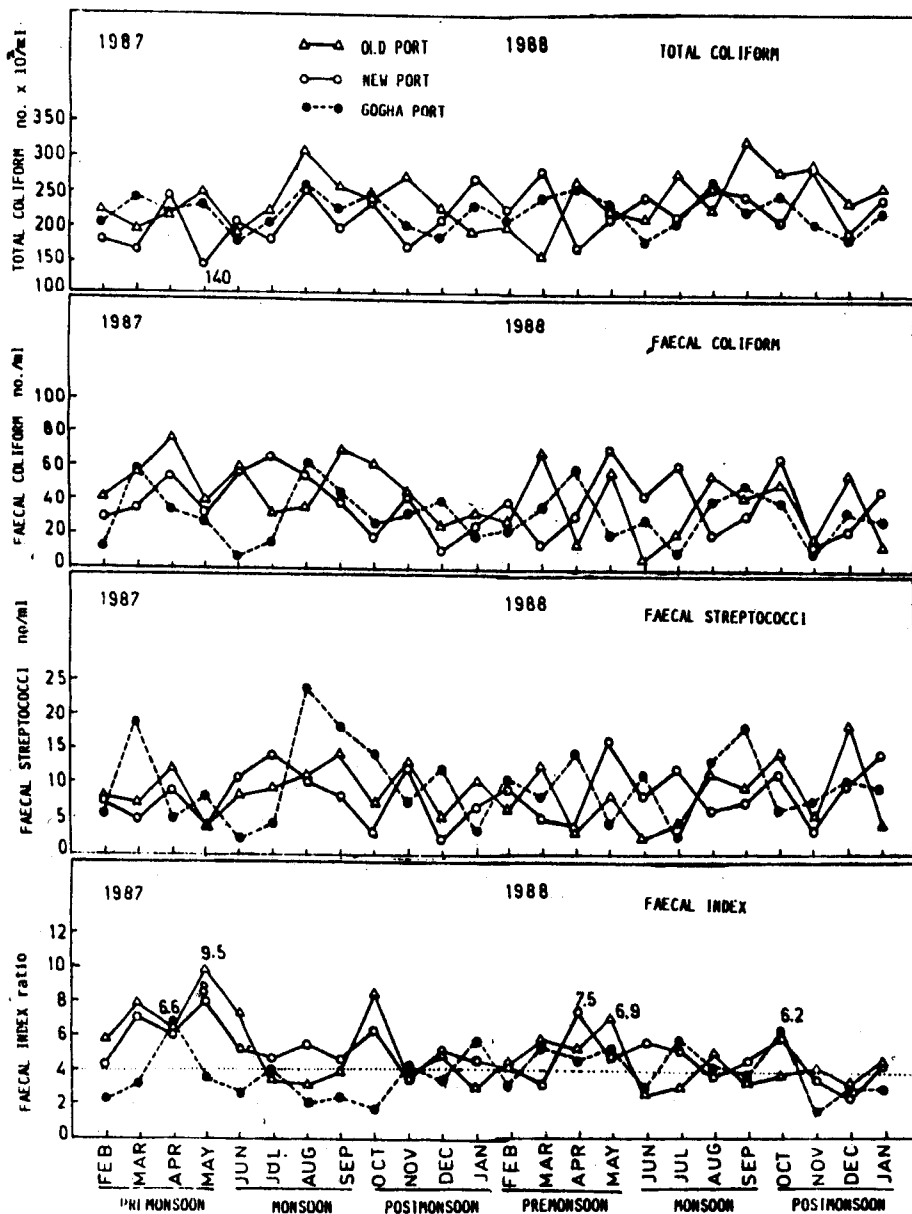


Fig. 1. Seasonal distribution of total coliform, faecal coliform, faecal streptococci and faecal index in the tidal waters.

late premonsoon months) except one exception (Old Port in 1987). Old Port harboured the highest population of the coliform bacteria during both years, may be due to the high sewage and drainage discharges at this station compared to others. The rise in population was least (1.4 times of its minimum) at Gogha Port during both years while the greatest difference in rise was noted at Old Port in 1988 (2.1 times).

The data show that there was no clear-cut season supporting the highest population atleast in the year 1987. While New Port and Gogha Port recorded their highest faecal coliform populations in July and August respectively, at Old Port it occurred in April. However, in 1988 the highest populations were noted only during the premonsoon months (March-May). Old Port recorded its minimum and maximum populations in 1987, but in 1988, the counts were different. Its lowest population was less than recorded for water of New Port and Gogha Port and its maximum population too was lower than that of New Port. One thing that cannot escape attention is the fact that the jump in population from minimum to maximum is very great ranging from 3.3 times to 13.3 times.

The surface water which showed smaller populations of the faecal streptococci at all the three stations, recorded its highest numbers in July-September in 1987, but in the next year it was different at different stations.

The faecal index of surface waters was above four; but these values frequently fell below 4. It is apparent that in 1987 Gogha Port had the faecal index above 4 only on three occasions; rest of the year it had a value lower than 4. However, in 1988, the situation was different when the index was above 4 during six months.

April and May are usually the months that showed highest faecal populations. The

least faecal pollution (ignoring one exception in each) occurred in August-December. In 1987 Old Port and in 1988 New Port showed the maximum water pollution. Least faecal index was noted for Gogha Port in both 1987 and 1988.

This study shows that the total coliform bacterial populations were always higher than faecal coliforms, as has been previously observed by Geldrich (1972), Lakshmanperumalsamy (1981) and Gore *et al.*, (1978), who recorded a higher incidence of coliform during premonsoon and monsoon months at Cochin waters. Venkateswaran and Natarajan (1987) reported a similar distribution and population of faecal streptococci in the east coast. Geldrich (1970) considered these bacteria as supplementary evidence of faecal pollution and they are better indicators than coliform, because faecal streptococci have not been reported to multiply or occur in waters or virgin soils.

The importance of FC/FS ratio in interpreting faecal pollution of a given watermass was suggested by several workers (Phirke and Varma, 1972; Thapliyal, 1972). Geldrich and Kenner (1960) while giving preference to FC/FS ratio in assessing and indicating human and non-human faecal pollution, emphasised the importance of collecting samples from nearest location of sewage outfall to formulate the ratio. Pradeep and Lakshmanperumalsamy (1986) reported a higher faecal index during most of the year in Cochin Backwater.

The result of this study indicates that Bhavnagar coastline especially the Old Port area which is very near to Bhavnagar City is highly polluted and is a potential threat to public health.

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