

### Short Communications

## Occurrence of enteric bacteria in seawater and mussels along the southwest coast of India

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Distribution of *Escherichia coli*, faecal streptococci, *Salmonella* and *Vibrio cholerae* at Neendakara, Vizhinjam and Kootappalli (Cape Comorin) during January 1986-January 1987 indicates that dispersion and disappearance of enteric bacteria in these environments are very conspicuous. However their residence time in the marine environments from where these samples were collected during the monsoon season is very high. This is evidenced by their presence in the brown mussel *Perna indica* collected from the mussel beds of the above locations. *Salmonella* spp. and *V. cholerae* 01 are totally absent during the study period, but *V. cholerae* non 01 is observed in some of the mussel samples collected.

Studies relating to pollution by the enteric bacteria have been carried out<sup>1-8</sup>. All coliform bacteria are not faecal and do not signify pollution though they may thrive in coastal marine environments. In the present study, an attempt has been made to correlate the disappearance of enteric bacteria with the bacterial contamination of edible mussels.

Monthly (January 1986-January 1987) surface water, beach sand and mussel samples from mussel beds were collected<sup>5</sup> from Neendakara, Vizhinjam and Kootappalli (Cape Comorin), along the southwest coast of India<sup>5</sup>. Brown mussel *Perna indica* was collected from the submerged rocks in the inshore waters. The mussel beds at the places of collection are situated 100 to 250 m away from the coast. The mussel samples collected were aseptically preserved in ice before processing. Isolation and enumeration of coliforms, *E. coli* and faecal streptococci were carried out<sup>3</sup>. Isolation of *Salmonella*<sup>5</sup> and *V. cholerae*<sup>8</sup> was also carried out.

Analysis of samples collected at various locations during different months indicated the presence of coliforms in surface water, beach sand and in mussels throughout the period of observation (Table 1). *E. coli* and faecal streptococci occurred in significantly high numbers in the mussel samples collected at all locations except at Kootappalli during the southwest monsoon (June-August) season. Along the west coast of India a strong southerly surface current pers-

ists during this season. Due to the strong southwest wind during the monsoon season high waves are also observed in the Arabian Sea during this period. The beach at Kootappalli is an open beach, exposed to the full fury of the monsoon. The mussel bed in this region is free of any microbial contamination even though the beach sand and surface water indicated the presence of *E. coli* and faecal streptococci. The mussel bed which is about 250 m away from the coast is exposed to strong wind and waves during this season. The prevalent littoral drift and wave action combined with the bactericidal property of seawater might have aided in the dispersal and disappearance of the microbial population. Bonde<sup>2</sup> observed that coliforms in sewage are much more resistant to the environment than pure culture and on mixing with seawater flocculation takes place thereby affecting the resistance to the environment. The other locations, viz. Vizhinjam and Neendakara are relatively protected beaches. The counts of *E. coli* and faecal streptococci were very high in surface water and beach sand at Vizhinjam. The presence of this bacteria was observed throughout the year and the counts were relatively higher during the southwest monsoon season. However the streptococci were present in small numbers in the surface water during the premonsoon (February to April) and postmonsoon (October to December) seasons. The mussel bed at Vizhinjam, situated  $\leq 75$  m away from the coast, recorded the presence of *E. coli* and faecal streptococci in high numbers during the monsoon months probably due to the land drainage. The

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Table 1—Enteric bacterial counts at Koottappalli, Vizhinjam and Neendakara

Month	Beach Sand (no. g <sup>-1</sup> )			Surface Water (no. ml <sup>-1</sup> )			Mussels (no. g <sup>-1</sup> )		
	TC	EC	FS	TC	EC	FS	TC	EC	FS
Koottappalli									
Jan. 1986	11	—	4	17	—	2	16	—	—
Feb.	23	—	1	20	2	—	11	—	—
March	28	—	—	18	—	—	14	—	—
April	23	2	1	20	2	—	13	—	—
May	24	2	2	30	3	—	19	—	—
June	42	21	3	41	20	7	18	—	—
July	45	14	7	24	16	5	17	—	—
Aug.	48	12	10	11	11	2	16	—	—
Sept.	9	9	—	4	2	—	—	—	—
Oct.	4	—	—	7	—	—	2	—	—
Nov.	12	3	—	8	2	—	7	—	—
Dec.	22	3	2	6	3	—	9	—	—
Jan. 1987	40	4	1	37	2	2	20	—	—
Vizhinjam									
Jan. 1986	18	9	7	12	3	—	—	—	—
Feb.	16	8	2	12	6	1	9	—	—
March	33	3	2	30	3	—	17	—	—
April	12	3	1	18	9	4	22	—	—
May	22	2	1	32	16	5	14	—	—
June	65	33	21	66	32	7	33	11	—
July	44	28	15	53	26	9	28	15	9
Aug.	23	23	8	40	21	11	18	18	8
Sept.	60	6	4	16	8	—	—	—	—
Oct.	16	8	2	6	6	—	3	—	—
Nov.	11	2	—	3	3	—	18	—	—
Dec.	10	6	3	40	4	2	18	1	—
Jan. 1987	27	9	7	30	3	2	11	—	—
Neendakara									
Jan. 1986	45	15	11	15	3	2	10	—	1
Feb.	48	8	4	72	8	7	30	3	—
March	18	6	4	22	2	—	17	—	5
April	10	1	1	12	6	—	8	—	—
May	10	7	2	18	9	2	7	—	—
June	35	35	18	38	38	23	34	17	6
July	72	36	7	61	30	21	18	9	2
Aug.	66	21	5	38	19	11	—	—	—
Sept.	46	6	—	18	3	—	—	—	—
Oct.	10	5	1	12	3	—	11	—	1
Nov.	10	10	—	13	6	—	26	3	—
Dec.	17	4	4	10	1	—	12	—	—
Jan. 1987	20	2	1	21	2	1	6	—	—

TC = total coliform; EC = *E. coli*; FS = faecal streptococci; — = Nil

low incidence of faecal streptococci during pre- and post-monsoon seasons may be due to the higher salinity of seawater prevalent during these seasons.

Of all the 3 locations, Neendakara beach is the most polluted one as indicated by the highest counts of *E. coli* and faecal streptococci. Here also the surface water was devoid of faecal streptococci during March and April, premonsoon and postmonsoon seasons. Highest counts (no. ml<sup>-1</sup>) of *E. coli* (38) and faecal streptococci (23) were recorded from surface water in June, while in the beach sand the highest incidence of *E. coli* was noted in July and that of faecal streptococci in June.

Enteric bacteria occurred in the mussel samples from Neendakara, collected in January, February, October and November. The heavily polluted beach of this area influences the mussel bed. Apart from this, the backwater system discharged into the sea further contributes to contamination, and lower the salinity of the waters leading to the survival and growth of these two bacteria.

Except a few, all samples collected from the various stations during the period of investigation were free from *Salmonella* spp. and *V. cholerae* 01. Few samples showed incidence of *V. cholerae* non 01, an organism related to *V. cholerae* 01. The mussels collected from this station were free from *V. cholerae* non 01, though the organisms were isolated from the surface water and beach sand. On comparing the 3 beaches it is clearly seen that the dispersion and disappearance phenomena exhibited by the enteric bacteria were marked in the open sea beaches, and not clearly marked in protected or semiprotected beaches. These phenomena of the enteric bacteria can be understood only if attempts are made to isolate and differentiate the species, quantify their general distribution in relation to distance from the source of pollution and finally record the decline in their number along with the rate of dilution as suggested by Bonde<sup>2</sup>.

The data indicate that the mussel bed off Vizhinjam gets contaminated during the monsoon season as indicated by the high counts of *E. coli* and faecal streptococci. *Vibrio cholerae* non 01 was recorded from the surface water in February and June. The mussel bed at Neendakara showed the presence of the enteric bacteria in smaller numbers in spite of the coast being highly polluted (Table 1). *V. cholerae* non 01 was isolated from the surface water in October and from the mussels in February. The mussel samples collected off Kootappalli never indicated the presence of either enteric bacteria or *V. cholerae*.

Contamination by *V. cholerae* non 01 at Kootappalli is restricted to the coast only. Though *V. cholerae* non 01 is not as dangerous as *V. cholerae* 01, the pathogenic role of the former has been well established<sup>6</sup>. The sporadic occurrence of the enteric bacteria during March, August and September at Kootappalli, February and July at Vizhinjam and October at Neendakara is of concern. The isolation of these organisms is not advisable due to public health reasons.

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