Bacterial Contamination of Mussels at Mahe Estuary, Malabar Coast

P.S. Gore, O. Raveendran, T.S.G. Iyer*
P.R.G. Varma* and V.N. Sankaranarayanan
Regional Centre, National Institute of Oceanography, Kochi - 682 018

Mussel samples from the mussel bed and near-by market, beach sand, sediment and water from the Mahe estuary were analysed for the bacterial quality. Indicator bacteria such as *Escherichia coli* and faecal streptococci were isolated from water, sediment and both mussel samples especially during monsoon and postmonsoon months. Pathogens like *Salmonella* and *Vibrio cholerae* non 01 were isolated from the mussel samples. The sewage and land drainage of the region contribute to the contamination of the environment.

Sewage and land drainage from towns and cities cause organic pollution in the coastal environment and become serious if they are untreated and let out in to the coastal system. The coastal areas are important as they are the regions where large scale fishing activity takes place. The beaches which are used for recreational purposes are to be monitored regularly for the pollution and contamination by microbes especially for pathogens and coliforms. Faecal pollution due to untreated sewage discharge has been a matter of detailed study.

The present study was undertaken to find out the bacterial quality of the beach sand, water and sediment from Mahe estuary and also the mussels from the mussel bed and market.

Materials and Methods

Beach sand, water and sediment were collected from the Mahe estuary. Mussel samples were collected from the mussel bed situated 50 - 100 m away from the coast and from the Mahe market and stored in ice. Isolation and enumeration techniques for coliforms, *Escherichia coli* and faecal streptococci were those described by Raveendran *et al.* (1978) and Varma *et al.* (1986) respectively.

Results and Discussion

Frequency of occurence of *Escherichia coli* and faecal Streptococci during different months of the year in various samples collected are presented in Table 1. *E. coli*, faecal streptococci and total coliforms were present in almost all the samples. High incidence of both *E. coli* and faecal streptococci was recorded during the monsoon season followed by low incidence in post monsoon and the lowest in the premonsoon months. The highest incidence however was in the month of September in the sediment from the bed and mussels bought from the market. The water samples collected from the coast also showed the presence of *E. coli* and faecal streptococci in small numbers during pre and post monsoon months and in large numbers during the monsoon. The water samples collected from the mussel bed area gave positive isolation for indicator organisms during monsoon and post-monsoon months, but they were either very low or absent during the pre-monsoon season. Beach sand samples collected during different months showed high numbers of *E. coli* and faecal streptococci during the south west monsoon and at lower numbers during the post and pre-monsoon seasons. The mussel samples collected from the bed also showed contamination to a

*Central Institute of Fisheries Technology, Kochi - 682 029

Table 1. *Occurrence of enteric bacteria in Mahe environments*

Months and year	Beach sand	Surface water	Sediment from bed	Water from bed	Mussel from bed	Mussel from market
October 1985						
TC	18	10	40	52	22	7
EC	-	1	4	5	2	3
FS	-	-	4	1	-	2
November						
TC	20	33	11	18	31	23
EC	2	3	1	3	3	12
ES	-	-	8	2	-	9
December						
TC	24	7	11	28	9	18
EC	12	-	-	7	-	6
FS	4	-	-	1	-	2
January 1986						
TC	18	31	44	51	23	14
EC	1	3	4	5	2	7
FS	1	-	4	1	-	3
February						
TC	21	30	20	22	19	18
EC	2	3	5	11	2	9
FS	1	1	1	3	-	5
March						
TC	23	10	27	21	13	22
EC	-	1	-	-	-	2
FS	-	-	-	-	-	1
April						
TC	10	11	23	13	10	12
EC	1	1	2	1	-	1
FS	-	-	2	1	-	1
May						
TC	17	19	10	21	7	14
EC	-	-	1	2	-	7
FS	-	-	2	-	-	3
June						
TC	22	24	30	63	20	45
EC	11	12	15	23	2	22
FS	9	7	4	10	1	17
July						
TC	26	27	21	19	16	33
EC	13	8	10	15	2	12
FS	4	4	3	8	1	9
August						
TC	30	30	11	14	12	20
EC	15	3	-	7	-	2
FS	4	1	1	5	-	-
September						
TC	17	13	29	18	8	27
EC	-	-	29	9	3	27
FS	-	-	5	-	5	3

TC: Total Coliforms; EC: *Escherichia coli; FS:* Faecal Streptococci.

Table 2. *Occurrence of pathogens at Mahe environment*

Month and year	Beach sand	Surface water	Sediment from bed	Water from bed	Mussel from bed	Mussel from market
October 1985						
Vibrio cholerae Non 01	-	-	1	1	1	-
February 1986						
Vibrio cholerae Non 01	-	-	1	1	1	-
April 1986						
Salmonella	-	-	-	-	-	1
Vibrio cholerae Non 01	-	-	1	-	-	-
May 1986						
Vibrio cholerae Non 01	-	-	-	1	-	-
June 1986						
Vibrio	-	-	-	-	-	-
cholerae Non 01	-	-	1	1	-	-

- = absent; 1 = present.
Vibrio cholerae 01 was not detected in any samples from October 1985 to September 1986

lesser extent in all the months except during December, March, May and August. The contamination of the mussel samples collected from the market was highest during the period June to September and November. But during other months also the contamination was observed to a lesser extent. The presence of indicator bacteria in the sediments of the mussel bed area clearly indicated the contamination of the mussels. The higher incidence of contamination of the mussel samples from the market clearly showed secondary contamination. Faecal coliform/Faecal streptococci (Fc/Fs) ratio (Table 3) was always more during the monsoon. Variation in dissolved oxygen showed no effect on these micro organisms where as the salinity variation resulted in changes in the magnitude of incidence during the period of observation. *Vibrio cholerae* 01 was not detected in any of the samples, but *Vibrio cholerae* non 01 was isolated from 41.6% of the mussel bed sediment samples, 41.6% of the overlying water samples and 25% of the mussel samples. This organisam was isolated only once from the coastal water while it was never detected in the beach sand. *Salmonella* was isolated from the mussel samples of the market only during April. All other samples did not indicate the presence of *Salmonella.*

Mussel samples collected from the mussel bed as well as those collected from the market showed high Faecal coliform/Faecal streptococci (Fc/Fs) ratio (1.2 to 9). The sediment samples from the mussel bed area as well as the overlying water also showed high Fc/Fs ratios (1.0 to 9) except during

Table 3. *Faecal coliform/Faecal streptococci ratio at Mahe environments*

Months and	year	Beach sand	Surface water	Sediment from bed	Water from bed	Mussel from bed	Mussel from market
October	1985	-	1	1	5	2	1.5
November	"	2	3	0.1	1.5	3	1.3
December	"	3	-	-	7	-	3
January	1986	1	3	1	5	2	2.3
February	"	1	3	5	3.6	2	1.8
March	"	-	1	-	-	-	2
April	"	1	1	1	-	-	4
May	"	-	-	0.5	2	-	2.3
June	"	1.2	1.7	3.7	2.3	2	1.2
July	"	3.2	2	3.3	1.8	2	1.5
August	"	3.7	3	-	1.4	-	2
September	"	-	-	5.8	9	2	9

November, when the ratio was 0.1. Mussels being filter feeders ingest and concentrate micro organisms present in the water. High microbial populations observed in the water samples might have caused contamination of the mussels and hence showed a high Fc/Fs ratio. High Fc/Fs ratio observed in the bottom sediments was due to adsorption and concentration of microbes from the overlying water.

Coliforms were present in all the samples analysed. Higher counts were observed in the mussel samples from the market collected during monsoon months. The high counts of total Coliforms and indicator bacteria showed the potential presence of other pathogens. *Vibrio cholerae* non 01 is not as dangerous as *V. cholerae* 01. Though there is no direct evidence to show that *V.cholerae* non 01 as an indicator of *V. cholerae* 01, the frequent isolation of *V. cholerae* non 01 is regarded as undesirable due to public health reasons. Isolation of *Salmonella* from the mussels collected from the Mahe market was highly significant, as Salmonella is generally found to be absent in the mussel growing environment (Table 2) Isolation of this pathogen from the mussels procured from the market might be due to contamination arising from unhygenic

Table 4. *Average of environmental parameters at Mahe*

Months and year		O_2 (ml/1)	Salinity ‰
October	1985	5.671	32.15
November	"	4.801	33.08
December	"	4.712	33.12
January	1986	4.182	34.03
February	"	4.032	34.84
March	"	5.123	34.85
April	"	4.678	34.43
May	"	4.813	32.83
June	"	4.941	26.31
July	"	4.928	24.01
August	"	4.508	27.03
September	"	5.891	31.74

premises and handling. The results of this study indicated that the mussel bed at Mahe was contaminated with bacteria of public health significance and therefore warrented the necessity for improvement of sanitation in the growing areas as well as in the market.

The authors are greateful to the Director, National Institute of Oceanography, Dona Paula, Goa and the Director, Central Institute of Fisheries Technology, Kochi for facilities and their keen interest and encouragements. Special thanks are due to Dr. D. Chandramohan, NIO, Goa for critically going through the manuscript and suggesting improvements.

References

Gore, P.S., Gopalakrishnan Iyer, T.S.G., Raveendran, O., & Unnitha, P.V. (1980) *Mahasagar Bull. Nat. Inst. Oceanogr.* **13** (2), 147

Raveendran, O., Gore, P.S. & Unnithan, R.V. (1978) *Indian J. mar. Sce.* **7**, 128

Varma, P.R.G., Iyer, T.S.G. & Nair, M.R. (1986) *J. Export. Insp.* **2**