



Sree Kumar is a Marine Biology post graduate and in the final year of her PhD in 'Study of the Role of Microbes as Source and Sink of Dimethyl Sulphide in Coastal Waters' at the National Institute of Oceanography, Goa, India. She is interested in studying about marine microbes and their role in various biogeochemical cycles in the marine environment.

Role of bacteria in DMS(P) cycle

Sree S. Kumar, Usha Chinchkar, Shanta Nair, P. A. Loka Bharathi and D. Chandramohan - contact: ksree@nio.org

National Institute of Oceanography, Dona Paula. Goa. India. 403 004

Dimethyl sulphide (DMS) was reported in oceanic waters by Lovelock *et al.*, (1972). Its precursor Dimethyl sulfoniopropionate (DMSP) is ubiquitous in the euphotic zone especially in regions dominated by phytoplankton. The biogeochemical importance of DMSP is based on its bacterial (Wolfe *et al.*, 1999) or algal mediated (Steinke *et al.*, 2002) enzymatic cleavage to acrylic acid and dimethyl sulphide (DMS). Dissolved DMSP can satisfy 1-15% of the total bacterial carbon and virtually all of the bacterial sulfur demand (Kiene *et al.*, 2000; Simo *et al.*, 2002). Bacteria play an important role in the cycling of sulfur and their role in the conversion of DMSP to DMS is important. The coastal ecosystems, especially tidally influenced estuaries are biogeochemically active zones. The estuarine region also harbours high DMSP concentrations, as they are highly productive areas. Although the importance of estuarine systems in determining the coastal DMS(P) cycle has been covered, studies pertaining to tropical areas are sparse. Hence this work examines the temporal variation in DMSP levels in Dona Paula waters. It also examines the influence of the different physiological groups of bacteria in DMS utilization. Knowledge of the abundance, physiology of the bacteria involved in DMS(P) cycle are vital in understanding the dynamics of these compounds.

The Dona Paula Bay, Goa (Fig.) is located on the west coast of India at the terminus of Zuari estuary. Sampling was carried out once in a month during receding high tide. Samples were analyzed for Total Viable Count

(TVC) (Kogure *et al.*, 1984), 'DMS' and 'DMSP' utilizers (Visscher *et al.*, 1991), TDLO (Thiobacillus denitrificans like organisms) (Loka Bharathi, 1989), SRB (Sulphate Reducing Bacteria) (Loka Bharathi and Chandramohan, 1985) and Heterotrophs respectively.

DMSP averaged high during monsoon (13.4 ± 2 nmol L⁻¹) with peaks in post - monsoon months of Nov (13.2 nmol L⁻¹) and Dec (15.1 nmol L⁻¹). DMS averaged high in post - monsoon (9.5 ± 9 nmol L⁻¹) with a peak in November (22.2 ± 2 nmol L⁻¹).

Total viable count (TVC) of bacterial population varied from 0.01 to 3.87×10^6 cells L⁻¹. Average Most Probable number (MPN) of bacteria utilizing DMSP were 2.4×10^3 , 7.5×10^3 , 6.7×10^3 cells L⁻¹, DMS utilizers were 1.6×10^2 , 4.6×10^2 , 2.9×10^2 cells L⁻¹ during pre-monsoon, monsoon and post-monsoon respectively. A positive coupling between TVC and DMS and DMSP utilizers during pre and post monsoon may suggest the response of the bacteria to the available substrates.

Utilization of DMS by different physiological groups of bacteria isolated from the field were monitored in the laboratory to grade their metabolic potential towards the substrate. The utilization rate day for TDLO was 0.6 nmol L⁻¹ day⁻¹, for heterotrophs 0.4 nmol L⁻¹ and SRB was 0.3 nmol L⁻¹ day⁻¹. On per cell basis, the values were 0.6, 0.43, and 0.23 fmol cell⁻¹ day⁻¹ for TDLO, heterotrophs and SRB respectively.

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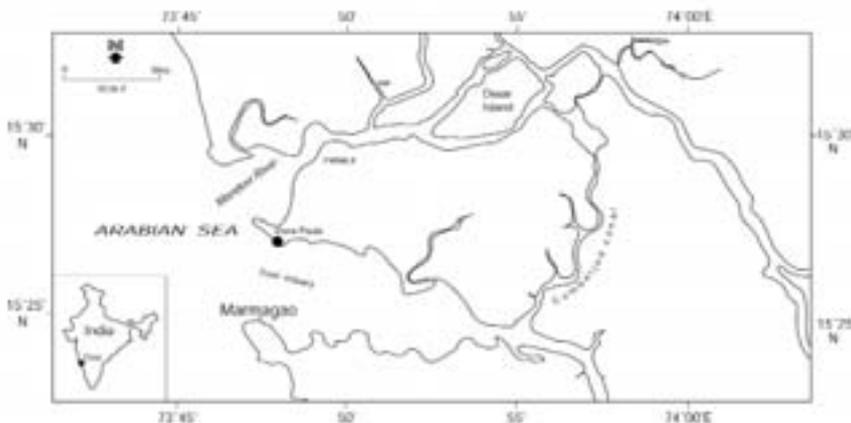


Figure: Study site