Distribution of Phytoplankton in Clambeds of Mulky Estuary in Relation to Water Quality Variables

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Abstract: - **Distributions of phytoplankton in clambeds of Mulky estuary in realtion to water quality variables was studied from August, 2007 to July, 2008 from the four different locations in the Mulki estuary. Hydrographical parameters exhibited a significant effect on the distribution of phytoplankton in the clambeds. The total phytoplankton numbers varied from 5,62,518 no/m^3 to 16,22,660 no/m^3 with maximum numbers reporting during post monsoon and minimum during monsoon months. About sixteen different species of diatoms, 15 species of green algae and Four species of dinoflagellates were reported from the study area and diatoms and dinoflagellates were recorded in maximum during post monsoon season, while green algae and blue green algae were maximum during monsoon season. Diatoms formed the bulk of the phytoplankters with a maximum of 3243025no/m^3. A significant difference has been reported on phytoplankton distribution in clambeds both spatially and seasonally.**

I. INTRODUCTION

Estuary is a semi enclosed water body along the coast where freshwater from rivers and streams meets and mixes with the salt water of sea. Estuary being dynamic nature offers a good habitat for many aquatic organisms. The change in the water level and the water quality offers a dynamic environment for the organism to thrive. The estuarine water bodies are highly characterised by tidal action and ingression of freshwater. Their properties are unique worldwide. No two estuaries are similar and they are different in their geography, morphology, topography, fresh water influx and tidal amplitude. The productivity of these estuaries are comparatively and chiefly determined by factors like abundant nutrients; conservative retention and efficient recycling of nutrients, inter dependence of phytoplankton, zooplankton, benthos, benthic micro-and macroalgae, sea grasses, mangrooves and fringing salt marsh vegetation that maximises the availability of light and space, tidal energy and circulation of water in the estuaries.

Estuaries and back waters in India occupy 1.44 million hectares water spread area (Anon., 2006). Both east and west coasts are interspersed with several estuaries and back waters of varying length. Each one of them is different from another mainly due to river inflow tidal ingress and basin topography. Phytoplankton is the microscopic plant matter which does not have independent locomotive capability but they drift by the mercy of wind, currents and tides. (Kudela and Peterson, 2009). Phytoplankton community is in general used as indicators of estuarine water quality (Paerl et al., 2007). Phytoplankton determines the primary productivity of the water body which forms a primary source of energy for the higher organisms in the foodweb. There are numerous factors affecting the production and distribution of phytoplankton in the estuarine environment such as salinity, temperature, tidal activity, nutrient levels etc. Studies on the phytoplankton distribution in estuarine waters are available in the works of Basil George (2012) in Tapi estuary, Gulf of Khambhat; Devassy and Goes (1989); Perumal (2009) in Kaduviyar estuary, Nagapattinam, South east coast of India.

II. MATERIALS AND METHODS

The Mulki and Pavanje rivers flows towards west and makes a confluence just before joining with the Arabian Sea leading to formation of Mulki estuary. The Mulki estuary (lat. 13° 4' N and long. 74° 17' E) is situated at about 45 km north of Mangalore. The estuary is connected to the Arabian sea throughout the year and is subjected to tidal influence to a length of 6.0 km in Mulki river and 6.6 km in Pavanje river (Reddy and Gopala 1982). The water samples were collected during the low tide period for determination of various physical and chemical parameters. The water quality parameters like temperature, pH, salinity, ammonical nitrogen and suspended solids were analysed and the phytoplankton samples were collected by filtering 100 liters of water every time through a nylon plankton net having 60µm pore size. Three aliquots of phytoplankton sample were selected from which 1.0 ml was drawn for qualitative analysis. The phytoplankton cells present were identified counted and recorded employing sedwickrafter type of cell and a compound microscope fitted with closed circuit television camera (CCTV camera). Phytoplankton cells were identified up to generic level and expressed in terms of number of cells/m^3 of water.

III. RESULTS AND DISCUSSION

The water temperature ranged from 29.54 to 30.11^{0}C during the entire study period and the maximum and

minimum values were reported in the months of May and August respectively. Cooler condition prevailed during the monsoon season and warmer conditions during the pre monsoon season. pH values ranged from 7.84 to 8.10 with high values during the post and pre monsoon and relatively lower values during the monsoon season. Clear cut seasonal variations were observed in the salinity of water with higher saline conditions during the post and pre monsoon season and during the peak monsoon season, the minimum value of 0.08‰ was reported during later part of August. The salinity concentration reduced rapidly due to copious amount of fresh water running into the sea and low saline condition was observed throughout the monsoon period. Dissolved oxygen of water varied from to minimum of 3.10 mg/l to 6.10 mg/l with mean values ranging from 4.59±0.52 to 4.68 ± 0.70 mg/l. The suspended solids varied from 50.42 to 59.65 mg/l during the entire study period. Ammonia Nitrogen content varied between 6.12 and 7.11 µg-at/l and the fluctuations encountered throughout the period of investigation which can be attributed to the conversion of ammonia into other forms of Nitrogen, sea water influence and utilization by planketrs. Nitrate - nitrogen values varied from 1.83 to 46.31 µg-at./l with the mean values ranging from 11.76 to 14.16 ± 13.54 µg-at./l. The values of nitrate declined from August reduced and remained uniformly in low concentrations till March 2008. Analysis of variance indicated a significant variation with respect to all the physical and chemical parameters spatially and seasonally.

The total phytoplankton numbers varied from 5,62,518 no/m^3 to 16,22,660 no/m^3 with maximum numbers reporting during post monsoon and minimum during monsoon months. The estuary was dominated by freshwater during monsoon months and during the onset of post monsoon, due to enhanced wind velocity and water mixing the water gets mixed up and which will improve the salinity in the estuary with good nutrient load resulting in enhanced phytoplankton production in post monsoon season (Palleyi, 2008). *Cyanophyceae, Chlorophyceae, Bacillariophyceae* and *Dinophyceae* groups were reported with Diatoms forming the bulk of the phytoplankters and dominated throughout the period of study with numbers varying from zero to 3243025 no/m^3. About sixteen genera of diatoms were reported, of which the commonly observed forms are *Bidulphia* spp., *Chaetoceras sp*., *Coscinodiscus spp*., *Gyrosigma* sp., *Leptocylindricus* sp., *Nitzschia* spp., *Pleurosigma* sp., and *Rhizosolenia* spp. Diatoms were dominant during early premonsoon with least numbers in monsoon period. Green algae ranged from 4779 to 16563 no/m^3, showing maximum production during monsoon months. 15 species of cholophycea were reported with maximum representation from *Anthyrodesmus* sp., *Closterium* spp., *Cosmarium* sp., *Desmidium* sp., *Docidium* sp., *Microspora* sp., *Micrasterias* sp., *Mougeotia* sp., *Pondorina* sp., *Pediastrum* spp., *Sphaerozosma* sp., *Spirogyra* sp., *Triploceras* sp., and *Zygnema* sp. Four species of dinoflagellates were reported with the numbers ranging from 1236 to 1407148 no/m^3 with maximum occurrence during premonsoon period at all the stations. *Ceratium spp*., *Dinophysis* sp. were the commonly occurred species at all the stations with *Ceratium* being the dominant sp. Total number of blue-green algae during the period of study ranged from 130 to 10264 no /m^3 with *Oscillatoria* sp, *Anabaena* and *Nostoc* occurring majorly. The maximum production was found to be in monsoon and pre monsoon months. Subrat Naik (2009) reported 63 species of diatoms, 8 species of dinoflagellates and 6 species of bluegreen algae in Mahanadi estuary. Phytoplankton exhibited a positive correlation with all the hydrographical parameters in the estuary and exhibited a significant difference spatially and seasonally.

Table 1: hydrographical and phytoplankton numbers observed in Mulki estuary

Parameter	Mean	Standard deviation
Water Temperature(^{0}C)	29.84	±1.84
Water pH	7.98	±0.56
Salinity($^0/_{00}$)	22.57	±14.76
Dissolved Oxygen (ml/lt)	4.62	±0.57
Ammonia-nitrogen(µg atom/lit)	6.67	±4.59
Chlorophyll a (mg/lt)	0.37	±0.20
Total Plankton(units/m^3)	12317x10^{-3}	±26030 x10^{-3}

Table 2. Correlation coefficients of phytoplankton in relation to different physico- chemical parameters in Mulki estaury.

Parameters	Water Temp.	pH	Salinity	Dissolved Oxygen	Ammonia	Chlorophyll a	Plankton
Water Temp.	1						
pH	0.621	1					
Salinity	0.310	0.815	1				
DO	0.598	0.991	0.823	1			
Ammonia	-0.578	-0.771	-0.560	-0.742	1		
Chlorophyll	0.166	0.433	0.617	0.432	-0.365	1	
Plankton	0.502	0.296	0.367	0.272	-0.320	0.344	1

Table 3: Monthly Percentage contribution of phytoplankton groups and total phytoplankton (no/m^3) in Mulki estuary

Group	Monsoon		Post monsoon				Premonsoon				Monsoon	
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Cyanophycea (%)	7.633	5.676	1.330	2.106	0.000	0.000	0.138	0.029	0.000	0.000	16.728	11.567
Cholorphyceae(%)	36.816	23.515	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	26.993	46.084
Bacillariophycea (%)	19.408	31.505	51.344	78.237	69.539	58.364	68.916	62.826	55.746	72.153	20.637	6.460
Dinophyceae(%)	36.143	39.304	47.326	19.658	30.461	41.636	30.946	37.145	44.254	27.847	35.642	35.889
Total phytoplankton (no./m^3)	14480	20411.2	12822.2	6292.7	72474.2	108095	2875697	1204115	175589.3	811329.3	61365.2	32317.2

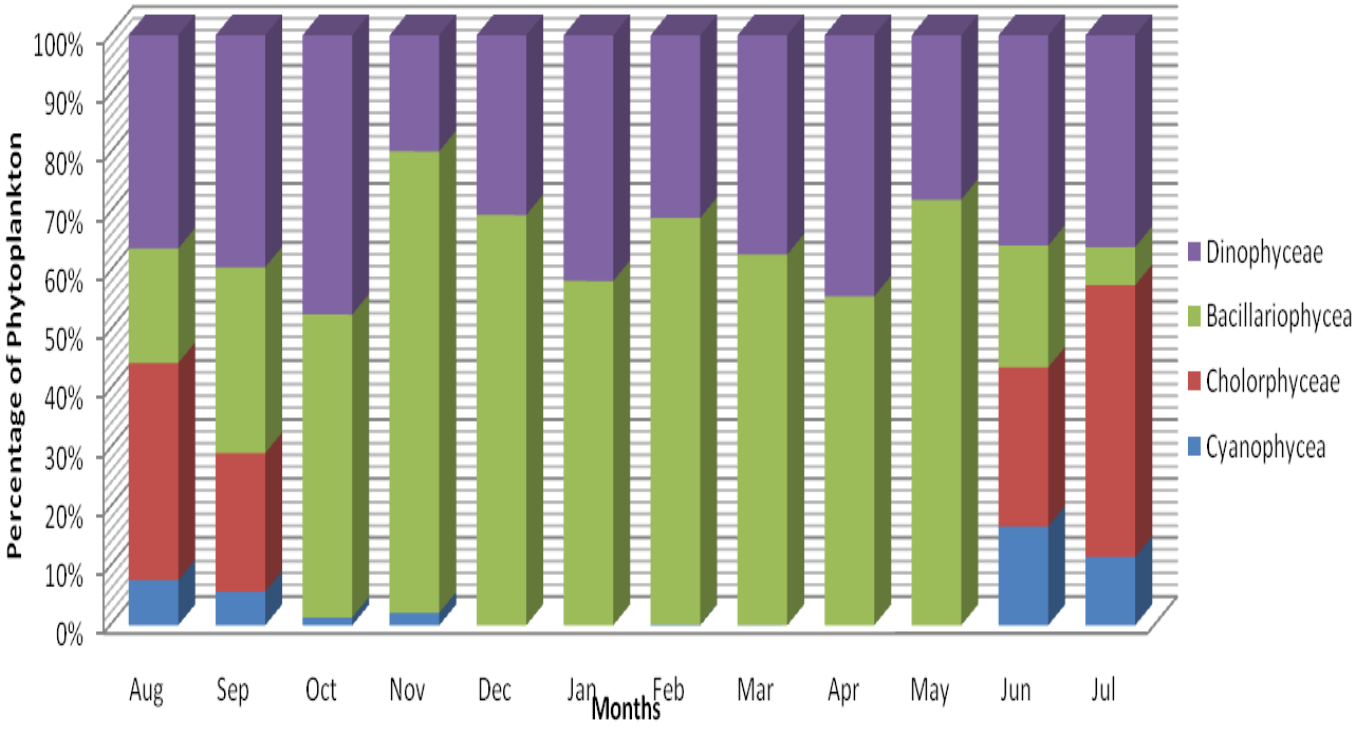

Fig. 1: Monthly percentage contribution of phytoplankton groups to total phytoplankton in Mulki estuary

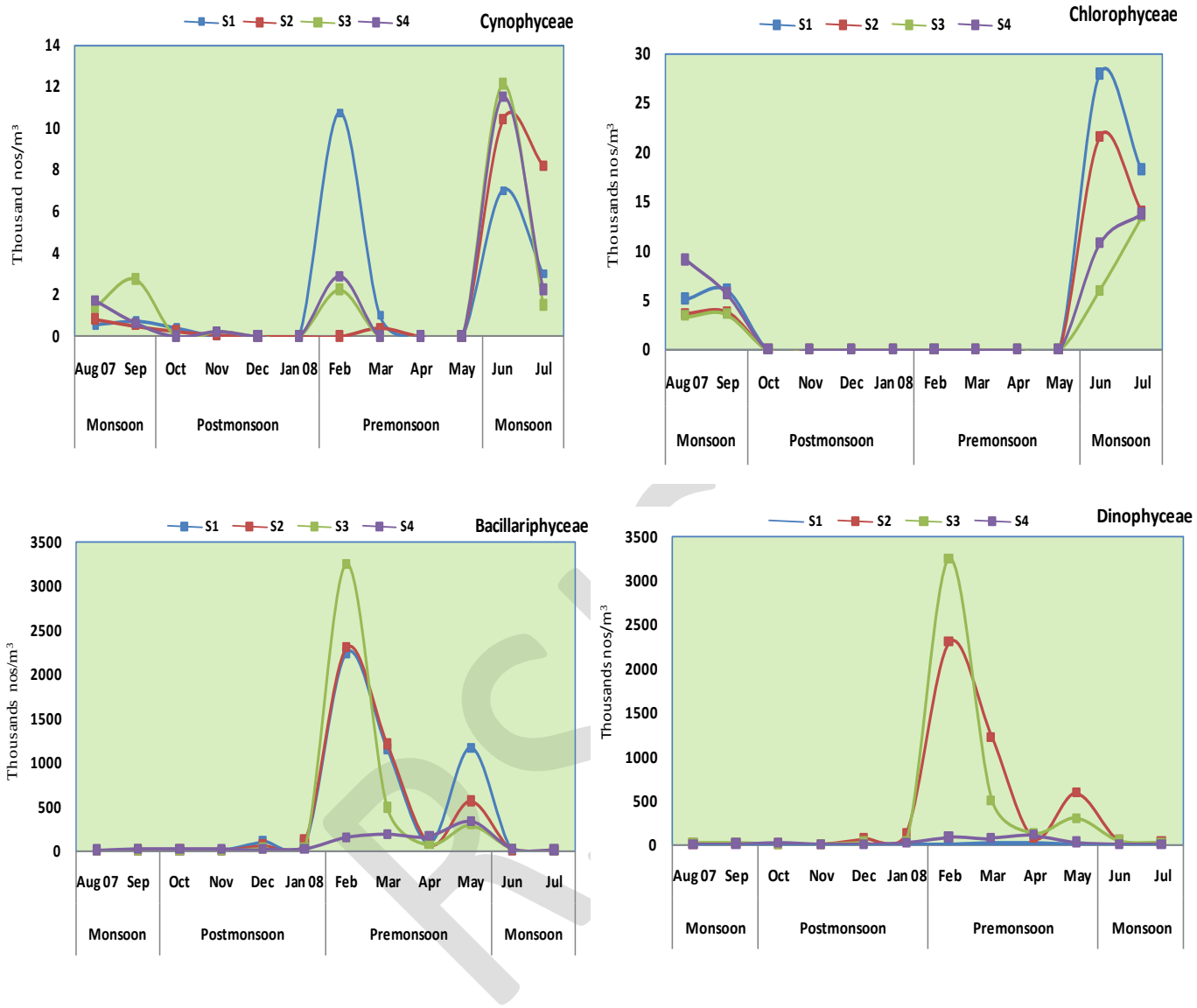

Fig. 2 Distribution of different groups of phytoplankton (thousand no/m^3) at different stations in Mulki estuary

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