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DIVERSITY OF PHYTOPLANKTONIC GROUPS IN THE RIVER KALI, WEST COAST OF INDIA.

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ABSTRACT Present study was carried out in Kali River and in all 44 genera were recorded , out of which 30 belonged to Bacillariophyceae , 6 each to Dinophyceae and Chlorophyceae and 1 each to Cyanophyceae and Rhodophyceae . In Kali River , primary peak was observed during post-monsoon and secondary during pre-monsoon . Annual percentage distribution data indicates that Bacillariophyceae was dominant (79.30%) followed by Chlorophyceae (11.09%) Dinophyceae (9.16%) while Rhodophyceae and Cyanophyceae were poor and noticed during certain period of present study. Positive correlation was observed between Cyanophyceae- pH , suspended load and nitrite while temperature and silicate showed positive correlation with Bacillariophyceae . Chlorophyceae exhibited positive correlation with dissolved Oxygen and phosphate . Negative correlation existed with air temperature and VEC with Dinophyceae members . Rhodophyceae exhibited correlation with water temperature and silicate . Phytoplankton distribution and abundance was governed by hydrological factors like Temperature , Salinity and nutrients .

KEYWORDS : Phytoplankton, Hydrological parameters, Kali river, Uttar Kannada.

INTRODUCTION

Studies on phytoplankton of different riverine systems of west coast of India have been carried out extensively projecting an ecology of phytoplankton and their role as a fin-fish diet and as an indicator of pollution and also the trophic status of water bodies (Qasim et.al., 1972, Zingde et.al.,1990,Naik and Neelkantan 1990)

Kali river is one of the major riverine system of maritime district of Uttar Kannada which originates in the western ghats at Kusavali Village in Supa Taluka after meandering nearly 165 Km and discharge the fresh water into the Arabian sea at Karwar, central west coast of india. Since a limited work was carried out on these area with an earlier works of Ramamurty (1965).Konnur (1981) and Naik And Neelkantan (1990) who have studied the distribution of phytoplankton in the Karwar Waters and in Kali river. No work has been carried out in the upper reaches of the river and hence the present investigation was carried out to study the variation in different groups of phytoplankton of this kali riverine system along with the hydrographic parameters. An attempt has also been made to correlate environmental variables and biotic entities.

MATERIALS AND METHODS

Kali river (14° 50' 21" N and 74°09' 05" E), one of the five major riverine systems of Uttara Kannada coast, located on the central West Coast of India. Kali River being the northern most riverine system of this coast is known for its fin-fish and Shell-fish fisheries. A monthly collection of water samples along with the plankton samples were made in this river from the fixed five study stations namely Kodibag (st-1), Sunkeri (st-2),Kinnar (st-3), Halga(st-4) and Kadra (st-5) for a period of 1 year(sept.2016-sept.2017).

The phytoplankton samples were collected from these study sites using a conical net of bolting nylon cloth of 0.018 mm mesh width, and mouth ring diameter of 35cms, with the help of an out trigger canoe. The net was hauled for the duration of 10 min as surface haul and volume of water filtered through it was determined by flowmeter attached to it. The net was back washed between the two stations to avoid clogging of meshes. The samples were preserved in 4% neutralized formaldehyde for further analysis in the laboratory. After diluting the sample to known volume, an aliquot of 1ml subsample was transferred to sedgewick's counting chamber and phytoplankton identified and quantified, similarly triplicate subsamples were analyzed and their mean was taken and multiplied to the total volume of the sample. Total standing crop of phytoplankton was represented as number of cells per 1cubic meter of water and their percentage composition is calculated. Hydrographic parameters such as temperature, salinity , dissolved oxygen , pH, suspended load, VEC, phosphate- phosphorous ,Nitrate-nitrogen, nitrite –nitrogen ,silicate-silicon were also recorded at the of plankton collection. These hydrographic parameters except water temperature were analyzed by following the standard methods as suggested by strickland and parsons (1975). Water temperature was recorded by using the ordinary thermometer.

RESULTS AND DISCUSSION

Steep fall in temperature from pre-monsoon to south-west monsoon was noticed while a gradual decreasing trend noticed from pre-monsoon to post-monsoon during the present study. The impact of south-west monsoon was severe which prevailed during June to September was vigorous on salinity the Table.1 and seasonal variation in Table.2. A similar trend was noticed by Naik And Neelkantan (1990). The salinity trends to decrease with increasing distance from the river mouth to upper reaches of the river and this could be probably due to run off the land, Rainfall during the monsoon season and evaporation from the river itself. In addition to this flow of fresh water from upper reaches through reservoirs and other tributaries of Kali River could be the reason for the lowering of salt content. Temporal variation of dissolved oxygen shows maximum during post monsoon (7.58 mg/l) and minimum during june (3.76 mg/l) while spatial variation showed a minimum value (4.35 mg/l) at station 2 , while a maximum (6.34 mg/l) at station 5. The pH value fluctuated between 7.19-8.71 with slightly higher values during post and pre-monsoon. According to Perkins (1976), the range of pH of estuarine waters at normal and unpolluted conditions is 6.7-9.25. Maximum suspended load was recorded during south-west monsoon period (0.0514 gm/l). The influence of highly turbid fresh water and land run off resulting in a higher suspending load as stated by Jerlov et.al., (1978) the concentration of suspended water vary from less than 0.1 mg/l in the open oceans to many grams per liter in the estuarine and nearshore waters. The present data coincides with the findings of the earlier workers Naik and Neelkantan (1990) .

Temporal variation in VEC shows a high value of 2.85 during the month of May and low value of 1.92 in July. Temporal variation of phosphate shows a high value (3.076 µg at/l) during the post-monsoon at station Halaga and low (0.445 µg at/l) during the pre-monsoon season. Nitrate was found maximum during post-monsoon (16.66 µg at/l) while minimum (3.19µg at/l) during the south west-monsoon. Comparatively an intermediate value (11.05µg at/l) noticed during pre-monsoon. A maximum concentration of this nutrient salt was observed at Kodibag (11.88 µg at/l) and lower value (6.14 µg at/l) at Hulga. Nitrite-N concentration was found maximum during the south-west monsoon (0.441 µg at/l) while the lowest values recorded during post-monsoon (0.063 µg at/l) concentration of content varied between (21.74 µg at/l – 43.26 µg at/l) with maximum during the pre-monsoon and minimum during post monsoon season. The present study was undertaken to evaluate an abundance and distribution of phytoplankton with respect to time and space. Totally 55 planktons were identified and are categorized into 5 groups. Namely Cyanophyceae, Bacillariophyceae, Dinophyceae, Rhodophyceae and Chlorophyceae . The biomass of phytoplankton varied between 0.12 – 2.0 ml/m³. It is summarized from the results that the annual mean of 5

study sites ranged between 0.48 ml/m³ (Kadra) and 0.72 ml/m³ (kinner) while other 3 stations showed a moderate value of phytoplanktonic biomas.

Among these study sites the early mean of phytoplankton density ranged between 5515 and 11082 /m³. The cyanophyceae group comprised of single species namely trichodesmium erythraecum and it's percentage composition varied between 0.54 and 6.25 in Halaga and Sunkeri study sites. Interestingly the density of this algae was found to be maximum in the 2 study stations located at lower reaches of the river and was found in a plankton sample only during the warmer months of biological calender. A similar findigs was observed by Naik and Neelkantan (1990) which indicates that , this algae prefer high saline mixed water. Bacillariophyceae was found to be dominant algae of the phytoplanktonic group throughout the study period. This group comprises 30 genera comprising 43 species of which Coscinodiscus, Skeletonema, Hemidiscus, Rhizosolenia, Fragellaria, Gyrosigma, Pleurosigma, Nitzschia were dominant species alone constituted 79.3% of the total phytoplankton density. Sunkeri and kodibag study sites have experienced the maximum density of this group.

Dinophyceae group stood third place in contributing the standing crop of phytoplankton and comprises 6 generas and 11 species. Among these Peridinium, Ceratium and Noctiluca were the dominant planktons during post and pre-monsoon. The maximum annual mean percentage observed during post and pre-monsoon and minimum during south-west monsoon. The members of this group were most common and present throughout the biological calender year with a maximum density during pre-monsoon and post-monsoon and minimum during south-west monsoon period, A similar trend was noticed by Ramamurthy(1965) , Konnur (1981) and Naik and Neelkantan(1990) in the Karwar waters.

The single genera identified and included under Rhodophyceae group is Polysiphonia, this group constituted about 0.24% of the total plankton density this species was found in the upper reaches of the river. Under Chlorophyceae group, there are 6 genera identified among which the Pediastrum & Spirogyra were dominant. The members of this group were usually represented poor contribution in the lower reaches of river, but their density found to be high in the eustuarine and riverine waters. In the present investigation this group constitutes 11.09% of the total plankton density. The density of this group found to be maximum during post- monsoon and minimum during south-west monsoon period.

The bimodal peak of phytoplankton was observed during the present study with the first peak was observed during post-monsoon season (9694/m³) and secondary peak (6438/m³) during pre-monsoon. The minimum standing crop was noticed during south-west monsoon period in all study sites.

The highest species diversity was observed in station Kodibag (st-1) and the data is presented in Table.3. The correlation between phytoplankton group and hydrological parameters are presented in table.4.

In the present investigation the Diatoms were the dominant group constituted about 79.30% of the total phytoplankton density and was followed by Chlorophyceae group (11.09%) while Dinophyceae constituted (9.16%). The Rhodophyceae and Cyanophyceae constituted (0.24% and 0.21%) respectively. This may be due to the net not retaining the smaller forms which are otherwise quite abundant (Qasim et.al,. 1972) in their distribution. In coastal waters the lowering of salinity and temperature is associated with the enrichment of water with nutrient elements which leads to an increase in phytoplankton production (Qasim et.al,. 1972). Naik & Neelkantan(1990) discussed the impact of the salinity on the phytoplankton abundance in the Kali estuary and stated that the seasonal variability of nutrients especially nitrite and phosphate controls the production of the phytoplanktons.

In the present study, an attempt was made to correlate between hydrological parameters and phytoplankton groups. It was observed that the Cyanophyceae group has established positive correlation with pH, suspended Load and Nitrite. Similarly a positive correlation of water temperature and silicate with Bacillariophyceae group while negative correlation with dissolved oxygen and phosphate. A negative correlation was observed with air temperature and VEC by Dinophycea members. Rhodophyceae group exhibited a positive correlation with water temperature and silicate concentration, while negative correlationship with dissolved oxygen and phosphate. The Chlorophysceae group established a positive correlation with dissolved oxygen and phosphate but negative with water temperature and silicate content.

Table.1 Mean value of hydrological parameters at study stations during the study period

Hydrological Parameters	Stn.1	Stn.2	Stn.3	Stn.4	Stn.5
Water temp.(˚C)	26.35	27.43	28.19	28.68	28.53
Salinity (‰)	0.189	1.729	4.32	21.96	26.77
Diss. Oxygen(ml/l)	6.34	5.29	5.07	4.35	5.38
pH	6.59	6.37	6.78	6.76	6.58
Susp. Lead (gm/l)	0.0228	0.0222	0.0242	0.0197	0.0193
VEC	2.46	2.15	2.15	2.44	2.39
Phosphate (ug at/l)	1.317	1.087	1.415	1.267	1.365
Nitrate (ug at/l)	11.88	11.08	8.3	6.14	8.43
Nitrite (ug at/l)	0.297	0.219	0.241	0.235	0.251
Silicate (ug at/l)	33.18	33.75	35.68	33	33.05

Table.2 Seasonal variation of hydrological parameters in Kali River.

Hydrological Parameters	Post Monsoon	Pre Monsoon	South west Monsoon	Mean
Water temp.(˚C)	26.42 (24.66-28)	28.19 (26.37-29.27)	26.88 (25.17-28.68)	27.16
Salinity (‰)	7.62 (2.62-11.88)	4.47 (2.18-6.01)	3.6 (2.41-4.66)	5.23
Diss. Oxygen(ml/l)	5.75 (4.91-7.58)	5 (4.22-7.02)	5.74 (3.76-7.25)	4.49
pH	6.23 (5.67-6.83)	6.42 (5.33-7.51)	7.15 (6.88-7.86)	6.72
Susp. Lead (gm/l)	0.00827 (0.0077-0.0090)	0.01165 (0.008-0.0171)	0.05135 (0.0088-0.1000)	0.02376
VEC	2.43 (2.20-2.71)	2.49 (2.0-2.85)	2.25 (1.92-2.40)	2.39
Phosphate (ug at/l)	3.073 (0.217-10.00)	0.445 (0.276-0.726)	0.513 (0.414-0.641)	1.344
Nitrate (ug at/l)	16.66 (3.419-38.99)	11.05 (0.54-17.75)	3.19 (0.344-9.515)	10.3
Nitrite (ug at/l)	0.063 (0.023-0.146)	0.231 (0.072-0.461)	0.441 (0.045-0.862)	0.245
Silicate (ug at/l)	32 (21.74-36.42)	37.74 (28.62-43.26)	33.21 (23.56-41.09)	34.32

Table 3. Variation in species diversity of Phytoplankton at study stations during the study period

Period	Stn.1	Stn.2	Stn.3	Stn.4	Stn.5
Sept.2016	2.702	1.543	1.78	2.245	2.026
Oct.	2.462	1.693	1.554	1.938	3.018
Nov.	1.819	1.76	1.741	1.611	2.182
Dec.	3.298	2.605	2.353	2.719	2.084
Jan.2017	1.197	1.162	2.444	2.457	2.633
Feb.	2.13	1.692	2.602	1.814	1.511
Mar.	1.961	2.176	0.898	2.104	2.82
Apr.	2.18	2.356	2.37	3.954	4.404
May	1.145	1.756	1.738	1.924	2.21
Jun.	0.963	0.993	1.675	1.708	1.702
Jul.	0.636	0.604	0.574	1.346	0.341
Aug.	1.528	0.658	1.494	1.273	1.225
Sept.	1.314	1.38	1.137	1.131	1.029

Table 4. Correlation between phytoplankton and hydrological parameters.

Season	Density					Sus.Load		Nutrients			
Groups	Of comparing groups	Water temp(˚C)	Salinity (%0)	Diss. Oxy.(ml/l)	pH	(gm/l)	VEC	Phosphate (ug/l)	Nitrate (ug/l)	Nitrite (ug/l)	Silicate (ug/l)
CYANO-PHYCEA											
Post Monsoon	0.1	26.42	7.62	5.74	6.73	0.00827	2.43	3.073	16.66	0.063	32

Pre Monsoon	0.22	28.19	4.47	5	6.42	0.01165	2.49	0.445	11.05	0.231	37.74
Monsoon	0.25	26.88	3.6	5.735	7.5	0.05135	2.25	0.513	3.19	0.441	33.21
BACILLARIOPHYCEAE											
Post Monsoon	72.3	26.42	7.62	5.74	6.23	0.00827	2.43	3.073	16.66	0.063	32
Pre Monsoon	73.88	26.88	3.6	5.735	7.5	0.05135	2.25	0.513	3.19	0.441	33.21
Monsoon	91.73	28.19	4.47	5	6.42	0.01165	2.49	0.445	11.05	0.231	37.74
DINOPHYCEAE											
Post Monsoon	1.92	28.19	4.47	5	6.42	0.01165	2.49	0.445	11.05	0.231	37.74
Pre Monsoon	8.32	26.42	7.62	5.74	4.23	0.00827	2.43	3.073	16.66	0.063	32
Monsoon	17.24	26.88	3.6	5.735	7.5	0.05135	2.25	0.513	3.19	0.441	33.21
RHODOPHYCEAE											
Post Monsoon	0.11	26.42	7.62	5.74	6.23	0.00827	2.43	3.073	16.66	0.063	32
Pre Monsoon	0.2	26.88	3.6	5.735	7.5	0.05135	2.25	0.513	3.19	0.441	33.21
Monsoon	0.4	28.19	4.47	5	6.42	0.01165	2.49	0.445	11.05	0.231	37.74
CHLOROPHYCEAE											
Post Monsoon	5.67	28.19	4.47	5	6.42	0.1165	2.49	0.445	11.05	0.231	37.74
Pre Monsoon	8.43	26.88	3.6	5.735	7.5	0.05135	2.25	0.513	3.19	0.441	33.21
Monsoon	19.17	26.42	7.62	5.74	6.23	0.00827	2.43	0.073	16.66	0.063	32

CONLUSION-

It is surmised from the results that the River Kali is unpolluted and one of the most productive riverine system of Uttar Kannada coast, which supports good phytoplankton diversity. Of Late, the anthropogenic activities has drastically increased at all stretches of the riverine systems and therefore it is suggested to conduct ongoing data collection on the phytoplankton in order to monitor the dynamics and any sort of impact on their community.

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