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Study On Distribution And Diversity Of Pytoplankton In Relation To Hydrography In Bhavanapadu Creek, Srikakulam District, South India

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ABSTRACT: *The phytoplankton abundance and diversity was studied with compare to the hydrographical parameters in Bhavanapadu Creek. Monthly samplings were carried out from December 2009 to November 2010 at 5 different stations. The four classes of phytoplankton comprises of 39 species and their distribution is Bacillariophyceae (97-91%), Pyrrophyceae (0-4%), Chlorophyceae (0-4%) and Cyanophyceae (1-8%). The Phytoplankton population density and diversity depends upon the hydrographical parameters and showed significant (P≤0.05) correlation with the parameters like temperature, salinity and dissolved oxygen (D.O.). The Shannon-weavers index (H) was "0" to "0.602".*

Keywords: *Phytoplankton, Diversity and Abundance, Hydrographical parameters, Bhavanapadu Creek.*

I. INTRODUCTION

The Bhavanapadu Creek is a backwater from the sea and the tidal amplitude is up to 16 km. The Creek is valuable resource for the aquaculture, salt pans and fishery for the local people. The creek in enriched by nutrients from 5 canals (Marripadu, Selagapeta, Musallagadda, Desigadda and Garibulagadda canals). The present study was the distribution, abundance and diversity of the phytoplankton at Bhavanapadu Creek for a period of one year. The phytoplankton, as the basis of the tropic chain, constitutes the most important biological community in any aquatic system. The phytoplankton composition was influenced by so many factors and they change according to ecological changes. The phytoplankton distribution was depends on the light penetration and also the availability of the nutrients [1]. The phytoplankton was changed qualitatively and qualitatively according to the seasons [2] and also change in the rainy and dry seasons [3].The phytoplankton biomass and community composition is important for the understanding the structure and dynamics of the ecosystem [4].The monsoon also shown impact on the phytoplankton abundance and its diversity [5] and the nutrients during monsoon periods [6] also shows the significant changes. Phytoplankton is the primary producers in food webs and ensuring ecological balance and also useful for indicators [7] of brackish waters, the dynamics of the creek system is supports to the diverse network life. The phytoplankton productivity and resources is helps the feature management of the fishery [8]. The small group of phytoplankton may be produces the toxic [9] and it may shows the significant effect on the ecosystem. The phytoplankton will increases the CO_2 due to insufficient nutrients [10] and it will effects on the physiology and community composition of the phytoplankton. Sometimes, they show high productivity but low diversity due to mass production of the fast growing of the diatoms [11]. Present study was planned to know the abundance of different types of phytoplanktons and their diversity in Bhavanapadu Creek in relation to hydrogrhaphy of the creek at different study centers.

II. MATERIAL AND METHODS

Five surface water samples were collected for water analysis at different stations i.e., Station I- Creek mouth (18°33'48.7"N & 84°21'19.6"E), Station II –Seethanagaram (18°33'01.1"N & 84°20'16.3"E),Station III - Kothalingudu (18°32'05.3"N & 84°18'09.3"E), Station IV- Akasalakkavaram (18°30'50" N & 84°16'10" E), Station V – Maruvada (18°30'30" N & 84°15'30" E) (Fig 1) in Bhavanapadu Creek from December 2009 to November 2011 to study the spatial and temporal variations of different hydrographical parameters and phytoplankton diversity and distribution. The sampling points were recorded where the fresh water canals was joined and also sensitive areas of the creek. The hydrographical methods were Depth measured by Masson's weight. The temperature was recorded by using Celsius thermometer of 0.1ºC readability. Salinity measured by Refractometer (Hand Refractometer- ERMA). The Secchi disc method was used to measure the transparency. The pH of the samples was estimated digital pH meter (Elico). The samples for dissolved oxygen collected in

separate 125 ml bottles and fixed by Wrinkler's reagents in situ. The further analysis of D.O. was carried in lab by following Winkler's method [12]. The water samples were carried to lab for the measurement of Salinity [13] again for accuracy. Nutrients (Ammonia, Nitrates, Phosphates, Silicates) measured by standard methodology [14]. The nitrates were estimated by "Cd" redactor method. The phosphates were estimated by Ascorbic acid method, the silicates were estimated by Molybdo-silicate method and the ammonia was estimated by Phenate method. The phytoplankton samples were collected through plankton nets (60µ) and preserved in 4% formaldehyde for further analysis. The phytoplankton samples were analyzed by using Sedgwick rafter cell (1ml Capacity) [15] After shaking the bottle the 1ml sample was drawn by pipette and poured in the rafter cell. All the 1000 squares on the chamber were screened and phytoplankton identified up to generic level by trinocular microscope (Labomed iVu 3000) and the phytoplankton was identified by standard keys [16] each sample was counted three times and taken as average value. The diversity of phytoplankton was calculated by Shannon's diversity index [17].

$$H = \sum_{i=1}^{s} - (P_i * \ln P_i)$$

Where:
H = the Shannon diversity index
P_i = fraction of the entire population made up of species i
S = numbers of species encountered
∑ = sum from species 1 to species S

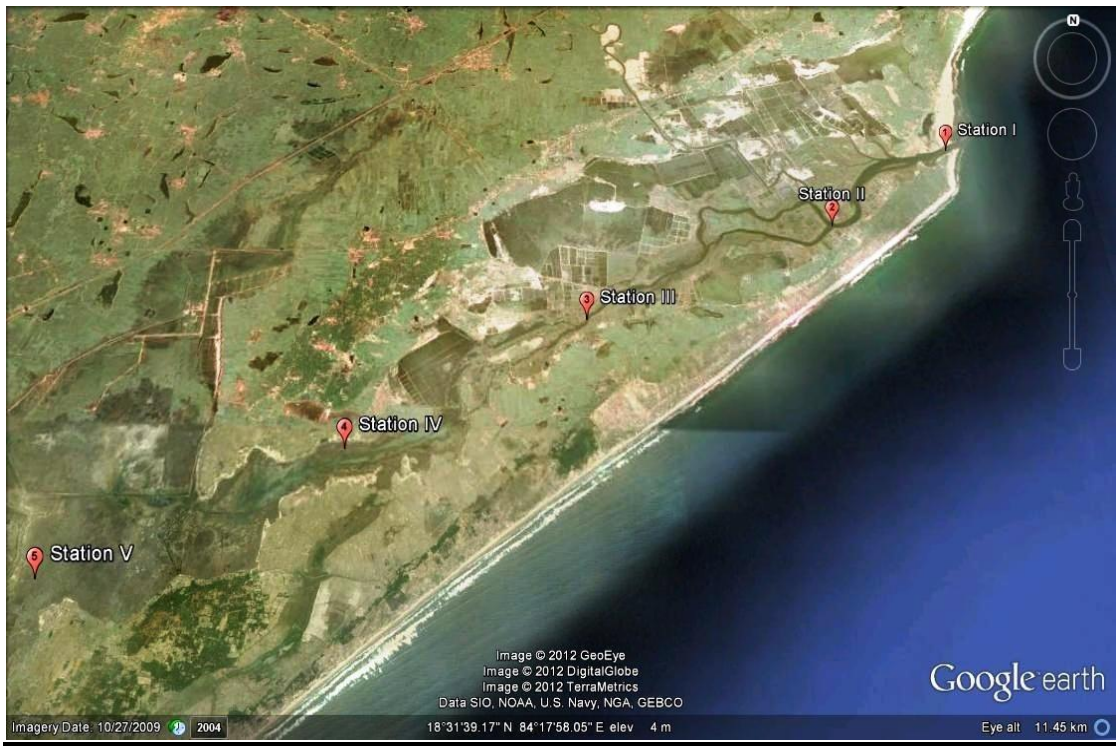


Fig-1: Different collection sites of Bhavanapadu creek, Srikakulum district, south India

III. RESULTS AND DISCUSSIONS

During the study period *Asterionella japonica, Rhizosolenia sp., Coscinodiscus sp., Ditylum sol, Bacteriastrum sp. Biddulphia sinensis, B .mobiliensis, B. heteroceros, Chaetoceros sp., Triceratium sp., Thallasiothrix longissima, Thalassiothrix frauenfeldi, Thalassionema nitzschioides, Skeletonema costatum, Pleurosigma sp., Ceratium sp., Spyrogyra sp., Oscillatoria sp.,* etc were dominant. The different species were recorded at different stations. From the Bacillariophyceae 24 species, 7 species from the Pyrrophyceae, 5 species from the Chlorophyceae and 3 species from the Cyanophyceae. Basically diatoms are more dominant than other classes, it was observed station I, II and III due to saline waters from the sea. The Physico chemical parameters of the water were compared to the phytoplankton population (Tables 1 to 5).The plankton was showed positive correlation to the salinity, temperature, dissolved oxygen, ammonia and depth at respective stations. The positive correlation was observed between salinity and phytoplankton and it indicates the

phytoplankton have favorable conditions to grow, if the increasing the salinity levels that indicates the species are belongs to the marine forms and they shows mass production [18] of the respective community. The temperature was shown as positive correlation and it indicates the growth and population will increase with increasing the temperature [19]. The ammonia showed as positive correlation that indicates the utilization the nitrates and also organic materials. The depth was also showed positive relation that indicates the availability of nutrients at particular depths for the favorable growth. The other nutrients are not shown significant due to lower concentrations or rapid recycling [20].

Table-1: Water quality parameter of station-1.

Station I	Depth	Temp.	Salinity	Trans.	D.O.	Ammonia	Nitrates	Phosphates	Silicates	Plankton
Depth (m)	1.	*	*	*	*	*	*	*	*	*
Temperature (ºC)	0.8212	1.	*	*	*	*	*	*	*	*
Salinity (ppt)	0.4832	0.6889	1.	*	*	*	*	*	*	*
Transparency (cm)	0.5669	0.47	0.521	1.	*	*	*	*	*	*
D.O. (mg/l)	0.3046	0.3885	0.199	0.0598	1.	*	*	*	*	*
Ammonia (mg/l)	0.6373	0.8455	0.6968	0.6753	0.504	1.	*	*	*	*
Nitrates (mg/l)	0.6981	0.5746	0.3964	0.5899	0.3501	0.6032	1.	*	*	*
Phosphates(mg/l)	0.4401	0.7654	0.4186	0.1487	0.1572	0.6966	0.2351	1.	*	*
Silicates (mg/l)	0.2734	0.4174	-0.0653	-0.0502	-0.0147	0.0681	0.0897	0.3417	1.	*
Plankton(/m3)	0.4324	0.5505*	0.6404*	0.5141	0.766*	0.6929*	0.4958	0.1223	-0.0894	1.

Table-2: Water quality parameter of station-2.

Station II	Depth	Temp.	Salinity	Trans.	D.O.	Ammonia	Nitrates	Phosphates	Silicates	Plankton
Depth (m)	1.	*	*	*	*	*	*	*	*	*
Temperature (oC)	0.4215	1.	*	*	*	*	*	*	*	*
Salinity (ppt)	-0.028	0.6997	1.	*	*	*	*	*	*	*
Transparency (cm)	- 0.2415	0.1466	0.6415	1.	*	*	*	*	*	*
D.O. (mg/l)	-0.478	-0.6704	-0.5578	-0.4031	1.	*	*	*	*	*
Ammonia (mg/l)	-0.5143	0.1749	0.3104	0.3061	-0.0082	1.	*	*	*	*
Nitrates (mg/l)	-0.3341	0.1747	0.181	0.178	-0.2317	0.8882*	1.	*	*	*
Phosphates(mg/l)	0.7193	0.221	0.0797	0.1373	-0.754	-0.382	-0.0688	1.	*	*
Silicates (mg/l)	0.4014	0.2261	-0.0585	-0.2698	-0.3824	-0.4307	-0.0574	0.4189	1.	*
Plankton(/m3)	0.5289	0.6182*	0.2164	-0.0944	-0.6219	-0.3125	-0.1026	0.4179	0.5774	1.

Table-3: Water quality parameter of station-3.

Station III	Depth	Temp.	Salinity	Trans.	D.O.	Ammonia	Nitrates	Phosphates	Silicates	Plankton
Depth (m)	1.	*	*	*	*	*	*	*	*	*
Temperature (ºC)	-0.5898	1.	*	*	*	*	*	*	*	*
Salinity (ppt)	-0.394	0.8416	1.	*	*	*	*	*	*	*
Transparency (cm)	0.7301	-0.5041	-0.1353	1.	*	*	*	*	*	*
D.O. (mg/l)	-0.3454	-0.2818	-0.6012	-0.34	1.	*	*	*	*	*
Ammonia (mg/l)	-0.3327	0.4244	0.5829	-0.1736	-0.3281	1.	*	*	*	*
Nitrates (mg/l)	0.1909	0.0827	0.0921	-0.2649	-0.2838	0.3126	1.	*	*	*
Phosphates(mg/l)	0.5006	0.0705	0.1851	0.4065	-0.712	0.2516	0.1909	1.	*	*
Silicates (mg/l)	0.5797	-0.3321	-0.3664	0.1985	-0.1245	-0.6378	0.0268	0.3074	1.	*
Plankton(/m3)	0.0905	0.3921	0.4178	0.1495	-0.5579	-0.3317	-0.179	0.3494	0.382	1.

Table-4: Water quality parameter of station-4.

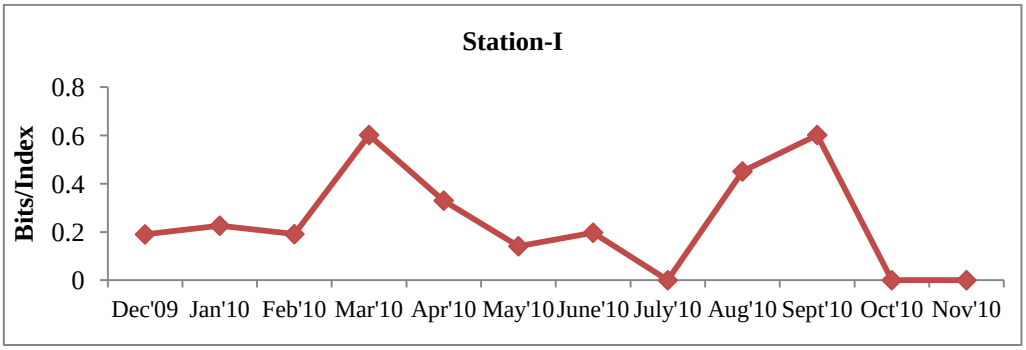
Station IV	Depth	Temp.	Salinity	Trans.	D.O.	Ammonia	Nitrates	Phosphates	Silicates	Plankton
Depth (m)	1.	*	*	*	*	*	*	*	*	*
Temperature (°C)	-0.5916	1.	*	*	*	*	*	*	*	*
Salinity (ppt)	-0.5447	0.6429	1.	*	*	*	*	*	*	*
Transparency (cm)	0.1053	-0.4516	-0.3315	1.	*	*	*	*	*	*
D.O. (mg/l)	0.0289	0.1481	-0.3827	0.1944	1.	*	*	*	*	*
Ammonia (mg/l)	-0.1532	0.1698	0.1035	-0.2859	-0.4817	1.	*	*	*	*
Nitrates (mg/l)	-0.3309	-0.0932	0.0127	-0.1139	-0.4206	0.7776	1.	*	*	*
Phosphates(mg/l)	0.5136	-0.2272	-0.1042	0.5589	0.1943	-0.5835	-0.7995	1.	*	*
Silicates (mg/l)	0.1888	-0.4046	0.1965	-0.2381	-0.5539	-0.2764	0.0195	-0.0609	1.	*
Plankton(/m3)	0.6286*	-0.678	-0.4755	0.2455	-0.0417	-0.1663	0.0154	0.1638	0.4168	1.

Table-5: Water quality parameter of station-5.

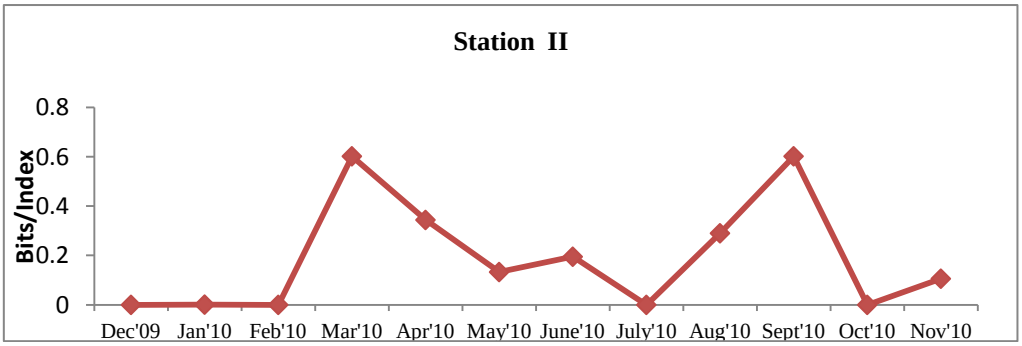
Station V	Depth	Temp.	Salinity	Trans.	D.O.	Ammonia	Nitrates	Phosphates	Silicates	Plankton
Depth (m)	1.	*	*	*	*	*	*	*	*	*
Temperature (°C)	-0.3848	1.	*	*	*	*	*	*	*	*
Salinity (ppt)	-0.483	0.4344	1.	*	*	*	*	*	*	*
Transparency (cm)	0.1493	-0.8397	-0.2851	1.	*	*	*	*	*	*
D.O. (mg/l)	0.0031	0.1825	-0.3239	-0.0623	1.	*	*	*	*	*
Ammonia (mg/l)	0.0828	-0.0862	-0.1656	0.3025	-0.058	1.	*	*	*	*
Nitrates (mg/l)	-0.1231	-0.3021	0.2168	0.2973	-0.6721	0.0435	1.	*	*	*
Phosphates(mg/l)	0.2366	0.5832	-0.2294	-0.4659	0.0225	0.2074	-0.2612	1.	*	*
Silicates (mg/l)	0.2929	-0.0777	0.2421	-0.1759	-0.4175	-0.0774	-0.0448	-0.1852	1.	*
Plankton(/m3)	0.82*	-0.2925	-0.3744	0.1699	-0.1569	0.4498	0.0295	0.2422	0.5053	1.

(P≤0.05, * showing significant)

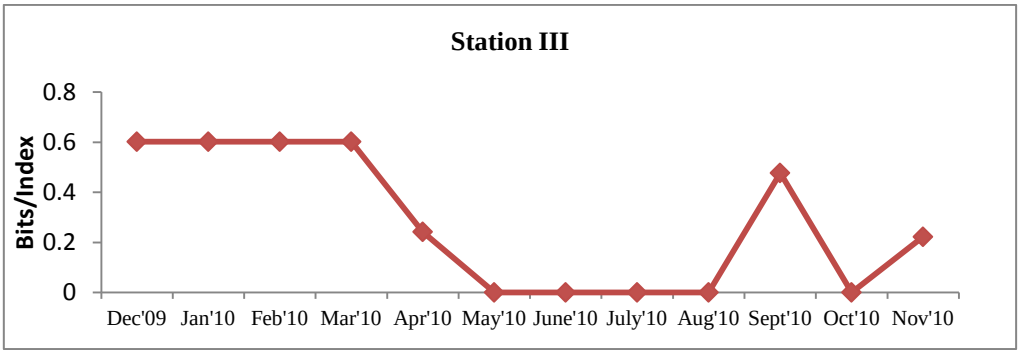
Graph-1: Water quality parameter of station-1.



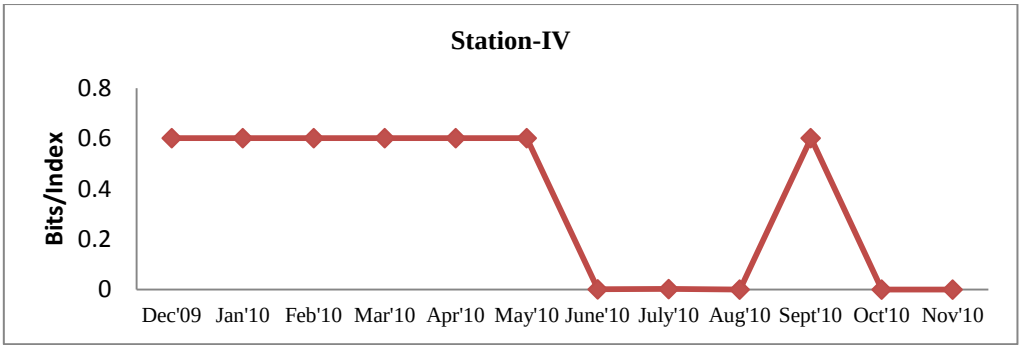
Graph-2: Water quality parameter of station-2.



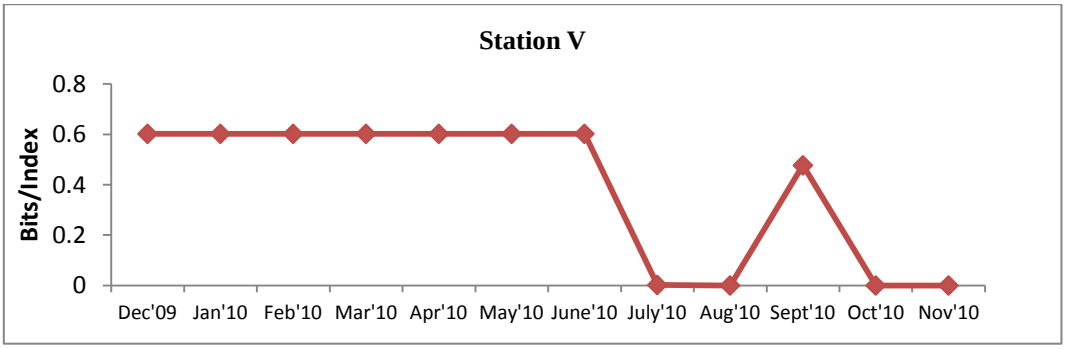
Graph-3: Water quality parameter of station-3.



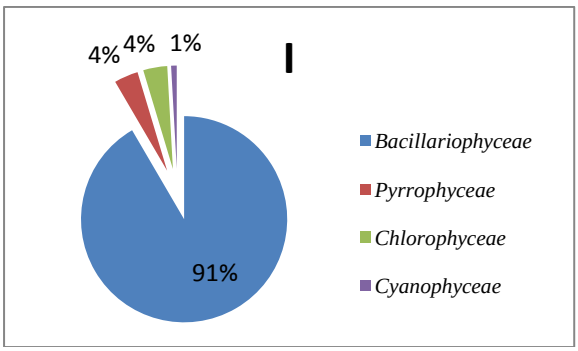
Graph-4: Water quality parameter of station-4.



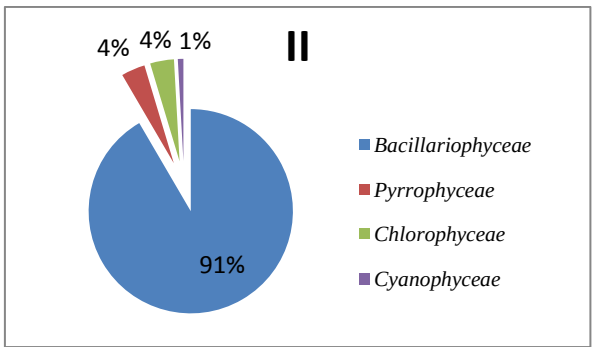
Graph-5: Water quality parameter of station-5



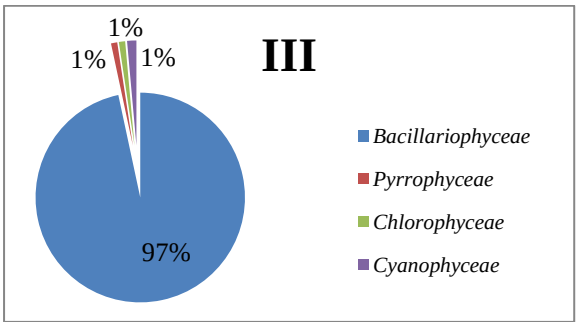
Graph-A: Abundance of phytoplankton in Station -1



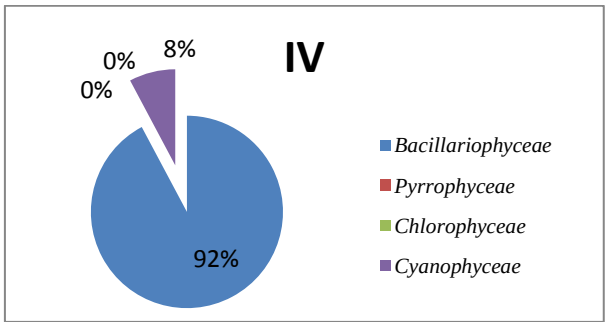
Graph-B: Abundance of phytoplankton in Station -2



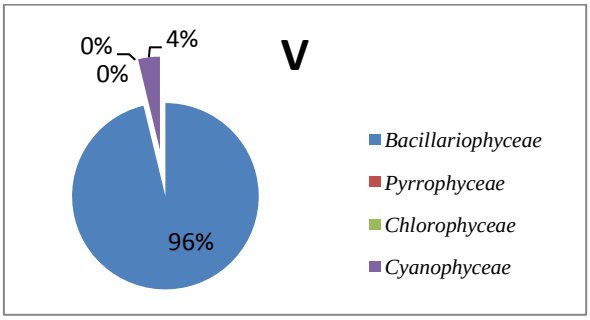
Graph-C: Abundance of phytoplankton in Station -3



Graph- D: Abundance of phytoplankton in Station -4



Graph-E: Abundance of phytoplankton in Station -5



The plankton density was 3.88×10^2 /m^3 reached as maximum. Among the phytoplankton *Asterionella japonica* was recorded more dominant. The pi diagrams (Graph A to E) indicate the Bacillariophyceae were more dominant in all the stations and followed by Cyanophyceae and than Chlorophyceae and than Pyrrophyceae members. At the station IV and V the fresh water influxes is more so Cyanophyceae and Chlorophyceae were showed more dominant than Pyrrophyceae and Bacillariophyceae members. The Shannon-weaver's diversity index was represented as a graph below (Graphs 1-5) and it was shown 0 to 0.602, during the study period in some months showing low diversity due to the number of different of species were low but not the density and the abundance. The plankton was shown seasonal variation in the creek and the planktonic communities served as indicator for change in the ecosystem [21]. The abiotic factors like depth, temperature and salinity were responses to the phytoplankton diversity [22] and also influenced by fresh water from the side channels of the creek. Further abiotic factors are changes both from the spatial and temporally according to the seasons [23]. The turbidity can effects on the light limitation factor and it will show effect on phytoplankton growth rates despite high nutrient concentrations [24]. The salinity is measured because of its influence on the distribution and the diversity of marine species. The overall observations of the present study, the some of the hydrographical parameters were strongly influences the species composition, abundance and diversity of the phytoplankton at Bhavanapadu Creek. There is no effect on the ecosystem because of the not recorded the toxic species. The study provides clear information regarding the low diversity in some months due less species proliferation in this Creek.

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