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Full Length Research Article

PHYTOPLANKTON DIVERSITY OF UPPANAR RIVER, CUDDALORE COAST (SOUTH EAST COAST OF INDIA)

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ABSTRACT

The present study was to assess the status of phytoplankton diversity and biomass in order to know the productivity of Uppanar River. A total 58 species were recorded out of 34 species belonged to Bacillariophyceae (diatoms), 13 species to Dinophyceae (Dinoflagellates), 6 species to Cyanophyceae (Blue-greens), 4 species to Chlorophyceae (Green) and 1 species to Chrysophyceae (Silicoflagellates). Present study revealed maximum percentage wise composition, the highest number of Bacillariophyceae (50%) in lower Cyanophyceae (Blue-greens), 4 species to Chlorophyceae (Green) and 1 species to Chrysophyceae wrer recorded.

INTRODUCTION

Plankton are the tiny organisms which are drifted by water currents. The word "Plankton" has been introduced by Victor Henson in 1887 which means wanderer in Greek. Phytoplankton are photosynthesizing microscopic organisms that inhabit the upper sunlit layer of almost all oceans and bodies of fresh water on earth. They are agents for "primary production," the creation of organic compounds from carbon dioxide dissolved in the water, a process that sustains the aquatic food web (Jump up and Thurman, 2007). Phytoplankton obtain energy through the process of photosynthesis and must therefore live in the well-lit surface layer sea, lake, or other body of water. Phytoplankton account for about half of all photosynthetic activity on earth Jump up *et al*. (2011). Their cumulative energy fixation in carbon compounds is the basis for the vast majority of oceanic and many freshwater food webs. The effects of anthropogenic warming on the global population of phytoplankton are an area of active research. Changes in the vertical stratification of the water column, the rate of temperature, dependent biological reactions, and the atmospheric supply of nutrients are expected to have important effects on future phytoplankton productivity (Jump up *et al*., 2011). Additionally, changes in the mortality of phytoplankton due to rates of zooplankton grazing may be significant.

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As a side note, one of the more remarkable food chains in the ocean remarkable because of the small number of links is that of phytoplankton feeding krill feeding baleen whales. Most all phytoplankton species are obligate photoautotrophs, there are some that are mixotrophic and other, non-pigmented species that are actually heterotrophic (the latter are often viewed as zooplankton). The term phytoplankton encompasses all photoautotrophic microorganisms in aquatic food webs. The production of plankton varies from season to season and even day to day in tropical region. The rate of production of phytoplankton depends on diet, tide, season and region. In any series of programme of study especially in the field of aquatic biology of the desirability of obtaining much more intimate knowledge of plankton becomes obvious. Hence, an analysis of phytoplankton becomes essential in any investigation relating to hydrobiology. Hence, the present attempt has been made to study the influence of physico-chemical natures of Uppanar estuary's water on the aquatic phytoplankton population diversity.

MATERIALS AND METHODS

Uppanar river is a tributary of Gadilam river which originates from the foothills and runs for the distance of 95 km, joins with adjoining paravanar estuary forming Uppanar- Paravanar estuarine complex and confluenceing into the Bay of Bengal. Site- I is located nearest to the Sellankuppam Village and from the river mouth, it is about 3km distance. The average depth of this site is about three meters.

Table 1. Phytoplankton diversity in two different sites recorded from September 2015 to August 2016 at Uppanar Rivar

S.No.	Name of the species	Site I	Site II
	BACILLARIOPHYCEAE (DIATOMS)		
1	*Amphoro coffeaeformis.*	+	+
2	*Asterionella japonica*	-	+
3	*Bacteriastrum comosum.*	-	+
4	*B. hyalinum*	+	+
5	*Biddulphia heteroceros*	+	+
6	*B. sinensis*	+	-
7	*Chaetoceros affinis*	-	+
8	*C. didymus*	+	+
9	*C. diversus*	-	+
10	*C. peruvianus*	+	+
11	*Coscinodiscus centralis*	+	+
12	*C. eccentricus*	-	+
13	C. gigas	+	+
14	*C. radiatus*	+	-
15	*C. sublineatus*	+	+
16	*Cyclotella* sp	+	+
17	*Ditylum brightwellii*	+	+
18	*Eucampia zoodiaacus*	+	+
19	*Fragillaria oceanica*	+	-
20	*Guinardia flaccida*	-	+
21	*Hemidiscus hardmanianus*	-	+
22	*Lauderia annulata*	+	+
23	*Melosira sulcata*	+	+
24	*Navicula granulata*	+	+
25	*Nitzschia closterium*	-	+
26	*Pleurosigma destuarii*	+	+
27	*P. elongatum*	+	-
28	*Rhizosolenia cylindricus*	+	-
29	*R. imbricata*	+	+
30	*Skeletonema costatum*	+	+
31	*Streptotheca indica*	+	+
32	*Thalassiosira decipiens*	+	+
33	*Thalassiothrix frauenfeldii*	+	+
34	*T. longissima*	-	+
	DINOPHYCEAE (DINOFLAGELLATES)		
35	*Ceratium breve*	+	-
36	*C. fusus*	-	+
37	*Dinophysis caudata*	+	+
38	*D. hastata*	+	+
39	*Goniaulax digensis*	+	-
40	*Gymnodinium breve*	+	-
41	*Ornithocercus steinii*	-	+
42	*Noctiluca scintillans*	-	+
43	*Protoperidinium pellicidum*	+	-
44	*P. pentagonium*	-	+
45	*P. venustum*	-	+
46	*Pyrocystis fusiformis*	+	+
47	*P. pseudonactiluca*	+	+
	CYANOPHYCEAE (BLUE-GREENS)		
48	*Anabaena sp*	+	-
49	*Microcystis sp*	+	+
50	*Nostoc linkia*	+	+
51	*Oscillatoria sp*	+	-
52	*Spirulina meneghiniana*	+	+
53	*Trichodesmium erythraea*	+	+
	CHLOROPHYCEAE (GREEN)		
54	*Chlorella vulgaris*	+	+
55	*Pediastrum sp*	+	+
56	*Spirogyra indica*	-	+
57	*Volvox sp*	-	+
	CHRYSOPHYCEAE (SILICOFLAGELLATES)		
58	*Distephanes speculum*	+	-

The mean salinity is ranged between 17%^{O} and 26 %^{O}. The bottom of this site is characterised with mud deposits. Site- II is located Cuddalore OT, The depth of this site is about two meters. The minimum level of salinity is ranged between 25%^{O} and 30 %^{O}. The bottom of the site is characterised with mud deposits. The collected micro algae were brought to the laboratory and preserved in 4% formalin. The collected samples were examined for the identification of different species and screened for the presence of Phytoplankton members in particular.

The phytoplankton species were identified with the help of classical manuals (Geitler, 1932; Desikachary, 1959; Iyengar and Desikachary, 1981; Anand, 1989 and Biswal and Das, 2004).

RESULTS

Totally of 58 species of phytoplankton were identified from the two study sites (Table 1) of Uppanar river during the study period. Out of 58 species identified, 34 species belonged to Bacillariophyceae (diatoms), 13 species to Dinophyceae

(Dinoflagellates), 6 species to Cyanophyceae (Blue-greens), 4 species to Chlorophyceae (Green) and 1 species to Chrysophyceae (Silicoflagellates). At site I, 25 species of Bacillariophyceae (diatoms), 8 species of Dinophyceae (Dinoflagellates), 6 species of Cyanophyceae (Blue-greens), 2 species of Chlorophyceae (Green) and 1 species Chrysophyceae (Silicoflagellates) were recorded. At site II, 29 species of Bacillariophyceae (diatoms), 9 species of Dinophyceae (Dinoflagellates), 4 species of Cyanophyceae (Blue-greens), and 4 species of Chlorophyceae (Green) were recorded. Among the genera isolated from both of the sites, Chaetoceros with 4 species and Coscinodiscus with 5 species was found to be dominant genus in site 1 and 2. The rest of the genera had single species each.

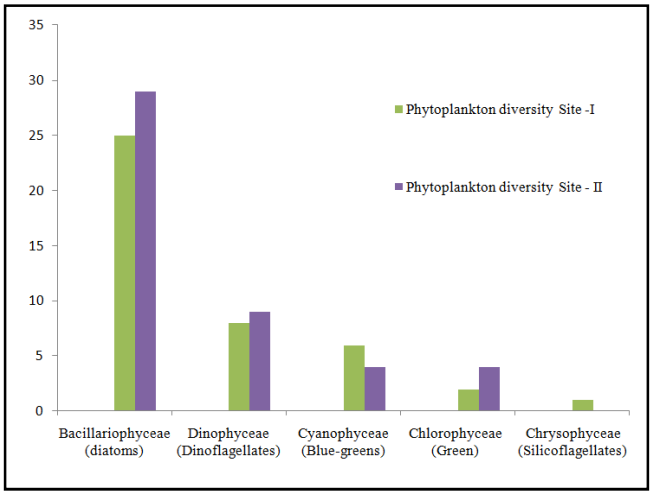

Fig. 1. Diversity level of Phytoplankton

DISCUSSION

The phytoplankton diversity was observed to a higher level during the summer season in the both the study sites. In this condition, phytoplankton grow, because the range of temperature permitting the growth of phytoplankton. In the present study At site I, 25 species of Bacillariophyceae (diatoms), 8 species of Dinophyceae (Dinoflagellates), 6 species of Cyanophyceae (Blue-greens), 2 species of Chlorophyceae (Green) and 1 species Chrysophyceae (Silicoflagellates) were recorded. At site II, 29 species of Bacillariophyceae (diatoms), 9 species of Dinophyceae (Dinoflagellates), 4 species of Cyanophyceae (Blue-greens), and 4 species of Chlorophyceae (Green) were recorded. Among the genera isolated from both of the sites, Chaetoceros with 4 species and Coscinodiscus with 5 species was found to be dominant genus in site 1 and 2. Anyinkeng *et al*., 2016 reported that, phytoplankton diversity and abundance in water bodies exposed to different anthropogenic pressures. Makhlough *et al*., 2016 reported that, Bacillariophyta species are reported to form the most abundant and widespread group throughout the Caspian Sea (Ganjian *et al*., 2010). It might be due to the absence of silica limitation in this area (Kasymov, 2004; Nasrollahzadeh *et al.*, 2012). Pyrrophyta is always known as one of the top two dominant phyla, particularly in the summer and fall, which is coincident with thermal stratification of water and low surface nutrients in the South basin and the Iranian coast of the Caspian Sea (Nasrollahzadeh, 2008). The percent abundance of Cyanophyta severely decreased in the summer of 2012 compared to that in 2001-2009. Small colonies of *Synecoccus* were the dominant species of Cyanophyta in 2012 (Makhlough *et al.*, 2014). There are some unpublished reports on the presence of this species in the Iranian coast of the Caspian Sea in the late 1990s and early 2000s. This species was observed in low numbers in 2009 and 2011 (Makhlough *et al.*, 2014). The species is one of the important producers in the ocean carbon cycle and it is able to support the fine sized flagellate growth (Christaki *et al.*, 2002). There has been no report for the occurrence of fine sized flagellates in the Iranian coast of the Caspian Sea before 2009. Then, after observing a low abundance in 2011, it was relatively well recorded with a high abundance in 2012, which was much higher than Cyanophyta abundance. David *et al.*, 2017 was studied Phytoplankton form the base of the marine food chain, and knowledge of phytoplankton community struc- ture is fundamental when assessing marine biodiversity. Policy makers and other users require information on marine biodiversity and other aspects of the marine environment for the North Sea, a highly productive European shelf sea.

This information must come from a combination of observations and models, but currently the coastal ocean is greatly under-sampled for phytoplankton data, and outputs of phytoplankton community structure from models are therefore not yet frequently validated. This study presents a novel set of in situ observations of phytoplankton community structure for the Uppanar river and physico-chemical analysis. The observations allow a good understanding of the patterns of surface phytoplankton biomass and community structure in the rivers for the observed months of August 2010 and 2011. Jiji Joseph, 2017 reported that, diversity and distribution pattern of microalgae in fresh water system represented by an open artificial pond. A total of 58 species of phytoplanktons were indentified from different groups during March 2014 to February 2015. Among the identified phytoplankton species Bacillariophyceae, Dinophyceae, Cyanophyceae formed the dominant group, followed by Chlorophyceae and Chrysophyceae. The fluctuations in the physico-chemical parameters like pH, temperature, BOD, nitrate, silicate, phosphate and were also been monitored. The result provides a primary documentation of the phytoplankton community and its diversity and basic understanding of hydrological variables in the pond ecosystem.

Phytoplankton are sensitive to the environmental changes and their distribution varies considerably with respect to seasons, water quality and nutrient concentrations (Thirugnamoorthy and Selvaraju, 2009; Ganaiji *et al*., 2010; Manickam *et al*., 2012). Planktonic communities are influenced by the prevailing physico- chemical parameters and these determine their abundance, occurrence and seasonal variations (Manickam *et al*., 2012). In the present study the values of physico-chemical parameters fluctuates greatly during different months. This may be due to various physico-chemical factors which are modifying the diversity of phytoplankton. Devika *et al.* (2006) suggests that physico-chemical conditions had a direct relationship on phytoplankton diversity in aquatic ecosystem. The pH, dissolved oxygen, alkalinity and dissolved nutrients are important for phytoplankton production (Bais and Agarwal, 1990). Makhlough *et al*., 2016 *et al.* (2015) observed that, Bacillariophyta species were the most abundant group of the phytoplankton diversity. The present results agree with those obtained by the phytoplankton diversity. The solubility of oxygen, or its ability to dissolve in water, decreases as the water's temperature increase.

Conclusion

Phytoplanktons were identified up to genus level. The higher diversity of bascillariophyceae was recorded among phytoplankton community. The study it is evident that both abiotic and biotic factors of the river are capable for providing a better condition for phytoplankton species in the river. Phytoplankton occurrence is high and diverse among water sources. The pollution status of these sources also varies with different anthropogenic activities. The study provides baseline data for future evaluation while recommending improved management of water sources in the nearby domestic and factories effluents.

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