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Diversity, Distribution and Abundance of Phytoplankton From Palghar Coast of Maharashtra

Kadam Surendra S.

Vice Principal & Head, Department of Zoology, GES, ACS College, Jawhar,
Dist.-Palghar -401603

Abstract

Diversity of phytoplankton and water quality of Dandi creek was studied during September 2009 to September 2010.Physicochemical parameters indicated variations in depth, pH, and temperature. DO, BOD, salinity, nitrite, nitrate, ammonium nitrate, phosphate etc. A total of 59 genera of phytoplankton were observed from Dandi creek system of which 50 genera were diatoms, 7 were dinoflagellates and 2 were other algae. *Coscinodisccus* was the most abundant genus in Dandi creek. Followed by *Ditylum, Biddulphia, Bacillaria, Certatium, Nitzschia, Naviculla, Plurosigma, Rhizosolenia, Thalasiossira* and *Thalassiothrix.* Variations showed in phytoplankton pigments at Dandi creek waters phytoplankton community. Variation of chlorophyll a ranged between 0.47 and 6.87 mg/m^3 (av.3.45 mg/m^3) and phaeophytin ranged between 0.18 and 2.8 mg/m^3 (av.1.04 mg/m^3). Concentration of phytoplankton pigments in the creek was fairly high. The chlorophyll a was higher in the outer zone than the interior zone of the creek. In general, phaeophytin level was lower than the chlorophyll a suggesting that the phytoplankton were in good physiological state. Seasonal variation in phytoplankton pigments was marginal. Phytoplankton pigments showed variations in concentration during pre-monsoon, monsoon and post monsoon seasons at 5 different stations of creek.

Keywords: phytoplankton, Dandi creek, water quality, physico-chemical parameters

Introduction

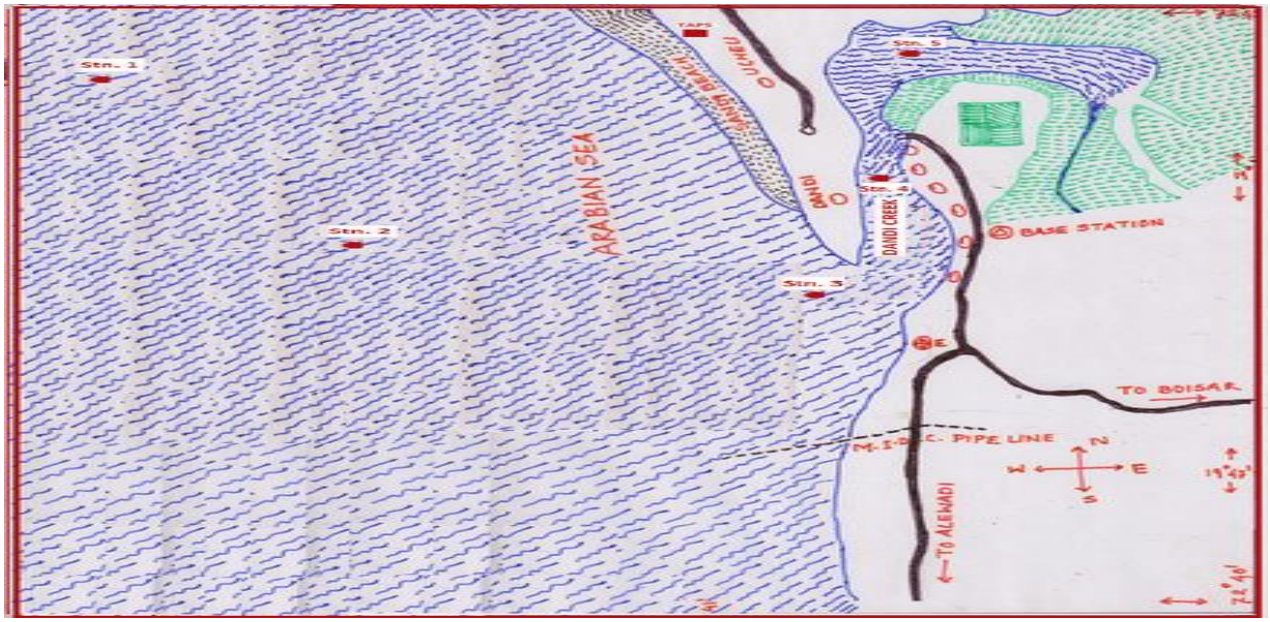
Phytoplankton communities dominate the pelagic ecosystem that cover 70% of the world's surface area. Phytoplanktons are the passively drifting plants found in the water bodies. They are autotrophic and main primary producers in the marine environment contribution about 95% of the total marine primary production, most of them are microscopic usually unicellular, solitary or chained forms. The quality and quantity of phytoplankton is good indicator of water quality (Mohammad Ali *et. al*, 2005). Marine phytoplankton which are the primary food source directly or indirectly, of all marine organisms are mainly composed of diatoms, dinoflagellates and cocolithophores, and these are major component of a marine ecosystem which initiates the aquatic food chain. The diatoms commonly known as 'pasture of the sea' or 'meadows of the sea' are unicellular autotrophic organisms and form about 90% of phytoplankton biomass. ''The ocean's invisible forest''- marine phytoplankton play a critical role in regulating earth's climate
(Falkowski, 2002). The marine phytoplankton come in a myriad of shapes, sizes and forms, some of them

quite beautiful, some drift on current while others have an ability to move around with the aid of flagella (Goswami, 2004). The present study in addition to adaptation information on ecological characteristics of phytoplankton will also help in providing baseline information for future monitoring of the system considering the industrial growth near the Dandi creek.

Area of Study

The present investigation has been carried out Dandi creek of Palghar district of Maharashtra during September 2009 to September 2010; Total five station were selected for the study of Phytoplankton, out of Station 1 and 2 were located in the open sea region, station 3 was near the mouth of the creek and station 4 and 5 were within the creek area.

Material and Methods



The water quality and phytoplankton study was carried out over a period of 13 months from September 2009 to September 2010 from 5 different locations in Dandi creek, west coast of India. Regular monthly collections were made from all the five stations. Collected samples were analyzed in the laboratory for various physico-chemical parameters, phytoplankton pigments and phytoplankton. A mechanized boat was used for the collection of samples by taking the help of local fishermen. Water samples for phytoplankton were collected from 5 different stations using clean plastic bucket and immediately transferred in 500 ml clean plastic bottles. The samples were immediately preserved by adding 5 ml of 4 % formalin and 2ml of Lugol's iodine solution. The samples were subjected to qualitative and quantitative evaluation of phytoplankton. Quantitative evaluation was carried out by Sedgwick Rafter counting cell and for qualitative evaluation standard monographs, published research papers in national and international journals were followed. Identification of phytoplankton was doneas per Subramanyan (1959)[3]. Diversity index of phytoplankton for each month was calculated by the following formula: *Diversity index* = $H = \frac{S-1}{In\ N}$

Where,

S = Number of genera of phytoplankton

N = Total number of phytoplankton

ln = Natural logarithm

Phytoplankton pigments (Chlorophyll a andPhaeophytin)

Estimation of Chlorophyll a and Phaeophytinwas carried out by Strickland and Parson Method (1972)[4]. The samples were filtered through a nylon cloth (0.3 mm mesh) followed by membrane filter(0.45 µm pore size), after adding 3 drops of 1% magnesium carbonate. The separated phytoplanktons were extracted with 90% acetone. Chlorophyll a and Phaeophytin were extracted by centrifugation and estimated spectrophotometrically by determining optical density and 665 nm before and after acidification.

Parameters	Outer Zone		Inner Zone		Entire creek Area	
	Range	Mean	Range	Mean	Range	Mean
Temperature (^{0}C)	22.5 – 35.5	28.8	22.0 -35.5	28.7	22.0 – 35.5	29.0
pH	7.45 – 8.41	7.9	7.7 – 8.69	8.01	7.2 – 8.69	8.09
Salinity (‰)	22.23 – 38.8	30.63	19.29 – 36.34	27.93	19.29 – 38.8	30.69
DO (mg/l)	3.39 – 5.31	4.36	3.28 -5.49	4.46	3.28 – 5.49	4.40
BOD(mg/l)	0.87 – 2.12	1.50	0.78 – 2.23	1.35	0.78 – 2.23	1.32
Phosphate (µ mol/l)	0.47-3.93	1.82	0.42 -3.65	1.88	0.42-3.93	1.55
Total Phosphorus (µ mol/l)	3.41-13.6	8.21	2.3 -12.6	7.28	2.3-13.6	7.57
Nitrite (µ mol/l)	1.38- 3.78	2.59	1.38 – 3.55	2.47	1.38 – 3.78	2.52
Nitrate (µ mol/l)	23.26 - 42.28	33.39	20.93 – 39.83	29.66	20.93-42.28	31.56
Ammonia (µ mol/l)	0.48-14.96	7.05	0.83-16.06	6.55	0.48-16.06	3.48
Total Nitrogen (µ mol/l)	41.63-142.08	84.92	45.03-116.63	80.14	41.63-142.08	76.6
Chlorophyll a (mg/m3)	2.14-6.87	4.31	0.47-6.43	2.68	0.47-6.87	3.45
Phaeophytin (mg/m3)	0.5-2.66	1.43	0.18-2.08	1.14	0.18 - 2.8	1.04
Phytoplankton Cell count(no.X10^3)	284 - 3238	1645.5	88 - 2965	5.68	88 – 3238	920.28

Table 1-Variation in different physic-chemical and biological parameter of surface and bottom water

Nutrients

All nutrients including Nitrate, Nitrite, Phosphate, Ammonium nitrate were analyzed calorimetrically using UV-Vis Spectrophotometer. At the time of sampling water temperature was measured by good quality thermometer. pH of samples was determined by calibrated digital pH meter. DO was measured by Winkler's Iodometric method. For the BOD direct unseeded method was employed. The sample was

filled in BOD bottle in the field and was incubated in the laboratory at room temperature for 5 days after which DO was again determined, and salinity was measured by Argentometric method.

Results and Discussion

A review of various physico-chemical parameters at different locations in Dandi creek revealed that abiotic features of Dandi creek were mainly influenced by tides and monsoon of the tropics some of the parameters showed spatial variations (Table 1). Temporal and spatial variations were observed in various parameters during the present study. The creek was sea water dominated throughout the study period. Temperature of water showed marginal variation mainly influenced by atmospheric temperature. The pH of sea water was mainly alkaline except monsoon season where it was below to standard pH value of coastal water. Salinity showed variation in premonsoon, monsoon and postmonsoon seasons. DO & BOD showed substantial variation, the average concentration was comparable with standard values given for coastal water. DO & BOD values indicated effective assimilation of organic load. Phosphate phosphorus and total phosphorus showed slightly higher values. Nitrite nitrogen, nitrate nitrogen and total were also in the range normally found in coastal water. Ammonia nitrogen concentration was slightly higher probably due to land drainage and industrial discharge in Dandi creek.

Total 59 genera of phytoplankton were observed during the study period comprising diatoms, dinoflagellates and other algae. Phytoplankton observed from Dandi creek including *Amphiprora, Amphitetra, Amphora, Asterionella, Bacillaria, Bacteriastrum, Biddulphia, Campylodiscus, Corethron, Caloneis, Cerataulina, Chaetoceros, Climacocosphemia, Coconeis, Coscinodiscus, Diploneis, Distephanes, Ditylum, Eucampia, Fragillaria, Gramatophora, Gunardia, Gyrosigma, Hemidiscus, Isthmia, Lauderia, Leptocylindrus, Licmophora, Lyngbya, Melosira, Navicula, Nitzschia, Ornithocercus, Oxytoxum, Planktoniella, Pluerosigma, Podocystis, Rhabdonema, Rhizosolenia, Schroederella, Skeletonema, Stauroneis Stephanopyxis, Surinella, Synedra, Thalassionema, Thalassiosira, Thalassiothrix, Triceratium, Ceratium, Dinophysis, Exuviaella, Gymnodinium, Peridinium, Prorocentrum, Protoperidinium, Oscillatoria, Phaeocystis*.

Phytoplankton Cell Count & Species Diversity

The phytoplankton cell count at station 1 ranged between 414 and 3238 X 10^3/l (av.1316.15 X 10^3/l). The highest cell count was observed in the month of March and lowest in the month of September. The average phytoplankton cell count for premonsoon (1550 X 10^3/l), monsoon (542 X 10^3/l) and postmonsoon (2050 X 10^3/l) seasons. Diatoms constituted the major group of phytoplankton contributing 91.96% of total phytoplankton population. The percentage contribution of diatoms for this station was 91.97%. The maximum percentage contribution was observed in the month of November and the minimum January. Seasonal percentage contribution of diatoms were respectively 34.52, 15.39 and 50.10 % for premonsoon, monsoon and postmonsoon. The dinoflagellates percentage for this station was 5.92 with highest contribution in the month of March and the lowest in the month of April. Seasonal percentage contribution of dinoflagellares was respectively 61.63, 17.10 and 21.27 for premonsoon, monsoon and postmonsoon. The percentage contribution of other algae at station 1 was 2.12. Their highest contribution was observed in the month of October and the lowest in the month of March. Seasonal percentage contribution of other algae for premonsoon, monsoon and postmonsoon periods were respectively 20.56, 36.67 and 42.78.

Months	Station 1	Station 2	Station 3	Station 4	Station 5
Sep,09	414	356	364	267	250
Oct	1738	1356	1268	1115	745
Nov	2381	1686	1520	1026	738
Dec	2628	2630	2205	1615	756
Jan,10	1453	1232	939	531	319
Feb	1340	995	964	576	328
Mar	3238	2563	2965	1204	661
Apr	619	425	396	299	182
May	1003	858	614	376	151
Jun	486	284	274	274	88
Jul	784	644	578	342	124
Aug	428	368	282	110	100
Sep	598	522	474	300	298

Table 2-Variation in phytoplankton cell count (no X 10^3/l) at different stations during 2009-10

Conclusion

Present investigation proposes that Dandi creek is fully rich with phytoplankton and supported a various community. Dandi creek an ecologically important estuarine system can be termed as slightly to moderately polluted because creek is surrounded by Tarapur industrial area and many industries are responsible for water pollution. Present baseline information on the phytoplankton pigments and community structure are useful for future ecological assessment andmonitoring of the coastal ecosystem of Dandi creek area.

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References

1 Tiwari LR, Nair VR. Ecology of phytoplankton from Dharamtar creek, west coast of India. Indian J marine sci.vol 27 (1998), 302 – 309.

2 Muhammad Ali *et al.* (2005). Studies on monthly variation in biological and physico-chemical parameters of Brackish water fish pond, Muzaffargarh, *Pakistan.Journalof Research (Science),* Bahauddin Zakaria University, Multan, Pakistan.Vol 16 (1) 27-38.

3 Subrahmanyan, R. (1959). Studies on the phytoplankton of the west coast of India.pt.I. Quantitative and qualitative fluctuations in the total plankton crop, the zooplankton crop and their interrelationship, with remarks on the magnitude of the standing crop and production of matter and their relationship to fish landings. Proc.Indian Acad.Sci. 50B: 113-187.

4 Strikland, J.D.J.and Parsons (1972).A practical handbook of sea water analysis .Bull.No.167 (Fis.Res.Bv.of Canada).

5 Gonkar, C. A., Sawant, S. S., Chandrashekar, A. Anil., Venkat Krishnamurthy and Gonzalves, E.

A.,1947. Variations in the seasonal compositions of the phytoplankton of Bombay harbour., Curr. Sci., 16:304-305.

6 Gopinath,C.P., 1972. Seasonal abundance of phytoplankton in Cochin backwaters., J. Mar.Biol. Ass. India,14:668-577.

7 Goswami S.C., 2004. Phytoplankton Identification Manual, National Institute of Oceanography, Goa :1- 35 pp.

8 Hutchinson, G. E., 1944.Limnological studies in Connecticut III A critical examination of the supposed relationship between phytoplankton and chemical changes in lake waters., Ecology 25(1).. 3-26.S

9 Jayalakshmi, K.V., Kumaram, S. and Vijayan, M., 1986. Phytoplankton distribution in Cochin backwarers –Seasonal study., Mahasagar-Bull.Nat.Inst.Oceangro.,19(1):29-37.

10 Kadam , A.S., 1958. Monoculture of marine planktonic diatoms and the effect of different media on their growth and survival., Journal of Indian Fisheries Ass.19:69-74.

11 Kaladharan, P., Alavandi, S.V., Pillai, V.K. and Balachandran,V.K., 1990. Inhibition of primary production as induced by heavy metal ions on phytoplankton population off Cochin. Indian Journal of Fisheries., 37(1):51-54.

12 Kofoid, C.A., 1903. Plankton studies IV the plankton of IIinois River, 1894-99 with introductory notes on the hydrography of the IIinois River and its basin. Paart I. Quantitative investigation and general results., Bull. III. Nat. Rist. Sury., 6 (2): 95-624.

13 Kotiwar, O. S., 2007. Distribution and abundance of phytoplankton along west coast of India. National symposium on conservation and valuation of marine biodiversity: 201-218.

14 Lodh, N.M., 1990. Ecological studies on plankton from near shore waters of Bombay., Ph.D. Thesis, University of Mumbai, 203 pp.