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SPATIAL DISTRIBUTION AND SEASONAL ABUNDANCE OF PLANKTON POPULATION OF BAY OF BENGAL AT DIGHA SEA-SHORE IN WEST BENGAL

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ABSTRACT

Seasonal variations of Phytoplankton and zooplankton dynamics were noted both quantitatively and qualitatively at Digha Sea Shore of Bay of Bengal. In total of 72 species of Phytoplankton known, 23 species of Chlorophyta (31.94%), 14 species of Bacillariophyta (19.4%) and 8 species of Cyanophyta (11.1%) were identified. Whereas in species variations of zooplankton, Protozoa (38.70%), Rotifera (25.80%) and Cladocera (22.58%) and Copepoda (12.90%) and constitute 12, 8, 6, and 4 species respectively. Chlorophyta amongst the Phytoplankton and Cladocera amongst the zooplankton imparted the highest numbers.

KEYWORDS : Plankton diversity, Bay of Bengal, Digha

Ocean reckoned as dynamic ecosystems with high productivity are no exception to the unwarranted trend of environmental degradation. The incessant demand for economic growth has tempted a small segment of individuals to make substantial profits from the non-sustainable exploitation of these resources without regard for the long term environmental consequences. Although, the fishes are considered as rich sources of food as they constitute 6% of the total proteins and 16% of the animal protein only consumed by the people (McGinn. 1999), but they are at present under stress and face the danger of severe depletion due to more frequent overfishing Furthermore, the technological advances along with impressive growth in the investment in fishery sector have resulted in the exploitation of the fisheries resources even in the most remote corner of the Planet. According to the estimates by the Food and Agricultural Organization (FAO, 1998), eleven of the worlds fifteen most important fishing areas and 70% of the major fish species are either fully or overly exploited. The amount of fish harvested surpasses the sustainable yield of fishery, the fish species would begin to shrink and its irrational continuance would land in collapse beyond possibility of any recovery.

Digha marine water offers one of the best lucrative fishing center in West Bengal fishery potentialities and thus serves as one of the most important economy. The composition of fish species is highly varies. The success of fishing operations depend upon the extent and efficiency of manpower(fishermen). Modern mechanization of the crafts and other ancillary facilities improve the fishing trade potential. The present study deals with the marine resources(i.e. plankton), its utilization and economic importance at Digha Sea-shore in West Bengal.

METERIALS AND METHODS

The planktons were Sampled by plankton net made of standard bolting silk cloth no-25(mesh size0.03-0.04mm) for different stations from 100 liter water sample by use of a plastic bucket of 10 liter capacity. Finally the planktons were preserved in 4% formaldehyde solution. The samples were thereafter taken to the laboratory for qualitative and quantitative analysis in Sedgwick rafter type counting cell(1 ml capacity) and then the planktons were identified as per standard methodology (Adhikari, 2000). After shaking the vials containing the concentrated plankton smaple, a sub sample of 1 ml was quickly drawn with the help of a pipette and poured in the plankton counting cell. All organisms encountered were made and the data represented in the text were mean value of counting. The planktons were idenditied as per species distribution and then tabulated accordingly.

Digha is one of the coastal district of West-Bengal, having a long stretch of coast-line.

The magnificence of Digha sea beach is embellished with unique scenic beauty and a popular tourist resort of West-Bengal. Its deep and clear blue waters instantly provoke many good swimmers to take a plunge and bathing temptation is irresistible.

May was the hottest month with average temperature reaching 37.5^{0}C. December and January were

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the cooler months with minimum temperature scaling to 12.0°C.

The study area experienced both seasonal and monsoon rains. South-Western monsoon start and from first week or mid-June and continued till the last week of October. Maximum annual rainfall was between June to September.

RESULTS

Phytoplankton

Seasonal variations of phytoplankton were noted quantitatively and qualitatively(Tables 1-4).

Three groups of algae were identified viz.(i) Chlorophyta, (ii) Bacillariophyta and (iii) Cyanophyta Of the total algal species, 53.6%, 29.45% and 16.75% belonged to Chlorophyta, Bacillariophyta and Cyanophyta respectively.

Bimodal nature of population peaks for whole phytoplankton was observed during early winter(December and January) and early summer(March and April) interms of percentage of distribution and standing stock.

At station I out of 28 species identified, 14 species belonged to Chlorophyta (50%), 6 species belonged to Cyanphyta (21.42%) and 8 species belonged to Bacillariophyta (28.57%).

At S:2 out of 31 species, 11 species were of Chlorophyta (35.48%), 8 species of Cyanophyta (25.80%) and 12 species we of Bacillariophyta (38.70%).

Phytoplankton showed their peak growth during winter 279.96 n/l at Sl, 178.34 n/1 at S2.

Zoopalnkton

Variations in quality and quantity composition of zooplankton were reported seasonally with the individual population peaks, shown in Table- 3 & 4.

Table 1 : Number of total phytoplankton species identified and their percentage belonging to various taxonomic groups at S1 and S2 during 2012

Species Group	S1		S2	
	No. of Species	%	No. of Species	%
Chlorophyta	14	50	11	35.48
Cyanophyta	6	21.42	8	25.80
Bacillariophyta	8	28.57	12	38.70

Table 2 : List of available species of phytoplankton identified from different stations(S1, S2) during 2012

CHLOROPHYTA	S1	S2
Euglena acns Ehrenb	-	+
Euglena acns Ehrenb	-	-
Euglena spirogyra Ehrenb	+	+
Euglena eleganas Ehrenb	+	-
Volvoxglobater (L) Ehrenb	+	-
Volvox aureas Klein	+	-
Pandorina morum Mull	-	+
Chlorococcum humicolum(Naeg) Rabenh	-	-
Hydrodictyon idium lyenger	-	-
Cladophora profunda Brand	+	-
Cladophora glomerate(L) Kutz	+	-
Cladophora ephiophila magnus and Wille	-	+
Cladophora callicoma Ag.	+	-
Oedogonium coreatematum wittr	-	+
Desmidium clylindricum Grev.	-	-
Zygnema pelisoporum Wittr	-	-
Zygnema varians Kutz	-	-
Zygnema pectinatum Vauch	-	-
Sprirogyra fluviatilis holes Var Africana	-	-
Spirogyra varians Kutz	-	-
Spirogyra scriformis(Reth) Kutz	-	-
Spirogyra longata Vauch	+	-
Spirogyra webri Kutz	-	+
Spirogyra majuscule hilse	+	-
Cosmarium Sp.	-	-
Cosmerium reniforme(Ralfs) Arch	-	-
Cosmarium botrylis menegh(after Dobard)	-	-
Closterium lannaceolatum kuz	-	+
Colpterium parvulam naeg	‡	-
Colsterium venus kutz	-	+
Clopterium paravulam Naeg	+	-
Closterium venus Kutz	-	+
Closterium Cambicum Arch	-	-
Closterium ehrenbergii Menegh(after Lutman)	-	-
Closterium leibleinii Kutz(after Steinecke)	-	-
Closterium striolatum Ehrenb(after west)	+	+
Estella botryoides W/West	-	-
Scenedesmus quardricauda Lurb	-	-
Ankistrodesmus spinulosam Naeg.	-	-
Sphaerozosma rotate Grev	-	-
Ulothrix rodia Kutz	+	-
Ulothrix variablilis Kutz	-	+
Ulothrix oscillatoria Kutz	+	-
BACILLARIOPHYTA	**S1**	**S2**
Amphora ovallis kutz.9	-	+
Cylotella comta(her) Kuz var. affairs gum	-	+
Baillaria paradoxa Gnel	-	+
Cymbella cistuba(hempa)Grun.	-	-
Navicula mutica kutz.	+	+
Gomphonema Llanceolatum ehrenb		+

(contd.)

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Pinnularia gibbaf. Subandulata Mayr.	+	+
Kelosira ganulata(e hr) Raif.	+	-
Cyclotella Comate(Her) Kutz.	-	+
Navicula laterostrate hust	+	+
Gyrosignma. Attenuatum kutz	-	-
Gomphonema ventricosum Gerg.	+	-
Pleurosignma spenceri karston	-	-
Pennularia major Kutz.	+	+
Pinnularia viridis kutz.	+	+
Navicula cuspidate Kutz.	+	+
Pleurosigma gigantum Gran.	-	+
CYANOPHYTA	**S1**	**S2**
Phormidium favosum(Bory) Gom	-	-
Anbaena Cricinalis Rabenh	+	+
Anabaena Biasolatiana	+	+
Synechocystis salansis Skuja	-	-
Oscillatoria borneti Zukal	+	+
Oscillatoria amphigranulata Van Goor	-	+
Oscilatoria lenuis Ag.	+	+
Microcystis aeruginosa kutz	+	+
Nostoc linckia(Rolth) Bornd Flah	+	+
Nostoc Commune Vauch	-	+
Rivularia munulula(kutz.) Bornd Flah	-	-
Rivularia biasolettiana monegh	-	-

Eight groups of zooplankton were identified viz. protozoa, Nematoda, Rotifera, Anostroca, ostracoda, Cladocera, Copepoda and Crustacian larvae, at two different stations.

In total 12 known species protozoa, 8 species of Rtifera, 7 species of Cladocera and 4 species of Copepod were identified. Amongst these, zooplankton groups occupied the highest number.

At S.I, out of 21 species, 38.09% protozoa, 28.57% Rotifera, 19.04% Copepoda and Cladocera, 4.28 at S.2 out of 28 species 39.28% Protozoa, 28.57% Rotifera, 21.42% Clodocera and 10.71% Copepoda were reported. Nematode, Anostroca Ostracoda and Crustacean larval were absent at S1 Cladocera and Copepods were found to be present in large numbers among all the groups of Zooplankton. Zooplankton showed their peak growth during winter (196.6 n/l at S1, 745.6 n/l at S2).

Number of total Zooplankton species identified and their percentage belonging to various taxonomic groups in S1, S2 during 2009).

Table 3 : List of available species of Zooplankton identified for different station(S1, S2) during 2009

Species Group	S1		S2	
	No. of Species	%	No. of Species	%
Protozoa	8	38.09	11	39.28
Nematoda	0	Nil	0	0
Rotifera	6	28.57	8	28.57
Anostraca	0	Nil	0	0
Cladocera	5	19.04	6	21.42
Ostracoda	0	Nil	0	0
Copepoda	4	14.28	3	10.71
Crustacean Larve	0	Nil	0	0

Table 4 : List of available species of Zooplankton identified for different station(S1, S2) during 2009

PROTOZOA	S1	S2
Amoeba protues Muller	+	+
Amoeba discoides Schaeaffer	-	+
Amoeba radosa Ehrenb	+	+
Arcella Gibbosa pennard	- +	+
Arcella Vulgaris Ehrenb	+	+
Arcella Discoides Ehrenb	+	+
Euglypha cristata Leidy	-	+
Euglypha tuberculata Dujardin	+	-
Euglaypha ciliate Ehrenb	+	+
Difflugia corona Wallich	-	+
Paramoecium caudatum Ehrenb	+	+
Verticella campanula Ehrenb		+
ROTIFERA	-	
Brichionus rubens Ehrnb	+	+
Keratella Tropica Apstein	+	+
Asplanchna priodonta Mastax	+	+
Rotaria vulgaris Schrank	-	+
Filina longiseta Ehrenb	+	+
Monostyla bulla Gosse	+	+
Monostyla quadridentata Ehrenb	+	+
Notholca accuminata Gosse		+
CLADOCERA	-	
Daphnia carinata King	-	+
Simocephalus vetulus Schoedler	+	
Diapha nosoma exisum Sars	+	+
Moina micrura Kutz	+	+
*Ceriodaphnia Rga*udi Richard		+
Ceriodaphnia reticulate	+	+
Bosmina sp.		+
COPEPODA		
Mesocyclopsleuckartii Claus	+	+
Mesocyclps hyalinus REhbrg		+
Diaptomus wierzeskii Richard	+	+
Heliodiaptomus viduus Gurney	+	

DISCUSSION

Phytoplankton plays a great role for the water quality and productivity of the aquatic environment.

(a) Economic importance of Plankotns: A number of investigators have studied about phytoplanktonic compositios, their frequency, distribution, periodicity of the dominant species and their movements in different aquatic environments (Bose and Gorai, 1993, Acharya etal, 2009).

Further Phytoplankton is the breathing house of all aquatic animals through their power of photosynthesis which liberates huge amount of dissolved oxygen and taking in expired free CO_2. Thus these autotrophes in one way helps all living beings for their environment and in other way consuming green house gases i.e. CO_2 to keep the aquatic environment clean and pollution free. Besides, phytoplanktons become day today food of Zooplankton which are important food items of all aquatic animals. Thus both phytoplankton and Zooplankton play a vital role to keep up the aquatic environment safe and healthy. Therefore, food chain and food web mechanism works in balanced condition due to harmonious relationship between autotrophes i.e. Phytoplankton and heterotrophes i.e. Zooplankton.

(b) Seasonal flunctuations of Planktons: The seasonal flunctuations of Bacilariophyceae follow those of the total phytoplankton closely. Cinophyceae show a peak during the South-West monsoon period (June 7 July) and one or more peaks during the North-East monsoon season. Cyanophyceae exhibit a peak during the North-East monsoon in the warmer months. The total quantity of phytoplankton per unit volume of water shows variations from year to year depending on the nature of floral elements present (Wanganeo, 2006).

In the present investigation definite seasonal variations were observed in the compositions (n/l) of phytoplankton, with the maximum and minimum of Chlorophyta, Cyanophyta and Bacillariophyta. The maximum number of the phytoplanktons during winter (November to January) and during Spring (March and April) indicates favorable physicochemical condition in relation to the phytoplankton population.

The above findings are supported by (Kulkarni and Nimbalkar, 1981).

Zooplankton like phytoplankton, shows a higher standing crop in the sea of the west coast of India than that of the east coast. International Indian Ocean Expendition Plankton Atlas (Prasad and Singh, 1980) contains maps of the total zooplankton biomass in the Arabian Sea and the total zooplankton biomass in the Indian ocean. Average of zooplankton volume collected during the South-West monsoon period in the Arabian Sea for the entire annual period, showed its maximum concentration in the Western half of the Sea with high production areas lying off the Somali and Arabian costs and to a certain extent, of the South-Western coast of India, the low productions zones being the central part of the Arabian sea Gujarat coast. These observations support to the distributional pattern of plankton biomass as determined during the present study. They also found that the areas of high productivity in the Arabian Sea are associated with upwelling along the Somali and Arabian coasts, an association which imparts a certain degree of predictability.

Among zooplanktons under present tudy, the commonly encountered organisms during South-West monsoon are Toraminifers, Radiolarians, Polychaete larvae, Cladocerans, small Copepods, Nauplii, Amphipods, Lamellibranch larvae, Salps, Tunicates with Prawn larvae dominating towards the end of the period.

The present findings of the effect that zooplankton community is influenced by the physicochemical regime of the water (Michal, 1984) and thus the seasonal changes are brought about in their life-processes and population dynamics find support and (Sharma and Saksena,1981),). Further, the water systems support fewer species although the number of individuals in each of them may be large, (Mitra,1982).

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