CERTAIN ASPECTS OF ECOLOGICAL PREFERENCES OF PLANKTON OF SUNDERBAN ESTUARY, WEST BENGAL, INDIA

ABSTRACT

In nine major rivers of Sunderban estuary nine water quality parameters and fifty four planktonic types were analysed statistically. From statistical analysis it appears that every species has some preference of water quality of its own.

MOST of the plankters are minute in size and very simple in structure. So they cannot adapt themselves rapidly to a wide range of fluctuations of the characteristics of the aquatic environment. As a result there occur species change in composition with the changing characteristics of the aquatic environment. In stressful condition, sensitive species die while the opportunistic species multiply and act as indicator of a particular condition of the habitat. In the three years survey programme, water quality and planktonic characteristics were analysed. It was revealed that every species has some preferences of aquatic environment of their own.

MATERIAL AND METHODS

Plankton were collected by a plankton net (30 μ mesh) from surface water of twelve sampling locations of nine rivers in Sunderban estuary. Several water quality parameters were analysed simultaneously by following the methods described in APHA (1992) and Parsons *et.al* (1984). The data thus generated were analysed by simple correlation.

RESULTS

This investigation was carried out during April 1995 to January 1998. Simple correlation analysis between water quality parameters and planktonic loads were done by taking them as the two sets of independent variables. There were 108 cases for each variable (12 sampling locations x 3 seasons x 3 years), used for these analysis. The parameters like water temperature, alkalinity, dissolved oxygen, nitrate, phosphate, silicate, total suspended solids and salinity played significant role in qualitative and quantitative spectrum of plankton population. From the above analysis it appears that there were both significant positive and negative correlation with planktonic loads of various species with water quality parameters. This is essentially due to different niche requirement of individual species. For instance during winter phytoplanktron like *Biddulphia mobiliensis, B. sinensis, Protoperidinium depressum, Lauderia annulata, Thalassionema nitzschioides* and *Bacteriastrum* sp. increased in number, while in summer mostly zooplankton increased in number like Herpacticoid copepoda (nauplius stage), *Acanthamoeba* sp. and Cyclopoid copepoda. *Ceratium extensum* and *C. triops* were the two dianoflagellates that increased in number during summer. On the whole, the total zooplanktonic load showed positive relationship with salinity. It is also possible to denote the euhaline and oligohaline plankton species from the estuary. The phytoplankton like *Biddulphia sinensis, B. mobiliensis, Coscinodiscus* sp., *Ceratium extensum, C. triops, Rhizosolenia* sp., *Thalassiothrix frauenfeldii* and *Triceratium* sp. and the zooplankton like Herpacticoid copepoda (nauplius stage) were euhaline type. In contrast,

TABLE 1. *Simple Correlation coefficient (r) between planktons and water quality parameters*

	Water temp	pH	Alkalinity	D.O.	Nitrate	Phosphate	Silicate	TSS	Salinity
Total Plankton	-0.248	0.232	0.244	0.158	-0.205	-0.118	0.098	-0.252	0.313
Total Phytoplankton	-0.264	0.219	0.224	0.176	-0.205	-0.112	0.085	-0.257	0.304
Total Zooplankton	0.271	0.349*	0.244	-0.362*	-0.020	-0.356*	-0.183	-0.101	0.380*
Phytoplankton classes									
Chlorophyceae	0.054	-0.210	-0.089	0.039	0.056	0.370*	0.386*	0.363*	-0.493*
Cyanophyceae	0.243	-0.158	-0.430*	-0.066	-0.046	0.268	0.032	-0.107	-0.228
Bacillariophyceae	-0.305	0.107	0.190	0.254	-0.155	-0.050	0.191	-0.220	0.190
Pyrrophyceae	-0.302	0.127	0.154	0.251	-0.256	-0.209	-0.034	-0.323*	0.358*
Euglenophyceae	0.110	0.026	0.204	0.003	0.010	0.424*	0.063	0.062	0.292
Phytoplankton									
Amphiprora sp.	-0.233	-0.123	0.139	0.259	-0.062	0.281	0553*	0.066	-0.168
Bacillaria paradoxa	-0.280	0.020	0.133	0.257	-0.106	0.005	0.243	-0.183	0.090
Bacteriastrum sp	-0.357*	-0.011	0.076	0.336*	0.182	-0.081	0.022	-0.221	0.184
Biddulphia sinensis	-0.347*	0.261	0.146	0.253	-0.352*	-0.276	-0.214	-0.359*	0.460*
Biddulphia mobiliensis	-0.506*	0.081	0.120	0.424*	-0.368*	-0.200	-0.153	-0.356*	0.386*
Biddulphia heteroceros	0.201	0.029	0.245	-0.282	0.246	0.216	-0.035	0.650*	-0.116
Campylodiscus clypeus	0.208	0.013	0.086	-0.190	0.163	0.354*	-0.012	0.565*	-0.256
Chaetoceros sp.	-0.268	-0.002	0.137	0.252	-0.096	0.002	0.267	-0.163	0.069
Coscinodiscus sp.	-0.258	0.318	0.297	0.166	-0.213	-0.171	0.149	-0.275	0.321*
Cyclotella sp.	0.080	-0.174	0.022	-0.117	0.029	0.236	0.102	0.302	-0.255
Ceratium extensum	0.272	0.482*	0.22	-0.419*	-0.012	-0.391*	-0.237	-0.063	0.436*
Ceratium triops	0.219	0.522*	0.229	-0.338*	-0.246	-0.382*	-0.247	-0.207	0.460*
Ceratium furca	0.023	0.250	0.152	-0.079	-0.177	-0.194	0.013	-0.261	0.287
Ditylum sp.	0.109	0.335*	0.155	-0.228	-0.015	-0.114	-0.205	-0.072	0.297
Fragillaria sp.	0.252	-0.258	-0.526*	-0.091	-0.009	0.410*	0.048	0.122	-0.495*
Frustulia sp.	0.060	-0.240	-0.223	-0.025	-0.127	-0.093	0.367	0.033	-0.199
Gyrosigma balticum	0.205	-0.212	-0.329*	0.139	-0.074	-0.001	-0.097	0.001	-0.221
Hemidiscuss cuneiformes	0.235	0.031	0.033	0.224	-0.151	-0.124	-0.069	-0.164	0.162

Lauderia annulata	0.378*	0.091	0.174	0.324*	0.234	-0.085	0.118	-0.275	0.222
Nitzschia sigma	0.072	-0.264	-0.305	-0.017	-0.089	0.007	-0.012	-0.003	-0.267
Peridinium brevipes	-0.314	-0.082	0.057	0.351*	-0.186	-0.021	0.246	-0.291	0.102
Protoperidinium depressum	-0.399*	-0.035	0.67	0.381*	-0.204	-0.103	-0.037	-0.232	0.228
Planktoniella sol	0.114	0.287	0.123	-0.187	-0.138	-0.200	0.140	-0.145	0.267
Pleurosigma sp.	-0.143	0.026	0.148	0.093	-0.256	-0.203	0.058	-0.239	0.248
Rhizosolenia sp.	0.133	0.354*	0.161	-0.197	-0.1081	-0.243	-0.169	-0.172	0.340*
Skeletanema costatum	0.285	-0.352*	-0.568*	-0.056	0.135	-0.091	0.229	-0.091	-0.298
Surirella sp.	-0.106	-0.297	-0.324*	0.166	-0.115	0.054	0.011	-0.165	-0.201
Thalassiothrix frauenfeldii	-0.024	0.654*	0.292	-0.124	-0.371*	-0.431*	-0.299	-0.366*	0.648*
Thalassionema nitzschioides	-0.359*	0.041	0.089	0.303	-0.207	-0.147	-0.055	-0.225	0.234
Thalassiosira coramandeliana	-0.258	-0.023	0.125	0.246	-0.068	0.049	0.291	-0.137	0.28
Triceratium sp	-0.007	0.252	0.136	-0.096	-0.339*	-0.292	-0.170	-0.304	0.448*
Tropidoneis elegans	0.166	0.252	-0.291	-0.071	0.081	0.701*	0.139	0.278	-0.408*
Zooplankton									
Acanthoamoeba sp.	0.229	0.037	0.299	-0.367*	0.163	-0.094	-0.006	0.366*	0.055
Appendicularia	-0.030	0.253	0.127	-0.081	-0.043	-0.100	-0.222	-0.106	0.300
Copepoda calanoid	0.173	0.243	0.260	-0.288	0.129	-0.280	-0.108	0.039	0.250
Copepoda cyclopoid	0.329*	0.349*	0.242	-0.391*	-0.149	-0.228	-0.098	-0.067	0.316
Copepoda herpacticoid	0.223	0.215	0.140	-0.299	-0.273	-0.299	-0.270	-0.054	0.321*
Copepoda herpacticoid (nauplius)	0.290	0.681*	0.300	-0.448*	-0.125	-0.453*	0.494	-0.124	0.526*
Foraminifera	0.100	-0.209	-0.023	-0.078	0.162	0.058	0.211	0.230	-0.251
Nematoda	0.066	0.333*	0.221	0.209	0.032	0.128	0.245	0.104	0.342*
Nauplius	0.092	0.204	-0.035	-0.080	-0.282	-0.069	-0.048	-0.366*	0.277
Nauplius (with telson)	-0.245	-0.036	0.155	0.196	-0.117	-0.151	0.028	-0.035	0.128
Polychaeta (larva)	-0.151	0.050	0.178	0.116	-0.186	0.133	0.366*	-0.109	0.059
Rotifera	-0.192	0.048	0.078	0.229	-0.115	0.055	-0.052*	-0.096	0.026
Sponge spicules	0.128	-0.066	-0.007	-0.076	0.296	0.516*	0.142	0.561*	-0.444*
Tintinopsis sp.	-0.030	0.020	0.245	0.037	0.120	0.181	0.528*	0.139	-0.114

Fragilearia sp., *Skeletonema costatum, Tropidoneis elegans* and *Phacus* sp. appeared to be oligohaline phytoplankton. The major euhaline plankton were collected largely from the central part of the estuary especially during summer and winter months while oligohaline species were collected from eastern and western margins of the estuary, particularly during monsoon. It is also possible to establish the positive relationship between plankton like *Tropidoneis elegans, Fragillaria* sp., *Campylodiscus clypeus, Phacus* sp. and the chlorophycean phytoplankton in general with phosphate; *Biddulphia heteroceros, Campylodiscus clypeus,* spong spicules and *Acanthamoeba* sp. with total suspended solids and lastly *Amphiprora* sp., tintinnids and polychaeta larvae with silicate. This study thus establish a significant niche relationship between various plankton types with different water quality parameters.

DISCUSSION

In the past, similar kind of studies were done in other estuaries viz. Cochin backwater (Gopinathan, 1975), Hoogly estuary (Nandy *et al*, 1990), Godavari estuary (Rao and Manjula, 1995) and Hoogly Matla estuary (Khan, 1995). Hoogly-Matla-Ichhamoti estuary of Indian Sunderban has a complex situation of planktonic distribution. Like other estuaries many plankton are common in this region. Both planktonic load and productivity appears to be fairly low due to extreme human activities and pollutant discharges. Urban untreated wastewater, oil spills from fast growing mechanised water transport and discharges of pesticides from croplands in the upper catchment area are adding enormous amount of pollutants in this estuary daily. The disturbances in planktonic density and diversity are definitely reflected in the status of estuarine ecosystem diversity and productivity as a whole.

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REFERENCES

American Public Health Association 1992. *Standard methods for the examination of water and waste water* published by APHA, AWWA, and WEF, Washington, USA. 18th edition.

GOPINATHAN, C. P. 1975. *Bull. Dept. Mar. Sci. Univ Cochin.* **7** : 995-1004.

KHAN, R. A. 1995 *Estuarine Eco.* Sr.pt.-2 Hoogly Matla Estuary. ZSI 417-464 pp.

NANDY, A. C., M.M. BAGCHI, S. K. MAJUMDER AND B. K. SAHA, 1990. *In* Arun G. Jhingran, V.K. Unnithan and Amitabha Ghosh [ed.] Contribution to the Fisheries of Inland Open Water Systems in India. Part 1. Inland Fisheries Society of India, Barrackpore.

Parsons T. R., Y. MAITA AND C. M. LALLI 1984. *A manual of chemical and biological methods for seawater analysis,* Pergamon Press, New York.

RAO M. U., AND S. MANJULA 1995. *Indian Hydrobiology* **1** : 27-36.