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Observations on the Hydrology and the Quantitative Studies on Benthic Macrofauna in a Tidal Creek of Sagar Island, Sunderbans, West Bengal, India

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Hydrological studies, in relation to benthic macrofauna have been conducted at six different stations in a tidal creek of Sagar Island, Sunderbans, during November 1976 to October 1977.

Salinity regime in the tidal creek exhibited a wide range of fluctuation ($0.5^0/_{00}$ to $18.5^0/_{00}$), which seem to have an immense impact on the distribution and abundance of macrobenthos in the creek. Water temperature variation (25.5°C to 32°C) is another factor that also plays an important role in this complex environment in combination with salinity fluctuation.

Actiniarians, Polychaetes, Nemertines, Decapods and Isopods among invertebrates and Gobiids, representing the vertebrate, are the permanent residents of the benthic community of the tidal creek. Echiurids, Amphipods, Bivalves, Pennatulacea and mud eel appear occasionally particularly in the post- and pre-monsoon months. A depletion of the fauna during south-west monsoon has been noticed, followed by a repopulation during the post-monsoon period and the maximum density was encountered in the pre-monsoon months.

Key Words: Hydrology and Benthic Macrofauna, Sagar Island

Introduction

Hydrological investigations have received much attention in this country and extensive studies have already been made in the South, South-west, and south-east coast of India. Information available on this subject is very much scarce from east coast of India (Ganapati & Murthy 1954, Rao & Rao 1962, Bose 1956, Dutta et al. 1954, Shetty et al. 1961).

A survey of literature reveals that studies on benthos in our country had been initiated since the time of Annandale (1907). However, almost no information is available about the hydrology macrobenthos and its possible

relationship in the extensive Hooghly estuarine system.

The Study Area

Sagar Island, the largest delta (figure 1) in the western sector of Sunderbans, is situated nearly 85 km south of Calcutta in deltaic West Bengal (21.56° to 21.88°N and 88.08° to 88.16°E). It is surrounded by large water bodies, river Hooghly in the north and western side and river Mooriganga in the eastern side. The southern part of the island faces the open sea, the Bay of Bengal.

The island has twelve tidal creeks all communicating the estuarine water, either on the east or west coast. The Mooriganga creek is 6 km long extending from the east to north-west direction in the northern sector of the island. The creek gradually decreases in the depth and breadth towards the distal end. Dense mangrove vegetation are found mainly at the stations IV and V.

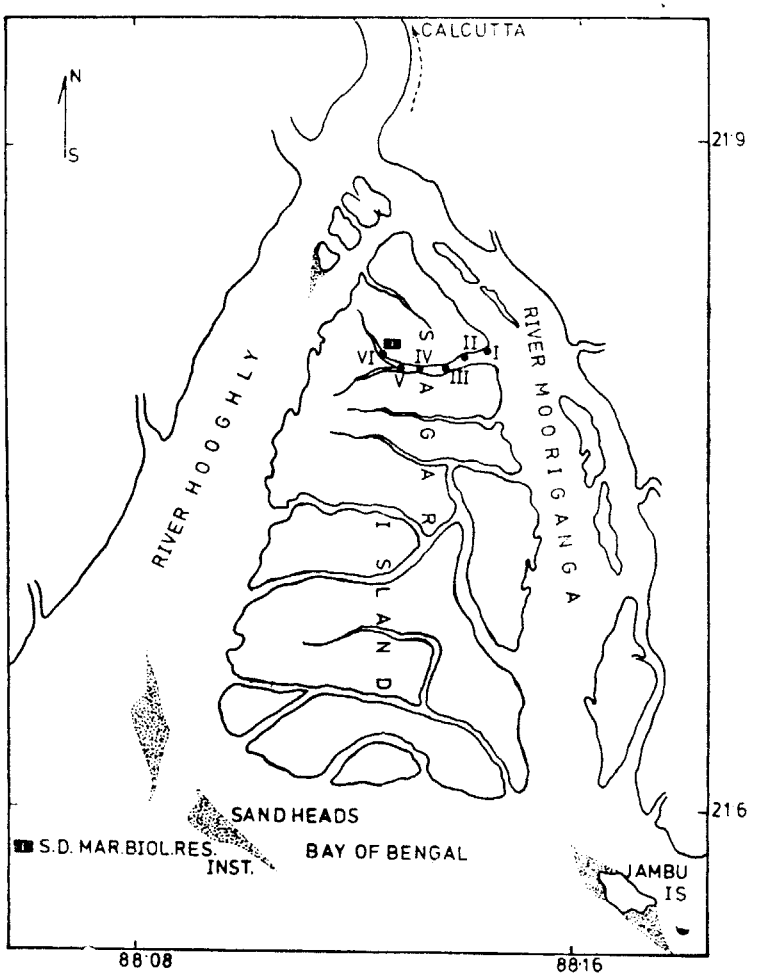

Figure 1 Showing the approximate stations position for hydrological and benthic study

The substratum is muddy. The creek receives a considerable tidal incursion twice daily sometimes with high amplitude of water. The seasons here are well recognised, each with four months duration. The premonsoon season (March to June) is the dry season with considerably higher temperature. The monsoon period (July to October) is accompanied by heavy rainfall (1255.6 mm) and the postmonsoon (November to February) comprises partly the winter season with comparatively lower temperature.

Materials and Methods

Water samples for the hydrological studies were collected fortnightly from six different stations during ebb tide. The temperatures (air and water) were recorded in degree centigrade in the field. The salinity of the sample was estimated by employing 'Mohr-Knudsen' method. The correction factors were found out frequently by titrating the silver nitrate solution against standard sea water. Winkler's method was followed to estimate the dissolved oxygen content of the sample and for *p*H colour comparator disc was used in the field.

The quantitative assessment on macrobenthos was based on monthly collection from six stations as shown in figure 1. The collections were made using a quadrat ($\frac{1}{2}$ sq. m) sampler. The fauna inhabiting the mud were carefully separated and expressed in number per m^2.

Observations and Discussion

Temperature

Both the air and water temperatures showed a marked fluctuation during the course of study (figure 2). The range of maximum and minimum temperature was 25.2 to 31°C for water and 25.5 to 32°C for air.

The rising trend of water temperature was noticed from the end of the postmonsoon season and attained first maxima in the premonsoon months and second in the monsoon season.

Sewell (1929) observed a bimodal type of temperature variation in the waters of Bay of Bengal. Bhunia and Choudhury (unpublished) also observed bimodal temperature oscillation during 1975–76. In the present study the primary maxima (31.5°C) in the month of April was slightly lower than the secondary maxima (32°C) in the month of October. This has been recognised as a characteristic feature of temperature oscillation during the period of study.

Salinity

Salinity showed a wide range of fluctuation ($0.5^0/_{00}$ to $18.5^0/_{00}$) during November 1976 to October 1977. The high values of salinity were recorded in dry months (premonsoon season) with a range of fluctuation of $10.5^0/_{00}$ to $18.5^0/_{00}$. The low values were observed in the monsoon months of July to October and the range read between $0.5^0/_{00}$ and $2.1^0/_{00}$. The increasing trend was noticed from the late postmonsoon months and attained peak value in the premonsoon season (figure 2). Almost similar observations have been reported by various workers (Ramamurthy 1954, Ganapati & Murthy 1954) from the Bay of Bengal. Salinity regime in the Mooriganga creek is very complex and influenced by the periodical fresh water influx from the adjoining areas and the tidal interplay.

Dissolved Oxygen

The concentration of dissolved oxygen in the tidal creek showed a variation range from 1.9 ml/l to 3.7 ml/l. The maximum value was encountered in August and

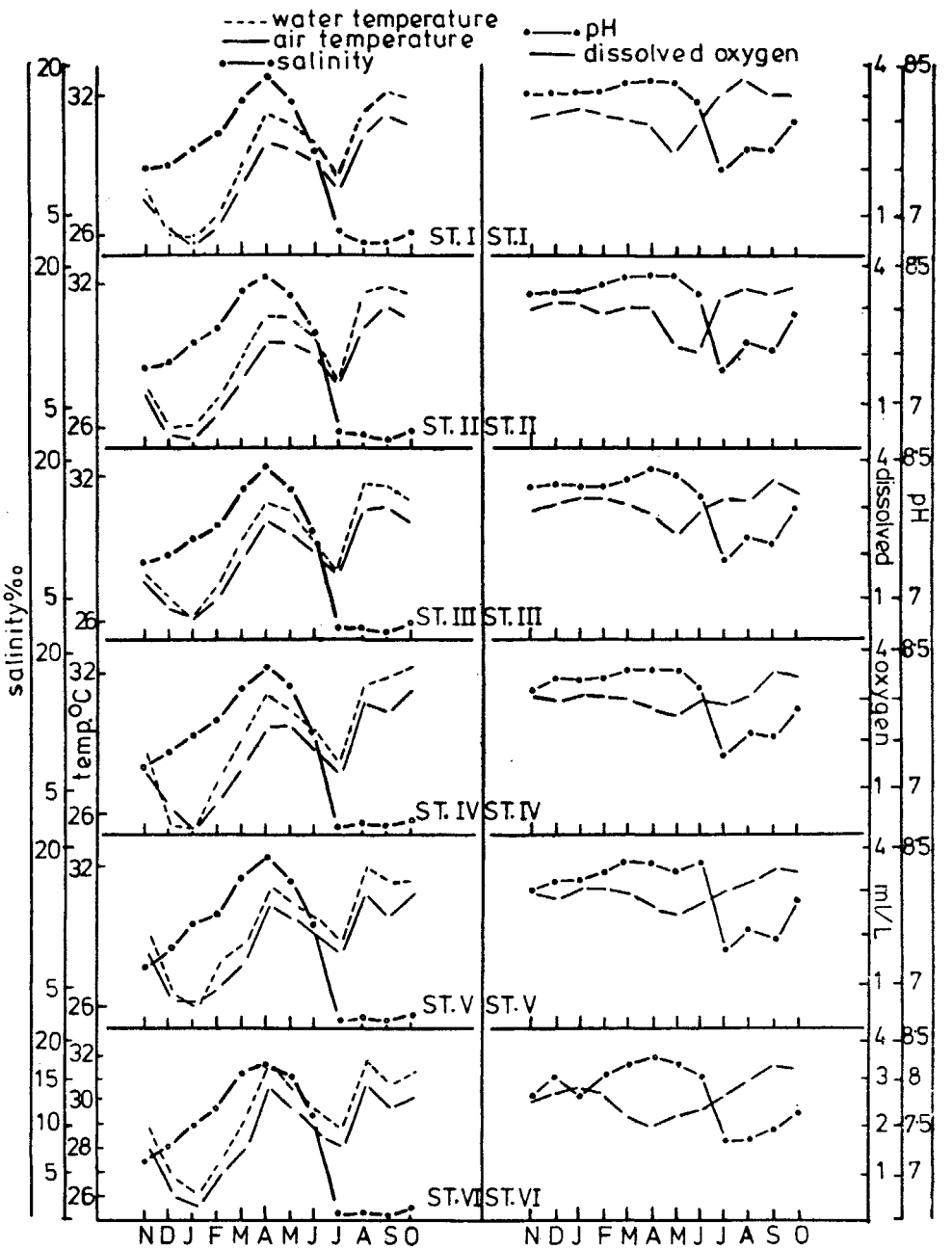

Figure 2 Seasonal variations of temperature (air and water), salinity, dissolved oxygen and *p*H during November 1976 to October 1977

minimum in May. The seasonal pattern of change in dissolved oxygen (figure 2) showed a gradual trend of decline from monsoon months to summer months through the winter.

*p*H

*p*H remained almost constant with a minor fluctuation throughout the year except during monsoon months. In the postmonsoon months the *p*H range read between 7.8 and 8.2 and the high values (8.0 to 8.3) were estimated during premonsoon months. In the monsoon months the *p*H range came down to a minimum (figure 2) due to monsoon rains.

Macrobenthos

The study was mainly concentrated on macrobenthos. The important components were mostly represented by actiniarians, polychaetes, nemertines, bivalves, echiurids, pennatulacea, decapods (crabs and mud shrimps), isopods and amphipods among invertebrates and gobiids (Boleopthalmus and Periophthalmus), among vertebrates.

The actiniarians constitute the major group (table 1) throughout the year at all stations which indicate that they are able to withstand wide range of salinity (Panikkar 1936, Cheriyan 1964). Errant polychaetes, nemertines, decapods, isopods and gobiids, form the second important group with minor seasonal fluctuation.

The fauna collected from the six stations in the tidal creek showed marked variation in distribution of groups as well as in number. The pattern of seasonal fluctuation of the population was mostly influenced by the hydrological changes in the ambient medium. A discontinuous distribution of benthic fauna is a characteristic feature in the creek. The stations I, II and III are situated near the mouth of the creek and thus have considerable estuarine influence; the occurrence of the population was very poor at station I due to most unstable condition of the substratum.

Numerically, the benthic population was seen to increase in the premonsoon months and late postmonsoon months, when the temperature and salinity values were increasing. The scarcity of the population was noticed during monsoon months, when the creek water gets diluted due to heavy precipitation and adjacent land run-off.

Stations II and III were represented by all the groups of benthic fauna. The maximum aggregation of fauna was recorded in March (62/m^2). A gradual decline in population number was noticed at stations IV, V and VI towards the distal portion of the creek (table 1).

Actiniarians, polychaetes, nemertines, decapods, isopods and gobiids are the permanent members of the faunal community in the creek. Bivalves, echiurids, amphipods and mud eels are recorded as seasonal residents.

The seasonal fluctuation of population number was well recognised during the period of study. In the postmonsoon period the variation in the quantitative distribution of organisms was 6 to 52/m^2 and in the premonsoon it was 8 to 62/m^2. The decline in population was due to heavy precipitation during the monsoon season, when the number of population recorded was 2 to 26/m^2 (table 2).

From the present study it appears that the benthic fauna inhabiting the tidal creek are limited in number as well as in groups. Stephen (1929, 1930, 1935), Gauld and Buchanan (1956) showed that the fauna of open wave exposed beaches are poorer than that of the protected beaches or estuarine mudflats. McIntyre (1968) observed a decrease of population

Table 1 *The total number of population indicate against the area (m^2) and the percentage of dominant group (Actiniarians) indicated in the parenthesis from November 1976 to October 1977*

Stations	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
I	10	10	10 (10.0)	10 (10.0)	16 (12.5)	12 (8.3)	12	14 (7.1)	10	12	12	6
II	24 (25.5)	42 (14.3)	32 (12.5)	52 (15.4)	62 (14.5)	30 (16.6)	34 (14.7)	34 (11.7)	18 (11.1)	18 (5.5)	26 (7.7)	24 (8.3)
III	28 (10.7)	38 (13.1)	34 (23.5)	36 (16.6)	50 (12.0)	34 (20.5)	34 (14.7)	24 (12.5)	14 (7.1)	10	20 (5.0)	14 (14.3)
IV	14 (14.3)	22 (18.2)	18 (22.2)	26 (26.9)	40 (15.0)	20 (20.0)	18 (11.1)	18 (16.6)	12 (16.6)	8 (12.5)	12	8 (12.5)
V	12 (16.6)	12 (16.6)	18 (16.6)	18 (11.1)	30 (13.3)	22 (13.6)	24 (8.3)	10 (10.0)	8	4	6	6
VI	6	12	12 (8.3)	10 (10.0)	20 (5.0)	16	14 (14.1)	8	6	8	2	6

Table 2 *The number of different faunal groups at different stations during November 1976 to October 1977*

		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Actiniaria	I	0	0	2	2	4	2	0	2	0	0	0	0
	II	6	12	8	16	18	10	10	8	4	2	4	4
	III	6	10	16	12	12	14	10	6	2	0	2	4
	IV	4	8	8	14	12	8	4	6	0	2	0	2
	V	4	4	6	4	8	6	4	2	0	0	0	0
	VI	0	0	2	2	2	0	4	0	0	0	0	0
Polychaeta	I	2	2	4	4	2	2	2	2	0	2	2	0
	II	4	4	4	6	6	6	4	4	2	2	2	4
	III	6	4	2	4	2	6	4	2	2	2	4	2
	IV	0	2	4	2	4	2	2	2	4	0	2	0
	V	2	0	2	2	4	4	4	0	0	0	0	2
	VI	0	2	2	0	4	2	0	0	0	0	0	0
Nemertines	I	4	4	2	4	4	2	4	4	4	2	4	4
	II	2	6	2	4	4	2	4	2	2	4	4	6
	III	4	4	2	2	6	4	2	2	2	4	4	2
	IV	2	2	2	2	2	4	2	2	2	2	4	0
	V	2	2	4	4	2	4	2	2	2	2	2	2
	VI	2	4	2	2	2	4	2	2	2	4	2	4
Decapoda	I	0	0	0	0	0	4	2	0	2	4	2	0
	II	2	8	4	8	8	4	4	2	4	2	4	4
	III	4	6	4	6	8	2	4	2	4	0	2	2
	IV	2	4	0	0	6	2	4	4	2	2	2	2
	V	2	2	0	0	4	2	4	2	4	2	2	0
	VI	2	2	0	0	2	2	2	2	2	0	0	0
Amphipoda	I	0	0	0	0	0	0	0	0	0	0	0	0
	II	2	6	0	2	4	0	0	4	0	0	2	3
	III	0	4	0	0	2	0	0	0	0	0	0	0
	IV	0	0	0	0	0	0	0	0	0	0	0	0
	V	0	0	0	0	2	0	0	0	0	0	0	0
	VI	0	0	0	0	0	0	0	0	0	0	0	0

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Isopoda	I	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	0	2	4	0	6	2	0	2	2	0
	III	0	0	0	2	4	0	4	2	0	0	2	0
	IV	0	0	0	0	2	0	2	0	0	0	0	0
	V	0	0	0	0	2	0	2	0	0	0	0	0
	VI	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	I	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	2	2	2	0	0	0	0	0	0	0
	III	0	0	0	0	2	0	0	0	0	0	0	0
	IV	0	0	0	0	2	0	0	0	0	0	0	0
	V	0	0	0	0	0	0	0	0	0	0	0	0
	VI	0	0	0	0	0	0	0	0	0	0	0	0
Pennatulacea	I	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	2	0	2	0	0	0	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	0	0
	IV	0	0	0	0	0	0	0	0	0	0	0	0
	V	0	0	0	0	0	0	0	0	0	0	0	0
	VI	0	0	0	0	0	0	0	0	0	0	0	0
Echiurida	I	0	0	0	0	0	0	0	0	0	0	0	0
	II	0	0	2	0	0	0	0	2	0	0	0	0
	III	0	0	0	0	0	0	0	0	0	0	0	0
	IV	0	0	0	0	0	0	0	0	0	0	0	0
	V	0	0	0	0	0	0	0	0	0	0	0	0
	VI	0	0	0	0	0	0	0	0	0	0	0	0
Gobiids	I	4	4	2	0	6	2	4	6	4	4	4	2
	II	8	6	8	12	14	8	6	6	6	6	6	6
	III	8	10	8	10	12	8	10	8	4	4	6	4
	IV	6	6	4	6	8	4	4	4	4	2	4	4
	V	2	4	6	4	8	6	6	4	2	0	2	2
	VI	4	4	6	4	10	8	6	2	2	4	0	2

in the open sandy beaches compared to the estuarine beaches of the same area at Porto-Novo. In the present communication, the reason for impoverishment in benthic fauna in the Mooriganga creek is due to most unstable conditions which are generally encountered at the confluence of two water bodies.

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