more rich in shrimp seed as compared to a sandy or highly muddy bottom. Compared to the creeks in Ratnagiri District, the creeks in Sindhudurg District were noted to be less exploited and so more suitable for prawn seed collections.

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STUDIES ON THE DISTRIBUTION OF GASTROPODA (MOLLUSCA) IN A MANGROVE FOREST (PRENTICE ISLAND) OF SUNDARBANS, INDIA

ABSTRACT

Observations were made on the distribution of gastropods in a mangrove forest of Sundarbans, West Bengal, India. The fauna can be categorised into two divisions : (i) those living attached to the stems and leaves of the mangroves and (ii) those distributed on the creek bank subject to daily tidal inundation and exposure. *Littorina* spp. were common on the trees and not on the ground. *Assiminea, Cerithidea* and *Telescopium* were generally encountered on the ground. The abundance of gastropods reached maximum at creek bank and declined sharply towards the deep forest. The results obtained during the present study have been discussed and compared with those reported from South India, Malaysia, South Africa and Thailand.

Introduction

THE GASTROPODA, ecologically very intimate group of associate in the mangrove ecosystem, constitutes a considerable part of benthic biomass. The distribution of this epifaunal component in different mangrove forest, have been well documented by many investigators. Reports of Berry (1963; 1972; 1975), Sasekumar (1974) from Malaysian mangroves; Brown (1971) from South African mangrove swamps; Coomans (1969) from West Indies; Dawn *et al.* (1976) from mangroves of Thailand are worthy mentioning.

In India, Roonwal (1954, 1964), Rajagopal (1964) reported some molluscan borers from Sundarbans Mangrove ecosystem; Ganapati and Rao (1959) studied few marine wood borers from Godavari Estuary. More recently, Subbarao and Mookherjee (1975) from Mahanadi Estuary, Radhakrishna and Janakiram (1975) from Godavari and Krishna Estuaries made some observations on gastropod fauna. Murty and Rao (1977) have added some more information on gastropod fauna from Machilipatanam on the east coast of South India. The purpose of the present investigations from a mangrove forest area of Sundarbans is to accelerate the scope of comparisons with those reported elsewhere.

Physiography of the study area : The Prentice Island, a fractional component of virgin mangrove forest area of Sundarbans, lies between 21°43' and 21°46'N and 88°18' and

88°19'E. The waterways bordering the island is formed by the River Saptamukhi (Fig. 1). The island is traversed by a number of creeks of which two are well contoured with repeated ramification retaining considerable tidal water even during the lowest low tide. The creek involved in the present investigation lies on the eastern side of the island. It is 10 m wide and 3-4 m deep in the mouth region and gradually tapers towards its distal flank with several ramifications. The substratum is muddy and it receives considerable tidal flow twice daily.

The present observations were made during the monitoring programmes on benthic faunal survey of Mangrove ecosystem of Sunderbans. The data presented here were collected from the surrounding area of the eastern largest creek (Fig. 2). Observations were made on the basis of sampling at 20 substations distributed on either side of the creek bank and extended upto 25 m transect within the forest with 3-4 random sampling keeping 5 m interval from the forest edge. At each sampling spot a 1 m^2 area was marked and all gastropod species on

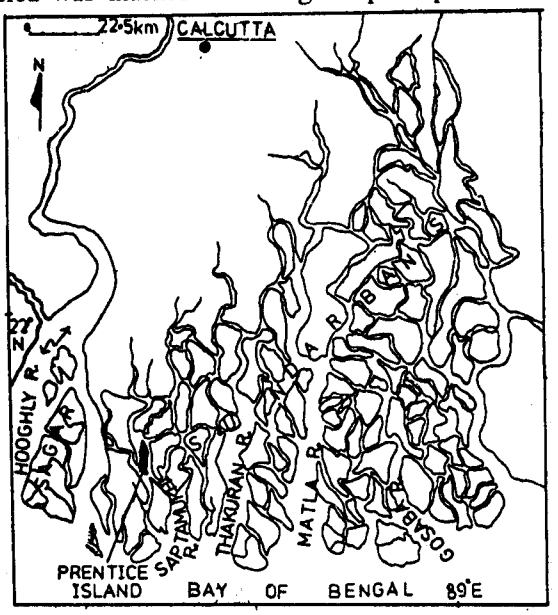

Fig. 1. Study area in Sundarbans.

TABLE 1. *Density of plants m^{-2} different sub-stations*

Trees	Sampling spots																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Avicennia officinalis	9	35	6	–	–	85	79	–	61	9	1	–	14	38	8	52	15	23	30	21
Avicennia alba	7	11	11	–	4	28	2	55	3	2	47	17	23	8	3	9	3	4	5	7
Ceriops roxburghii	1	8	1	–	–	–	–	–	–	–	–	5	–	–	7	2	–	14	2	17
Ceriops decandra	–	4	–	–	–	7	–	–	–	–	–	4	6	–	9	6	–	2	1	5
Acanthus ilicifolius	–	2	–	–	57	17	13	5	–	–	–	–	2	–	–	–	5	–	–	3
Suaeda meritima	–	–	–	9	–	27	–	–	–	–	–	4	–	–	–	–	–	–	–	–

TABLE 2. *Density of gastropod m^{-2} on plants at different sub-stations (Group - A)*

Gastropod	Sampling spots																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Littorina melanostoma	3	4	–	3	4	5	5	1	1	1	3	8	3	3	3	3	7	10	3	2
L. undulata	1	–	–	2	6	4	3	–	–	3	–	–	–	–	–	1	–	2	2	3
L. carnifera	–	–	–	1	–	2	–	–	–	–	–	1	–	1	–	6	1	–	1	1
Nerita articulata	–	4	–	4	–	–	6	–	5	8	–	–	–	20	–	–	10	–	2	–
Cerithidea obtusa	–	5	4	–	9	–	–	10	–	–	6	–	–	–	4	–	2	–	–	–

the ground as well as on the mangrove plants were counted. Simultaneously, the quantitative study of mangrove flora species distributed over the study area was made.

no particular pattern of succession among the members of the genus *Avicennia* and *Ceriops* rather discontinuously distributed in the area. The gastropod fauna were separated in two

TABLE 3. *Density of gastropods m^{-2} on the ground at different sub-stations around the canal bank (Group B)*

Gastropods	Sub-stations																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Assiminea brevicula	–	60	14	116	135	54	33	42	59	48	31	29	20	130	58	104	17	49	102	556
Cerithidea cingulata	55	10	4	–	–	40	9	5	7	34	1	3	–	–	10	1	5	12	1	1
Telescopium telescopium	10	4	3	4	2	6	2	3	4	6	13	26	8	2	1	3	10	2	–	–
Cymia carinifera	–	–	–	–	–	2	4	–	–	–	–	2	–	–	–	–	1	–	–	–

Observations and results

The quantitative data on the halophytes (Table 1) reveals that the study area was dominated by the saplings of *Avicennia* sp. The creek bank was occupied mainly by *Suaeda meritima* and *Acanthus ilicifolius*. There was

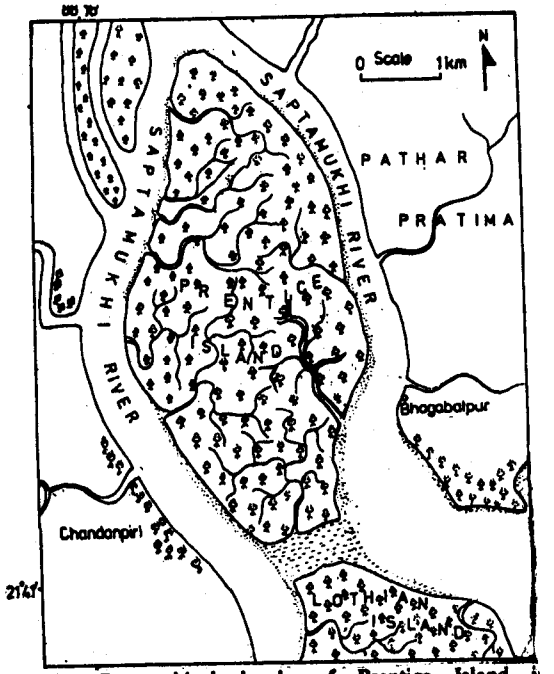

Fig. 2. Geographical locale of Prentice Island in Sundarbans

groups on the basis of their ecological habit. Those living attached to the stems and leaves of the mangrove plants were placed in group 'A' (Table 2) and those distributed on the mudflat substratum, which experiences daily inundation and exposure by the tidal waters, were placed in group 'B' (Table 3).

Littorina melanostoma, L. undulata and *L. carnifera* were the common climbers and were not found on the open ground. *Nerita articulata* and *Cerithidea obtusa* were also

TABLE 4. *Density of gastropod m^{-2} on plants and on ground over a 25 m transect*

Mollusc	Forest edge	Distance (m) within the forest			
		10	15	20	25
On plants					
Littorina melanostoma	7	4	3	–	–
L. undulata	3	2	3	–	–
L. carnifera	1	–	1	1	–
Nerita articulata	1	–	1	1	–
On the ground					
Assiminea brevicula	31	15	–	–	–
Cerithidea cingulata	5	2	1	–	–
Telescopium telescopium	4	5	3	2	–
Onchidium tigrinum	1	–	1	1	–
Cymia carinifera	1	–	–	–	–

found on the trees, but their position on the halophytes was related to the rise and fall of tidal waters. They moved higher during high tide and descended to the ground level during low tide regime. The members of the genus *Assiminea, Cerithidea* and *Telescopium* are the resident of the mudflat and are abundant on the ground. *Onchidium tigrinum* and *Cymia carinifera* were scarcely found in this zone. The pattern of distribution of all the gastropod species except *Onchidium tigrinum* and *Cymia carinifera* was found more or less uniform on the creek bank and forest edge and decline sharply towards the forest (Table 4).

Discussion

The floral compositions and the gastropod fauna in this mangrove zone of Sundarbans were more or less similar to those reported from a major tidal creek of Krishna, Machilipatnam (Murty and Rao, 1977) with the exception that *Assiminea brevicula* was more abundant in that estuary.

The distribution of gastropod species assessed in the present communication was more or less uniform over the study area except for the difference in their relative abundance. Among the members of littorinids distributed on the mangrove trees, *L. melanostoma* was more abundant than *L. undulata* and *L. carinifera*.

While comparing the present assessment with those published from Malaya (Berry, 1972, 1975) and South India (Murty and Rao, 1977), the data suggest that *L. melanostoma, Assiminea brevicula* and *Telescopium telescopium* were the common forms encountered from each region. *Littorina scabra* which was often recorded from Malaya, South India, South Africa (Brown, 1971) and mangroves of Phuket Island, and Southern Thailand (Dawn *et al.*, 1976) was not available in the present investigation, whereas *L. carinifera* being the common tree dwelling fauna in the Sundarbans locale was absent in South Indian, Malaysian and South African mangroves, but was reported from the mangroves of Phuket Island.

TABLE 5. *Density of plants m^{-2} over a 25 m transect*

Trees and saplings	Forest edge	Distance (m) within the forest			
		10	15	20	25
Avicennia officinalis	35	14	8	12	8
Avicennia alba	7	17	2	10	4
Ceriops roxburghi	–	–	6	–	3
Ceriops decandra	–	2	5	–	1
Acanthus ilicifolius	2	5	10	1	9
Suaeda meritima	–	4	–	2	6

From the foregoing comparison it may be concluded that there was a wide range of geographical diversity in the distribution of various species of littornid gastropods. The overall data of the present observation suggested that the distribution of gastropod fauna of Sundarbans displayed closer similarity to those of South Indian and Malaysian mangrove ecosystems that of South African mangrove swamps.

The authors are thankful to the Department of Environment, Govt. of India for financial assistance to carry out this survey work and the authority of S. D. Marine Biological Research Institute, Sagar Island for providing laboratory facilities.

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EFFECT OF DDT ON THYROID GLAND OF THE MULLET *LIZA PARSIA* (HAMILTON-BUCHANAN)

ABSTRACT

Liza parsia was exposed to 0.02 ppm DDT in sea water for 15 days. This resulted in a decrease of the follicular epithelial height, degeneration of the epithelial cells and depletion of colloid materials in the lumia of the thyroid. Even few follicles devoid of colloid materials were also seen in the gland of 15 days - treated fish.

Introduction

THYROID hormones (T_3, T_4) in fish are involved in development (Higgs *et al.,* 1982; Nacario, 1983; Lam, 1985; Lam and Sharma, 1985; Lam *et al.,* 1985; Kobuke *et al.,* 1987; Sullivan *et al.,* 1987; Tagawa and Hirano, 1987, 1990; Pandey, 1989), metamorphosis (Eales, 1979; Letherland, 1982; Inui and Miwa, 1985), oxidative (intermediary) metabolism (Gorbman *et al.,* 1983; Peter and Oommen, 1989 a, b) and reproduction (Pickering and Christie, 1981; Sower and Schreck, 1982; MacKenzie *et al.,* 1987; Flett and Letherland, 1989; Norberg *et al.,* 1989; Sower *et al.,* 1992; Weber *et al.,* 1992). Further, they have also been implicated to play a role in parr-smolt transformation in salmon (Hoar, 1976; Bern, 1978; Dickhoff *et al.,* 1978, 1982; Eales, 1979; Scholz, 1980; Morin *et al.,* 1989. Recently, a number of studies have shown that pollutants affect thyroid physiology of freshwater teleosts (Deb and Bhattacharya, 1976; Bhattacharya *et al.,* 1978, Sathyanesan *et al.,* 1978; Ram and Sathyanesan, 1984, 1987; Katti and Sathyanesan, 1987, Kirubagaran and Joy, 1989). So far, there exists no report of the effect of DDT on the thyroid gland of fish. Hence, this study was undertaken to fill this void.

The authors are highly grateful to Dr. P. S. B. R. James, Director, C. M. F. R. I. for his encouragement and inspiration. Help extended by Prof. A. G. Sathyanesan and Dr. K. P. Joy is thankfully acknowledged.

Material and methods

Live specimens of *Liza parsia* (average size 10.5 cm) were collected from Vypeen Island (near Cochin) and transported to the