

STUDIES ON THE MALACOFAUNA OF MURIGANGA ESTUARY,
SUNDERBANS, WEST BENGAL.

N. V. SUBBA RAO, A. DEY AND S. BARUA
Zoological Survey of India, Calcutta

ABSTRACT

An ecological survey of malacofauna of river Muriganga around Kakdwip and Namkhana in 24-Parganas, West Bengal established presence of 21 species of gastropods and bivalves. Depending on their ecological niche molluscs of Muriganga estuary fall under two categories ; (1) Plant dwellers and (2) mud dwellers. The former category includes those living on the surface (e.g. *Littorina*) or burrowing into dead or living plant material (e.g. *Teredo*). Mud dwellers include those that crawl on the substratum or burrow into it. Gastropod species of *Assiminea*, *Telescopium*, *Cerithidea*, *Onchidium* and *Haminea* generally crawl on the substratum. *Nerita* species is found on mangrove trees and in areas having no such plantation it clings to the crevices, as near Kachuberia. The burrowing forms include six species of bivalves namely *Dosinia excisa* Schröter, *Tellina iridescens* (Benson), *Strigilla splendida* (Anton), *Siliqua albida* Dunker, *Solen kemp* Preston, *Theora opalina* (Hinds).

Majority of the gastropods are found in all the collecting stations. The species in the order of relative abundance are *Assiminea brevicula* (Pfeiffer). *Assiminea beddomeana* Nevill and *Telescopium telescopium* (Linnaeus). Bivalves are restricted to the central part of canals. The bivalve species in the order of their abundance are *Dosinia excisa* Gmelin, *Tellina iridescens* (Benson) and *Strigilla splendida* (Anton). The population density of other species is considerably low.

Breeding observations were recorded for some of the gastropods like *Assiminea brevicula* (Pfeiffer) and bivalves like *Strigilla splendida* (Anton).

INTRODUCTION

Many descriptive and general studies have been made on the ecology of mangrove swamps. Our knowledge on the molluscs is mostly restricted to that of Indo-West Pacific region (Macnae, 1968) : Malaysia (Lim, 1963 ; Berry, 1963, 1972, 1975 ; Sase Kumar, 1974). In India mangrove malacofauna has been recorded from Godavari and Krishna estuary (Radha Krishna and Janakiram, 1975), Mahanadi estuary (Subba Rao and Mukherji, 1975), Machilipatnam, Andhra Pradesh (Murty and Balaparameswara Rao,

1977). The malacofauna of Sunderbans was reported by Annandale and Prashad (1919). The earlier studies were concentrated on epifaunal elements only and included mostly gastropods. Knowledge on bottom fauna comprising mostly bivalves, is still meagre.

This paper records the ecology, distribution and abundance of malacofauna of Muriganga, a part of Hooghly estuary.

Muriganga is a branch of the river Hooghly and debouches into Bay of Bengal near Fraserganj. The river separates Kakdwip

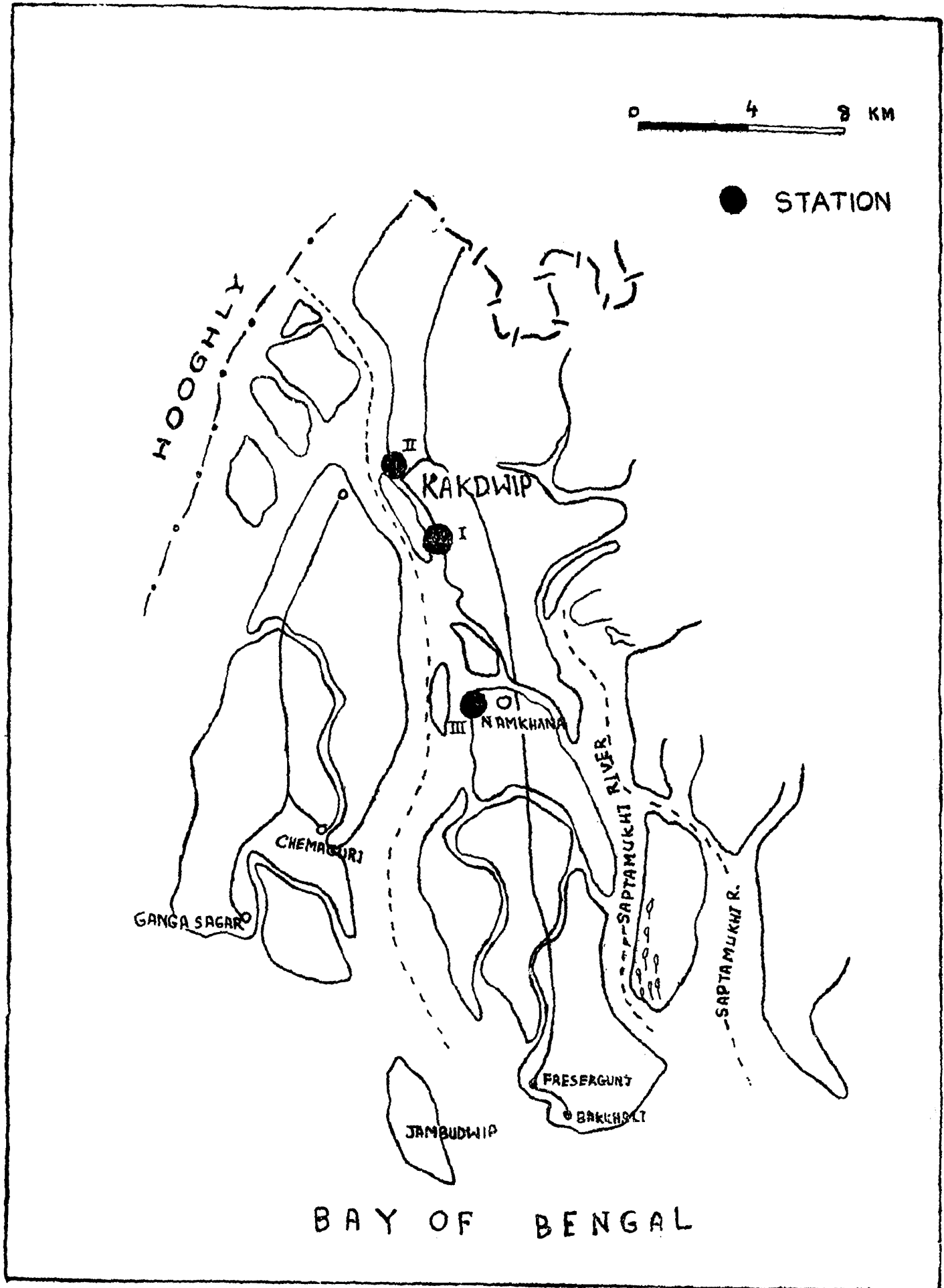


Fig. 1. Map of Muriganga estuary showing the place of study.

from Sagar Island and has a number of small islands near its mouth, like Ghoramara, Lohachara, Kankramarichara, Mousumi etc. At Kakdwip a small branch, locally known as Ghiapata river, separates from the main river Muriganga. The Ghiapata branch receives a few tributaries from Kakdwip side, takes a winding course and meets the main river about 3 kms. south-west of Kakdwip town. A small island called Maina Chara has come up between the main river and its branch. During low tide Ghiapata river gives the appearance of a small channel with water remaining in the central part only (Pl. I,

fig. 1). The substratum is of silty mud. At Namkhana, the Muriganga gives off a branch, Hathaniya-Duyania which connects it with Saptamukhi river. The area of study is shown in the Figs. 1 & 2.

The temperature range was 19.3° to 32.29° C in 1959-62 and 19° to 32.5° C in 1963-67 period. Yearly temperature distribution is bimodal with peaks in May-June and September-October.

Salinity range was wide-1.5‰ to 32.77‰ with only one peak in pre monsoon (March-June ; Jhingran, 1978).

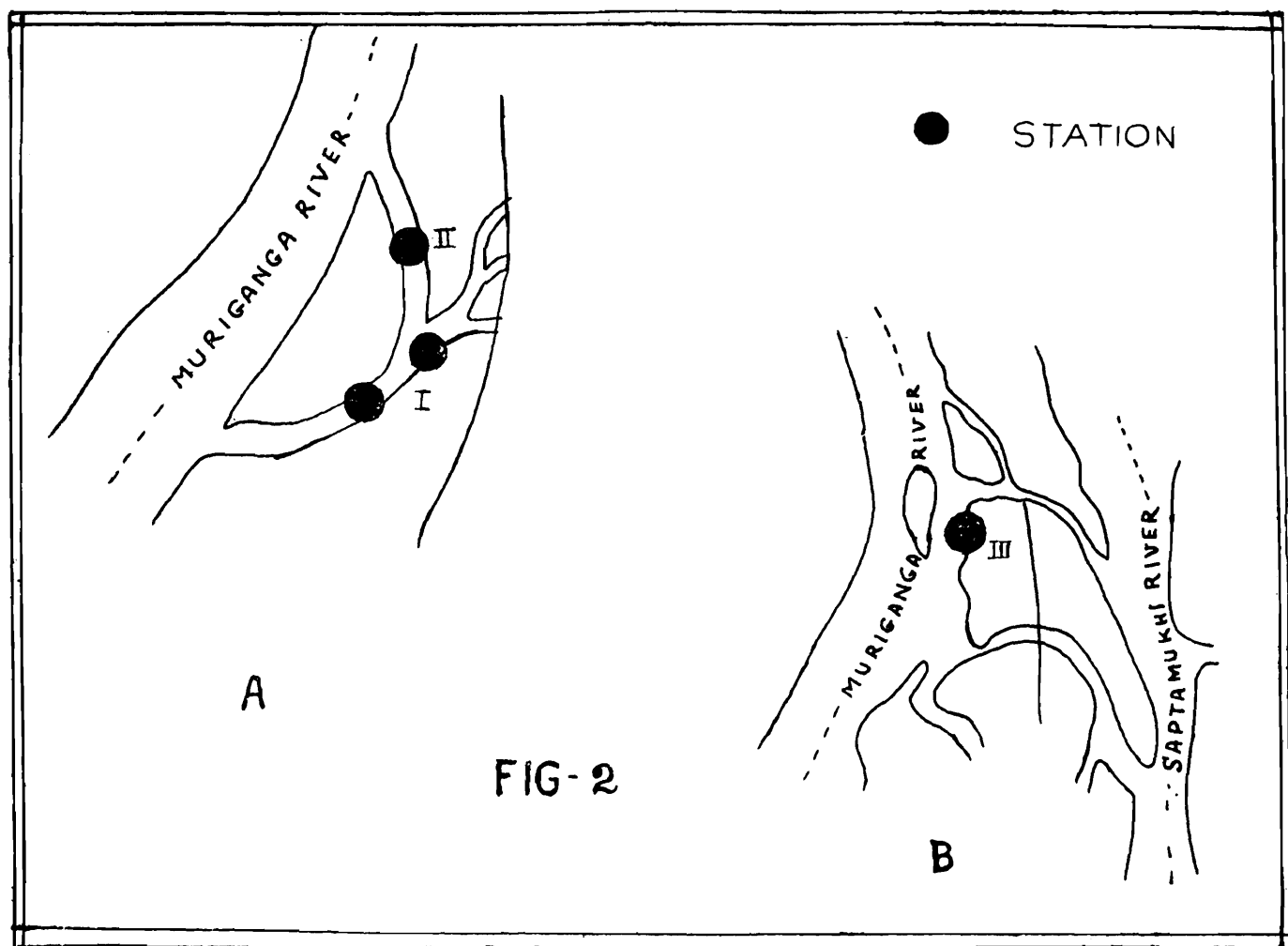
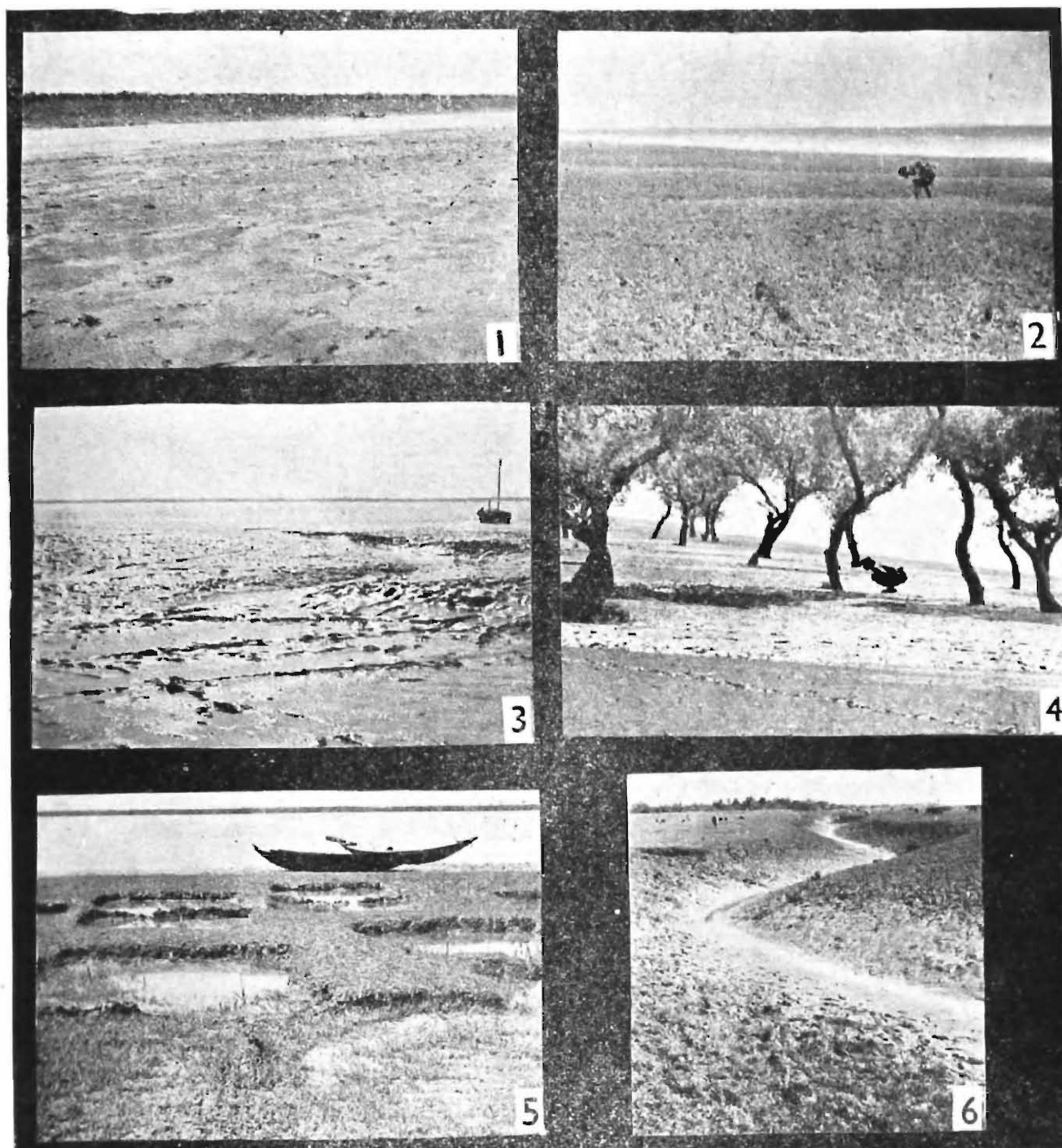


Fig. 2. A, Diagrammatic map of Kakdwip area showing the place of study (Station I and Station II)
 B, Diagrammatic map of Narayanganj, Namkhana area showing the place of study (Station III)



Figs. 1 & 2 : Ghiapata river (Kakdwip) during low tide.
Fig. 3 : Muriganga—Ghiapata confluence during low tide
Fig. 4 : A part of Hathaniya-Duyania river near Narayanganj (Namkhana) showing vegetation.
Fig. 5 : Muddy area with grasses at Narayanganj (Namkhana) above high tide mark.
Fig. 6 : A branch canal at Kakdwip.

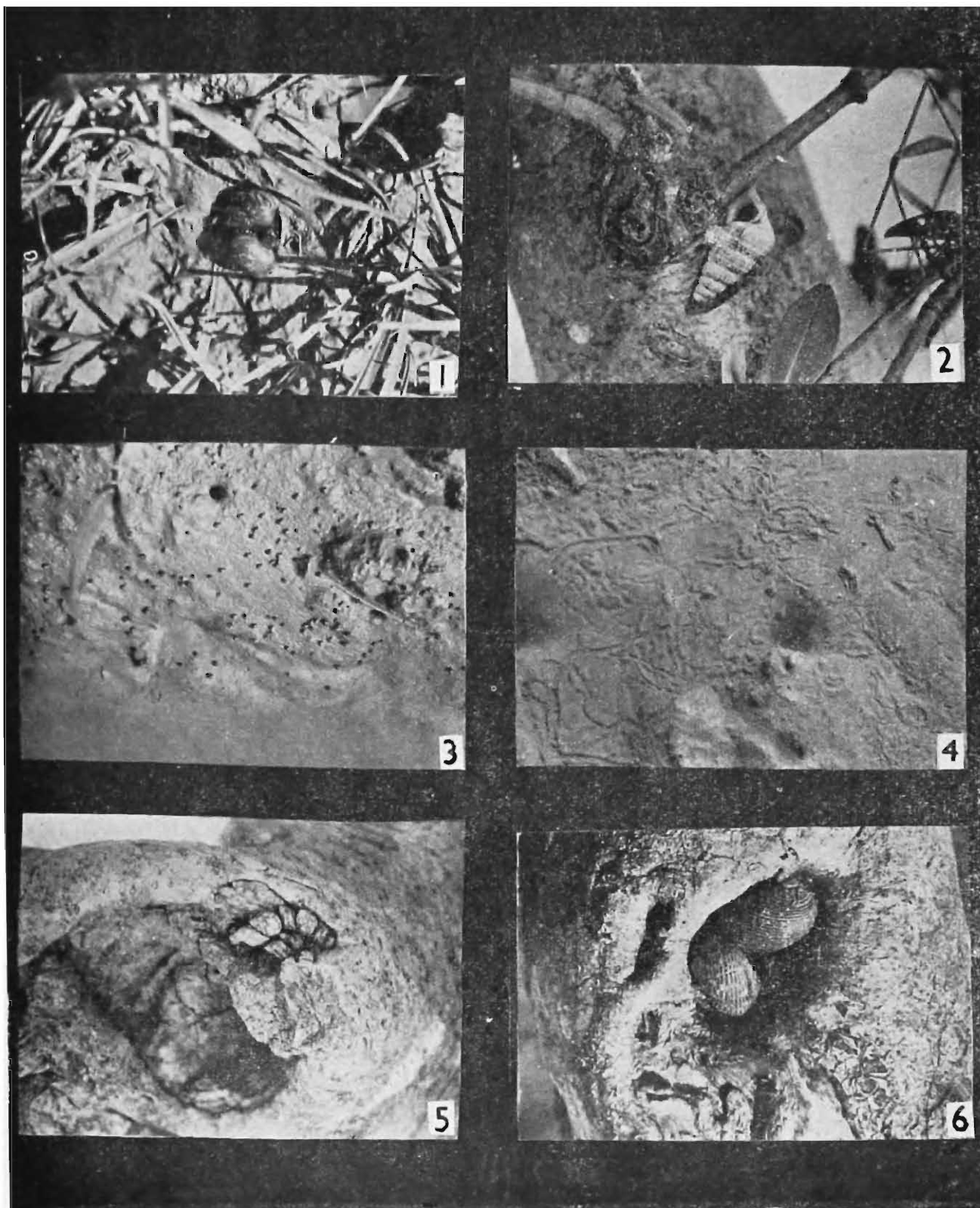


Fig. 1 : Copulating pair of *Haminea crocata* at Station III.
Fig. 2 : *C. obtusa* attached to mangrove plant at Station III.
Fig. 3 : *A. brevicula* crawling on the mud at Station I.
Fig. 4 : *S. deltae* crawling on the mud at Station II.
Fig. 5 : *L. scabra scabra* attached to the mangrove at Station III.
Fig. 6 : *N. articulata* attached in a crevice of mangrove plant at Station III.

List of the species recorded in Muriganga estuary :

- Class GASTROPODA
Order ARCHAEOGASTROPODA
Family NERITIDAE
1. *Nerita articulata* Gould
 2. *Neritina (Dostia) violacea* Gmelin.
 3. *Pseudonerita sulculosa* Martens.
- Order MESOGASTROPODA
Family LITTORINIDAE
4. *Littorina (Littoraria) melanostoma* Gray
 5. *Littorina (Littorinopsis) scabra scabra* Linnaeus
- Family STENOTHYRIDAE
6. *Stenothyra deltae* Benson
- Family ASSIMINEIDAE
7. *Assiminea beddomeana* Nevill
 8. *Assiminea brevicula* (Pfeiffer)
- Family POTAMIDIDAE
9. *Telescopium (Telescopium) telescopium* Linnaeus
10. *Cerithidea obtusa* Lamarck
- Order CEPHALASPIDEA
Family ATYIDAE
11. *Haminea crocata* Pease
- Family ELLOBIIDAE
12. *Auricula gangetica* Benson
 13. *Pythia plicata* Ferrussac
- Order ONCHIDIACEA
Family ONCHIDIIDAE
14. *Onchidium tigrinum* Stoliczka
- Class BIVALVIA
Order MYTILOIDA
Family MYTILIDAE
15. *Modiolus undulatus* (Dunker)
- Order VENEROIDA
Family SOLENIDAE
16. *Solen kempii* Preston

Family CULTELLIDAE

17. *Siliqua albida* Dunker

Family TELLINIDAE

18. *Tellina (Pharaonella) iridescens* (Benson)
19. *Strigilla (Aeretica) splendida* (Anton)

Family SEMELIDAE

20. *Theora opalina* (Hinds)

Family VENERIDAE

21. *Dosinia excisa* Schröter

MATERIAL AND METHODS

Monthly surveys of Muriganga river near Kakdwip, Narayanganj (Namkhana) and nearby islands were undertaken at three stations.

Station—I.

Ghiapata river near Mainapara. The banks on both the sides were of soft mud, with small grasses above the high tide mark (Pl. I, figs. 1-2).

Station—II.

The point of origin of Ghiapata river from Muriganga. Here also the banks were muddy (Pl. I, fig. 3).

Station—III.

Hathaniya-Duyania river, 3 kms. south of Namkhana near Narayanganj. An area of about 40-50 meters was exposed with small grasses ; water touches the area only during the spring tide, and it was all soft mud above the high tide mark (Pl. I, fig. 5). Mangrove vegetation extends scarcely for about 400 meters in this region (Pl. I, fig. 4).

The population counts of gastropods were made from one square meter area. An average of five counts was taken as mean value of the population. For bivalve population from one cubic meter area was

considered. To determine the area or the volume a square steel frame, each wall measuring $\frac{1}{3} \times 1$ meter was taken. The frame was fixed on the substratum; for counting gastropods it was kept superficially, but for bivalves it was inserted deep into the substratum. The mud within the frame was collected and sieved through 1 mm. net to retain even the juveniles. For determining the concentration of bivalves a 100 m. transect was taken and ten samples were collected at an equal distance of 10 meter each.

OBSERVATIONS

Gastropoda :

Family : NERITIDAE. Three species viz. *Nerita articulata*, *Neritina violacea* and *Pseudonerita sulculosa* were common in the area. They were observed at Namkhana, Kachuberia, attached to the mangrove plants (Pl. II, fig. 6) upto a height of 2 meters above the ground level. They were either solitary or in clusters of 7-9 individuals.

Family : LITTORINIDAE. Two species, viz. *Littorina (L.) melanostoma*, and *L. (L.) scabra scabra*, common to all the stations were found mostly attached to the mangroves (Pl. II, fig. 5) upto a height of 1.5 meters above the ground level. The population density of these species varied with season and locality. For *L. melanostoma* the density was 3 to 52/m² and for *L. (L.) scabra scabra* it was 2 to 12/m² (Table 2).

Family : STENOTHYRIDAE. *S. deltae* has been recorded in all places from Kakdwip to Namkhana. It was found crawling on the mud (Pl. II, fig. 4). The population density varied from 2 to 408/m². The population level was highest in Sept. 1980 (Table 2).

Family : ASSIMINEIDAE. *A. brevicula* and *A. beddomeana* were abundant. *A. brevicula* generally either crawl on the mud (Pl. II, fig. 3) or remain attached to grasses in all muddy localities. Vertical distribution is restricted to 10 meters downwards from high water mark. Adult population was 8 to 108/m² from August, 1979 to Feb., 1980, which increased to 200 to 250/m² from Mar., 1980 onward. Copulation among adults was observed during Aug., 1979 to Dec., 1979 and the juveniles were recorded from Oct., 1979 to April, 1980. The number of young snails varied from 350 to 2106/m². The adult population of this species reduced to 29 to 40/m² at Stations I & II in Sept., 1980, the reasons for which could not be ascertained. No mass mortality was, however, observed.

A. beddomeana was recorded in the holes, and crevices of the muddy area. The population varied from 2 to 544/m². Juveniles were present in Jan., 1980 and they grew to adults by April, 1980, when copulating pairs were very common.

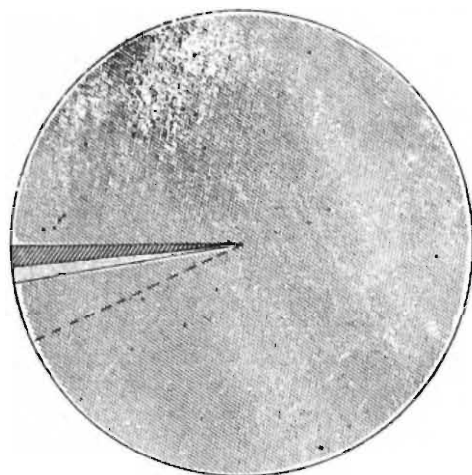
Family : POTAMIDIDAE. *T. telescopium*. was common on the banks of small ditches or canals with a little flow of water. It was found crawling on the mud. The population varied from 1 to 10/m². But during the month of April, 1980 a large concentration of the species was found near Narayanganj where there was some water flow. Juveniles counted for nearly 50% of the total population.

C. obtusa was found crawling on the mud or on plants which were wet with spring tides. It was recorded from a height of 0.5 meter from the ground level. Population

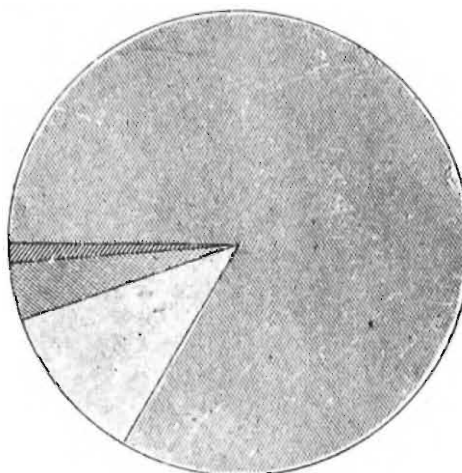
RAO *et al.*

PLATE III

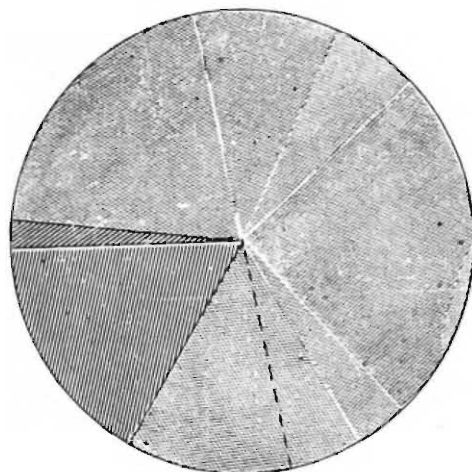
GASTROPODS



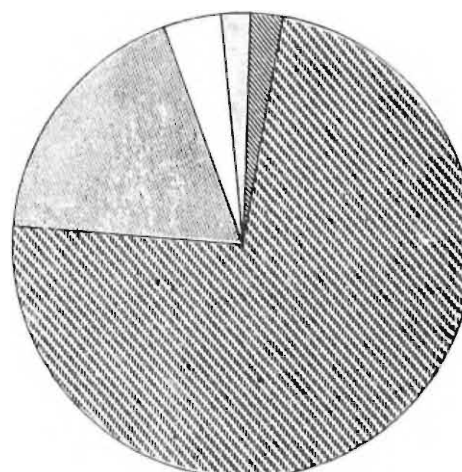
OCT 79



JAN 80



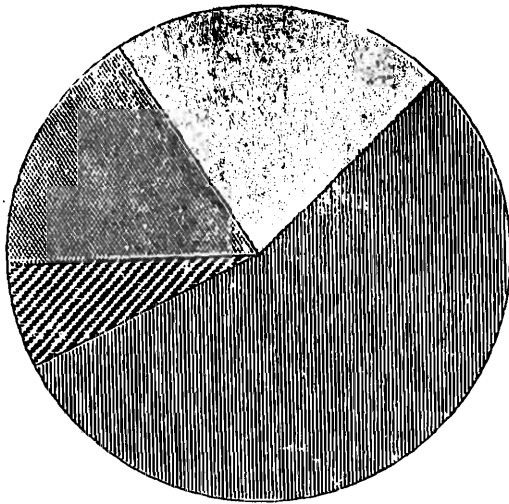
APR 80



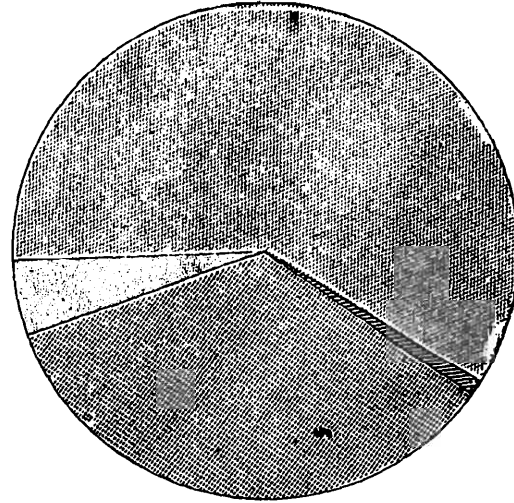
SEPT 80

- ▨ ASSIMINEA BREVICULA (PFEIFFER)
- ▨ ASSIMINEA BEDDOMEANA NEVILL
- LITTORINA (LITTORINOPSIS) MELANOSTOMA GRAY
- ▨ TELESCOPIUM (TELESCOPIUM) TELESCOPIUM (LINNAEUS)
- ▨ HAMINEA CROCATA PEASE
- ▨ STENOTHYRA DELTAE BENSON
- ▨ OTHERS

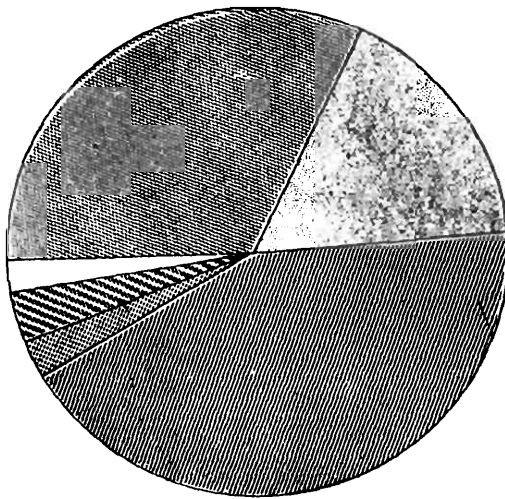
BIVALVES



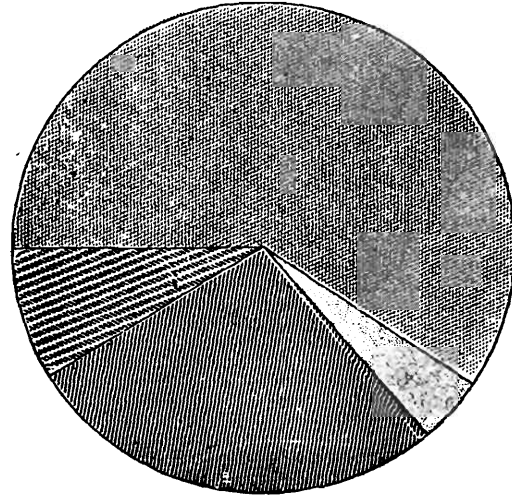
OCT 79



JAN 80



APR 80



SEPT 80







-  TELLINA IRIDESCENS BENSON
-  STRIGILLA SPLENDIDA (ANTON)
-  DOSINIA EXCISA SCHROTER
-  SILICUA ALBIDA DUNKER
-  THEORA OPALINA (HINDS)
-  SOLENI KEMPI PRESTON

TABLE II. Showing population density of molluscs/m² at different stations during different periods.

Name of the species	October, 1979			January, 1980			April, 1980			September, 1980		
	Station I	Station II	Station III	Station I	Station II	Station III	Station I	Station II	Station III	Station I	Station II	Station III
1. <i>Assimineia brevicula</i> (Pfeiffer)	81+1908	92+2106	108+2008	8+1069	6+2005	210+1050	250+1103	203+1101	6+350	40	29	153
2. <i>A. beddomeana</i> Nevill	14	12	46	10	12	544	12	11	nil	nil	2	30
3. <i>Littorina melanostoma</i> Gray	nil	nil	40	nil	nil	4	nil	nil	3	nil	nil	52
4. <i>L. scabra</i> Linnaeus	nil	nil	12	nil	nil	2	nil	nil	2	nil	nil	2
5. <i>Telescopium telescopium</i> Linnaeus	2-10	2-6	7-9	2-8	2-10	4-10	2-5	2-5	632	2-3	1-2	1-2
6. <i>Haminea crocata</i> Pease	nil	nil	3	nil	nil	208	15	12	12	nil	nil	nil
7. <i>Stenothyra deltae</i> Benson	nil	nil	nil	nil	nil	nil	nil	nil	nil	258	219	408
8. <i>Nerita articulata</i> Gould	nil	nil	4	nil	nil	3	nil	nil	5	nil	nil	1-6
9. <i>Tellina iridescens</i> (Benson)	5.6	6.4	nil	9.2	11.6	nil	46.4	9.6	nil	41.5	8	nil
10. <i>Sirigilla splendida</i> (Anton)	0.8	7.6	nil	nil	nil	nil	26	2	nil	3	2	nil
11. <i>Dosinia excisa</i> Schröter	17.2	22.4	nil	0.4	nil	nil	66.8	6.8	nil	21.7	9.2	nil
12. <i>Siliqua albida</i> Dunker	nil	nil	nil	8.6	2.4	nil	2	2.4	nil	nil	nil	nil
13. <i>Theora opalina</i> (Hinds)	nil	5.6	nil	nil	1.6	nil	nil	6	nil	nil	10	nil
14. <i>Solen kempii</i> Preston	nil	nil	nil	nil	nil	nil	2.8	nil	nil	nil	nil	nil

and *Strigilla splendida* were found in the mud at a depth of 4 to 10 cms. in the canals at Stations I & II. Population density of *T iridescens* ranged from 5.6 to 11.6/m² in an average, but increased to 46.4/m² during the month of April, 1980. The juveniles were recorded from Jan., 1980 and onward upto April, 1980 and population density ranged upto 97/m². Population of *S. splendida* varied from 2 to 26/m². Juveniles were found from January, 1980 to April, 1980 with the density of 18/m².

Family : SEMELIDAE : *Theora opalina* was recorded from the small canal near Kakdwip (Pl. I, fig. 6). It was absent in the main canal. Population density was 1.6 to 10/m² on an average. Juveniles were observed from Jan., 1980 to April, 1980.

Family : VENERIDAE : *Dosinia excisa* is commonly found in the mud of the canals near Kakdwip and Namkhana. The young ones were noticed more during April, 1980. Population density varied from season to season and it was 1-2/m² from October, 1979 to February, 1980 and increased to 104 to 108/m² from March, 1980 and onward.

DISCUSSION

The above study reveals, that depending upon the ecological niche the malacofauna of Muriganga estuary can be broadly divided into two categories : (1) Plant dwellers and (2) Mud dwellers. Among the plant dwellers, while species like *Littorina melanostoma*, *L. scabra* and *Nerita* spp. inhabit the surface of the plants, there are species like *Teredo* which burrow into dead or living plant material. Only dead specimens of *Teredo* were observed. Mud dwellers include species of *Assiminea*, *Telescopium*, *Stenothyra*, *Haminea*, *Auricula*,

Pythia, *Nerita* and *Onchidium* which inhabit the surface of the muddy substratum, or the crevices whereas all bivalves, viz. *Dosinia*, *Tellina*, *Strigilla*, *Solen*, *Theora*, burrow inside.

Among gastropods, *A. brevicula* is the dominant species accounting for about 81.3% to 97.5% of the total molluscan population, but during September, 1980 it reduced to 18.4% only (Pl. III). The population density of this species reaches its peak in the month of October (Table 2 & Pl. III). The less abundant species are *Nerita* spp. which occurs only 1-6/m², that too on mangrove trees.

Pairing was common in *A. brevicula* in the period of August to December and in *A. beddomeana* in April. In *Haminea crocata* pairing was noticed in December and April.

The two sympatric species of *Assiminea* occupy different ecological niches. *A. brevicula* crawl on the mud whereas *A. beddomeana* live in the holes and crevices of the muddy substratum. Breeding seasons were also different—the former in December and the latter in April. The breeding season of *Assiminea* started in the monsoon when there was a large influx of freshwater and continued for three months after that.

More bivalves were collected from the samples 4, 5, and 6 which is just above the low water mark on both sides of the river. *T iridescens* was present in all the samples and it was the dominant species, but its place was taken by *D. excisa* during the month of October, 1979 and April, 1980 (Pl. IV). Young ones of *Tellina*, *Strigilla*, and *Siliqua* were recorded from Jan., to April. Juveniles of *Solen* were recorded only in the month of April, 1980 and following which no *Solen* either juveniles or adult was seen. *Tellina*,

Strigilla, *Dosinia*, *Siliqua* and *Solen* were common in the main branch of Muriganga, but *Theora* was found only in the small sub-branches or canal.

Burrowing in the case of *S. splendida* was completed in 4-6 jerks which take 30 to 60 seconds. The foot was protruded from between the two valves and forwarded at the anterior end and the body jerked repeatedly till the whole animal got inside the mud. The animal remained vertical after completion of burrowing with extruded siphons moving around in the water.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. T. N. Ananthakrishnan, Ex-Director and Dr. B. K. Tikader, the Director, Zoological Survey of India for the facilities and interest shown in the project and to Dr. K. C. Jayaramakrishnan, Joint Director and Dr. A. K. Mandal, Superintending Zoologist for the encouragement.

REFERENCES

- ANNANDALE, N. AND PRASHAD, B. 1919. Some gastropod molluscs from the gangetic delta. *Rec. Indian Mus.* **16** (3) : 241-257.
- BERRY, A. J. 1963. Faunal zonation in mangrove swamp. *Bull. natn. Mus. St. Singapore*, **32** : 90-98.
- BERRY, A. J. 1972. The natural history of West Malaysian mangrove faunas. *Malayan Nat. J.*, **25** (2) : 135-162, 6 figs. 16 pls. 3 tabs.
- BERRY, A. J. 1975. Molluscs colonizing mangrove tree with observations on *Enigmonia rosea* (Anomiidae). *Proc. Malac. Soc. Lond.*, **41** : 589-600.
- JHINGRAN, V. G. 1978. Fish and Fisheries of India. pp. 1-954. Hindusthan Publishing Corporation.
- LIM, C. P. 1963. A preliminary illustrated account of mangrove molluscs from Singapore and South-West Malaya. *Malayan Nature. J.*, **17** : 235-239.
- MACNAE, 1968. A general account of the fauna and flora of mangrove swamp and forest in the Indo-West Pacific Region. *Adv. mar. Biol.*, **6** : 73-270.
- MURTY, A. S. AND BALAPARAMESWARA RAO, M. 1977. Studies on the ecology of molluscs in a South Indian Mangrove swamp. *J. moll. Stud.*, **43** : 223-229.
- RADHAKRISHNA, Y. AND JANAKIRAM, K. 1975. The mangrove molluscs of Godavari and Krishna estuaries. In *Recent Researches in Estuarine Biology* (R. Natarajan ed.), 177-184, Delhi, Hindusthan Publishing Corporation.
- SASEKUMAR, A. 1974. Distribution of macrofauna on a Malayan mangrove shore *J. Anim. Ecol.*, **43** : 51-69.
- SUBBA RAO, N. V. AND MOOKHERJEE, H. P. 1975. On a collection of Mollusca from the Mahanadi Estuary, Orissa. *Recent Researches in Estuarine Biology* (R. Natarajan ed.), 165-176.