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APPEARANCE AND GROWTH OF BENTHIC FAUNA IN A NEWLY EXCAVATED BRACKISHWATER FISH POND*

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ABSTRACT

Benthic organisms constitute an important component in the food of the culturable varieties of prawn and finfish. So growth of benthos is considered as the prerequisite for stocking a brackishwater pond. In the present investigation, physico-chemical parameters, G.P.P. and benthic fauna have been studied in a newly constructed brackishwater fish pond. The tide-fed pond was inundated by tidal water immediately after completion of the excavation and all parameters were observed to find the time of appearance and subsequent growth of benthic fauna which indicate the maturity of the pond in terms of its suitability for stocking with fish and prawn seed.

The temperature of the pond varied between 20.5 to 30.8°C, salinity changed from 0.2 to 23.4‰, dissolved oxygen varied from 5.5 to 9.5 mg/l and pH fluctuated between 6.5 to 8.0. G.P.P. was found to increase from 3.35 to 41.31 mgC/m³/hr. Of the benthic fauna, nemertineans were found to first establish in the new environment which was later invaded by polychaetes, gastropods and amphipods in succession.

INTRODUCTION

UNDERSTANDING the environmental parameters and productivity of a biotope is a prerequisite for the effective utilization of its fishery resources. Benthic organisms as such form the food of certain bottom dwelling fishes and the developmental stages of most of these organisms are pelagic, forming important components in the plankton community, which in turn are consumed by fish population (Murugan *et al.*, 1980). Hence the growth of benthos is considered as the prerequisite for stocking a brackishwater pond and therefore soil fertilization instead of water fertilization is more effective in brackishwater fish farm. Studies so for made, revealed the importance of benthic flora and fauna as food of brackishwater fishes and prawns (Hiatt, 1944; Gopalakrishnan, 1952; Pillay, 1954; Kuttyamma, 1974; Miroshnichenko, 1970). The role of benthic fauna as an important natural food component in case of brackishwater fish has been emphasized by William (1959), Dall (1968) and Marte (1980). Benthic flora had been described by Schutter (1952) in the 'tambaks' of Java and Pillay (1954) in the 'bheries' of West Bengal had been described by Datta and Sarangi (1980). But our knowledge on the appearance of benthic fauna in

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newly excavated brackishwater pond is very poor.

The results of an year round study on the growth of macrobenthos and its population density in a newly excavated brackishwater fish pond is presented.

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excavation work was started on 2-5-1986 and was completed on 1-7-1986. The pond was divided into 4 segments (Fig. 2) and the excavation work was done segment-wise. An uniform depth of 1.55 m was maintained in the pond. After completion of the excavation, tidal water was introduced into the pond through a huge pipe which was kept open for free tidal water exchange.

Sampling was carried out at 15 days interval from four different points of each segment by Ekman's dredge (15.25 × 15.25 cm). Macrobenthos were carefully sorted out, counted and expressed as No./m^2. Simultaneously the

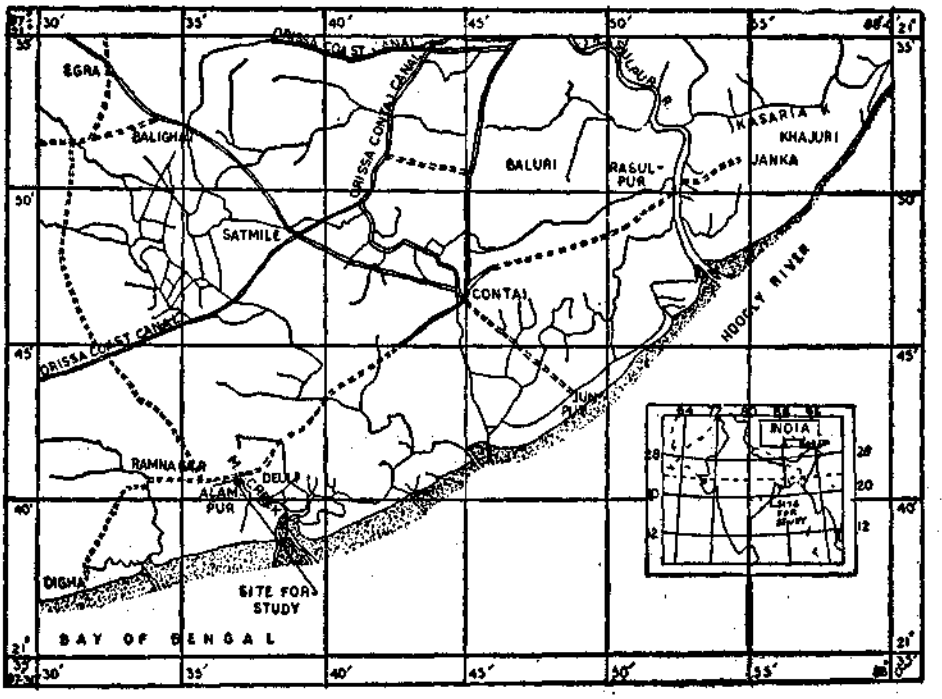

Fig. 1. Location of the study area.

Materials and Methods

The pond (area 0.98 ha) in which the study was carried out is located adjacent to a tidal creek named Mandarmani Canal in the Midnapore District of West Bengal (Fig. 1). The water samples were collected for the estimation of different hydrographic parameters. The salinity of the samples was estimated by salinometer (Yellow Spring, Ohio, USA) and temperature was recorded in degree centigrade by a precision thermometer. The Winkler's

method was used to estimate the dissolved oxygen content of the sample and pH was recorded by a pH meter (Systronics, India). Soil temperature was measured by a soil thermometer (Zeal, England). Measurement of G.P.P. was made at fortnightly interval according to light and dark bottle oxygen technique given by Strickland and Parsons (1972). The study was carried out from 2-5-1986 to 5-6-1987.

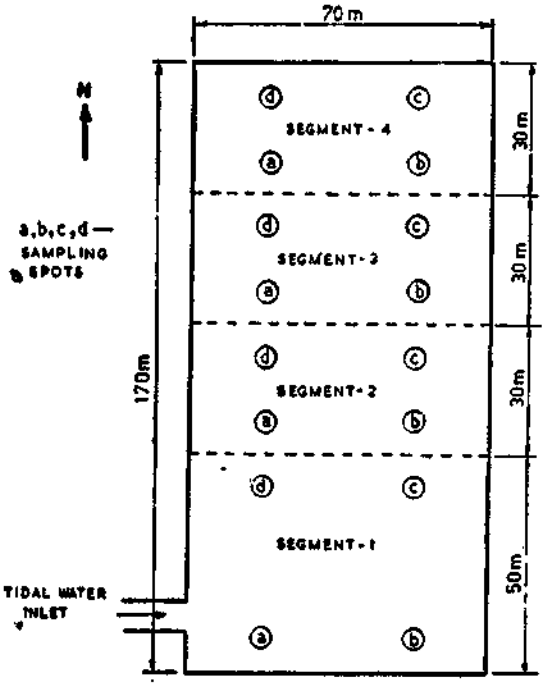

Fig. 2. Sampling stations in different segments of the pond.

RESULTS

Temperature : The maximum and minimum water temperature were recorded as 30.8°C and 20.5°C respectively and the variation of temperature in different months of the year is shown in Table 1. During the study period, the highest temperature was noticed in the premonsoon period and lowest during the postmonsoon period.

Salinity : The salinity of the pond water was influenced by the salinity of the adjoining creek which received the drainage water from the agricultural fields and also due to direct precipitation during the monsoon months. The maximum and minimum salinity recorded were 23.4‰ in June 1987 and 0.2‰ in September 1986 respectively. The variation of salinities during the study period is shown in Table 1. The salinity was maximum in the premonsoon months (March to June) which accounts for no rain higher temperature and was minimum in the monsoon months (July to October) due to heavy rains.

Dissolved oxygen : The dissolved oxygen content of the pond water fluctuated between 5.5 and 9.3 mg/l during the period of study (Table 1).

pH : pH of the pond water varied between 6.5 and 8.0. Initially the pond water was acidic in nature, but later on became alkaline (Table 1).

G.P.P. : The gross primary production of the pond water varied between 3.35 and 41.31 mgC/m³/hr. The G.P.P. values were towards the higher side almost throughout the year except during January (Table 1).

Macrobenthos : The population was first observed in segment No. 1 and later on appeared in segment No. 2, 3 and 4 consecutively. The population density increased from November to June, along with the increase in salinity. The abundance of benthic fauna varied from a minimum of 3.75/m² in segment No. 3 to a maximum of 57/m² in segment No. 1. As a whole, nemertineans dominated the collection in each month. The other benthic macrofauna were the polychaetes, gastropods and amphipods. Of the benthic fauna, nemertineans were found to first eatablish in the new environment which was later invaded by polychaetes, gastropods and amphipods in succession.

DISCUSSION

During the present study, quantitative analysis of macrobenthos in four segments throughout

the year presented a composite structure of faunal community of the newly excavated pond. Generally the group composition varied according to the influence of prevailing hydrographic conditions and the period of exposure of the pond bottom to the sun of the particular segment.

On analysing the population structure of bottom fauna at various salinity changes in different seasons, it has been noticed that the nemertinean population increased with increase in salinity. While the polychaete population was available in wide range of salinity *i.e.*

TABLE 1. *Some physico-chemical factors of the newly excavated brackishwater pond during the period* 4-8-1986 to 5-6-1987

Date	Water temperature (°C)	Salinity (ppt)	pH	Dissolved oxygen (mg/l)	Gross primary production ($mgC/m^3/hr$)	Soil temperature (°C)
04-08-1986 ..	29.0	2.2	6.5	6.5	22.02	28.0
21-08-1986 ..	29.5	2.0	6.5	7.0	19.87	29.0
08-09-1986 ..	30.8	2.4	6.5	5.5	21.50	30.2
21-09-1986 ..	30.6	0.2	6.5	7.9	18.05	30.0
07-10-1986 ..	30.0	1.5	6.5	6.5	11.23	29.0
24-10-1986 ..	29.8	2.0	7.0	7.5	16.37	28.2
10-11-1986 ..	28.5	2.5	7.0	7.3	18.76	29.0
25-11-1986 ..	27.2	3.0	7.5	7.1	19.65	28.0
11-12-1986 ..	23.0	6.5	7.5	8.2	36.27	23.5
03-01-1987 ..	20.5	10.2	7.5	8.4	3.35	20.8
18-01-1987 ..	22.0	9.8	7.5	7.1	6.70	22.5
04-02-1987 ..	23.0	12.6	7.5	6.9	8.40	22.4
20-02-1987 ..	25.6	14.0	8.0	6.4	31.26	25.2
06-03-1987 ..	28.5	17.2	8.0	8.0	18.61	28.0
24-03-1987 ..	30.0	19.5	8.0	9.3	8.18	29.5
10-04-1987 ..	29.8	22.9	8.0	7.8	9.67	29.3
05-05-1987 ..	30.2	23.2	8.0	7.5	31.12	30.0
19-05-1987 ..	30.0	23.0	8.0	7.3	41.31	29.6
05-06-1987 ..	30.8	23.4	8.0	8.2	33.50	30.2

In brackishwater aquaculture, before starting the culture, the pond bed is exposed to sun to increase the fertility of the bottom soil where the benthic organisms grow. The bottom macro-invertebrates show a great variety of adaptations to their mode of life. They adapt to the substratum, to the amplitude and rhythm of physical and chemical factors and to the exploitation of food resources (Sanders, 1960 ; Perkins, 1974 ; Kurian, 1984 ; Ansari *et al.*, 1986).

2.5 to 23.4‰, because of its euryhaline nature and prolonged breeding season.

The dominance of the polychaetes next to nemertineans throughout the year was observed in the present study and such a condition was also reported by Kurian *et al.* (1975) and Raman *et al.* (1975). The postmonsoon rise in polychaete density followed by a fall during increased salinity and temperature in summer as obtained in the present study is not in agree-

ment with that of Damodaran (1973) who reported a premonsoon rise in Kerala mud flats. Raman *et al.* (1975) and Datta and Sarangi (1980) observed the monsoon abundance of polychaetes in Pulicat Lake, Tamil

benthic organisms (burrowings, suspension and tube builder) have sharp boundaries with neighbouring assemblages. These sharp boundaries are due to interaction between the established infaunal individuals and settling

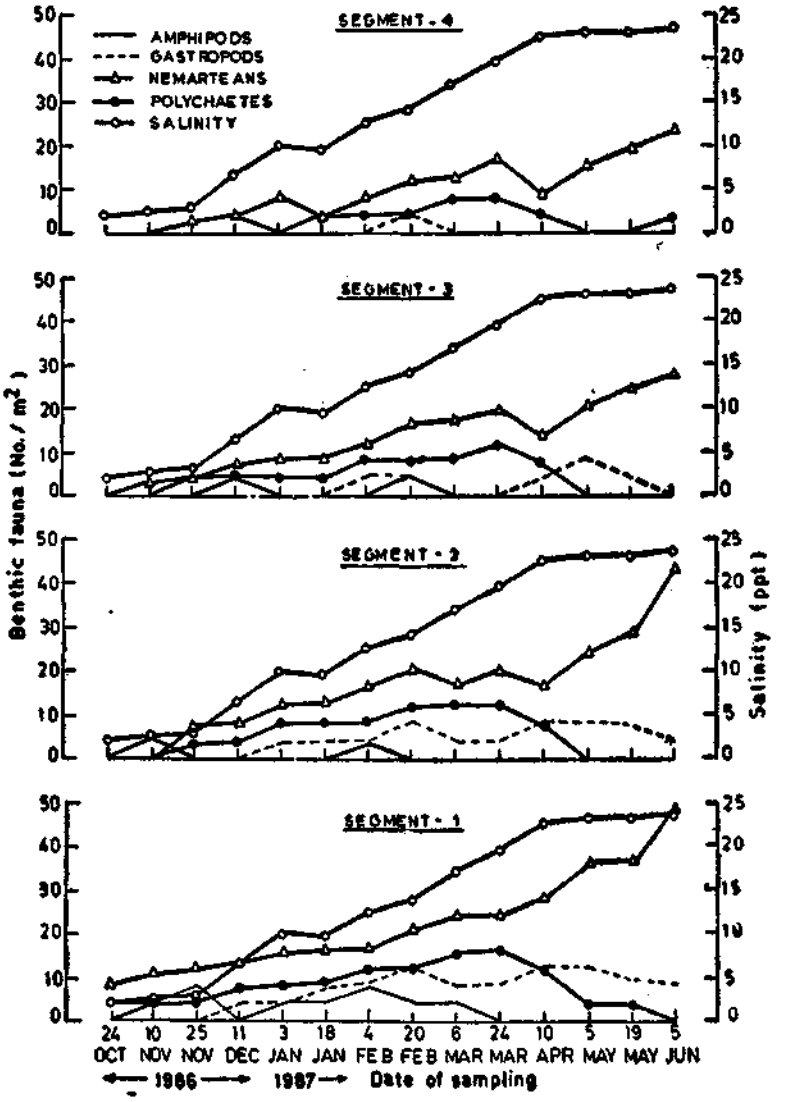

Fig. 3. Growth of macrobenthic fauna in different segments of the pond with corresponding salinities.

Nadu and in a brackishwater bheri at Taldi, West Bengal, which are corroborated by the present observation. Dense assemblages of

planktonic larvae (Woodin, 1976). There are many barriers which the pelagic larvae of macrobenthic animals have to cross before

they finally settle on the bottom and that each type of bottom deposit will attract a very limited and selected set of species (Thorson 1966). Such biotic interactions coupled with the extreme variability of environmental factors resulted in the evolution of benthic fauna.

The area of the pond which is exposed more to the sun become highly productive sooner than the unexposed area. So this may be one of the reasons for which the benthic organisms first appeared in the segment No. 1, which was exposed to the sun for 22 days before inundation.

Productivity of benthos is presumably related to the primary productivity of the overlying water column (Lie, 1968). Settling of products of primary production which are not consumed by pelagic herbivorous zooplankton (Inverson *et al.*, 1979) could enhance benthic secondary production in sediments directly. In this newly excavated pond it was noted that primary productivity value increased as the pond grew older along with the increase in total benthic population.

Though the importance of sediment nature was emphasized for the benthic faunal distribution by many workers (Sanders, 1960; Thorson, 1966), but in this newly excavated water body the submerged soil character did not change much throughout the study period. So it appears that the change in salinity of the medium, reproduction of dominant species and period of exposure of pond bottom to sun, are largely responsible for the growth of benthic organisms, when all other environmental conditions are congenial.

The average number and weight of benthic organisms has a correlation with production, climatic factors and also with the demersal fish production. Relation between the benthic production and exploited demersal fishery resources has also been reported (Harkantra *et al.*, 1980). Damodaran (1973) has reported dependence of shrimps on benthos and also a relationship between benthos and prawn catch. An increase in prawn catch towards the southwest coast of India associated with an increase in benthic biomass and an analysis of the Statewise benthic production showed a good relationship with the demersal fish catch (Harkantra *et al.*, 1980). A direct relationship was observed between the benthic biomass and demersal fish catches along South Kanara Coast (Prabhu and Reddy, 1987). Such a correlation indicates the important role of benthic biomass in the dietary of demersal fish. Hence, for the culture of brackishwater finfish and shellfish in a newly excavated pond, the quantitative data on benthos can be used as an efficient tool for stocking the pond.

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