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# EXTENT OF DAMAGE TO DIFFERENT CRUSTACEANS AND FIN FISHES IN COLLECTING *PENAEUS MONODON* (FABRICIUS) POST-LARVAE IN SATKHIRA COASTAL REGION

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ABSTRACT

The study was conducted in 1992 in the five rivers of Satkhira coastal region to assess the extent of damage caused by the collectors of *Penaeus monodon* post-larvae on other shrimp species, fin fish and macrozooplankton population. It has revealed that for each *P. monodon* post-larva, about 38 larvae of other shrimps, 6 of fin fish and 56 macrozooplanktors were killed. The number of shrimp seed collectors has been increasing rapidly with the increase in demand of shrimp seeds. An average of 78 *P. monodon* post-larvae were collected per person per day during the peak period. The seed collectors caused a serious damage to other shrimps, fin fishes and macrozooplankton, thus adversely affecting the natural productivity and ecological balance of the estuary.

## INTRODUCTION

COASTAL aquaculture in Bangladesh is a promising area of development for increasing shrimp production, boosting foreign exchange earning, providing more employment opportunity and improving the economic condition of rural people in coastal belts. Shrimp culture both in brackish and freshwater has been increasing day by day with the increased demand of shrimp in the international market. So, the demand for shrimp seeds has been increasing to a greater extent. It may be mentioned that the wild post-larvae of 'bagda' *(Penaeus monodon)* are still the only major source of shrimp seeds for stocking. The demand for 'bagda' post-larvae has also increased the fishing pressure for its collection from rivers and shore water. Mahmood (1986) and Funegaard (1986) described the gears and methods used for collecting 'bagda' shrimp post-larvae in the estuarine and near shore waters. They also described that the whole catch along with debris of every 20 to 30 minutes haul was usually transferred to a plastic, aluminum or clay bowl by splashing water on the net. Besides *P. monodon* post-larvae the catch included plenty of other zooplankton. A whitish mussel shell or cup was used for segregation of *P. monodon* post-larvae (about 20 mm in length) which were easily

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distinguished by the presence of dark brown coloration (chromatophores) visible to naked eyes as a horizontal line throughout the length of the body. After segregation, the by – catch including post-larvae of other shrimps, fin fishes and zooplanktons were just carelessly thrown on the sand beach (Mahmood, 1989).

Some of the workers namely Howlader (1976), Ahmed (1979, 1981), Mahmood and Khan (1980), Kibria (1983), Anon. (1985), Funegaard (1986) and Mahmood (1988) had carried out investigations on the abundance of post-larvae and juveniles of penaeid shrimps. But none of these works could clearly quantify the colossal losses caused to other valuable resources of shrimp, fin fish and zooplankton community while collecting 'bagda' shrimp post-larvae in our coastal estuaries. Therefore, the present investigation was undertaken to study the distribution pattern and to assess the extent of damage done to different crustaceans and fin fishes during collection of P. monodon post-larvae in the five different rivers of Satkhira coastal region in Bangladesh.

## Material and Methods

The study area was located in the Satkhira district south-western part of Bangladesh. Five different rivers of the region, *viz.*, Ichamati, Coxali, Kalindi, Kholpatua and Mother were selected for sampling. In each river two stations were selected for collecting samples. Sampling stations of the five different rivers are shown in (Fig. 1). In the Ichamati river, station $I_1$, was located near the bank of Debhata Thana and $I_2$ at a distance of 4 km upstream from station $I_1$. In the Coxali river, station $C_1$ was selected at a distance of 3 km of Kaliganj Thana sadar and $C_2$ at 2 km downstream from the $C_1$. In the Kalindi river, station $K_1$ was selected adjacent to the Basantapur village, 6 km away from Kaliganj Thana sadar, and station $K_2$ 5 km downstream from the station $K_1$. In the Kholpatua, station $Kh_1$ was selected near the Nowabaki Bazaar, 10 km away from Shaymnagar Thana sadar, and station $Kh_2$ 4 km upstream from the station $Kh_1$. In the Mother, station $M_1$ was selected adjacent to the Vetkhali Bazaar, 9 km away from Shaymnagar Thana and station $M_2$ was located 3 km upstream from station $M_1$.

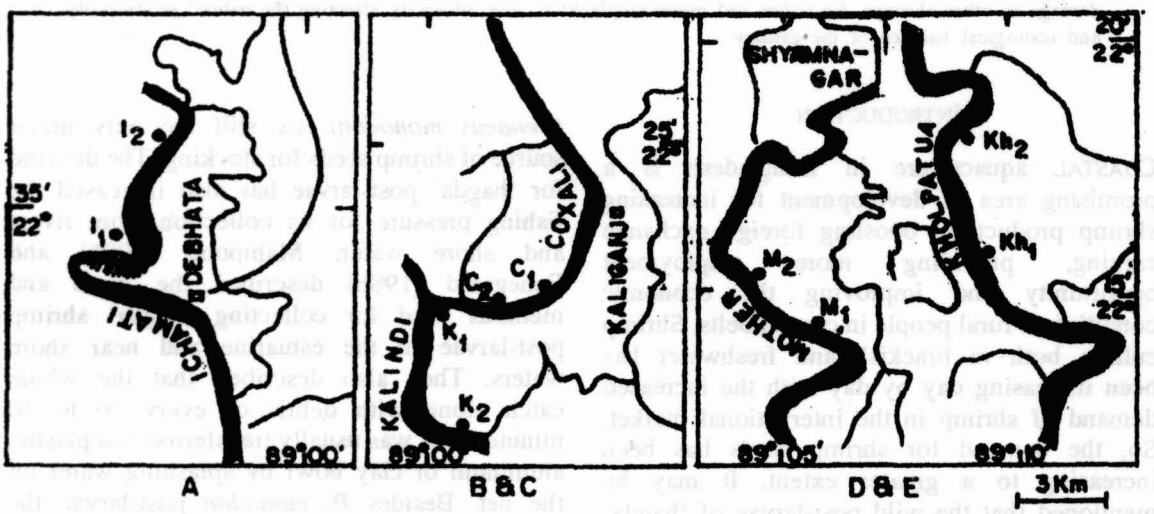


FIG. 1. Geographical locations of different sampling stations in the different rivers of Satkhira coastal region.
A. Ichamati (stations $I_1$ & $I_2$) B. Coxali (stations $C_1$ & $C_2$) C. Kalindi (stations $K_1$ & $K_2$)
D. Kholpatua (stations $Kh_1$ & $Kh_2$) E. Mother (stations $M_1$ & $M_2$)

TABLE 1. Water temperature, pH, dissolved oxygen and salinity of five different rivers of Satkhira coastal region, 1992

| Name of River | Parameter | Months | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec.. |
| Ichamati | Water temp.(°C) | 17.5 | 23.3 | 26.4 | 32.2 | 35.6 | 33.9 | 33.6 | 32.2 | 32.8 | 31.1 | 23.0 | 18.3 |
| | pH | 7.5 | 7.0 | 7.5 | 8.0 | 7.2 | 8.5 | 8.0 | 7.5 | 7.0 | 7.6 | 7.5 | 8.0 |
| | Dissolved oxygen (ppm) | 6.0 | 6.5 | 6.2 | 7.0 | 8.2 | 7.0 | 6.7 | 7.0 | 5.9 | 5.8 | 5.5 | 6.0 |
| | Salinity (ppt) | 4.0 | 7.0 | 11.0 | 15.0 | 16.0 | 3.0 | 1.0 | 3.0 | 1.0 | 1.0 | 4.0 | 4.0 |
| Coxali | Water temp. (°C) | 19.4 | 19.9 | 26.9 | 33.3 | 33.3 | 32.2 | 29.1 | 31.1 | 24.4 | 26.7 | 23.0 | 18.3 |
| | pH | 8.0 | 8.0 | 8.1 | 7.5 | 7.5 | 8.2 | 8.0 | 7.6 | 7.5 | 7.0 | 8.0 | 8.5 |
| | Dissolved oxygen (ppm) | 6.9 | 7.0 | 7.5 | 8.0 | 10.0 | 7.8 | 7.7 | 6.5 | 5.9 | 7.1 | 5.0 | 5.5 |
| | Salinity (ppt) | 5.0 | 7.0 | 10.0 | 12.0 | 17.0 | 15.0 | 7.0 | 2.0 | 1.0 | 0.00 | 5.0 | 9.0 |
| Kalindi | Water temp. (°C) | 20.5 | 26.1 | 29.4 | 32.2 | 32.8 | 35.6 | 37.2 | 33.3 | 28.9 | 26.1 | 23.9 | 20.4 |
| | pH | 7.5 | 8.0 | 8.0 | 8.0 | 7.5 | 7.5 | 8.0 | 8.4 | 7.0 | 6.9 | 7.1 | 7.0 |
| | Dissolved oxygen (ppm) | 5.7 | 7.4 | 8.0 | 9.0 | 8.5 | 7.5 | 7.0 | 6.8 | 7.9 | 5.7 | 6.5 | 6.0 |
| | Salinity (ppt) | 5.0 | 8.0 | 11.0 | 13.0 | 18.0 | 16.0 | 7.0 | 3.0 | 1.0 | 2.0 | 5.0 | 5.0 |
| Kholpatua | Water temp. (°C) | 19.7 | 26.6 | 21.1 | 28.9 | 32.2 | 36.7 | 38.9 | 32.0 | 29.9 | 28.4 | 23.0 | 17.7 |
| | pH | 7.5 | 7.0 | 8.0 | 7.5 | 8.0 | 7.9 | 6.9 | 7.8 | 8.1 | 6.7 | 6.8 | 6.8 |
| | Dissolved oxygen (ppm) | 7.1 | 7.0 | 6.8 | 7.2 | 7.0 | 8.5 | 8.0 | 7.2 | 5.9 | 6.5 | 6.2 | 5.4 |
| | Salinity (ppt) | 11.0 | 16.0 | 19.0 | 21.0 | 23.0 | 23.0 | 19.0 | 11.0 | 10.0 | 8.0 | 9.0 | 11.0 |
| Mother | Water temp. (°C) | 14.4 | 20.6 | 23.9 | 29.4 | 35.6 | 33.9 | 30.6 | 30.0 | 28.9 | 26.7 | 23.3 | 20.6 |
| | pH | 7.5 | 7.5 | 7.5 | 8.0 | 8.0 | 8.0 | 8.5 | 8.0 | 8.2 | 8.0 | 7.5 | 7.0 |
| | Dissolved oxygen (ppm) | 5.8 | 8.5 | 7.2 | 6.9 | 7.8 | 9.0 | 6.7 | 7.2 | 5.9 | 8.0 | 5.9 | 6.0 |
| | Salinity (ppt) | 12.0 | 15.0 | 18.0 | 20.0 | 22.0 | 22.0 | 18.0 | 10.0 | 7.0 | 7.0 | 9.0 | 9.0 |

Shrimp seed samples were collected fortnightly from January 1992 to December 1992 using a drag net, locally known as *Tana jal.* The diameter of the nets' mouth was 160 cm along the long axis and 55 cm along the short axis and mesh size was 1 mm. Two samplings were made at day time during low and high tide conditions. The net was pushed manually in the shallow areas for about 10 minutes. The samples were preserved in 5% neutralized formalin.

The analyses were completed within two weeks to take advantage of the chromatophores for identification of the post-larvae upto species level (Muthu,1978; Motoh and Buri, 1980). Macrozooplankton samples including shrimps and fin fishes were separated into major taxonomic groups and the 'bagda' shrimp post-larvae were sorted out from the other post-larvae.

Water quality parameters, such as, temperature, dissolved oxygen, pH and salinity were also recorded with the help of portable water test kit (HACH kit, model-FF 2) during the sampling period.

## Results and Discussion

Water temperature, dissolved oxygen, pH and salinity of the five rivers are shown in (Table 1). No apparent variations were observed in water temperature, pH and dissolved oxygen of different rivers. Higher values of dissolved oxygen were recorded during the rainy season and lower in winter. There was slight variation in dissolved oxygen content in different sampling stations of various rivers.

Higher values of salinity were recorded during February to June and lower during July to January. Comparatively higher salinity was recorded in the river Kholpatua (23‰; May-June) and Mother (22‰; May-June). At the same time salinity in the rivers Ichamati, Kalindi and Coxali were 16‰, 18‰ and 17‰ respectively.

Table 2 shows monthly distribution (individuals/unit effort) of shrimp seeds, fin fishes and other macrozooplankton in the different rivers of Satkhira region. Macrozooplankton showed variation in their abundance in all the five rivers and was recorded at higher density in the river Kholpatua (74.74%), followed by Mother (66.75%), Coxali (63.24%), Kalindi (46.32%) and Ichamati (25.10%). In the river Kholpatua, shrimp and fin fish post-larvae occupied about 25%, in Mother 33%, Kalindi 54%, Coxali 37% and Ichamati 75% of the catch. However, shrimp post-larvae alone contributed more or less the same amount to the total annual population in the river Coxali, Mother and Kholpatua (29.70%, 27.90% and 20.96% respectively). But in the river Ichamati and Kalindi it showed great variation in total population and was about 70% in the former and 43% in the latter.

At present, the source of *'bagda'* shrimp fry in Bangladesh is only from wild and is fished intensively from the coastal waters causing damage to the young ones of many species of fin fish, shell fish and other macrozooplanktors. Therefore, estimate has been made to assess the extent of damage on the basis of this investigation. By average distribution (in percentage) the *'bagda'* shrimp occupied 0.98%, other shrimps 37.33%, fin fishes 6.46% and other macrozooplankton 55.23% in the catch (Table 3). The other micro-aquatic zooplanktors could not be obtained in the present investigation, as the net used in sampling was of 1 mm mesh size. The results revealed that for catching one post-larva (PL) of *P. monodon,* the shrimp seed collectors killed 38 other shrimp PL, 6 fin fish larvae and 56 other macrozooplanktors (Table 3). Mahmood (1990) also reported in the Chakaria Sundarban, Satkhira and Khepupara that for catching a single individual of *'bagda'* shrimp fry, 14 other shrimps, 21 fin fish PL and 1631 other zooplanktors were killed. For sampling, he used a rectangular plankton net described

TABLE 2 Monthly distribution (individuals/unit effort)* of shrimp seeds, fin fishes and other macrozooplankton in the different rivers of Satkhira coastal region.

| Major group | Months | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Yearly Total | % |
| A. Ichamati river | | | | | | | | | | | | | | |
| *Penaeus monodon* PL | 1 | 2 | 2 | – | – | 1 | – | – | 1 | 2 | – | – | 9 | 0.61 |
| Other Shrimp PL | 51 | 94 | 29 | 34 | 46 | 125 | 49 | 65 | 74 | 181 | 105 | 163 | 1016 | 68.93 |
| Fin fish PL | 2 | 8 | 5 | 5 | 11 | 2 | 1 | 4 | 6 | 17 | 5 | 13 | 79 | 5.36 |
| Other macrozooplankton | 8 | 15 | 29 | 52 | 30 | 14 | 8 | 5 | 7 | 29 | 107 | 66 | 370 | 25.10 |
| Total number | 62 | 119 | 65 | 91 | 87 | 142 | 58 | 74 | 88 | 229 | 217 | 242 | 1474 | 100 |
| B. Coxali river | | | | | | | | | | | | | | |
| *Penaeus monodon* PL | 1 | 1 | 1 | 1 | 1 | – | – | – | – | 1 | 1 | – | 7 | 0.73 |
| Other shrimp PL | 9 | 18 | 11 | 35 | 15 | 18 | 11 | 12 | 17 | 21 | 34 | 78 | 279 | 28.97 |
| Fin fish PL | 2 | 4 | 1 | 4 | 8 | 3 | 1 | 1 | 4 | 10 | 28 | 2 | 68 | 7.06 |
| Other macrozooplankton | 42 | 7 | 27 | 40 | 32 | 42 | 25 | 3 | 5 | 14 | 198 | 174 | 609 | 63.24 |
| Total number | 54 | 30 | 40 | 80 | 56 | 63 | 37 | 16 | 26 | 46 | 261 | 254 | 963 | 100 |
| C. Kalindi river | | | | | | | | | | | | | | |
| *Penaeus monodon* PL | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 14 | – | – | 25 | 1.79 |
| Other shrimp PL | 24 | 18 | 43 | 44 | 42 | 112 | 38 | 27 | 23 | 40 | 63 | 109 | 583 | 41.67 |
| Fin fish PL | 3 | 4 | 20 | 12 | 13 | 3 | 1 | 7 | 5 | 34 | 37 | 4 | 143 | 10.22 |
| Other macrozooplankton | 16 | 18 | 27 | 66 | 26 | 52 | 25 | 7 | 5 | 37 | 310 | 59 | 648 | 46.32 |
| Total number | 44 | 41 | 92 | 123 | 82 | 168 | 65 | 42 | 35 | 125 | 410 | 172 | 1399 | 100 |
| D. Kholpatua river | | | | | | | | | | | | | | |
| *Penaeus monodon* PL | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | – | 4 | – | – | 15 | 0.66 |
| Other shrimp PL | 49 | 55 | 26 | 19 | 28 | 28 | 21 | 30 | 12 | 23 | 81 | 91 | 463 | 20.30 |
| Fin fish PL | 4 | 13 | 6 | 13 | 6 | 1 | 1 | 4 | 9 | 18 | 16 | 7 | 98 | 4.30 |
| Other macrozooplankton | 15 | 46 | 32 | 309 | 95 | 79 | 51 | 23 | 268 | 534 | 211 | 41 | 1704 | 74.74 |
| Total number | 70 | 116 | 66 | 342 | 130 | 109 | 74 | 58 | 289 | 579 | 308 | 139 | 2280 | 100 |
| E. Mother river | | | | | | | | | | | | | | |
| *Penaeus monodon* PL | 1 | 2 | 4 | 2 | 2 | 1 | 1 | 1 | – | – | – | – | 17 | 1.09 |
| Other shrimp PL | 17 | 22 | 29 | 37 | 20 | 11 | 7 | 13 | 14 | 60 | 43 | 144 | 417 | 26.82 |
| Fin fish PL | 8 | 8 | 12 | 7 | 5 | 1 | 1 | 3 | 6 | 23 | 6 | 3 | 83 | 5.34 |
| Other macrozooplankton | 8 | 9 | 10 | 69 | 61 | 65 | 39 | 34 | 23 | 21 | 122 | 577 | 1038 | 66.75 |
| Total number | 34 | 41 | 55 | 115 | 88 | 78 | 48 | 51 | 43 | 106 | 171 | 725 | 1555 | 100 |

* operating a drag net (160 × 55 cm) for about 10 minutes as a unit effort.

by Mahmood and Khan (1982) having $0.5m^2$ mouth opening and netting material with hydrobios nylon mesh with aperture size of 0.5 mm. But fry collectors did not use such type of nets to collect shrimp fry in our coastal estuaries. Shrimp fry collectors commonly used nylon nets with mesh size 1mm was used in the present study. More zooplanktors (1631) as collected by Mahmood might be associated with the fine mesh size of the net used by him in his study.

TABLE 3. Percentage contribution of shrimps, fin fishes, macrozooplankton and no. of other sp. killed for each *P. monodon* post-larvae caught in the different rivers of Satkhira coastal region.

| Major Groups | Average % | No. of other sp. killed for each *P. monodon* |
|---|---|---|
| *P. monodon* | 0.98 | - |
| Other shrimps* | 37.33 | 38 |
| Fin fishes** | 6.46 | 6 |
| Macrozooplankton*** | 55.23 | 56 |

* *P. indicus, Metapenaeus monoceros, M. brevicornis, Prapenaeopsis sculptilis, Palaemon (Expalaemon) styliferus, Macrobrachium rosenbergii, M. villosimanus, M. dyanus M. dolichodactylus, M. rude.*

** *Polynemus paradiseus, Eleutheronema tetradactylum, Liza parsia, L. tade, Lates calcarifer, Rhinomugil corsula, Coilia sp., Setipinna phasa, Stolephorus* sp., *Mystus gulio, Glossogobius giuris.*

*** *Acetes sp., Mysids, Isopods, Amphipods, Copepods, Alima larvae, Crab larvae.*

Funegaard (1986) made observation on the number of fry collectors per km during the peak season (Feb./March), and reported about 20,000-25,000 people were engaged in shrimp fry collection in the Satkhira district. In 1982, fry collectors could catch about 2000 *'bagda'* shrimp fries/net/day. Whereas, during the same time of the year of 1986, the catch was only one tenth of what it was before. But in 1992, about 85,000 people (man/women/children) were engaged to collect shrimp fries in the whole year. During peak period (Feb./March) the number of collectors nearly reached about 45,000-50,000 (it is also based on the no. of boats and persons involved in fry catching/km, length of the river under observation). Moreover, in the present study, only 78 *P. monodon* post-larvae on average were found to be caught by a shrimp seed collector per day/net during the peak period.

The number of fry collectors has been increasing everyday with the rise in demand for shrimp seeds. But due to continuous fishing pressure the natural stock of shrimp fry is gradually decreasing. Such indiscriminate killing of aquatic organisms might results in ecological imbalance. Cultured shrimp production depends on wild seed collection. So, to preserve the ecological balance as well as natural productivity of the estuarine environment, it is advisable that the Government takes necessary measures to educate the seed collectors through suitable extension methods, so that during *P. monodon* seed collection the unwanted species are released alive, back to the river water.

## REFERENCES

AHMED, M. K. 1979. Occurrence and relative abundance of prejuveniles of penaeid prawn in the Chakaria Sundarbans and Bankhali river-estuary of Cox's Bazaar during Nov. 1978- Oct. 1979. *Fresh. Fish. Res. Stn., Chandpur, Bangladesh. Res. Rept. No.* **2** : 33.

———— 1981. Behundi net fishery in brackishwater area of Satkhira with emphasis on bionomics and mortalities of shrimps. *Fresh. Fish. Stn., Chandpur, Bangladesh. Res. Rept. No.* **3** : 42.

ANON 1985. Agricultural production system. Cropping patterns, Inputs and yields. *Ministry of Irrigation, Water Development and Flood Control. Tech. Rep. No.* 14, Dhaka, Bangladesh.

FUNEGAARD, P. 1986. Shrimp seed any to sell? Come to Satkhira, Bangladesh. *Bay of Bengal News, 22nd issue, BOBP, Post Bag* 1054, Madras 600 018, India. 2-6.

KIBRIA, G. 1983. *Shrimp fishery and shrimp farming in Bangladesh (In Bengali).* Jahan printing press, Khulna, Bangladesh. p. 20.

MAHMOOD, N. 1984. Studies in the tidal area of Bangladesh- a summary report on hydrobiological survey during 1982-1983. *Paper prepared for FAO/UNDP Fishery Resources Survey System,* BGD/79/105, p. 17.

———— 1986. Effect of shrimp farming and other impacts on mangroves of Bangladesh. *Proc. 3rd. sess. IPFC Working Party of Experts on Inland Fisheries, Bangkok, Thailand, 19-27 June, 1986, FAO Fish. Rept. No.* 370, 46-66.

———— 1988. Coastal fisheries and shrimp farming. *Paper presented at the National Workshop on 'Bangladesh Coastal area Resources and Management' organised by the CARDMA, Oct. 3-4, Dhaka,* p. 19.

———— 1989. Shrimp culture in Bangladesh-problems and prospects therein (In Bengali). *Paper presented at the seminar on maximum utilization of internal resources in the socio-economic development of Bangladesh, sponsored by the Chittagong Chamber of Commerce and Industry,* Bangladesh, 17-18 May, 13 (mimeo).

———— 1990 An assessment on the quantum of damage caused to the zooplankton while fishing 'bagda' shrimp *Penaeus monodon* fry in Bangladesh estuaries. *Proc. 7th. Nat. Zool. Conf.,* Bangladesh, 87-94.

————, Y. S. A. KHAN 1980. On the occurrence of post-larvae and juvenile penaeid prawns at Bankhali estuary and adjacent coastal area of Cox's Bazaar with notes on their utilization in aquaculture, *Final Report. Res. Prog., U.G.C., Dhaka,* p. 26.

———— AND 1982. Designing and Feasibility studies on post-larval nets. *U.G.C. Res. Prog., Final Report.* 14 pp.

MOTOH, H. AND P. BURI 1980. Identification of the post-larvae *Penaeus* (Crustacea, Decapoda, Penaeidae) appearing along shore waters. *Aquacult. Dept., SEAFDEC, Trigbaun, Iloilo, Philippines, Quarterly (2nd). Res. Rep.* 4 (2) : 15-19.

MUTHU, M. S. 1978. Larval development-specific identify of penaeid post-larvae found in brackishwater areas in coastal aquaculture. Marine prawn culture. Part-1. Larval development of Indian prawns. *CMFRI, Bull.,* (28) : 86:90.