Pak. j. sci. ind. res., vol. 37, no.11, November 1994

IMMIGRATION OF PENAEID POSTLARVAE IN THE KUTUBDIA CHANNEL, BANGLADESH

MOHAMMAD ZAFAR, M. H. DARO*, NURUDDIN MAHMOOD AND AZIZUR RAHMAN KHAN

Institute of Marine Sciences, University of Chittagong, Chittagong-4331, Bangladesh

(Received July 28, 1993 ; revised July 24, 1994)

Only Penaeid postlarvae are available for coastal aquaculture ponds in Bangladesh, an investigation was made from March 1988 to Feb 1989. The data indicated that immigration of penaeid postlarvae takes place throughout the year in the Kutubdia channel. They were most abundant in April (301.91 indivs./100m^3) when higher salinity condition (25.13%) also prevailed, and the minimum was recorded in Oct (6.17 indivs./100m^3) when the salinity was 13.25%. The postlarval community of penaeid shirmps of this area was dominated by *Penaeus indicus* (15.35%); *P.monodon* (12.60%); *P. scmisulcatus* (8.24%); *P. merguiensis* (6.94%);and *P. japonicus* (4.13%). Their temporal and spatial distribution in the study area are presented here.

Key words: Penaeid postlarvae, Immigration, Channel.

Introduction

Shrimp farming in coastal tidal areas is the most popular and profitable business in Bangladesh. Shrimp is one of the important exportable commodities and a foreign exchange earner of this country. The southern part of the country is bordered by about 710 km (excluding major indentations) long coastal area, extending from Teknaf to Shyamnagar where brackishwater shrimp farming is done. Practice of monoculture and polyculture of penaeid shrimps in coastal aquaculture pond in Bangladesh depend on natural seed supply. Penaeid shrimp breed in the sea and their planktonic larvae (usually 5 to 15 days old) enter the estuaries and brackishwater as they transform into late mysis or postlarval stages [1]. An assessment of postlarval resources (qualitative and quantitative) in the vicinity of the farm site is essential for planning a brackishwater aquaculture farm [2]. Only limited information for the occurrence and abundance of postlarval shrimps in the estuaries and coastal waters [3-6] is available. The present report concerning temporal and spatial distribution of five commercially important penaeid postlarvae in the Kutubdia channel is an addition to those studies.

Materials and Methods

Field work was started in March, 1988 and continued till Feb. 1989 at four stations in the Kutubdia channel (Fig.1). Most of the shore area on two sides of the channel is covered by poor mangrove vegetation, with the adjacent land consisting of coastal salt pans being used for salt extraction during premonsoon dry period and for aquaculture afterwards. Zooplankton samples were collected at fortnightly intervals from surface waters at four stations in the investigated channel. A small circular plankton net was used, having 25 cm mouth opening, and netting material of hydrobios nylon net with aperture size of 335 µm. A Karl kolb digital flowmeter was used to record the quantity of water passed through the mesh while sampling. Samples were immediately preserved in 5% neutralized formalin in the field. Concurrently, atmospheric temperature, surface water temperature, salinity, dissolved oxygen, pH and transparency of water were recorded following standard procedures. Rainfall data were obtained from the meteorological observatory of Kutubdia Island.

Penaeid shrimp PL were sorted out from the zooplankton samples in the laboratory. Identification of penaeid postlarvae

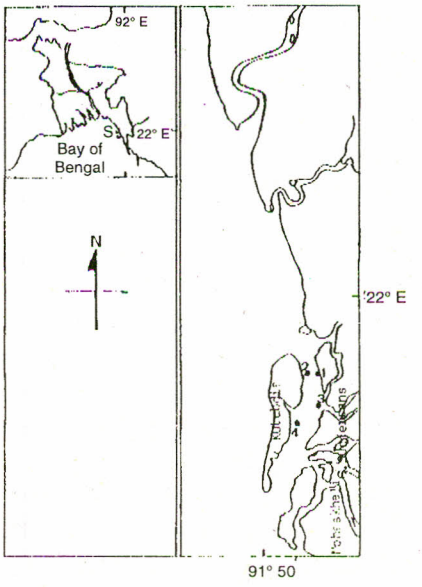

Fig. 1. Left inset, showing geographical location of the study area (S) in the southeast corner of Bangladesh. The same has been expanded at right to show the exact location of the sampling stations (1,2,3 and 4) in the Kutubdia channel.

*Vrije University, Brussel, Belgium.

TABLE 1. MONTHLY DISTRIBUTION OF PENAEID POSTLARVAE (INDIVIDUALS/100m³) AND HYDROMETEOROLOGICAL PARAMETERS IN THE KUTUBDIA CHANNEL, BANGLEDESH.

Months 1988-89	*Penaeus indicus*	*Penaeus monodon*	*P. semi-sulcatus*	*P. mer-guiensis*	*P.japo-nicus*	Other penaeids	Total penaeids	Atmospheric temp. (°C)	Water temp. (°C)	D. O. (ml/1)	Salinity (%)	Secchi depth (cm)	pH	Rainfall (mm)
March	13.54	9.61	5.21	5.21	9.61	27.89	71.07	28.94	26.73	5.37	28.13	21.81	8.30	26
April	28.37	27.36	25.54	25.54	7.58	187.52	301.91	27.49	28.33	7.52	25.13	17.42	7.91	107
May	8.50	5.03	4.25	5.90	+	9.55	33.23	30.68	29.73	8.51	24.65	18.33	7.29	310
June	32.88	8.26	5.76	5.02	-	10.02	61.94	27.65	27.68	4.31	20.18	11.50	7.13	768
July	5.14	15.87	12.09	+	-	32.06	65.16	30.75	29.95	4.04	9.12	14.33	7.14	516
August	+	0.93	2.26	+	-	4.46	7.65	29.85	28.93	4.47	10.68	16.12	7.13	531
September	-	4.10	-	-	-	16.55	20.65	33.25	31.08	3.94	10.47	20.75	7.10	559
October	-	1.02	-	-	-	5.15	6.17	32.10	27.63	4.89	13.25	24.10	7.10	192
November	2.14	4.13	+	+	+	38.33	44.60	28.48	27.84	3.87	24.48	28.00	7.94	118
December	6.16	3.98	+	+	+	18.82	28.90	25.16	25.29	4.34	26.49	32.20	7.97	13
January	5.75	3.39	+	5.34	5.34	16.30	36.12	26.63	23.18	5.07	28.98	37.69	8.37	00
Feburary	5.24	47.4	2.71	1.66	6.40	3.39	24.14	28.10	24.98	5.52	29.21	21.13	8.26	00

(+) Indicates presence but density less than 1. indiv./100 m³; (-) Indicates absence.

were based on morphometric characters followed earlier [7-11].

Results and Discussion

Statistial analysis Kruskal-Wallis showed no significant result observed 1% or 5% level between the four stations in different recorded hydrological factors. So, only average hydrological factors were indicated in Table 1. The hydrological parameters of the study area varied seasonally. Atmospheric temperature ranged from 25.16 to 33.25°C. The min. (25.16°C) was recorded in Dec. and the maxi. in Sept. (33.25°C). Water temperature varied between 23.18°C and 31.08°C, the lowest was recorded in Jan. and the highest in Sept. The concentration of dissolved oxygen varied from 3.87 ml/1 to 8.51 ml/1 with highest value recorded in May and the lowest in Nov. Salinity ranged between 9.12% and 29.21%, with the maxi in Feb. and the mini. in July. Secchi-depth varied from 11.50 cm (June) to 37.67 cm (Jan). The pH varied from 7.10 to 8.37. The effective rainfall was confined in the monsoon months, with the maxi. in June (768 mm).

Occurrence and abundance of penaeid postlarvae. Penaeid postlarvae were present in the study area throughout the period of investigation. The maximum density was in April. (301.91 indivs./100m³) when salinity gradually began to decrease due to rainfall. The mini. was occurred in Oct. (6.17 indivs./100m³) when salinity was gradually increasing (Table1). A positive and nonsignificant correlation was showed between penaied PL abundance and salinity (r=0.237, P>0.05). The most abundant penaeid postlarvae in the Kutubdia channel were *Penaeus indicus, P.monodon, P. semisulcats, P. merguiensis* and *P. japonicus*. The relative abundance of these penaeid postlarvae were 15.35%, 12.60%, 8.24%, 6.94%, 6.94% and 4.13%, *P.indicus, P. monodon, P. semislcatus, P. merguiensis* and *P. japonicus* respectively. The remanining penaeids constituted 52.74% of the total population (Fig.2).

Temporal and spatial distribution penaeid PL. Temporal an spatial distribution of potlarvae of these five species indicated large variation (Table 1). Postlarvae of the dominant species *Penaeus indicus* occurred throughout the study period except during Sept. and Oct., when salinity was low (10.47 - 13.25%). They were most abundant (32.88 indivs./100m³) in June. *Penaeus monodon* postlarvae occurred throughout the period of investigation. This species was most abundant during March through July, with the maxi. density (27.36 indivs.100m³) in April. The postlarvae of *Penaeus semisulcatus* occureed between Nov. and Aug. Their maximum abundance was in April (25.54 indivs./100m³). *Penaeus merguiensis* was absent in Sept. and Oct. in the study area with the peak of its occurrence (25.54 indivs./100³) in April. *Penaeus japonicus* appeared in the study area during Nov. through May, when high salinity was 24.48% to 29.21%. Their maximum abundance was (9.61 indivs/100m³) in March. Beside these five dominant species, other penaeid potlarvae were recorded

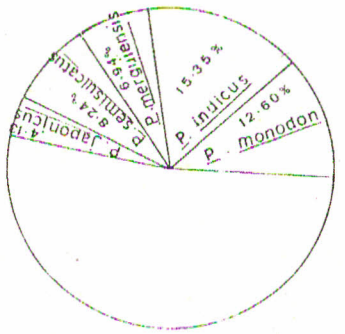

Fig. 2. Annual percentage occurrence of different penaeid PL of the southeastern part of the Bangladesh coastal water in the Kutubdia channel.

throghout the period of study, with a maxi. density in April (187.52 indivs. 100m^3) and the mini. (3.39 indivs./100m^3) in Feb.

Among the four sampling stations, penaeid postlarvae *(Penaeus indicus, P. monoon, P.semisulcatus, P.merguiensis, P.Japonicus* and other penaeids) appeared in higher densities in the eastern part of the channel (Fig.3). Statistical analysis PCA clearly indicated that (Fig.4) the abundance of five *Penaeus* shrimp PL in the eastern stations (1 and 3) were different from western stations (2 and 4). This phenomenon may be related to the southwestern monsoon effect (seasonal coastal upwelling) of the Bay of Bengal.

Among the penaeids and also with respect to total shrimp postlarvae of the Kutubdia channel, the genus Penaeus was dominant (Fig.5) which included five dominant species, *Penaeus indicus, P.monodon, P.semisulcatus, P.merguiensis and P. japonicus.* It is apparent from the results that abundance

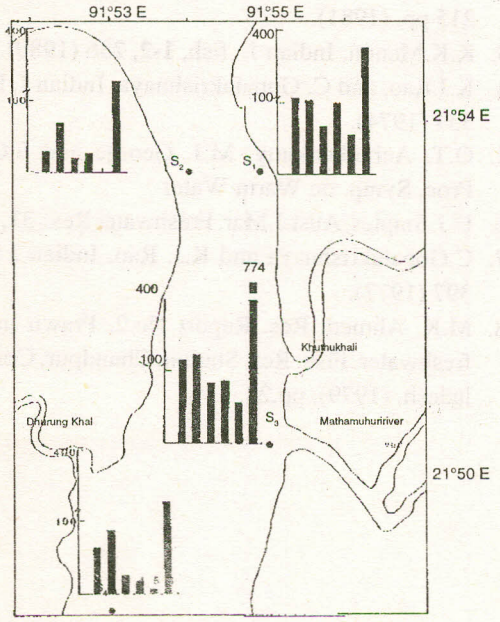

Fig. 3. Yearly total distribution of Penaeid PL (1. *Penaeus monodon,* 2. *P. indicus,* 3. *P. semisulcatus,* 4. *P. merguiensis,* 5. *P. japonicus,* 6. Other penaeidPL) in the four sampling stations (S_1, S_2, S_3 & S_4) of the mangrove ecosystem in the Kutubdia channel.

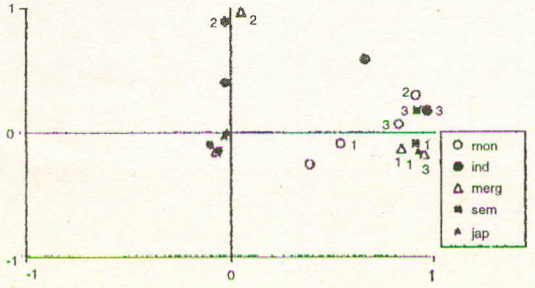

Fig. 4. PCA analysis for spatial differences of five commercially important penaeid PL at four stations in the Kutubdia channel, Bangladesh.

of postlarvae of five indentified species and also other penaeids were influenced by seasonal changes. Higher densities of penaeids ingress during premonsoon months (Jan-April.) during higher salinities and opposite relationship was found with rainfall. For instance, during late monsoon and early postmonsoon months (Aug.-Oct.) lower densities of penaeid postlarvae were recorded in the Kutubdia channel. Statistical analysis showed a positive and nonsignificant correlation between penaeid abundance and salinity. Thus the seasonal fluctuations on distribution of penaeid was not reflected only the salinity changes in the study area, but only the *Penaeus japonicus* strictly maintain a positive and significant relation with salinity (r=0.633, P<0.05). Motoh [9] and Gercia and Reste [12] also inferred similarly.

In the Kutubdia channel, peak ocurrence of *Penaeus indicus* was recorded in June. Menon [13] stated that postlarvae of this species were encountered more in numbers during May - June in Korapuzha estuary. Mahmood and Khan [4] reported that the postlarvae of *P. indicus* were available in the Bakkhali and adjacent coastal area of Cox's Bazar with a peak in June.

Postlarvae of *P.monodon* (PL 15 - 20) occurred throughout the period of this year long investigation with the maxi. in April and July. Rao and Gopalakrishnaya [14] observed that *P.monodon* were available throughout the year and its peak recruitment period during July to Nov. and March to April in the Pulicate Lake. Basu and Pakrasi [2] recorded the peak abundance of *P.monodon in* April and May in Bakkhali area of the lower Sunderbans in West Bengal. Zafar [6] found *P.monodon* postlarvae to occur all months in the Satkhira estuarine area with the peak in abundance during April through July.

Gopalakrishnaya and Rao [17] reported the peak abundance of *P.semisulcatus* in the Pulicate Lake to be in March and April, our investigation in the Kutubdia channel records its maxi. density in April.

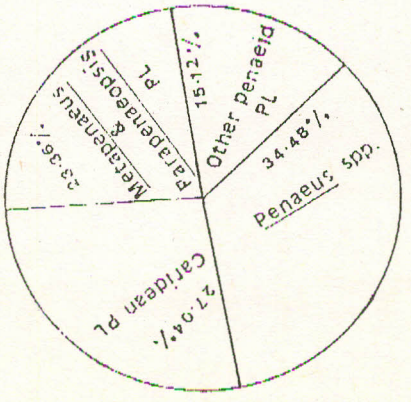

Fig. 5. Annual percentage of different *Penaeus* spp. in the Kutubdia channel, northeastern part of the Bay of Bengal.

Achthankutty *et al.* [15] recorded the postlarvae of *P. merguiensis* during Nov. and Dec. with subsidiary peaks in Jan. and April. Staples [16] recorded this species in the Norman river and adjacent off-shore area in the Gulf of Carpentaria durig Nov. to May. Postlarvae of *P.merguiensis* was ecountered in our study area during Nov. to Aug. with the peak in April. *Penaeus japonicus* immigrated in the present study area during Nov. to May which coincided with a higher salinity regime. Ahmed [18] reported its occurrece in the Chakaria sunderban and the Bagkhali river estuary durig Jan. to March and in May. All these comparative discussions in respet of occurrence and abundance of penaeid postlarvae of five species under the the genus Penaeus suggest present finding are more or less similar to those of other workers mentioned above.

Staples [16] expressed that in offshore areas the current and wind drift play a major role in determining whether the postlarvae under the influence of the tidal flow of the estuary where active mechanisms become more important. In this study area also such a mechanism may be responsible for dispersal of penaeid postlarvae, greater densities of postlarvae were found at stations 1 and 3 (Eastern side of channel) in comparison to those at stations 2 and 4 (western side).

References

1. M.Zafar, M.Sc.Thesis, Fundamental and Applied Marine Ecology, Free Univ. Brussel, Belgium, (1992), pp.258.
2. N.C. Basu and B.B. Pakrasi, J. Inland Fish, Soc. India, **11** (1), 40 (1979).
3. M.K.Ahmed, M.Sc. Thesis, Inst, Mar, Sci. Univ. Chittagong, Bangladesh, (1983), pp.17.
4. N.Mahmood and Y.S.A. Khan, Univ. Grants Comm. Bangladesh, Res.Pro.Final Report, 22 (1980).
5. M.S. Elias, M.Sc. Thesis, Inst. Mar. Sci. Univ. Chittagong, Bangladesh (1983), pp.124.
6. M.Zafar, M.Sc.Thesis, Inst.Mar.Sci.,Univ.Chittagong, Bangladesh (1986), pp.238.
7. S.M. Hoque and H.Hassan, Pakistan, J.Zool; **7** (2), 145 (1975).
8. K.H. Mohamed, P.V. Rao and M.J. George, FAO Fish; Report, 57(2), 487 (1968).
9. H.Motoh, Studies on the Fishries Biology of the Giant Tiger Prawn, Aquaculture Dept., Illoilo, Philippines, (1981), pp.128.
10. M.S. Muthu, Larval Development of Indian Prawns, C.M.F.R.I., Bull., **28,** 86 (1978).
11. H.Motoh and P.Buri, Aquacult, Dept., SEAFDEC Tigbauan, Iloilo, Philippines, Quarterly (2nd) Res. Rep., 4(2), 15 (1980).
12. S.Garrcia and L.Le Reste, FAO, Fish. Tech. Paper (203): 215 pp. (1981).
13. K.K.Menon, Indian J. fish, **1-2,** 236 (1980).
14. K.J.Rao, and C. Gopalakrishnaya, Indian J. Fish, **22** (2): 339 (1974).
15. O.T. Achuthankutty, M.J. George and S.C.Goswami, Proc. Symp. on Warm Water.
16. D.J. Staples, Aust.J.Mar. Freshwater Res., **31,** 635, (1980).
17. C.Gopalakrishnaya and K.J. Rao, Indian J.Sci., **45** (6), 397 (1977).
18. M.K. Ahmed, Res. Report No.2, Prawn investigation, freshwater. Fish. Res. Station, Chandpur, Comilla, Bangladesh, (1979), pp.23.