J. Asiat. Soc. Bangladesh, Sci. 41(1): 105-113, June 2015

LOSS OF AQUATIC FAUNA DURING COLLECTION OF *PENAEUS MONODON* POST LARVAE IN TIDAL WATER OF MONGLA RIVER, BAGERHAT

M. S. ISLAM[1], M. M. RAHMAN[2], K. K. U. AHMED[2], MD. MOTAHER HOSSAIN[3], P. P. BARMAN[1] AND M. J. ISLAM[4]

Dept. of Coastal and Marine Fisheries, Sylhet Agricultural University, Sylhet-3100
[2]Shrimp Research Station, Bangladesh Fisheries Research Institute, Bagerhat-9300
[3]Dept. of Fisheries Technology & Quality Control, Sylhet Agricultural University, Sylhet-3100
[4]Dept. of Aquatic Resource Management, Sylhet Agricultural University, Sylhet-3100

Abstract

The study was carried out in Mongla tidal river of Bagerhat district from May 2012 to April 2013 to ascertain the abundance of black tiger shrimp (*Penaeus monodon*) post larvae (PL) and to quantify the damage of different aquatic fauna during collection of *P. monodon* PL. It was found that around 1650 larvae of other shrimp species, 1562 fin fishes and 6787 other macrozooplankton were cruelly damaged at the time of collection just for single PL of *P. monodon*. During the survey period about 0.18 million man days/ year were calculated to be engaged in shrimp PL collection and on average 6.5 million of *P. monodon* PL were collected annually from the studied area. It was also ascertained from the present study that about 29,988 million of other shrimp species, fin fishes and macrozooplankton were destroyed annually by the shrimp seed collection activities in Mongla river. The results of the study reveals that present seed collection practice caused severe damage of other valuable aquatic fauna, which directly affect the biodiversity of neritic and offshore fauna, natural productivity of tidal waters and ecological balance of coastal and marine environment.

Key words: *Penaeus monodon* post larvae, Aquatic fauna, Tidal water

Introduction

Coastal Shrimp farming in Bangladesh is increasing day by day due to high demand of shrimp both in domestic and international markets. It almost depends on the natural tiger shrimp (*Penaeus monodon*) seed owing to its high growth, high diseases resistance and high market value. Among 45 shrimp species available in Bangladesh, only 7-9 species are cultivable (Nuruzzaman 1992). Out of different shrimp species, black tiger shrimp (*P. monodon*) locally known as 'bagda chingri' is the most popular. Post larvae (PL) of *P. monodon* migrate towards the shallow coastal waters for their food and shelter, and they grow rapidly there due to high biological productivity of that ecosystem. Due to high demand, low investment and lucrative business of *P. monodon* PL, it is encouraged thousands of resource poor people of the coastal areas to be engaged in shrimp seed

[1] Corresponding author: E-mail: islamms2011@ yahoo.com

collection. Seed collectors harvest PL from different places using various types of nets such as drag net, push net and set bag net. These nets are made of nylon materials with fine mesh size (0.1-0.3 mm). After each hauling, seed collectors themselves or their family members sort out and collect only the targeted *P. monodon* PL from the hauling and the rest comprising of other different species larvae, which are unwanted to them is mercilessly thrown on the dry and burning shore. An intensive study on the catch composition of this haul is most imperative to determine the loss of biodiversity of aquatic fauna due to these activities.

Some investigation done by many researchers (Howlader 1976, Ahmed 1981, Hossain 1984, Elias 1983 and Funegaard 1986) could not clearly quantify the colossal loss caused to valuable aquatic organisms such as shrimp, fin fishes and other faunas' larvae while catching *P. monodon* PL. Mahmood (1990) and BFRI (1996) surveyed on the collection of *P. monodon* PL and provided some information on the colossal loss of crustacean, zooplankton and other organisms during shrimp PL collection in the tidal waters of Chakaria Sundarbans, Satkhira, Khepupara, Khulna, Cox's Bazar, Patuakhali, Noakhali, Bhola and Borguna. The present year round study was carried out in three sites of Mongla tidal river of coastal district Bagerhat to assess the abundance and catch composition of the drag/push net used for collecting PL of *P. monodon* and to quantify the damage caused to different shrimp species, fin fishes and zooplankton larvae while collecting PL of tiger shrimp.

Materials and Methods

Samples were collected from three different sites/spots of Mongla tidal river of Bagerhat district from May 2012 to April 2013 (Fig. 1).

Monthly sampling was done by a fine meshed (0.3 mm) push net made of nylon with bamboo split frame (1.6 m x 0.6 m) locally called "Tana jal". The net was manually operated in shallow water against the current. Each hauling time was only 10.0 minutes. Sampling was done twice in a day during low and high tides. After each hauling, samples were stored in plastic pots and preserved with 5% buffered formalin solution. After return to the laboratory, samples were segregated and penaeid shrimp larvae were identified upto species level following Muthu (1978) and Motoh and Buri (1980). Macrozooplankton including other shrimp and fin fishes were identified as major taxonomic groups following George (1969) and Fischer and Witchead (1974).

Salinity of water was estimated using a portable refractometer (ATAGO, Hand-Held Refractometer). Water temperature and pH were measured using an alcohol thermometer and a digital pH meter, respectively.

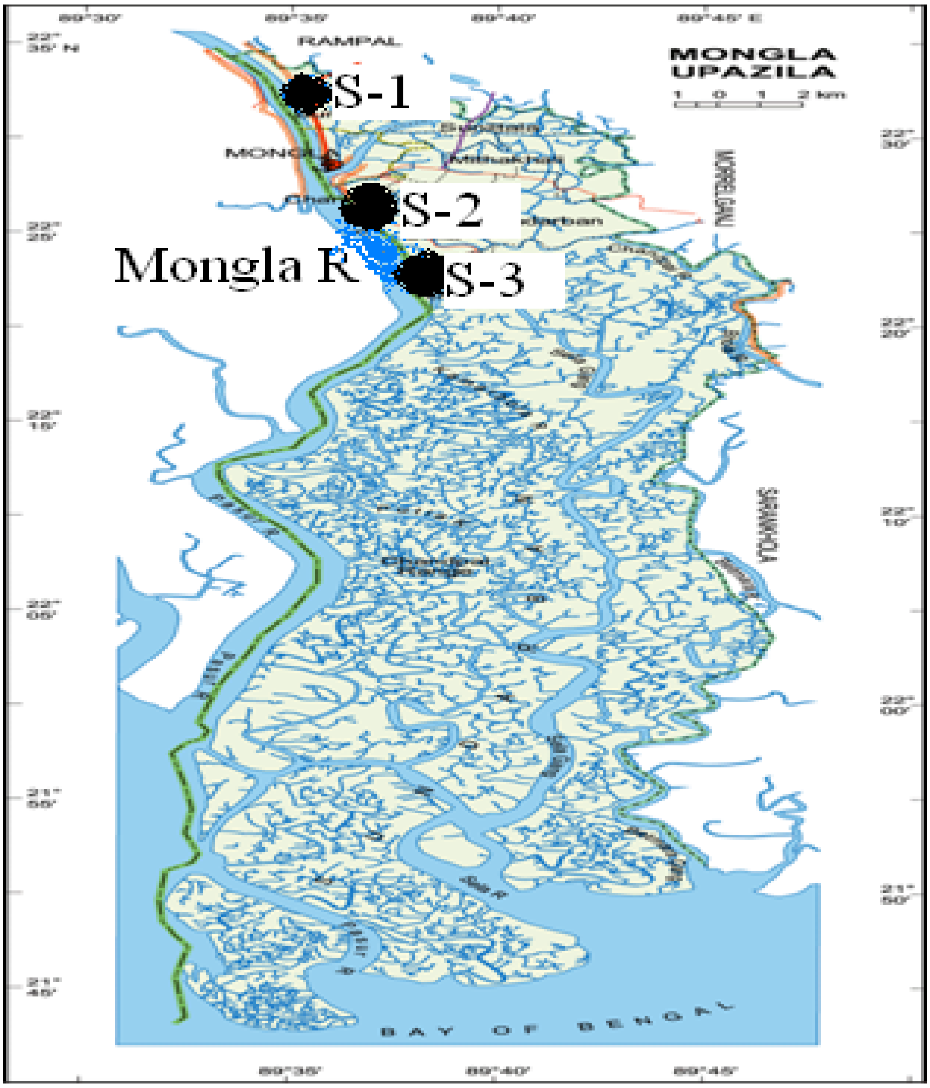

Fig. 1. Map of Mongla upazilla showing the location of sampling stations.

Results and Discussion

Mean monthly values of water temperature and salinity are presented in Fig. 2. There was no remarkable variation in water temperature but a wide fluctuation in salinity was observed in all the sites. Highest temperature (32.1°C) was recorded in September and the lowest (19.4°C) in February. This observation is more or less similar with the observation made by Islam *et al*. (1999a) who recorded temperature ranging from 21.5 to 31.7 °C in Andermanik river and Kuakata coast in Patuakhali.

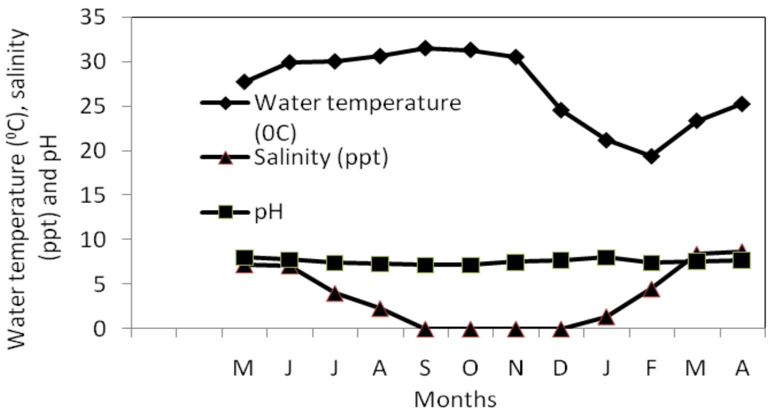

Fig. 2. Monthly fluctuation of water temperature (°C), salinity (ppt) and pH in the river of Mongla.

Water salinity ranged from 0.0 to 12.5 ppt, which is more or less similar with the findings of Islam *et al*. (1999a) who recorded salinity of 0.0—15 ppt from the tidal water in Andermanik river and Kuakata coast. Highest salinity (12.5 ppt) was found in April at all the sites. Salinity dropped off to zero ppt from September to December, which might be associated with monsoon effect, river run-off, land drainage and heavy shower. On the contrary, salinity was found to increase gradually after the month of December.

In the present study the range of pH value from 6.8 to 8.2 was found to coincide with the findings of Islam *et al.* (1999a) who had reported pH values ranging from 6.7 to 8.2 in Patuakhali. pH found from the different sites indicated that water of these places were within alkaline range.

Monthly distribution (individual/unit effort) of *P. monodon*, other shrimp species, fin fishes and other macrozooplankton in Mongla river is presented in Table 1. Data showed that during the period of May to December, *P. monodon* PL was entirely absent in all the sites while salinity was comparatively lower or zero ppt. The larvae of *P. monodon* were very rarely available during January to March while salinity gradually increased. On the other hand, abundance of other shrimp species were found to increase during the month of August to February and maximum was recorded in September through January and February in all the sites. There was no uniform pattern in distribution of both fin fishes and zooplankton. Their abundance also fluctuated from one month to another month. During post monsoon period, comparatively higher quantity of fin fishes and zooplankton were observed than the other part of the year. This observation is in agreement with the results of Rahman *et al*. (1997) and Islam *et al*. (1999a) where the authors implied that lower salinity and temperature are probably the key factors influencing greatly the larval distribution of aquatic fauna.

Table 1. Monthly distribution (individual/unit effort)* of *Penaeus monodon*, other shrimp seeds, fin fishes and macrozooplankton in the Mongla tidal river.

Major groups	Months												Yearly total	%
	M	J	J	A	S	O	N	D	J	F	M	A		
Mongla river (Spot 1)														
Penaeus monodon	0	0	0	0	0	0	0	0	1	0	1	0	2	0.02
Other shrimp	150	80	60	165	290	97	136	89	201	194	75	99	1636	18.34
Fin fish	20	31	36	59	240	294	145	158	189	167	84	67	1490	16.70
Macrozooplanktons	389	480	856	1000	297	612	157	511	498	601	159	234	5794	64.94
Total number	559	591	952	1224	827	1003	438	758	889	962	319	400	8922	100.00
Mongla river (Spot 2)														
Penaeus monodon	0	0	0	0	0	0	0	0	0	1	0	0	1	0.01
Other shrimp	165	67	72	155	302	86	142	101	88	213	82	78	1551	15.39
Fin fish	16	42	29	72	251	269	163	148	205	171	73	82	1521	15.09
Macrozooplanktons	421	511	786	1400	952	634	216	544	519	582	232	209	7006	69.51
Total number	602	620	887	1627	1505	989	521	793	812	967	387	369	10079	100.00
Mongla river (Spot 3)														
Penaeus monodon	0	0	0	0	0	0	0	0	0	0	1	0	1	0.01
Other shrimp	143	72	81	174	269	104	135	94	230	219	127	100	1748	16.01
Fin fish	23	35	38	65	246	287	177	184	223	199	95	91	1663	15.23
Macrozooplanktons	439	540	893	1520	971	653	238	507	584	632	244	285	7506	68.75
Total number	605	647	1012	1759	1486	1044	550	785	1037	1050	467	476	10918	100.00

* Operating a push net (1.6 x 0.6 m) for about 10 minutes taken as a unit effort.

Post larvae of *P. monodon* were found to occupy very small portion in the total annual catch composition such as 0.02, 0.01 and 0.01 at three sites in Mongla river, respectively. Juveniles of other shrimp species (*P. indicus*, *Metapenaeus monoceros*, *M. brevicornis*, *Palaemon styliferus*, *Macrobrachium rosenbergii*, *M. villosimanus*, *M. dyanus*, *M. dolichodactylus* and *M. rude*, etc.) exerted 18.34% in spot 1, 15.39% in spot 2 and 16.01% in spot 3 of Mongla river. Larvae of fin fishes (*Liza parsia*, *L. tade*, *Rhinomugil corsula*, *Lates calcarifer*, *Setipina phasa*, *Tenualosa ilisha*, *Pangasius pangasius*, *Glossogobius spp*., *Puntius* spp., and *Mystus* spp.) shared 16.70, 15.09 and 15.23% of the total catch in spot 1, spot 2 and spot 3, respectively. Macrozooplankton (*Acetes* sp., Mysids, Isopods, Copepod, Alima, Crab larvae, etc.) showed higher density of 64.94, 69.51 and 68.75% in three sites of Mongla river, respectively. Mahmood (1990) stated that higher density of zooplankton (98.30%) was found in Chakaria Sundarbans followed by Satkhira (97.72%) and Khepupara (97.53%). Moreover, other shrimp and fin fishes occupied only about 2% of the zooplankton community and shrimp (*P. monodon*) post larvae alone contributed a very small quantity to the total annual catch (0.7% in Chakaria and Khepupara, and 1.2% in Satkhira).

Islam *et al*. (1999a) reported that zooplankton recorded in Andermanik river of Patuakhali (53.51%) and Ichamati river (93.19%) as well as Kholpatua river (96.56%) of Satkhira district were also higher than fin fishes and other shrimps. Other shrimps and fin fishes secured 40.60 and 5.28%, respectively in Patuakhali Andermanik river. But these were 5.18 and 1.57% in Ichamati river, and 9.84 and 0.92% in Kholpatua river, Satkhira, respectively. PL of shrimp (*P. monodon*) alone scored the minimal number in both Patuakhali (0.61%) and Satkhira (0.06 and 0.05%) region, which were more or less similar with the present findings.

The catch composition and the extent of damage caused to macrozooplankton and other aquatic organisms as a result of mercilessly harvesting of *P. monodon* PL have been presented in Table 2. It was found that on average in the total relative abundance, *P. monodon* PL contributed only 0.01%, other shrimp species 16.50%, fin fishes 15.62% and other macrozooplankton 67.87%. There are no remarkable differences in yearly catch composition in three spots of Mongla river (Table 1). But in the monthly distribution, higher quantity of macrozooplankton was obtained in August in spot 3 (1520) followed by spot 2 (1400) and spot 1 (1000). The results of the study implied that shrimp seed harvesters killed around 1650 other shrimp species, 1562 fin fishes and 6787 other macrozooplankton for catching a single PL of *P. monodon*. According to Mahmood (1990) for catching only one PL of *P. monodon*, 14 other shrimp spp., 21 fin fishes and 1631 zooplanktons were destroyed in the Chakaria Sundarbans, Satkhira and Khepupara estuaries. The variations in the zooplankton population with the present findings might be due to difference in mesh size of the collection net. Mahmood (1990) used a rectangular nylon net with smaller mesh size (0.5 mm). The mesh size of the net used in the present study was 0.3 mm which is similar to that used by seed collectors. For this reason, smaller zooplankton and other species could not escape through smaller mesh (0.3 mm) of net used in the present study. BFRI (1996) reported that one PL of *P. monodon* was collected at the cost of 356 larvae of other shrimp species, fin fishes and macrozooplankton in the Bagerhat region in 1996. Islam *et al*. (1999b) stated that for catching a single PL of *P. monodon*, the fry collectors destroyed 587 larvae of other shrimps, fin fishes and macrozooplankton in Satkhira region. The tremendous loss of valuable different aquatic organisms was also reported by BOBP (1992) and Khan *et al.* (1988). In addition to, this practice also causes death of huge number of *P. monodon* PL owing to there is every possibility of damaging different appendages of PL and also become stress during collection and transportation, which ultimately causes mortality.

Table 2. Average catch composition (%) of *Penaeus monodon*, other shrimp species, fin fishes and macrozooplankton in the Mongla river.

Major taxa	Catch/unit effort (No.)	Relative abundance (%)	No. of other species damaged for each *P. monodon* PL collection
Penaeus monodon PL	1	0.01	-
Other shrimp species	1,645	16.50	1,650
Fin fishes	1,558	15.62	1,562
Macrozooplankton	6,769	67.87	6,787
Total	9,973	100.00	9,999

Observation on the number of seed collectors/km, length of the river, number of boat and hour of engagement reveals that 0.18 million man days/year were involved in shrimp seed collection activities in Bagerhat district. Funegaard (1986) reported that about 20,000-25,000 people were engaged in shrimp fry collection in Satkhira district while according to Chowdhury (1990) about 75,000 fry collectors were found only in Satkhira district. It was observed that about 6.5 million of *P. monodon* PL were collected in Mongla river in 1998-99. Islam *et al*. (1999b) reported that about 11.60 million *P. monodon* PL were collected in Satkhira in 1996 and it was 18.0 million in 1992 (BFRI 1996), which was higher than the present findings. From the present study, it was also ascertained that 29,988 million of other shrimp species, fin fishes and macrozooplankton were destroyed annually by the shrimp seed collectors in Bagerhat Mongla river, which was much higher than the findings of Islam *et al*. (1999b) who estimated 6809 million of other aquatic organisms in Satkhira. This is very much alarming for the biodiversity of aquatic organisms. The severe impact of shrimp seed collection activities drastically reduced the availability of *P. monodon* from 2,000 shrimp fry/net/day (Funegaard 1986) to only 200 fry/net/day (Alam 1990) in Satkhira district. So, the findings of the above mentioned studies and also the present study reveal that there has been a trend of gradual decreasing in the abundance of other shrimps, fin fishes and other zooplankton larvae in neritic and offshore. This might be associated with over fishing with smaller mesh sized nylon nets and indiscriminate killing of zooplankton and other shrimps that hinder the normal recruitment pattern to the original mother stock. Therefore, appropriate measures should urgently be taken to stop such massive destruction and to grow awareness among the seed collectors to release back the unwanted organisms into the waterbodies without any damage. These initiatives would help to conserve the biodiversity of aquatic fauna and to keep in a congenial environment of coastal as well as marine waters.

References

Ahmed, M. K. 1981. Behundi net fishery in brackishwater area of Satkhira with emphasis on bionomics and mortalities of shrimp. Freshwater Fish. Res. Stn., Chandpur, Bangladesh. *Research Report No*. **3**: 42 pp.

Alam, M. M. 1990. Study on the colossal loss of shell fish and fin fish post larvae for indiscriminate catch of *Penaeus monodon* post-larvae along the coastal waters of Cox's Bazar and Teknaf. M. Sc. Dissertation. Institute of Marine Science, University of Chittagong, Bangladesh. 45 p.

BFRI (Bangladesh Fisheries Research Institute). 1996. Survey and Assessment of Shrimp Fry Resources of Bangladesh-Annual Report. *In*: Research Progress Report (1991-96). BFRI, Mymensingh, Bangladesh (unpublished). 65 p.

BOBP (Bay of Bengal Project). 1992. The estuarine set bagnet fisheries of Bangladesh. *Bay of Bengal News*, Issue No. 47, Madras, India: 1-10.

Chowdhury, M. R. 1990. A study on biological and social aspects of shrimp fry collection in the Sundarbans. *In*: Seminar on Environmental and Policy Aspects of Shrimp Cultivation, BAAS, Bangladesh: 20-29.

Elias, M. S. 1983. Zooplankton of the Mathamuhuri estuaries with special reference to shrimp and fin fish larvae. M. Sc. Thesis, Institute of Marine Science, University of Chittagong, Bangladesh. 172 pp.

Fischer, W. and P. J. P. Witchead (Eds). 1974. FAO species identification sheets for fishery purposes. Eastern Indian Ocean Fishing Area 57 and Western Central Pacific Area 71. Rome, FAO, *Pag-Var*., **1-4**: 99-126 pp.

Funegaard, P. 1986. Shrimp seed any to sell? Come to Satkhira, Bangladesh. *Bay of Bengal News*. **22**: 2-6.

George, M. J. 1969. Prawn fisheries in India, II. Systematics-taxonomic consideration and general distribution. *Bull. Cent. Mar. Fish. Res. Inst.* **14**: 5-48.

Hossain, M. A. 1984. Studies on zooplankton communities of the Mathamuhuri river estuary with special reference to shrimp larvae during south west monsoon. M. Sc. Thesis, Institute of Marine Science, University of Chittagong, Bangladesh. 38 pp.

Howlader, M. S. 1976. A taxonomic account of penaeid shrimp of Bangladesh waters. *Bangladesh J. Sci. and Ind. Res*., **XI** (1-4): 122-138.

Islam, M. S., M. M. Islam and S. U. Ahmed. 1999a. Abundance of *Penaeus monodon* post larvae and effect of post larvae collection on the biodiversity in estuaries of Patuakhali, Bangladesh. *Bangladesh J. Fish*., **22** (2): 35-40.

Islam, M. S., M. M. Islam and S. U. Ahmed. 1999b. Colossal loss of shell and fin fish larvae during collection of *Penaeus monodon* (Fab.) fry in the rivers of Satkhira. *Bangladesh J. Fish. Res*., **3** (1): 107-112.

Khan, M. G., M. S. Islam, Z. A. Chowdhury and S. C. Paul. 1988. Shrimp resources of Bangladesh-four stages of its exploitation and their comparative effect on the stock. Marine Fisheries Survey, Management and Development Project, DoF, Bangladesh. pp. 1-12.

Mahmood, N. 1990. An assessment on the quantum of damage caused to the zooplankton while fishing tiger shrimp *Penaeus monodon* fry in Bangladesh estuaries. *Proc. Seventh Zool. Conf. Bangladesh*. pp. 87-94.

Motoh, H. and P. Buri. 1980. Identification of the postlarvae *Penaeus* (Crustacea, Decapoda, Penaeidae) appearing along shore water. Aquaculture Dept. SEAFDEC, Trigbaun, Iliolio, Philippines, *Res. Rep*. **4** (2): 15-19.

Muthu, M. S. 1978. *Larval development: Specific identity of penaeid postlarvae found in brackishwater areas in coastal aquaculture*. *In*: Marine Prawn Culture, Part-1: Larval development of Indian penaeid prawns (ed. KNK Kartha). *CMFRI Bulletin*, **28**: 86-90.

Nuruzzaman, A. K. M. 1992. *Shrimp culture in Bangladesh*. Bangladesh Agricultural Research Council, Farmgate, Dhaka, Bangladesh. pp. 1-42.

Rahman, S. L., M. M. Islam, M. E. Hoq, G. C. Halder and S. U. Ahmed. 1997. A study on damage caused to crustacean and fin fish larvae during collection of *Penaeus monodon* (Fab.) post larvae in the estuaries of Barguna, Bangladesh. *Bangladesh J. Fish. Res*., **1** (1): 41-46.

(Received revised manuscript on 25/11/14)