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Survey of *Penaeus monodon* Post Larvae in Semi Saline Zone of Kholpatua River of Satkhira Near Sundarbans Reserved Forest Bangladesh

Rajib Hasan, Sharmin Akter Nipa, M Niamul Naser and Harun Or Rashid
Department of Zoology, Department of Biological Sciences, University Of Dhaka, Dhaka 1000, Bangladesh

Abstract: This study monitored the present status of *Penaeus monodon* post larvae (PL.) of Kholpatua river in Satkhira. The survey was conducted in Kholpatua river from January 2014 to December 2014 and was compared with the ten years old secondary data. The results showed that there was a 41.57% decrease in number of catches of *P. monodon* PL. over the course of time from ten years ago to the year of 2014. Although the number of active fishermen's boats have increased from 250 to 360 in ten years. The study also showed that the severe shrimp seed collection activities reduced the availability of *P. monodon* PL. at Satkhira district, which has a severe negative impact on the availability of total catches. To control such decrease of *P. monodon* PL. in Bangladesh, more intensive study should be done.

Key words: *Penaeus monodon* post larvae, wild collection, catch availability.

1. Introduction

Penaeus monodon is one of the most important shrimp species currently being cultured commercially in many countries, especially in Southeast Asia [1-3]. It has attracted attentions for aquaculture studies because of its high survival and good growth rate [4].

Bangladesh has a number of marine shrimp species suitable for culture. Of these, the black tiger shrimp (*P. monodon*) locally known as Bagda chingri, is the most popular one due to its high value in national and international markets. The wild post larvae (PL.) of *P. monodon* are major seed source for shrimp aquaculture in Bangladesh. The high demand for *P. monodon* PL. and low investment but high returns have encouraged thousands of coastal girls, men and women of low income groups in shrimp fry collection. Observation on the number of seed collectors, length of the river, number of boats and hours of engagement reveals that 0.53 million men days/year were involved in shrimp seed collection activities in Khulna district [5]. Extensive sampling has shown that juvenile penaeid prawns are often highly abundant in mangrove habitats [6-8]. Considering the high abundance of *P. monodon*, the Kholpatua river, located in the semi-saline zone, followed by the rivers of the freshwater zone (Passur, Sibsa and Koyra rivers) along the Sundarbans had been focused in this study.

The rapid expansion of coastal aquaculture in Bangladesh, coupled with a trend towards shrimp monoculture, has resulted in a tremendous demand for the seed of tiger shrimp, *P. monodon*. But a paucity of shrimp hatcheries has attracted thousands of coastal fisher folks to collecting *P. monodon* PL. from Sundarbans and nearshore waters, causing destruction of non-target species and damage to nursery grounds [9].

2. Material and Methods

The study area was located in the Shyamnagar Upazila under Satkhira district, the south-western part of Bangladesh (Fig. 1). Area of the Shyamnagar

Corresponding author: Rajib Hasan, research assistant, main research fields: aquatic ecology and conservation biology.

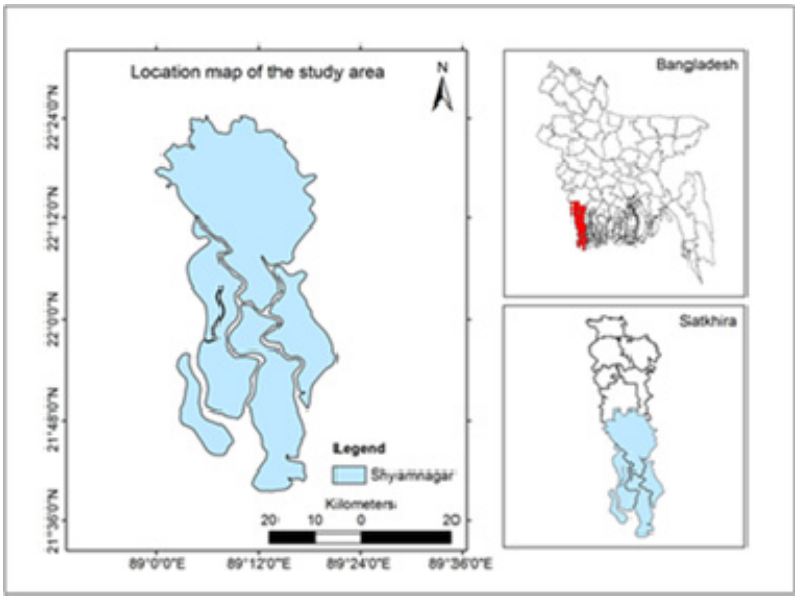

Fig. 1 Map showing the study area of Shyamnagar upazila of Satkhira.

upazila is about 455.31 sq. km. (1,903 sq. km. with Sundarbans). Shyamnagar upazila consists of 12 unions and there are about 364,922 people live within the upazila [10]. (Source: Upazila Parishad). Kholpatua river was focused to conduct this study. A survey was conducted in about six square kilometers area of the Kholpatua river from January 2014 to December 2014. The study area was between latitude 22°13'59.50" to 22°15'54.62" North and longitude 89°14'13.20" to 89°15'02.09" East. Data was collected from 40 fry collecting boats within the selected study site. The interview was taken from those fry collectors who had engaged with this work for the last 10 years. They were asked about the status of fry collection about ten years ago comparing with the catch and boat number in 2014. The Participatory rural appraisal tools like observations, seasonal calendar and trend analysis were used for data collection. Secondary data were also collected from upazila parishad. In order to delineate the trend of catches of over the courses of times and condition, data analysis were conducted using Microsoft excel.

3. Results

The present study surveyed total 40 fisher folk boats of Kholpatua river of Shyamnagar upazila who were completely dependent on the fisheries resources of the Sundarbans and who were actively involved with the *P. monodon* PL. collection. The study found that there were 360 active fry collector boats in 2014. The total catch from the studied 40 boats was 499,638 in 2014, where the mean catch or catch per boat per year was 12,490.9 ± 2,936.9. But there were only 250 fry collector boats available in ten years ago and the total catch in ten years ago was 855,100. The mean catch was 21,377.5 ± 4,962.87 in ten years ago (Table 1).

The study reveals that there was a 41.57% decrease in the number of catches of *P. monodon* PL. over the course of time from ten years ago to year of 2014. Although the number of boat has been increasing over the years, the total catches have decreased alarmingly.

The catch of *P. monodon* PL. were higher at high tide than the catch at low tide ten years ago, as well as in 2014 (Figs. 2 & 3).

There were 80,015 ha of Bagda shrimp area in 1992, mostly concentrating on Rampal and Paikgacha Upazila. After 1992, the practice of Bagda shrimp farming increased dramatically, and a big amount of fallow land (95,000 ha) was converted to Bagda areas (Table 2) [11].

Table 1 Comparison of total catches of *P. monodonn* PL. in 2014 and ten years ago.

No of boat surveyed	Total catch in ten years ago	Mean catch in ten years ago (Mean ± SD)	Total catch in 2014	Mean catch in 2014 (Mean ± SD)
40	855,100	21,377.5 ± 4,962.87	499,638	12,490.9 ± 2,936.9

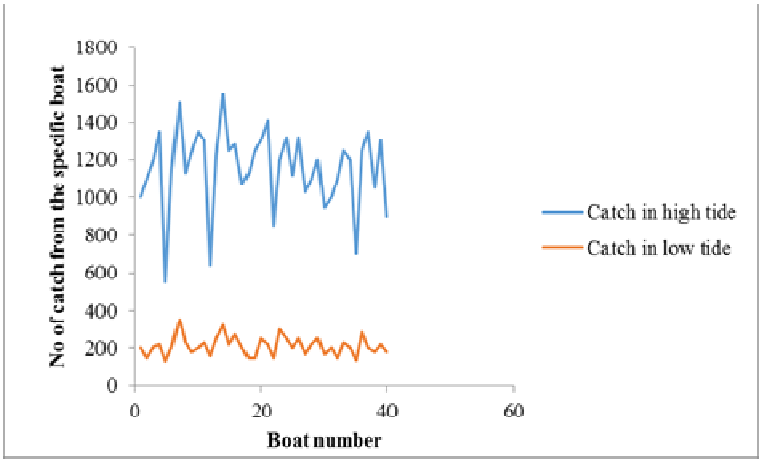

Fig. 2 Comparison of catches of *P. monodon* PL. at high tide and low tide at ten years ago.

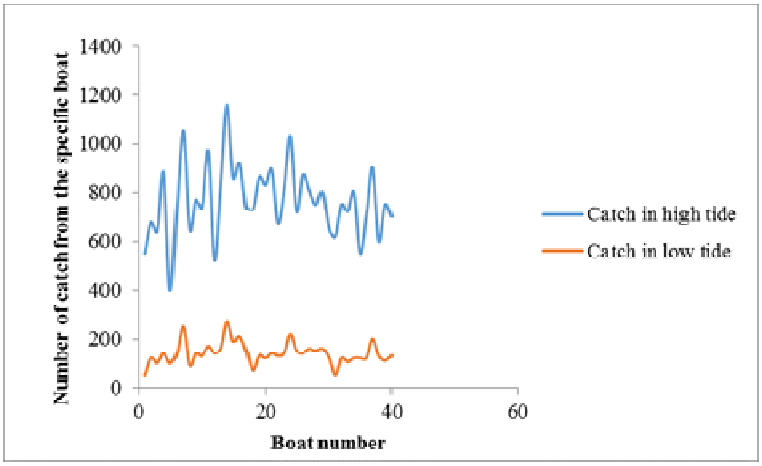

Fig. 3 Comparison of catches of *P. monodon* PL. at high tide and low tide in 2014.

A total of 175,331 ha of land were under Bagda farms in 2001 and spreads other adjoining Upazila such as Shyamnagar, Assasuni, Dacope and Koyra. From 2001 to 2005, Bagda farms kept increasing but obviously in a reduced pace. In 2005, the total area under Bagda farming was about 187,644 ha [11] (Fig. 4).

4. Discussion

Availability of *P. monodon* PL. was significantly ($P < 0.05$) reduced in 1995 and 1998 compared to that in 1992 in all rivers except Kholpatua. In Kholpatua river, abundance of *P. monodon* PL. declined in 1995, but increased in 1999. Occurrence of other shrimp spp. and finfishes were comparatively low in Kholpatua river in 1995 [9]. Studies also showed that *P. monodon* fry collection was in peak during 1993-94 to 1996-97 [12].

The larvae of *P. monodon* became available during January to March while salinity gradually increased. On the other hand, abundance of other shrimp species at all sites was found to be increased during the months of July to December with the maximum number recorded in September and November at all sites [5].

Table 2 Bagda shrimp areas in three different years.

Upazila name	1992	2001	2005
Shyamnagar	3,750	22,401	23,612
Assasuni	4,298	18,243	21,651
Paikgachha	14,195	19,733	21,006
Kaliganj	2,250	14,488	16,117
Rampal	15,658	15,792	15,960
Dacope	7,507	15,206	15,456
Morrelganj	3,277	15,137	15,147
Mongla	9,283	12,567	12,858
Debhata	5,793	10,442	11,436
Koyra	196	7,501	8,788
Dumuria	2,812	7,092	7,494
Bagerhat Sadar	3,836	4,835	4,840
Batiaghata	2,570	4,143	4,394
Satkhira	1,166	3,192	3,807
Tala	740	3,270	3,740
Kachua	352	1,054	1,066
Sarankhola	0	1,47	172
Fakirhat	2330	89	99
Total	80,015	175,331	187,644

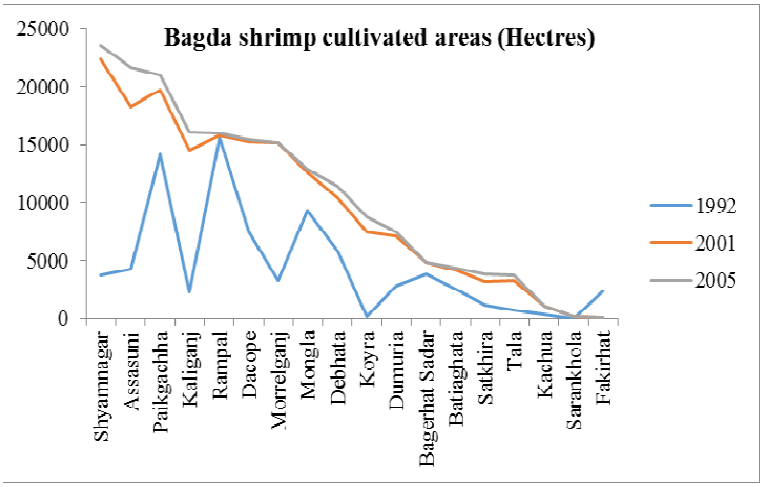

Fig. 4 Upazila wise Bagda shrimp areas in three different years [11].

Generally, *P. monodon* PL. was abundant from October to February, associated with moderate salinity. A major peak in abundance did not occur, however, during our study years. This decline of *P. monodon* PL. from 1992 to 1999 is a potential threat to their future. In winter and premonsoon, two peaks for penaeid recruitment and settlement has been observed at average salinity and high temperature [13, 14]. A similar trend was found in the present study. However, in another study the density of penaeid post larvae was found to be highest in July at high salinity and lowest in March in estuarine waters near Sundarbans [15]. *P. monodon* PL. is available year-round, but its abundance is limited when required for stocking in coastal aquaculture ponds. Water temperature in the studied five rivers was negatively correlated with *P. monodon* PL. abundance. However, it was positively correlated in Sibsa, Kholpatua and Madar rivers only for the 4 times. Salinity have positive, in some cases significant, correlation with PL. abundance [9].

It was recorded that about 59 million *P. monodon* PL. were collected in the water of Khulna estuaries in 1998-99. The severe impact of Shrimp seed collection activities reduced the availability of *P. monodon* from 2000 at Satkhira district. From the ecological point of view, it is necessary to consider this waste which occurs during Bagda chingri (*P. monodon*) fry collection. About 384 larvae of other shrimp species, 208 finfish and other macro zooplankton were destroyed during the collection of only one PL. of *P. monodon* [16].

In September 2000, the Government of Bangladesh imposed a ban on wild fry collection. The lack of alternative livelihoods for PL. collectors is one of the principle constraints on implementing any policies, laws and/or regulations toward the development of a sustainable resource use strategy as well as conservation effort for the wise use of the marine, coastal and estuarine resources of Bangladesh [17]. For this, in February 2002, the Government placed the enforcement of the fry collection ban into abeyance pending further review of how the resource and biodiversity could be conserved at the same time as protecting the livelihoods of 300,000 fry collectors [18].

Shrimp seed supply is the main input of shrimp farming. At the initial stage shrimp fry from wild sources was only the source of this input with the expansion of the shrimp farms. The demand of fry increased very rapidly depending on the hatcheries for artificial PL. production. On the basis of this demand, shrimp fry collection from the wild sources has now become a popular occupation. The majority of the fry collector in the study area possesses some land property and homestead pond and they are also interested in taking aquaculture and agriculture as their alternative livelihood options [19].

It is estimated that 10 kg of fish and shrimp larvae are destroyed by the collection of every 1 kg of tiger shrimp PL. in the Sundarbans of West Bengal, India [20]. In Bangladesh, up to 5,000 shrimp PL. may be wasted for every 100 marketable shrimp PL. captured by collectors [21].

The results indicate that the recruitment of other shrimps, finfishes and macro-zooplankton components of the aquatic food chain will severely decline within the next few years as the consequence of extensive *P. monodon* PL. collection. It is essential that the shrimp post larvae reach the small creeks and brackish waters of the estuaries to find their shelter and food. The recruitment of shrimp in the deep sea is directly dependent on the survival of these juveniles in the mangrove nursery grounds. If these are reclaimed and/or juveniles are captured, this will negatively reflect on the adult population. This scenario will also apply to finfish larvae, indiscriminately exploited with the targeted *P. monodon* PL. with disastrous effects on artisanal and commercial fisheries in the near future [9]. Overfishing and over-exploitation of plant and wildlife species are placing great stress on the viability of this ecosystem.

5. Conclusion

Coastal aquaculture in Bangladesh is a promising area of development for increasing shrimp production, providing more employment opportunities and improving the economic condition of rural people in coastal belts. It may be mentioned that the wild post-larvae of 'Bagda' (*P. monodon*) are still the only major source of shrimp seeds for stocking. The demand for 'Bagda' post-larvae also increased the fishing pressure for its collection from rivers and shore water [22]. The number of fry collectors is found to be increased considerably during the last ten years with corresponding increase in fishing effort whereas the volume of fry catch reduced [12].

At present, overfishing already occurs in some species and many other species are at risk. There is a need for the introduction of hatcheries and a strict regulation on the mesh size of nets, the release of unwanted species back to the water, and improved methods of preserving live *P. monodon* PL. to reduce

the post-harvest mortality. Measures to regulate the SRF fishery by the introduction of closed seasons and protected zones should be considered. The migration of fish and crustaceans from protected areas to the overfished waters could help the fishery to be sustained. Regulation of size at first capture and mesh size should be enforced by random inspection. The size of the fishery should be controlled by limiting the number of weekly gear licenses issued [9].

It is high time to take necessary measures to stop such indiscriminate destruction of the wildlife during *P. monodon* PL. collection for the sake of biodiversity conservation, as well as, the natural productivity of the estuarine environment.

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