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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Feasibility Study on the Culture of Mud Crab *Scylla serrata* in the Mid Coast Region of Bangladesh

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Abstract: A study was conducted at Hatiya and Nijhum Island, Noakhali in the mid coastal region of Bangladesh to identify feasibility of mud crab culture for a study period of six months from January 2010 to June 2010. Data were collected through questionnaire interviews, focus group discussions and cross check interviews. Average yearly collection of mud crabs in this area was about 890.36 tons where lower grade crabs 45.16% and these can be brought under culture practice. It has observed that saline water intrusion was evident 670 Ha. In Hatiya and vast inundated area with saline water was found in Nijhum Island. Overall water salinity range was between 2-10 ppt., pH range of 7.8-8.6 and the soil was silt-loamy. The average temperature of the last three years was approximately 26.10°C and rainfall was almost 10.85 mm. It was observed that natural feeds were available in this study area and there was existed a small potential marketing channel with 3-4 middlemen. Also there was a good transportation system both water and road way. So, present study revealed that the area is suitable for crab culture during April to October.

Keywords: Mud crab, mid coast of Bangladesh, salinity, pH, silt-loamy soil

INTRODUCTION

The mud crab is widely distributed in the Indo-West-Pacific region from Hawaii, Southern Japan, Taiwan and the Philippines to Australia, Red Sea and East and South Africa (Motoh 1979; Dai and Yang, 1991; Macintosh *et al.* 2002). There are 15 species of crab available in Bangladesh, among them 4 species inhabit fresh waters while the remaining 11 species inhabit marine waters (Ahmed, 1992). Mud crabs occurs throughout the coastal districts of Cox's Bazar, Chittagong, Noakhali, Bhola, Patuakhali, Bagerhat, Khulna and Satkhira in Bangladesh (Khan and Alam, 1991). Considering the increasing demand of mud crab in the local and international markets, it has been gaining popularity among the coastal communities in mid-coastal regions of Bangladesh. China, USA, Japan, Korea and Thailand are ranked as the top five biggest consumers of crab (Brein and Miles, 1994). Female crabs especially are playing an important role in marketing, particularly in Asian countries such as Japan, Taiwan, Hong Kong and Singapore (Keenan, 1999; Agbayani, 2001). Also, there is a growing market for mud crab meat as a value added product and for frozen soft-shelled mud crab in the USA (Keenan, 1999; Wickins and Lee, 2002).

Crab culture implies (1) rearing of young crabs in large farms and (2) fattening of post molt 'water crabs' to attain marketable sizes. Worldwide crustacean aquaculture mainly represents culture of shrimp and lobsters. But in recent decades crab culture particularly the culture of mud crab, *Scylla serrata* has received the most attention because of its market demand, high flesh content and rapid growth rates in captivity. However, it has been limited due to the often low and unpredictable larvae survival. This may be due to inadequate nutrition disease "molt death syndrome" and sub-optimal environmental conditions or a combination of all. So, to understand the culture potentiality of mud crab in mid-coast region of Bangladesh, this study has been undertaken. The objectives of this research are:

- To know the availability of mud crab in the research area
- To examine the meteorological characteristics (temperature, humidity, rainfall) of the research area
- To examine the soil quality (soil type, water stability) of the research area
- To examine the water quality parameter (salinity, pH) of the research area

MATERIALS AND METHODS

The research work has been done by collection of primary data from individual fisherman, fish traders, boat owners, Upazilla Fisheries Officer, local Chairman. Some meteorologists were involved in the design of the survey for the present study.

Site selection: In the southern part of the Noakhali district, where developed many scattered char area and those could be the resourceful area for crab collectors, especially for Mud crab. There are nine Upazilla in Noakhali district where Subarnachar Upazilla and Hatiya Upazilla including Nijhum Island are the lower portion of this mid-coastal region. The availability of crab in this area and the involvement of the coastal people inspired to conduct such a study. Moreover crab culture could contribute in countries foreign exchange. In this point of view, study was conducted at Noakhali district in the mid coastal region of Bangladesh.

Design and test of questionnaire: A questionnaire was made first to know the abundance of the mud crab of different size range, the collection site, a gross survey on trading system of crab, number of involved fisherman with crab collection and crab marketing system. It was made on the assumption that crab farming is not yet practiced here and only collected grade sized crab is used to transport in distant market. This questionnaire was also contained questions to local coastal people to know about the water stability of the soil, average rain fall pattern, land wise salinity intrusion of the survey area, local perception about crab consumption and culture and the available culture practices that are usually done here. So this questionnaire was only developed for the crab collectors, aratders (depot owners), coastal residents, other villagers and important reliable person of the society.

Data collection: A survey was conducted to collect data in the selected area within January 2010 to June 2010 in Hatiya Upazilla, Nijhum Island and Subarnachar Upazilla. About 90 people were introduced in different location. To conduct the survey it was found that some people were already trying to do this culture practice with their little knowledge especially those who are engaged in crab culture such as depot owners, suppliers.

Questionnaire interviews: For questionnaire interviews, simple random sampling method was followed for 45 crab collectors, crab fatteners, fishermen, fish traders and

owners of fishing boat in Chairman Ghat, Gazi kalur Ghat, Tomuruddin Ghat, Sonadia Ghat, Char Iswar Ghat, Jahajmara Ghat, Char King, Das Para Bazar, CDSP Bazar and Ochkhali Bazar, where they were interviewed at their working area. Different person took different time period to complete their interview.

Focus group discussion (FGD): For the present study, participatory rural appraisal (PRA) tool such as, Focus Group Discussion (FGD) was conducted with fishermen. FGD was used to get an overview of abundance and availability of crab species, total amount of crab catch, seasonal variation of catch, market demand and also discussed existing marketing systems. FGD held when fishermen were free and there was spontaneous gathering. That was a tea stall along with Nolchira Ghat. Another FGD was held in Nijhum Island (locally called Nijhum Dwip).

Cross-check interviews: Cross-check interviews were conducted with key persons such as five school teachers, five local leaders, two Upazilla Meteorological officers (UMO), two Upazilla Fisheries Officers (UFO), District Fisheries Officer (DFO) and relevant NGO workers for confirmation of the relevant information. The UMOs provided specific data about average temperature, average rainfall and average humidity of the last three years. The interviews were conducted in their offices.

Data processing and analysis: The collected data were summarized carefully before actual tabulation. Some of the data were collected into local units and these data converted into international units. Preliminary data were compared with computer spread sheets to ensure the accuracy of the data. After data entry, "Microsoft Excel" and "SPSS" (Statistical Package for Social Science) computer was used to perform descriptive statistical analysis of data.

RESULTS

Zonation of study area (according to soil salinity)

Slightly saline: This ranges from 0 to <4 ppt. These are upper portion of coastal districts. In entire Noakhali this only found in its northern trip.

Slightly to moderately saline: This ranges from 4 to 8 ppt. Begumgonj sub-district, Senbug sub-district, part of Noakhali Sadar, Western part of Hatiya Island and part of Companygonj sub-district constitute this region.

Table 1: Yearly average meteorological condition of the study area

Month	Average temperature (°C)		Average rainfall (mm)
	Min.	Max.	
January	16.35	25.00	0.16
February	14.30	26.50	0.34
March	20.65	31.33	0.51
April	24.56	33.63	0.96
May	25.65	33.43	1.80
June	25.45	28.20	45.48
July	25.88	30.15	36.90
August	25.93	31.45	17.53
September	26.25	33.20	21.00
October	23.18	32.70	5.50
November	19.10	30.13	0.00
December	16.45	27.13	0.00

Table 2: Water resources in study area

Type	No.	Area (ha.)
River	3	30800
Canal	185	970
Flood plain	5	800
Coastal shrimp farm	4	3
Hatchery	3	
Pond	1011	

*Sources UFO office, Hatiya

Moderately to highly saline: It ranges from 8 to 15 ppt. Southern part of Noakhali Sadar subdistrict, Companygonj sub-district and Feni district constitute this region.

Highly saline: These criterions include the areas having soil salinity rise higher than 15 ppt. Eastern part of Hatiya Island and Nijhum Island fulfill this criteria.

Soil quality: It was observed that, the soil quality of the study area was sandy, sandy-loamy, silty-loamy. The soil was free from NH_3 and the amount of organic materials was 5-15%.

Meteorological condition: Meteorological information of the study area was obtained from Hatiya Weather Office. It contained information on monthly minimum and maximum average temperature, average rainfall (Table 1) of the year round.

Water sources: A thorough investigation was done to find out the water resources of the study area (Table 2).

Water quality: The study area was abundant with good quality water. Various water quality parameters were observed as follows:

pH: pH parameters were collected from various locations from the study area (Fig. 1). It showed a variety of range. pH meter was used to measure the water pH.

Table 3: Water salinity ranges in different location in study area

Location	Salinity (ppt.)	Average salinity (ppt.)
Char amla	3-4	3.5
Dashpara, Hafajia bazar	0-2	1.0
Char ishwar	3-4	3.5
Bangla bazar	3-4	3.5
Burirchar	0-2	1.0
CDSP bazar, Jahajmara	7-8	7.5
Tuhin market, Nijhum dwip	8-9	8.5
Lama bazar, Nijhum dwip	9-10	9.5

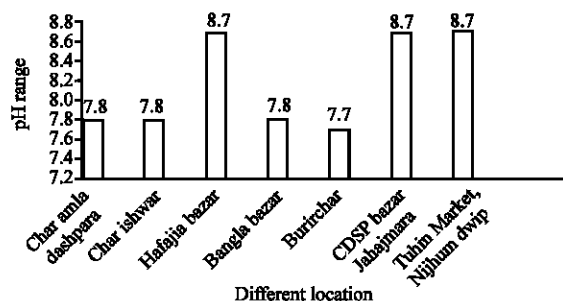


Fig. 1: pH ranges in different locations of study area

Salinity: Saline water was collected from various locations from the study area (Table 3). It showed a variety of salinity range. Refractometer was used to measure salinity.

Present status of mud crab collection: In present, mud crabs are usually collected by crab collectors in Hatiya Island and Nijhum Island. They are not permanent collectors of crab. They are usually fishermen and engaged in part time crab collection. The peak harvesting season from mid to late monsoon (June-August), early monsoon (April-May) and early post monsoon (September-October) are seasons of modest harvest. They collected crabs from newly developed char area. As there was no demand for crab lings because lack of culture system and they usually collected only grade sized mud crab. The average yearly collection of crab in weight is given in Table 4.

A Table 5 show the yearly collection of higher and lower grade crabs in tons and (Fig. 2) also relative percentages. This help to give an accurate estimation of the total collection of crab in this area along with the percentage of male and female collection in Hatiya and Nijhum Islands.

Availability of feed: It was found that, the physical water bodies (pond, canal, emerged rice fields) of the area contained tilapia, shrimps, bivalves, soft shelled snails, mussel and animal entrails. From market analysis, trash fishes, offal etc. has been observed.

Availability of crab lings: It was observed that, local fishermen collected crab lings from natural sources. There

Table 4: Yearly average collection of crab in different grade in different market

Market Name	No. of Depots	Male grade crab	Collection (average wt. kg per year)	Female grade crab	Collection (average wt. kg per year)
Hatya Island	Dashpara	XXL	8789.52	FF1	8520.12
		XL	27334.10		
		L/LM	11593.30	F1	3008.50
		M/MM	5262.10		
				F2	8487.71
				F3	3736.81
		SSM	5656.80		
		XXL	25228.53	FF1	18560.62
	Bangla Bazar, Sonadia	XL	79013.30		
		L/LM	34779.30	F1	1032.80
		M/MM	16223.70		
		SSM	22205.68	F2	30226.20
	Sefu Market	SSM	14972.00	F3	14208.60
		XXL	17623.60	FF1	15220.27
Nijhum Island	Burirchar	XL	52336.20		
		L/LM	11362.24	F1	5280.2
		M/MM	15320.24	F2	20520.0
		SM	10250.70		
		SSM		F3	72125.0
		XXL	19232.50	FF1	14114.5
Tuhin market and Lama market	2	XL	50112.20	F1	6310.2
		M/MM	8210.30	F2	25120.0
		SM	14310.20	F3	70210.0
		SSM	12121.70		

Table 5: Higher and lower grade male and female weight (Tons) per year

Crab	Higher grade male	Lower grade male	Higher grade female	Lower grade female	Total
Weight (Tons)	363.748	154.1	128.147	244.363	890.357

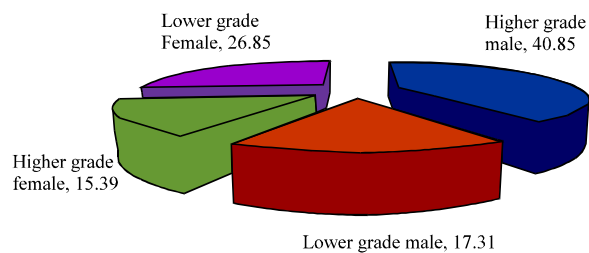


Fig. 2: Relative percentages of yearly collection of male and female crabs

were huge amount of physical water bodies from where crabs can be collected for culture.

Transportation: The transportation system of the study area was observed and it was found that, main transportation systems of the area were road and river. It has a good communication with other parts of the country.

Mud crab marketing system: In crab marketing systems, there were a number of middlemen involved in the study

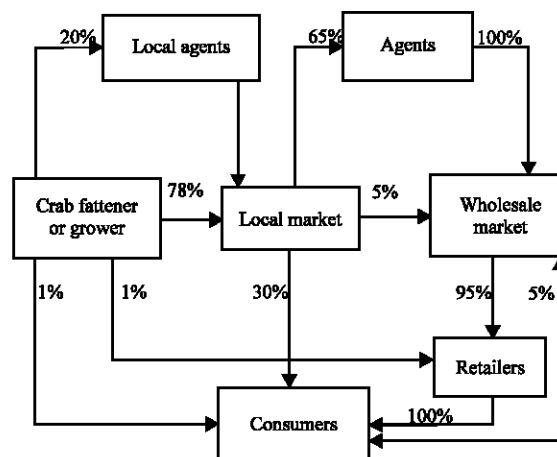


Fig. 3: Crab marketing channel in study area

area. The market chain from fatteners to consumers passes through a number of intermediaries: local crab agents, agent, wholesalers and retailers (Fig. 3).

DISCUSSION

Hatiya and Nijhum Island situated in Noakhali district that is in the mid coastal region of Bangladesh. From survey, about 890.36 tons of crabs were collected per year. So crab abundance is much higher. Ahmed (1992) also reported that mud crabs are found in coastal region of Noakhali.

From my study, found that the water salinity in east and west part of Hatiya Island showed moderate salinity range of 3-4 ppt., south of Hatiya and Nijhum Island showed higher salinity range of 7-10 ppt. Bhuyian and Islam (1981) found mud crabs are extremely tolerant of salinity variation and can survive in a salinity range of 2 to 50 ppt. Khan and Alam (1991) found that, *Scylla serrata* is distributed over a wide range of salinity, from 2 ppt. to oceanic waters.

The water pH was measured from same location where saline water sample were collected. The results showed the pH range of 7.8 to 8.6. Cholik and Hanafi (1988) recommended pH 7.5 to 8.5 for crab culture practice.

From my study, average temperature found in Hatiya and Nijhum Island about 23.18°C to 33.6°C in April-October and 14.3°C to 30.1°C in November to March. Cholik and Hanafi (1988) reported that, temperature 26°C to 31°C were generally acceptable levels for mud crab culture. Bhuyian and Islam (1981) found that mud crabs are extremely tolerant of temperature variation that is 12°C to 35°C.

From my survey, rainy season occurred at June-September, winter at November-December and April to October was the suitable season for crab culture in this area.

From study area, it was found that, the physical water bodies of the area contained tilapia, shrimps, bivalves, soft shelled snails, mussel and animal entrails. Ahmed (1992) reported that, crab food is usually raw, fresh and consists of crushed fish, small crabs, oysters, mollusks, shrimp or fish heads.

In the Hatiya and Nijhum Island, there was a potential marketing system found, that was started from crab collectors and closed to exporters. Also a good transportation system was found both water and road way.

Abundance of mud crabs in this area was quite well and feeds for crabs were also available here. All the meteorological condition such as soil quality, pH, salinity, temperature was suitable for crab culture in the month of April to October. With providing adequate training and technical support by the government and NGOs, this area could be one of the potentially important crab culture areas in Bangladesh.

CONCLUSION

Besides shrimp we also export some fisheries product from Bangladesh. Mud crab is one of the prominent fisheries products in Bangladesh. No doubt, the greatest challenge of Bangladesh is to combat the prevalent malnutrition almost 90% of the people. To overcome this problem it is necessary to supply protein rich diet to the people. Fisheries items are the major protein contributing source of Bangladeshi people where mud crab is one of this.

However all the facilities were available here for crab fattening practice in Hatiya and Nijhum Island and some occasional crab fatteners already engaged themselves in fattening practices without proper maintenance of the farm. Although survival rate is high enough, that is near 70%, due to adequate feed supply.

ACKNOWLEDGMENTS

I would like to express my heartfelt gratitude to my honorable teacher, Md. Rakeb-Ul Islam, Chairman, Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali for his supervision, guidance and enthusiastic encouragement throughout the entire period of research work and in

preparation of the thesis. Also give thanks Mr. Abdul Matin, Chairman, Hatiya Upazilla, Noakhali.

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