

Socio-economic condition of crab fatteners in Rampal Upazila of Bagerhat

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ABSTRACT

The present investigation was carried out to assess the mud crab fattening system and the socio-economic condition of crab fatteners. The survey was conducted during October to November 2017 in Rampal Upazila under Bagerhat district. Data were collected through survey of randomly selected 40 crab fatteners through questionnaire interview and focus group discussion. It was reported that the peak fattening season of male crab was in dry season (October–May) whereas the peak fattening season of female crab was in wet season (June–September). In the study area, fatteners usually used 95 gm-215gm crab seed for fattening. The average stocking density was 67pieces/ decimal. About 25% fatteners used tilapia feed for stocked crabs. Fattening is usually done for 2-4 weeks. The average production was 14.36 kg/decimal and net benefit was 15,230 TK/Yr/decimal according to the cost–benefit analysis. There were 30% crab fatteners were belongs to the age group of 41-45 years, who were the main working force in the society. Among the fatteners 67% were Hindus. Forty two percent (42%) of crab fattener's monthly income range was BDT 16000-30000. In the study area, 45% fatteners were found to live in tin shed house and only 27% of fattener used pacca toilet. The 35% of the crab fatteners were up to class 10 pass. Fifty percent fatteners were depends on upazila health complex for their treatment. Most of the crab fatteners take loan from the money lender. According to the survey, most of the crab fatteners increased their income level through crab fattening but housing and sanitary condition was not developed proportionate to the income. Crab fattening is gaining popularity day by day because it is a very easy, profitable and takes less time. However, the fatteners are still practices old fattening system. It is needed to introduce recent update system and feeding system following other countries.

INTRODUCTION

Bangladesh is also one of the leading aquaculture producing countries in the world. Fortunately, the perpetual sea-level rise and salinity intrusion is making the coastal waters of this area economically and environmentally feasible for coastal aquaculture. Among the edible shrimps, lobsters and crabs, the large-clawed mud crabs are considered as one of the important seafood items for aquaculture in South-West coastal region of Bangladesh due to their esteemed delicacy, medicinal value and demand for local and export trades (Ali et al, 2004)

Recently the mud crab (*Scylla olivacea*) has emerged as a potential aqua species in the coastal arena of Bangladesh. Farming of mud crab is progressing rapidly due to a promising market

value and profitability. In domestic market, mud crab is much demandable and fetches a good price compared to other crab species due to its excellent meat quality.

The mud crab (*Scylla olivacea*) is very common in estuaries and mangrove swamps throughout the Indo-pacific region as mangrove associated fauna. It is a euryhaline, bottom feeder, invertebrate belongs to the family Portunidae, class of Crustacea. They have ten legs so they are called decapods. Most species of crabs are marine but a few are freshwater. They can tolerate a wide range of salinity as well as temperature. Crabs can exchange their views with making and feeds in slow moving and sessile benthic invertebrates and prefers small crabs (mainly grapsid), bivalves and detritus (Prasad et al., 1985; Christopher, 1992). It is also a voracious predator of young fish and

prawans (Azom et al., 1998). Mud crab is nocturnal in behavior, remaining buried during the day time and emerging at night (Christopher, 1992). However, it can't prey fast moving one (Hill, 1976).

The mud crab (*Scylla olivacea*) is an important species of the class crustacean under the phylum arthropoda. Sixteen species of crabs have been so far reported from Bangladesh waters, of which the common ones are *Scylla serrate*, *Portunus pelagicus*, *Portunus sanguinolentus*, *Charybdis feriata*, *Charybdis rostrata*, *matulalunaris*. *M. planipes*, *Clappalophos*, *C. pustulosa*, *Varuna litterata*, *Sartoriana spinigera*, *Ocypoda cratophthalma*, and *Gelasimus annulipes*. The six important genera used as food crabs are *Scylla*, *Portunu*, *Charibdis*, *Matuta*, *Varuna* and *Sartorina*. Most of these species are economically important but the serrated mud crab, also known as mangrove crab or *Scylla olivaceae* is now the most commercially important species and is widely distributed in the Indo-pacific region, including the Bay of Bengal.

The genus of crab *Scylla*, commonly referred as mud crabs, are commercially important with an Indo-Pacific distribution. Mud crab is locally called as "Shilakankra", "Habbakankra", "Kankra". It is commonly known as "green crab" or "mangrove crab". It is available in brackish coastal waters and estuaries and has a great potential for aquaculture. Crab culture and fattening are however, still in the experimental stage in South Asia (Samarasinghe et al., 1992). The importance of live mud crab as an export commodity has opened up great opportunities for crab fattening. Considering the increasing demand of mud crab in the local and international markets, it has been gaining popularity among the coastal communities in greater Khulna and Chittagong regions (Azom et al., 1998).

In Bangladesh, crab fattening in ponds was started in early 1990's (Kamal, 2002), while fattening and culture of mud crab in bamboo cages, pens, and pots only at experimental level and started at early 2000's (Kamal, 2002). Salam, et al. (2012) conducted a research on crab culture potential in South-Western region as the alternative to shrimp culture for climate change adaptation using GIS

(Geographical Information System) tools in Bangladesh.

Rampal Upazila under Bagerhat district is one of the leading areas of crab production in Bangladesh. The present study was undertaken to know about the fattening practice of mud crab in Rampal Upazila and to know the socio-economic condition of crab fattener in Rampal region. The study focused on the crab fattening system and with particular attention to socio-economic condition of crab fattener a wide range of data was collected to that effect.

MATERIALS AND METHODS

Study area

Most of the crab farms are located in south - western part and Chittagong region in Bangladesh. Khulna is a renowned district for shrimp culture. Beside shrimp culture, crab culture also practices in this region. A good number of farms are located and considerable numbers of people are involved for mud crab (*Scylla olivacea*) fattening. There are huge number of tidal canals and availability of huge number of crab trading shops (depots) from where seed crabs could be purchased daily. Communication facilities also well as fattened crabs could be sold in shorter time. Therefore Rampal Upazilla in Bagerhat district was selected for the present study.

Study design

A pretested questionnaire was developed by consulting with relevant experts and literature. In the pilot survey, much attention was given to any information from the people, which was not designed to be asked but was important and informative towards the objectives. Finally a well-defined complete questionnaire was prepared through the experience gained from the pilot survey.

Data collection methods

In order to collect relevant information, interview technique was followed. For the study a combination of questionnaire interview, Participatory Rural Appraisal (PRA) tool such as

Focus Group Discussion (FGD) and cross-check interviews with key informants were used.

Questionnaire interview

A total of 40 people from different location of fattening dominancy union at Rampal Upazilla in Bagerhat district were selected for questionnaire interviews. The people were selected for questionnaire through random sampling method.

Questionnaire survey and focus group discussion

Participatory Rural Appraisal (PRA) was a group of methods to collect information from target group in participatory fashion. In the study, FGD was used to get an overview of particular issues. A total of two FGD sessions were conducted where each group size of FGD was 2-6 crab fatteners.

Cross-check interview

After collecting the data through questionnaire interviews and FGD's, it was necessary to check the information for justification of the collected data. If there were any items contradictory, then information's were collected from key informant. Cross-check interviews were conducted with key person such as Upazilla Fisheries Officer (UFO) and District Fisheries Officer (DFO), and District Forest Officer (DFO), Local leaders, NGO workers where information was contradictory or requested for further assessment. The interviews of the respondents were conducted in their office during office hour or in houses.

Data processing and analysis

The collected data were coded, summarized and processed for analysis. These data were verified to eliminate all possible errors and consistencies. The analysis of collected was mainly based on tabular description technique. Tabular technique was applied for the analysis of data by using simple statistical tools like averages and percentages. Collected has been analyzed by Microsoft Excel 2010 software.

Problems faced during data collection

Some issues were confronted during interview. A good number of fatteners were not educated; they

thought the researcher to be the government official of tax or other department and fear to talk. Language was also a problem. These problems were overcome through rapport building with fatteners. Finally the data were collected with satisfaction.

RESULTS

A wide range of data was collected to characterize the crab fattening system and the socio-economic condition of mud crab fattener. These were stocking, feeding, harvesting, management and cost benefit analysis in mud crab fattening system and religion, marital status, sex ratio, sanitation facility, treatment facility, loan facility, housing condition etc. of crab fattener.

Mud crab fattening system

There were some ways of fattening system in the study area such as fattening in pond, pen and cages. Ponds with a depth of 1 to 1.5 meter and size between 0.025 to 0.2ha were used for crab fattening. These ponds are fenced by bamboo sticks locally known as "Pata" to prevent escaping of crab. Fattening usually requires 2- 4 weeks to complete. Within this time, premature crabs are well fed to develop their gonad fully. Most of the ponds were divided into 4-6 components by using bamboo fenced of 1 to 2 meters height. Most of the ponds water rectangular having a common inlet and outlet made of PVC pipes. Crab fattening also done in pens, floating net cages and bamboo cages in shallow water ways and inside large shrimp ponds with good tidal water influx. Bamboo splits and nylon were used for netting material and the cage (3 m long, 2 m wide and 1m height) used for crab fattening (Figure 1).



Figure 1: Crab fattening in pen

Crabs were also fattened in floating cages in the study area where single and small cages were used. Here each cage was used for single crab. But this system is not so popular among the crab fattener. In the study area only 15% fatteners use this system. Recently fatteners start to use this cage system for crab fattening (Figure 2).



Figure 2: Guard room for protecting crab from their

Source and season of crab fattening

In the study area crabs were collected from Sundarbans and adjacent rivers for commercial purposes and the rejected and lean crabs were brought back in crab ghers from crab depots. They were transferred for trading again into the crab depots. All respondents in the study area were reported on availability of seed crab that dry season (October-May) had the peak season of female crab fattening whereas the wet season (June-September) was the peak season for male crab fattening.

Size of gher

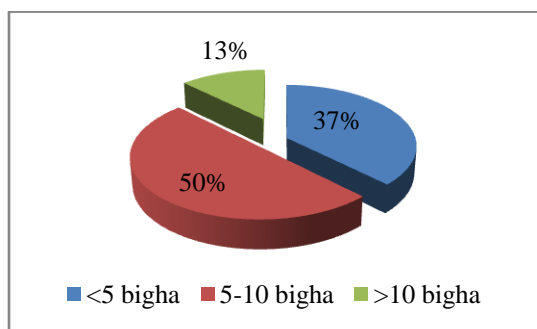


Figure 3: Size of fattening gher in the study area.

In the study area, the average size of crab fattening gher in 198 decimal. Also the maximum and minimum size of gher/pond is 526 and 16.5 decimal. It is reported that 40% of the crab fattener used 165-330 decimal area for crab fattening (Figure 3).

Grading of crab used as seed for fattening

There were different grade male and female crabs used as seed for fattening (Table 1&2).

Table 1: Grading of male crab used as seed for fattening.

	Weight (gm)	Claw	Shell
PD-XXL	>500	Developed	Hard
PD-XL	>400	Early developed	hard
PD-L	>300	Partial developed	soft
PD-M	>250	Partial developed	soft
PD-SM	>200	Partial developed	soft

Table 2: Grading of female crab used as seed for fattening

Grade	Weight (gm)	Gonad	Shell
KS1	>180	Partial	Hard
KS2	>150	Partial	Hard
KS3	>120	Partial	Hard

Stocking

Most of the fatteners stocked their pens with rejected grade (lean or empty) female crabs locally called "khosa" and (soft shell) male crabs. Farmers mainly collected these rejected crabs from crab trading depots and from shrimp gher. Stocking time of crab in fattening ponds depend on the availability of rejected crab in the local market. Most of the fatteners stocked their pens with rejected grade male and female crabs. The stocking practice was dependent on the supply of rejected grade male and female crabs. Thus fatteners had no chance to follow any fixed stocking time

In the study are fatteners usually 90gm-160gm crab seed for fattening. Fatteners did not maintain any stocking density during seed crabs. The average stocking density was 0.758 kg/m². The

minimum and maximum stocking density 0.600kg/m² and 0.909kg/m² respectively.

In the present study area most of the fatteners stock and harvest their ponds simultaneously. There was no fixed time of stocking mud crabs in the study area. The stocking density was varied in the study area. The average stocking density was 67pieces/decimal irrespective of sex and grade. Zafar (2004) stocked 120 crabs (27kg) in open cage (79pieces/decimal area). These stocking was not similar with the present study because in the present study most of the farmers practiced traditional culture.

Feeding

Almost all of the respondents used various small and trash fish to feed their stocked crabs at regular interval. The fish used as feed for crabs including snail (24%), tilapia or chela fish (25%) and also popcorn, wheat (17%) and someone used both chela and snail as a food. It was found that 70% fatteners used snail overall in the study area, and others used tilapia, punti and domestic feed (Figure 4).

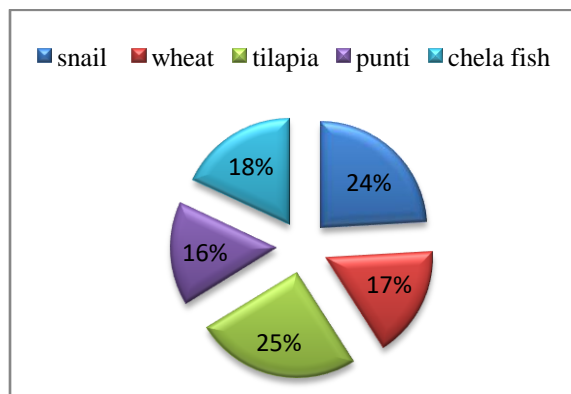


Figure 4: Feed used for fattening crab

Most of the fatteners in the study area followed at fixed rate of feeding during fattening. They fed crab at the rate of 5 to 10% or 8.24±2.35% of body weight. The maximum fatteners (65%) provided feed once a day during fattening period in the study area while only (35%) fatteners provided feed at alternative day. According to the respondent, the feeding time of mud crab are morning and evening.

All most of the respondents used various small and trash fish to feed their stocked crabs at regular interval. The fish used as feed for crabs including tilapia, snail and someone use both tilapia & snail as a food. It was found that 70% fatteners used tilapia, 30% fatteners used tilapia and snail. Most of the fatteners in the study area followed at fixed rate of feeding during fattening. They fed crab at 8.24±2.35 body weight. The maximum fatteners (72%) provided feed once a day during fattening period in the study area while only (28%) fatteners provided feed at alternate day. According to the respondent, the feeding time of mud crab are morning and evening.

Fattening period

The period of crab fattening and hardening varied from 2-4 weeks depending on the stage of maturity of the gonad and prices of fattened crabs in the depots. However, some fatteners kept fattened crabs in their pond for extended period of time, usually 1-2 weeks, in order to get good prices.

Harvesting

Only fattened crab, i.e. carapace was full with hepatopancreas and/or gonad and hard shell crab was harvested regularly. Harvested female's crab was checked by light examination of the dorso- anterolateral slides of carapace of the crabs while male crabs with full meat under carapace and claws were harvested. The fattened crab was taken out from the pond by using small push net. A few fatteners, however, found to use bare hands for harvesting fattened individuals. Total harvesting was tied with nylon threads, kept in the bamboo basket and transported immediately to the nearby crab landing center by tricycle van. Most of the fatteners harvested all crabs at a time in the pond. Only a few followed selective partial harvesting.

Most of the fatteners followed single complete harvesting regime once the stocked crabs become marketable. Fatten female are recognized by the presence of fully developed gonad by passing light through the dorsoanteriolateral sides of carapace. No light would pass across the carapace if the female contain fully developed gonad. Marketable males are recognized by pressing thumb on to the abdomen. No thumb impression would be visible

if the carapace of male becomes hardened. Total harvesting was done at the end of fattening season by hand after dewatering the pond. Selective harvesting is done when demand and /or price in local market increase significantly.

Management

To increase the growth rate of crab and to protect them from disease, it is essential to maintain water quality properly. For good result, 40% water exchange should be needed in every full moon and new moon. Therefore, to protect the water quality, fertilizer and CaO should be applied. In the meantime of fattening period, water exchange is done and it is done at new moon. Exchange of water was done only before stocking new batch or when water quality deteriorated severely. Farmers usually did not use any kind of fertilizer in their pond. They only use lime and alum at minimal rate for water purification.

Cost benefit analysis

The cost benefit analysis of mud crab fattening which analyzed for one decimal pond is shown in Table 3. Cost of crabs was the major cost for crab fattening. Among fixed cost, construction of bamboo fencing was found highest. The cost-benefit analysis from the investigation of mud crab farm in the study area was TK 15,230 decimal/yr. The total amount of stocking is about 1540 pieces and the average weight is 0.210 kg and the survival rate is 78%. The stocking density was 67pieces/decimal. The average weight of crab is 0.275 kg after fattening.

Table 3: Cost- benefit analysis of crab fattening in the study area

Parameters	Average
Farm area (decimal)	23
Fattening period (days)	16
Running cost (TK)	
Cost of crab (1540 pieces×44 tk)	67,760
Cost of feed provided (624 kg×42tk)	26,208
Total labor cost	2150
Lime	195
Total running cost/crop (1+2+3+4)	96,313
Stocked crabs (Pieces)	1540

Survival rate	78%
Survived crabs (Pieces) (1540*78%)	1201
Fixed cost (year) TK	
Land lease (TK/yr)	7625 (23 decimal)
Bamboo fencing	22300
Netting	2630
Scope net, basket, jhuri, ladder etc	1130
Land development	1150
Total fixed cost	34835
Returns	
Production (kg) (0.275kg*1201)	330,275
Selling price (TK/kg)	380
Total return/crop (TK)	125,504
Gross income /crop (Total return- Total running cost) (TK)	29,191
Number of crops per year	12
Income per year (Gross income× No. or crop) (TK)	350,298
Net income TK/ Decimal/yr [(Income Per year Total fixed cost)/ Farm area]	15,230

Liong (1992) reported that purchase of stackable crab and trash fish constituted the major operating expense. Liong (1992) mentioned the high profit rate in the pond system mainly due to low operating cost. The similar trend was also noticed in the present investigation of the study area. In the present study area cost of crabs was the major cost for crab fattening. Among fixed cost, construction of bamboo fencing was found highest. The net income from the investigation of mud crab farm in the study area was 14755 TK/Yr/decimal. The increasing prices for large sized seed crabs set the main constraints in mud crab fattening by the resource poor fatteners in the study area.

Socio-economic status of crab fatteners

The livelihood opportunities of the households of the crab fatteners were of much significance in the planning the development activities whose nature and extent was influenced largely by such issues. In addition, most of the crab fatteners were poor in terms of basic needs, which also affect their livelihoods. In the section the socio-economic condition, livelihood of crab fatteners were

described. A sustainable livelihood approach for any given population must take some factors that were observed at the study time.

Age structure

In the study area, it was found in highest (30%) of mud crab fatteners were belonged to the year class of 41-45, whereas 5%, 10%, 17.5%, 22.5% and 7.5% of them were under the age groups of 21-25, 26-30, 31-35, 36-40, 46-50 and above 50 years, respectively. In case of crab fatteners, 36% crab fatteners were in the age group of 33-41 years, whereas 4%, 28%, 20% and 12% of them were under the age groups of 15-21, 24-32, 42-50 and above 50 years, respectively (Table 4).

Table 4: Age structure of the crab fatteners in Rampal Upazila, Bagerhat District

Age	No	%
21-25	2	5
26-30	4	10
31-35	7	17.5
36-40	9	22.5
41-45	12	30
46-50	3	7.5
Above 50	3	7.5

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Religious and marital status

The crab fatteners were dominated by Hindu (67%), whereas 25% were Muslims and 8% were Christian. This agrees with the findings of Ahmad, 1992 who reported that the majority of the fishermen in different parts of they are Hindus. Religious restriction on eating crab might also discourage the Muslims to be involved in catching

crabs. In the study area, 80% crab fatteners were married while rest (20%) was unmarried (Table 5).

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Sex ratio

In Rampal upazila, 82% of the crab fattener were male and rest (18%) were female. The reason for less involvement of female in crab fattening activities was social restriction (Table 5).

Housing condition

The crab fatteners were found to live in three types of house. Maximum crab fatteners live in tinshed (Table 5).

Table 5: Religion, sex, marital status and housing condition of crab fatteners

Characteristics	Percent	
Religious status	Hindu	67
	Muslim	25
	Christian	8
Sex ratio	Male	18
	Female	82
Marital status	Unmarried	20
	Married	80
Housing condition	Pacca	25
	Kancha	30
	Tinshed	45

Occupation

The main occupation of crab fatteners was crab fattening for uphold their livelihood. The fatteners collected crabs from the depots that was rejected

and had no demand in foreign market. Some labor worked in the fattening farms. The highest percentage of crab fattener's (30%) secondary occupation were shrimp culture, whereas the rest were engaged in crab fattening (25%), business (5%), day labor (5%), fishing (12.5%) and agriculture (22.5%) (Figure 5).

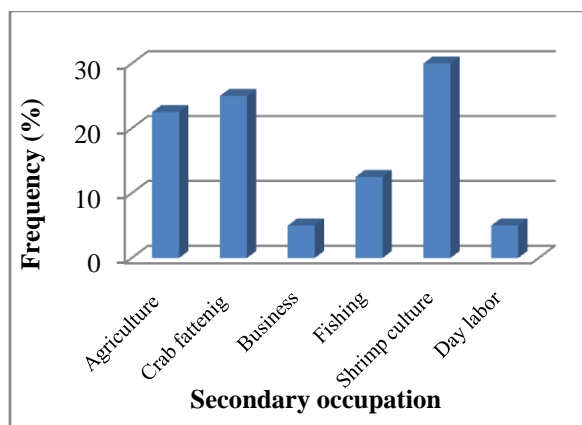


Figure 5: Secondary occupation of crab fatteners in Rampal Upazila, Bagerhat District

Monthly income

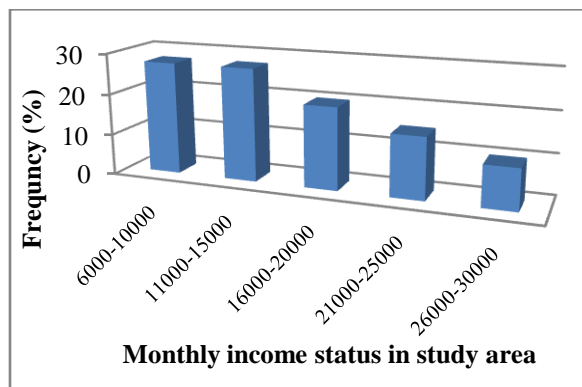


Figure 6: Monthly income status of crab fatteners in Rampal Upazila, Bagerhat District

In the study area, 27.5% of the crab fatteners were monthly income BDT 6000-10000 & BDT 11000-15000 while 20%, 15% and 10% earned BDT 16000-20000, BDT 26000-30000 and BDT 21000-25000 respectively (Figure 6). DoF (1993) stated average income of fishermen is 15000/yr. Khayruzzaman (2007) reported that 72% fish retailers earned an average Tk. was 10000-50000 per year.

Educational status

In investigation areas, the crab fattener comprised of the most marginal segment of the coastal population. But it has developed day by day and as such as 35% crab fattener were class 10 pass, 20% were secondary level, 15% were class 12 pass, 5% Bachelor, 12.5% were primary level and 12.5% were can only sign (Figure 7).

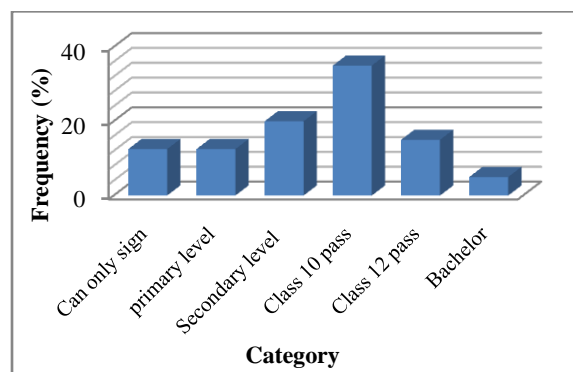


Figure 7: Educational status crab fatteners in Rampal Upazila, Bagerhat District.

Family size

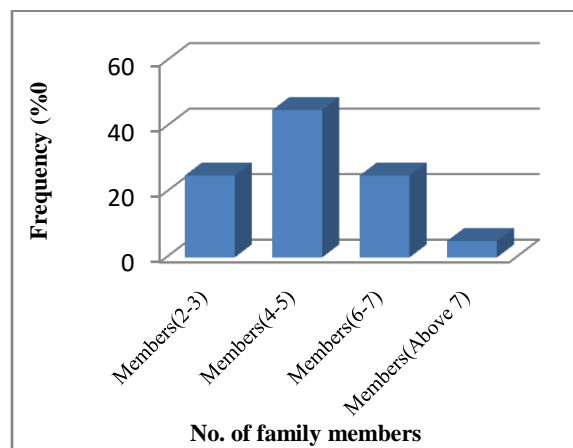


Figure 8: Family size of crab fatteners in Rampal Upazila, Bagerhat District

In Rampal Upazilla, it was observed that 45% of the crab fattener had 4-5 members in their family, whereas 25%, 25%, and 5% had 2-3, 6-7 and above 7 members in their family respectively (Figure 8). Molla et al. (2009) found that 80% fatteners the lower family size in the present study than the national average would be due to smaller sample

size. The average family size of the crab fattener was 4.828, which is lower than national average of 5.7 people / household (BBS, 2003).

Table 6: Different facilities available in the study are used by crab fattener

Facilities		Percentage
Sanitation facility	Kancha	34
	Semi-pacca	39
	Pacca	27
Treatment facility	Private	20
	Village doctor	30
	Upazilla health complex	50
Loan facility	Bank	5
	Money lender	65
	NGO's	20
	Not taken	10
Electricity facility	Have	88
	Do Not	12
Drinking water facility	Tube well	50
	Rain water	27.5
	Purified water	22.5

Sanitation facility

Three types of toilets such as 1) Kancha toilet-made of bamboo walled, ring slave with good drainage system 2) Semi-pacca 3) Pacca were found to be used by used by the crab fattener. In the study area, 34%, 39% and 27% of fattener used kancha, semi-pacca and pacca toilet respectively (Table 6).

Treatment facility

Most of the fattener (50%) were found to be dependent on Upazilla health complex for their treatment, while 30% got health service from quack and 20% got from private doctor (Table 6). Where Minar et al. (2012) found that 70% of the fishermen received health service from village doctors, 24% from upazilla health complex and remaining 6% got health service from MBBS doctors.

Loan facility

In Rampal Upazilla 10% of the crab fattener did not take any loan or dadon, whereas (90%) took

loan from bank (55%), NGO's (20%) and money lender (70%) (Table 6). The crab fattener did not get any credit facility from any sources. Government organization could play a vital role to promote the socio-economic condition of crab fatteners by providing low interest of credit. Due to natural disasters in every year or season, they can't escape from loan or dadon. Where Sultana et al. (2007) found that 55% fattener take loan. Higher rate of interest was the main constrain for their socio-economic developments. Government organization could play a vital role to promote the socio-economic condition of crab fatteners by providing low interest of credit.

Electricity facility

Nowadays electricity facility reaching the door of every stages of people. Because of this 88% of the crab fattener of Rampal upazila has electricity facilities (Table 6).

Drinking water facility

It was found that, majority (50%) of the crab fattener used tube well water, whereas 27.5% and 22.5 used rain water and purified water (Table 6).

Constraints of crab fattening

From the present study a number of constraints were found such as natural disasters like flood, difficult to get pass without marketing problem, lack of money, lower market price and poor quality of crab seed of technical knowledge. Rahman (2003) stated in his report that the major constraints of carp farming were lack of money and production cost.

CONCLUSION

There is a growing interest among farmers for fattening. The main factor for promoting the farming of crabs and the business is the increasing demand for crab in the international market. After the outbreak of shrimp and prawn disease, many farmers diverted from shrimp farming to crab fattening. According to their responses, they can get higher profit within a shorter time and with lower investment required compared to shrimp. The Fisheries Research Institute in Rampal Upazila is playing a significant role by providing

different training programs for the farmers and establishing model farms for disseminating modern aquaculture techniques. Various non-government organizations in the southwest of Bangladesh (Caritas, Shushilan) are also encouraging the crab fatteners and working with the fishers of sustainable farming practices and for adopting new technology through different development programs.

In the study area most of the fattening farms are established near the bank of river or canal where brackish water was available throughout the year. Very poor living condition of the mud crab fishermen was founded by the study. For sustainable of crab fattening, training can be provided to crab fatteners. Thus crab can be an alternative source of income and sustainable livelihood for the coastal people.

Mud crab fattening was considered as a profitable and feasible business by most of the marketing operating. However, the fatteners suggested that the government should pay some attention to this sector to prevent overexploitation of this species and to prevent environmental degradation affecting their habitat.

Considering the total export earnings from mud crabs, the fishery shows future potential. To achieve this, development and support from government and different non-governmental organizations needs to be greater and perceptions regarding the activity needs to improve for more sustainable mud crab fattening in Bangladesh.

REFERENCES

- Ali MY, Kamal D, Hossain SMM, Azam MA, Sabbir W, Mushida A, Ahmed B and Azam K (2004). Biological studies of the mud crab, *Scylla serrate* (Forsk.) of the Sundarbans Mangrove ecosystem in Khulna region of Bangladesh. Pakistan Journal of Biological Science, 11: 1981-87.
- Azam K, Kamal D and Mostafa M (1998). Status and potential of mud crab (*Scylla serrate*) in Bangladesh. In: MA Rahman, MS Shah, MG Murtaza, and MA Matin (Editors). Ganges Floodplains and Sundarbans Ecosystem. Proc. Nat. Sem. Integr. Manage. July 16-18, 1994, 150-160.
- BBS (Bangladesh Bureau Statistics) (2016). Economic Survey.
- Christopher L (1992). A brief overview of the ecology and fisheries of the mud crab (*Scylla serrate*) in Queensland. In: CA Angel (Editors), Mud Crab: Report of the Seminar on the Mud Crab Culture and Trade. Surat Thani, Thailand, November 5-8, 1991, 65-70.
- DOF (1993-94). Fish Catch Statistics of Bangladesh (Computer copy, Department of Fisheries, Government of Bangladesh.
- Hill BJ (1976). Natural food, foregut clearance-rate and activity of the crab *Scylla serrate*. Marine Biology, 34: 109-116.
- Prasad PN, Sudarshana R and Neelakantan B (1985). Feeding ecology of the mud crab, *Scylla serrate* (Forsk.) from Sun kerri backwaters, Karwar. Journal of Bombay Natural History Society, 85: 79-89.
- Kamal D (2002). Development of fattening technology for the mud crab (*Scylla serrate*) in small ponds with special reference to biology, nutrition, microbial quality, marketing and transportation from the South-western region of Bangladesh. Final report, Action Research for poverty Alleviation Project, 91.
- Khayruzzaman (2007). Livelihood of Fish retailers in Jamalpur District, MS Thesis, Department Of Aquaculture, BAU, Mymensingh. 28-40.
- Liong PC (1992). The fattening and culture of mud crab (*Scylla serrate*) in Malaysia. In: CA Angel (Editors), Mud Crab: Report of the Seminar on the Mud Crab Culture and Trade and Trade. Surat Thani, Thailand, November 5-8, 1991, The bay of Bengal Programme Report no: BOBP/REP/51, Madras, India.
- Rahman MM (2003). Socio-economic aspects of carp culture development in Gazipur, Bangladesh MS Thesis. Department of Agriculture Economic, Bangladesh Agricultural University, Mymensingh, 83.
- Salam MA, Islam SMM, Jianbang Gan and Ross LG (2012). Crab culture potential in southwestern Bangladesh: alternative to shrimp culture for climate change adaption, 1(4): 15-31.
- Samarasinghe RP, Fernando DY and Silva D, OSSC (1992). Pond culture of mud crab in Sri Lanka. In: CA Angel (Editors), Mud Crab: Report of the Seminar on the Mud Crab Culture and Bengal Programme Report no: BOBP/REP/51, Madras, India. 161-164.
- Zafar M (2004). Culture of mud crab (*Scylla serrate*) through participation of the poor coastal people, Bangladesh. DFID-UGC SUPER Project Report, University of Chittagong, Bangladesh, 6-16.