Bangladesh J. Zool. **46**(2): 263-273, 2018 ISSN: 0304-9027 (print)
2408-8455 (online)

STUDY FOR ASSESSING MUD CRAB (*SCYLLA SERRATA*, FORSKAL, 1755) MARKET CHAIN AND VALUE-ADDED PRODUCTS DEVELOPMENT IN BANGLADESH

Syed M. Istiak

Deep Sea Fishers Ltd & ASAP Healthy Food Ltd, Dhaka-1215, Bangladesh

Abstract: *Scylla serrata* (Forskal, 1755) is playing an alternative to shrimp culture where 0.3 million people are directly involved in crab value chain. A study was carried out in the south-west and south-east coastal regions and Dhaka to asses mud crab market chain and value-added products development activities in Bangladesh. About 70% of mud crab come from Khulna and the rest from Chattogram, Barishal, and Noakhali region for export. Mud crabs were collected from nature, shrimp farm, coastal pen, and cage. The crabs value chain comprises farms/nature-collectors-small depot, large depot and exporters. Peak trading season was June to December and off-peak was January to March. In 2015-16 about 88% of crabs were exported to China which fulfilled 20-30% of buyer's demands. Four types of crab products were exported, of which 78% were live crabs. About 20% exporters produced crab meat and leg. Crab export has significantly increased (p□0.05) from 2009 to 2016.

Key words: *Scylla serrata*, mud crab, value chain, value-added product, grading

INTRODUCTION

Mud crab (*Scylla serrata,* Forskal, 1755) is one of the most important coastal aquatic crustacean species among 12 marine/brackish water species in Bangladesh. The mud crab plays an important role in the national economy by earning from export (Joarder 2014). The contribution of crabs is 0.34% into the total fish production of Bangladesh in 2015-16 (DoF-2017). Juliette (2010) reported that in the Philippines the mud crab represents between 20 and 30% of the value of the production against 20 - 50% for the shrimp (Salam *et al.* 2002). Crab fattening is widely practiced in Thailand, Taiwan, Malaysia, Singapore, India, Indonesia and Bangladesh (Begum 2009). According to Sudhakar (2009) and Yousuf *et al.* (2017) mud crab has been well-accepted as a good source of protein and antioxidant properties, scrumptious and demandable crustacean in the world.

Live crab marketing is a profitable business. China, USA, Japan, South Korea and Thailand are the top five consumers. In recent years, crab business has been increasing due to buyers demand (Kamata *et al.* 2013). About 2.5 - 3.00 lakh people are directly involved in crab value chain (Jahan and Islam 2016a,b). Bangladesh started exporting crab in 1977 and earned US $2,000

*Author for correspondence: <syedistiak75@gmail.com>
 DOI: http://dx.doi.org/10.3329/bjz.v46i2.39066

(Jahan and Islam 2016a,b) and in 2015-16 earned US $23.82 million by exporting live and frozen crabs to 17 countries. China is the single largest crab importer.

In the southwest coastal belt of Bangladesh, millions of poor fishers, traders, and transporters are directly or indirectly dependent on live crab catching and collection. In Bangladesh, about 19,408 hectare water bodies have been used to produce crab and in 2015 -16 produced 13,160 MT crabs (DoF 2017). The production of mud crab has attracted several private sectors into this emerging and profitable sector.

In order to know the market system, value chain and value adding of crabs, it was necessary to conduct a study with an objective to (i) assess the local Mud Crab value chain in Khulna region; (ii) analyze the mud crab market dynamics (includes - supply, demand trend, policy barriers, expectation of exporter, importers); and (iii) recommend for future actionable strategies and examine the value addition, processing potentials of mud crab in the local and international market.

MATERIAL AND METHODS

Following activities were done to achieve the objectives of the study. Primary Data Collection Questionnaire Survey: The data were collected during 16 June to 31 August 2017 from the south-western and south-eastern parts (coastal areas) of Bangladesh through a structured questionnaire survey. About 20 major questions along with another 22 sub-questions were asked to collect the primary data. Some of the open-ended questions were asked to know their strengths, weaknesses, recommendations, marketing strategies, and policy barriers.

Personal interviews and meetings: Interviewed 17 pre-selected respondents in government, NGOs, foreign buyers, processors, and researchers to collect data.

Focus group discussion: There were three FGDs conducted to validate the data. Online interview were conducted with the crab fatteners, farmers, depot holders, regulatory authorities to validate the data.

Secondary data collection: Secondary data were collected from some published reports, papers and some official documents and web-based information.

Literature review: Collected and reviewed the available literature on crab marketing, value chain, fattening, production, value addition, crab business, etc on Bangladeshi crab market.

Data entry and analysis: Data were entered into MS Excel spreadsheet and analyzed using MS Excel Data Analysis Tool Kit. At each stage of the survey, data were checked, edited and coded in the field.

RESULTS AND DISCUSSION

In Bangladesh, about 19,408 hectare water bodies were used to produce crab and in 2015-16 produced 13,160 MT crabs (DoF 2017). Interviews showed that mud crabs were collected from sources like nature, shrimp gher, coastal pen, cage, soft shell crab farms. Survey results revealed that most of the exporters established direct link with farmers from 2014. According to Fig. 1, about 70% of mud crab were landed from the Khulna region which supported by Chandra *et al.* (2012). The survey showed that about 60% of mud crabs were landed from Khulna, 30% from Satkhira and 10% from Bagerha. A total of 1811 depots (685 in Khulna, 367 in Satkhira and 759 in Bagerhat) were identified those were responsible to collect crabs from different farms and nature (Joarder 2014).

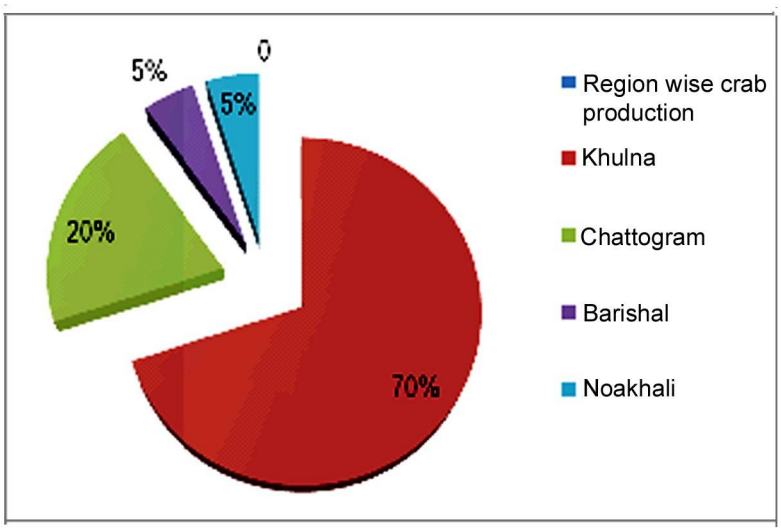

Fig. 1. Region-wise crab production in Bangladesh.

Grading: Exporters reported that they had collected mud crab with mixed composition and grading starts in large depot and separate male and female crabs, tighten the legs and transport through the bamboo basket (Shelley 2011). The survey showed that about 3% crabs were wastes due to broken of legs, bad packing, transportation, and mishandling (Shelley and Alessandro 2011). Female crab with minimum weight at 120 gm and male with 200 gm were considered for export. Table 1 showed that the grading system for the domestic

market which varies from the grading system for the international market showed in Table 2. Usually, male crab with hard carapace and full of meat was considered for export, while for female crab with hard carapace with eggs was considered for export.

Table 1. Grading of male and female live crabs

Grade: Female		Grade: Male	
Grade	Weight	Grade	Weight
F1	>180g	XXL	>500g
F2	>150g	XL	>400g
F3	>120g	L	>300g
		M	>250g
		SM	>200g

Table 2. Grading system of mud crab by sex and weight in international markets

Grade: Female		Grade: Male	
Grade	Weight (gm)	Grade	Weight (gm)
FF1	>200	XXL	>500
F1	>180	XL	>400
KS1	>180	L	>300
F2	>150/100	M	>250
F3	>120	SM	>200/150
KS3	>120		

Crab trading seasons: The results showed that the mud crab trading season started in June and end of March. The peak trading season was June to December and January to March was the off-peak season. About 90% crabs were landed in peak season and 15% in off-peak season. During January to February the exporters bought about 40% crabs from shrimp gher and about 60% from nature (Sundarbans, estuary, sea, etc). Results showed that during June to December the exporters bought about 75% crabs from shrimp gher and 25% from nature.

Transportation and post harvest management:: The survey showed that primarily live crabs were carried using bamboo baskets to the local depot by wooden boats, bicycle, rickshaw van, etc. During export in the winter season, about 90% crabs were carried using styrofoam box and 10% using net plastic box. Shelly (2013) suggested that for export markets involving air freight, wax-lined cardboard boxes, with ventilation holes at each end of the box were very effective and for domestic markets, mud crabs can be packed in plastic crates or

containers (FAO 2013). Survey Showed that all collected crabs from different small and local depots were transported to Dhaka by truck or pick up van usually at night. During the transportation, they sprayed water into the box to increase humidity for reducing mortality which was supported by the statement of Ferdoushi *et al.* (2010) and Dagoon (1997). Betel-nut leaf was placed in the bottom to prevent dehydration and to keep the temperature low. The results showed that during the summer season about 40% styrofoam boxes were used and 40% net plastic boxes were used to export live crab. Ferdoushi (2013) reported that sometimes mud crab keep a long tube, made of bamboo, in the center of the plastic boxes to prolong the shelf life of the exported crabs. Mud crabs can survive in air for about 4 to 5 days in good condition (Ferdoushi *et al.* 2010). To reduce mortality during transportation, harvested crabs were tied with coarse twin (Shelley and Alessandro 2011) and keep 95% humidity by sparying water (Dagoon 1997).

Mud crab value chain: There were five types of value chain actors who played the main role in crab business from 2014. Before 2014 crabs value chain were more complex and eight types of actors were operating the main business (IFAD 2010). Fig. 2 showed the present crab value chain developed based on the findings of the survey.

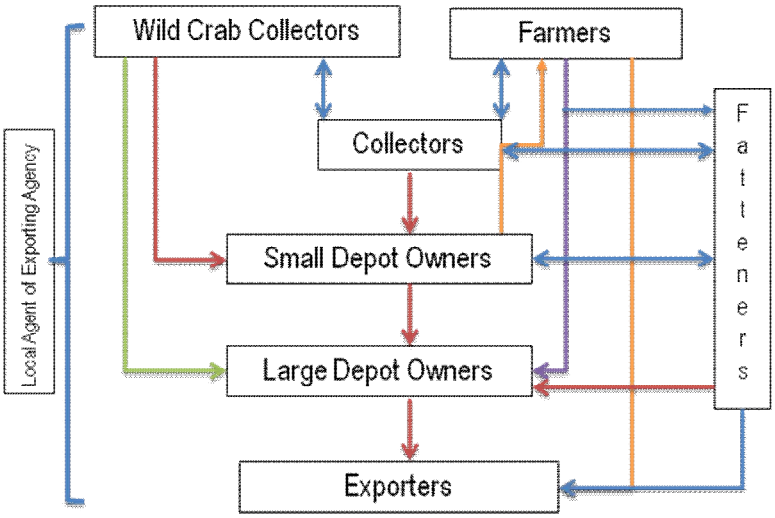

Fig. 2. Crab supply chain 2017 according to exporters.

Export market: Fig. 3 showed that the major crab exporting countries were China, Singapore, Malaysia, Taiwan, Thailand, and South Korea. The top five mud crab consumers of the world were China, USA, Japan, South Korea and Thailand. Most of the exporters have their own crab farms and depot. They have

contact farmers who received money in advance to fattening the crabs. Most of the exporters were living in Dhaka. Joarder (2014) reported that about 30% of the exporters were running the business by joint ownership. About 80% reported that they exported only live crabs. The mortality was about 5% during transportation from farm to export depot and 7% mortality was during export. Fig. 2 showed that about 88% crab were exported to China. Buyers reported that they were getting only 20 - 30% of their demand. A Singapore buyer demands 5,000 MT crabs meat and legs/year but Bangladeshi exporters were not able to supply this amount. Individual interviews revealed that there was a huge demand for Bangladeshi crabs due to its taste, size, and nature. Female crabs were popular in Japan, Taiwan, Hong Kong, Singapore and crab meats were popular in the USA and Canada (Farhana *et al.* 2015). About 20% of crab exporters had produced crab meat and leg by the 3% by-products (dead and defective) and sold to Singapore.

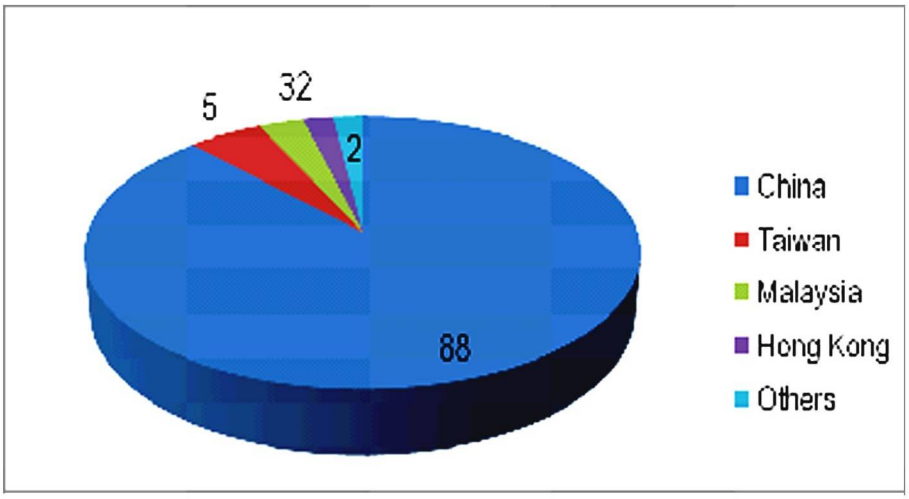

Fig. 3. Country wise crab export % in 2015-16.

According to Joarder (2014) Bangladesh had no crabmeat processing industry but there was a huge scope for developing crab meat processing industry. About four types of value-added products developed from crabs which shown in Fig. 4. Crab shell was used as an ingredient of poultry feed. The interview showed that an entrepreneur started to construct a processing plant for making canned industry where they would produce canned crabmeat. Zafar (2014) stated that the increasing demand of mud crab in the local and international markets helped gain price supported by Aldon and Dagoon 1997).

They reported that the export mortality was high due to delayed shipment. Results showed that there was no warehouse at the airport to store live crab before shipment. The weather was hot into cargo areas of the airport where the crabs stored before shipment. Data revealed that there were insufficient scanning machines in the warehouse, no facilities for exporting live products, no air-conditioned facilities and very less priority for shipment of live products. Survey showed that the required shipment time was 12 hrs to reach the products in buyers store but it took 24 hrs. That why the mortality was increased. Fig. 5 showed that the demand, supply, and export increased dramatically from 2009 to 2015 with little fluctuation in 2013-14.

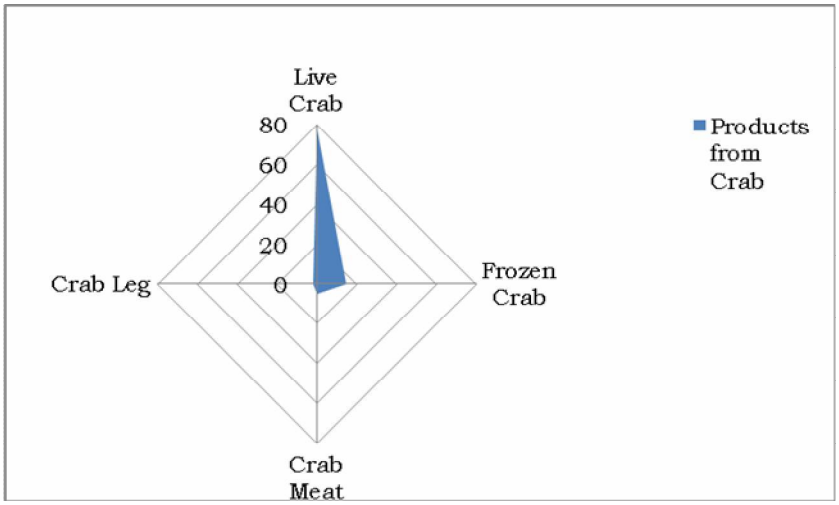

Fig. 4. Crab based product in Bangladesh for export..

In 2015, about 12,850 MT crabs were exported and earned USD 23.85 million. The income was increased 1732% in 2015 than that of 2009. Jahan and Islam (2016a,b) stated that the mud crab business in Bangladesh was highly profitable. Joarder (2014) reported that the export volume had increased to 38 per cent in the last 15 years. Results showed that the following factors, seasonal demand and supply, abundance, occasions (Chinese New Year, Christ-mass), type and sources, and influence of agent are influencing the crab price (Chandra *et al.* 2012). Price variation was found according to grade in a different season (Joarder 2014). Crab project of DOF reported that some of the crab consignments were rejected due to the presence of nail.

Crab business related association: Survey showed that there was a registered association namely Bangladesh Live and Chilled Food Exporters Association, located at Uttara, Dhaka. They were responsible to collect and export live crab

but about 20% members of BLCFEA reported that they were also exporting crab meat and leg. BLCFEA reported that about 160 crab exporters were presently doing this business, of which 153 were their members (Ferdoushii 2013).

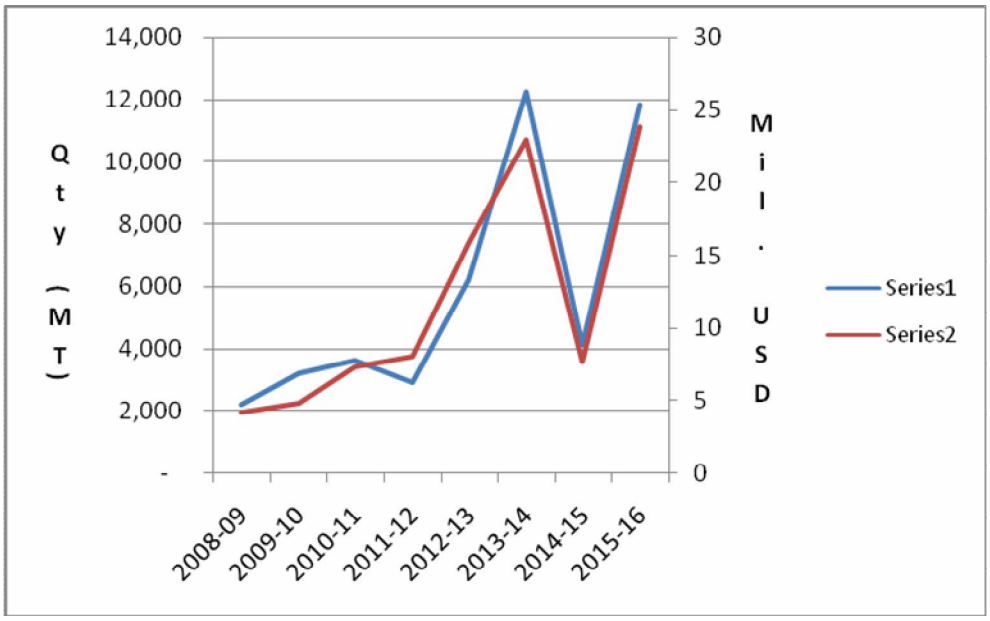

Fig. 5. Crab export trend from 2008 to 2016.

Policy barriers and problems associate with crab business: The survey showed that the Ministry of Forest and Environment, Ministry of Commerce and Ministry of Fisheries were directly involved in monitoring, assisting and transferring technology of crab business. Department of Forest was responsible to give the license for harvesting hard shell crabs whereas Department of Fisheries (DoF) was responsible to give permission for installing soft shell crab farm (DoF 2017) and issued the health certificate for export. Results showed that the Export Promotion Bureaw was responsible to give permission to open L/C for export.

About 70% of the respondents reported that the factors like bad communication between collection points and the depots, insufficient market information, weak registration process of the government, inadequate marketing facilities, lack of credit, influence of middleman, grading fraudulence, inadequate space, high mortality rate due to mishandling and poor transport system, inconsistency and the low survival rates of the larvae accelerate the growth of the crab industry Joarder (2014).

CONCLUSION

The findings of this study show that the live mud crabs business is playing a major role in the economy of Bangladesh. Value addition of crabs is also promising business. There are four types of crab based value-added products in Bangladesh. It has a huge potentiality to be a part of major exporting products of the fisheries sector. The crab value chain has become simpler than previous value chain. June to December is the main trading season for crab and about 70% crabs come from Khulna region. China is the major importing country of crabs and the export is increasing significantly. Some policy changes may help to sustain this business.

Following are the recommendations to augment this business in Bangladesh supported by Joarder (2014), Zafar (2014), Jahan and Islam (2016), Karim *et al.* (2015) and Ferdoushi (2013).

1. Installation of Crab Hatchery.
2. Develop live product export facilities and equipment in airport.
3. Accelerate shipment time as priority basis and the shipment should be completed within 12 hours.
4. Develop crab farming, transportation, export and hatchery operation policy.
5. Ensure loan/credit facilities to the stakeholders to enhance business.
6. All intermediate players in crab trading should be brought under a single apex body like the Department of Fisheries.
7. Use Styrofoam box during transportation of live crab from the farm during export till it reaches buyers hand.
8. Grading has to be done immediately after catching.
9. Develop value-added products and production facilities.
10. Undertake a detailed socio-economic study to determine the importance of mud crab farming to coastal communities and to demonstrate the growing value of mud crab farming.

Acknowledgements: I express my sincere gratitude to the Bangladesh Practical Action for providing me fund and assistance to conduct the study. I am thankful to the officers of Department of Fisheries, Export Promotion Bureau, Bangladesh Live and Chilled Food Exporters Association, Ministry of Forest and Environment and the Department of Forest for providing the necessary data and documents. I am also thankful to the value chain actors who helped me to conduct the survey. I express my gratitude to Mr. Amanullah Chowdhury, Fatema Pervin Putul, Sumaiya Ahmed and my son Sholok who inspired and assisted me to conduct the study smoothly and effectively. I also express my heartiest thanks to the reviewer of the Zoological Society of Bangladesh for making this paper meaningful.

LITERATURE CITED

ALDON, E.T. and DAGOON, N.J. 1997. The Market for Mud Crab. *SEAFDEC Asian Aquaculture* **19**(3): 11-13.

BEGUM M. 2009. Comparative study of mud crab (*Scylla serrata*) fattening practices between two different systems in Bangladesh. *Journal of Bangladesh Agricultural University* **7**(1): 151–156.

CHANDRA, K.J., PAUL, A.K. and DAS, D.R. 2012. A Survey on the Production and Marketing of Mud Crab, *Scylla serrata* (Forskal,1755) in the south-western part of Bangladesh. Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh. *International Research Journal of Applied Life Sciences* **1**(3): 47-48.

DAGOON, N.J. 1997. Mudcrab post-harvest processing. *SEAFDEC Asian Aquaculture* **19**(3): 23 P.

DOF. 2017. National Fish Week, 2017 Compendium. Department of Fisheries, Ministry of Fisheries and Live Stock, Bangladesh. 138 pp.

FAO SMART FISH PUBLICATION 11, 2013. Handling of Mud Crab Illustrated Operators `Manual, Food And Agriculture Organization Of The United Nations, Smart Fish Programme, Mauritius. pp. 12-15.

FARHANA K., MUSTAFA, G. M. AHSAN, A. D. and KHAN, R.A.M. 2015. Bacterial Flora of Mud Crab, *Scylla olivacea*, collected from different markets of Dhaka City. Department of Fisheries, University of Dhaka, Dhaka-1000, *Bangladesh. Bangladesh J. Zool.* **43**(1): 55 P.

FERDOUSHI, Z., ZHANG, X. and HASAN, R. M. 2010. Mud crab (*Scylla sp.*) marketing system in Bangladesh, *Asian Journal of Food and Agro-Industry* **3**(02): 248-265.

FERDOUSHI Z and ZHANG XIANG-GUO. 2010. Role of women in mud crab (S*cylla sp.*) fattening in the south-west part of Bangladesh. *Marine Res. Aqua* **1**(1): 5-13.

FERDOUSHI Z. 2013. Crab Fattening in Bangladesh: A Socio-economic Perspective. *Journal of Environmental Science and Natural Resources* **6**(1): 145-152.

IFAD-PKSF-PROCASUR 2010. Crab Culture Value Chain Development under FEDEC Project, The Case of Crab Culture in Satkhira, Bangladesh, PKSF, Bangladesh. pp. 8-11.

JAHAN, H. and ISLAM, M.S. 2016. Supply chain and distribution channels of mud crab (*Scylla serrata*) in Bangladesh, *International Journal of Fisheries and Aquatic Studies* **4**(1): 438-441.

JAHAN. H. and ISLAM, M.S. 2016. Socio Economic performance of live crab (*Scylla serrata*) business in the southwest coastal region of Bangladesh, *International Journal of Fisheries and Aquatic Studies* **4**(1): 453-457.

JOARDER M.F. 2014. Crab (*Scylla serrata*) Natural Breeding Technology, MS Thesis, FMRT, Khulna University.

JULIETTE G. 2010, Development of the Mud Crab Sector in Three Provinces of The Philippines-Constraints And Prospects, CIRAD Agricultural Research for Development-World Fish Center, Philippines.

KARIM F., MUSTAFA, G.M., AHSAN, A.D. and KHAN, R.A.M. 2015. Bacterial Flora of Mud Crab, *Scylla olivacea*, Collected From Different Markets of Dhaka City. *Bangladesh J. Zool.* **43**(1): 55-62.

KAMATA E.L., LAMTANE, H.A., and ABDALLAH, J.M. 2013. The impact of climate change on mud crab fishery and fattening to the communities livelihood in Pangani and Rufiji estuaries in Tanzania, Department of Forest Economics, Sokoine University of Agriculture, P. O. Box 3000, Morogoro, Tanzania.

SALAM A.M., LINDSAY, G.R. and BEVRIDGE, M.M.C. 2002. A comparison of development opportunities for crab and shrimp aquaculture in southwestern Bangladesh, using GIS modeling, Institute of Aquaculture, University of Starling, Starling, FK9 4LA, Scotland, UK.

SHELLEY C. and ALESSANDRO L., 2011. Mud crab aquaculture- A practical manual, FAO Fisheries and Aquaculture Technical Paper-567, FAO Fisheries and Aquaculture Department, Rome, Italy.

SHELLEY C. 2013. Scoping study for mud crab farming in Bangladesh – Part 2, FAO Fisheries and Aquaculture Department, Rome, Italy.

SUDHAKAR M., MANIVANNAN, K. and SOUNDRAPANDIAN, P. 2009. Nutritive Value of Hard and Soft Shell Crabs of *Portunus sanguinolentus* (Herbst), *International Journal of Animal and Veterinary Advances* **1**(2): 44-48.

YOUSUF W.R.W., AHMAD, B.F. and SWAMY, M. 2017. A Brief Review on the Antioxidants and Antimicrobial Peptides Revealed in Mud Crabs from the Genus of Scylla, *Journal of Marine Biology* **2017**: 7.

ZAFAR M.N.A. 2014. Marketing and Value Chain Analysis of Mud Crab (*Scylla* sp.) in the Coastal Communities of Bangladesh, Books of Abstract, Bangladesh Fisheries Research Forum (BFRF).

(Manuscript received 20 November, 2018; revised on 30 November, 2018)