SOFT-SHELL MUD CRAB FARMING IN BANGLADESH: CHALLENGES AND PROSPECTS

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Mud crabs are the second most commercially important crustacean species in Bangladesh, due to its high demand in international markets. Soft-shell crabs are especially favoured among consumers worldwide, as they have a delicate flavour and texture; and are more nutritionally complete, lower in calories and richer in essential minerals than hard-shell ones. During the 2024–25 fiscal year, the country exported 1 166.89 tonnes of mud crabs (including soft-shell crabs), worth over USD 14 million. This technical article highlights the background, trade value chains, and socio-economic importance of soft-shell crabs; and presents step-by-step guidelines for farming. It also intersects the cost-benefit analysis of a one-acre farm which may help new entrepreneurs to make investment decisions. The authors assert that despite some challenges, soft-shell mud crab farming can be a lucrative business in most Asia-Pacific countries.

Soft-shell crab is farmed in perforated plastic boxes, Cox's Bazar, Bangladesh.

The fisheries and aquaculture sector in Bangladesh contributes significantly to the national GDP (2.53% in national GDP; 22.26% in agricultural GDP) and accounts for 60% of the country's animal protein supply. It also generates about 20 million full- and part-time jobs, of which 1.4 million are held by women. The 2024 FAO flagship report, The State of World Fisheries and Aquaculture (FAO 2024[1]) recognised Bangladesh as the world's fifth-largest aquaculture-producing nation (5 million tonnes) and the second-largest inland fisheries producer (1.3 million tonnes). In addition, Bangladesh is the world's largest producer of hilsa shad and the third-largest producer of tilapia (DOF 2024[2]).

Unlike in many Asian countries, mud crabs[3] *(Scylla olivacea*, previously known as *S. serrata),* also known as mangrove crabs, became a popular commercial aquaculture species in Bangladesh due to their high demand in international markets and relatively easy culture. Crab fattening and soft-shell crab farming activities are carried out on a wider scale as compared to grow-out farming.

Soft-shell crabs are delicacies for many seafood consumers. Unlike regular crab harvesting, soft-shell crab farming involves rearing of hard-shell crabs in controlled brackish water conditions and monitoring them closely so that they can be harvested at the right moment, i.e. immediately after they moult and lose their hard shells. At that point, their new shells are still soft. This stage lasts only a few hours, and it is when the crabs attract higher prices in export markets than hard-shell crabs because of their delicate texture and juicy flavour.

The beginnings of the industry

Soft-shell crab culture started in November 2011 when many shrimp farmers were looking for alternatives due to severe disease outbreaks, price volatility and environmental pressures. In addition, soft-shell crab farming was relatively easy compared to shrimp farming. Commercial production started in February 2012 at Khurushkul Union of Cox's Bazar Sadar Upazila, Cox's Bazar District. This two-acre site, belonging to Irawan Trading, continues to farm mud crabs in 40 000 perforated plastic boxes. Technical know-how was received through training provided by soft-shell crab farmers from Ranong province, Thailand.

Soft-shell crab acclimatisation before stocking.

[1] *FAO. 2024. The State of World Fisheries and Aquaculture 2024 – Blue Transformation in action. Rome. https://doi.org/10.4060/cd0683en*

[2] *DOF 2024. 2024 Yearbook of Fisheries Statistics of Bangladesh, 2023-24. Fisheries Resources Survey System (FRSS), Department of Fisheries; Ministry of Fisheries and Livestock, 2024. Volume 41; 140p. 4c64d1e387d446ec97430228bcc06ddc.pdf*

[3] *Rouf, M.A., I.M., Shahriar., S.I.M., Sarower, M.G., and Ahsan, M.N., 2016. Taxonomic Clarification of Mud Crab Species of Genus Scylla (Brachyura: Portunidae) Available in the Coastal Regions of Bangladesh. Asian Fisheries Science 29 (2016):124-136. https://doi.org/10.33997/j.afs.2016.29.3.001*

Due to the strong international demand, this non-traditional aquaculture commodity expanded rapidly along the southwest coast of Bangladesh (Satkhira, Bagerhat and Khulna), where hard-shell mud crabs are more abundant in the wild around the vast areas of the Sundarbans (one of the largest mangrove forests in the world, which lies on the delta of the Ganges, Brahmaputra and Meghna rivers, is rich in wide range of biodiversity, and is listed as a UNESCO World Heritage Site[4] and Ramsar Site[5]).

The shift towards soft-shell crab farming

Coastal communities used to be almost wholly dependent on small-scale fishing, traditional shrimp farming, gleaning of crabs, collection of honey and mangrove wood from the Sundarbans, and fattening of hard-shell crabs seasonally. However, these livelihood options are sometimes impacted by animal attacks (for example, tigers and crocodiles), fishing bans and disease outbreaks. Soft-shell crab farming offers a more predictable source of cash income which is attractive for unemployed and under-employed people in coastal communities, especially women and youth. Consequently, many small-scale holders have converted their traditional shrimp farms and hard-shell crab fattening activities to soft-shell crab farms due to higher profits, shorter culture periods and lower susceptibility to diseases.

Soft-shell crab farming at a large coastal farm in Bangladesh.

Present status and geographic coverage

Previously, soft-shell crab farming was concentrated around Cox's Bazar (southeast region) but for the last five years it has become more prevalent in Shyamnagar, Munshiganj Upazila, in Satkhira District (southwest region). This is due to the natural abundance of crablets, juveniles and sub-adults in the adjacent Sundarbans mangrove areas. This region has now become the national hub for soft-shell crab production and is home to thousands of small-scale soft-shell mud crab farms, together with some larger farms.

[4] *The Sundarbans, The Sundarbans - UNESCO World Heritage Centre*
[5] *The Sundarbans Reserved Forest, https://rsis.ramsar.org/ris/560*

Economic importance

Local consumption of hard-shell crabs is restricted mainly to the tribal and minority communities. Consequently, Bangladesh is a significant exporter of hard-shell crabs, with the soft-shell variety constituting a new addition to the country's wide range of aquaculture commodities. According to the Export Promotion Bureau, Bangladesh exported frozen crab worth USD 12.3 million in 2020–21, destined for China, the United States, and parts of Asia and Australia. In subsequent fiscal years, mud crab shipments from Bangladesh rose significantly from 644.77 tonnes in 2023–24, to about 1 166.89 tonnes in 2024–25. Meanwhile, export value increased from about USD 8 million to over USD 14 million, showing strong international demand[6]. However, it is important to mention that the available data does not distinguish between hard-shell and soft-shell mud crab exports. The major markets for soft-shell crabs are Japan, the Democratic People's Republic of Korea, Europe, the United States, and ASEAN countries.

Frozen (IQF) soft-shell crabs packed and ready for export.

Employment generation and socio-economic significance

Soft-shell crab farming contributes significantly to foreign exchange earnings and employment. Currently, the sector directly supports about 10 000 people, offering employment in farming, processing, and supply chain operations. Women and youth contribute to daily monitoring activities at the farm level and in the factories through handling and processing activities.

A soft-shell crab processing facility in Bangladesh.

[6] *Export Promotion Bureau, Bangladesh.*

Soft-shell crab farming: Step-by-step guidelines

Medium-size adult hard-shell crabs (60g–90g) are usually stocked in perforated plastic boxes. Larger crabs (100g–120g) are also accepted, where fattening is done up to the next moulting stage, as per buyers' requirement. The culture duration for each batch of soft-shell crab production is about 20–30 days, and approximately eight production cycles can be accomplished each year. After the crabs are sourced, they are placed in individual boxes, positioned in the brackish water ponds, and monitored until the next moult. Intensive monitoring throughout the moulting period (often checked every four hours) is required to harvest crabs at the perfect soft-shell stage. The moulted crabs are then transferred to clean freshwater to slow down the shell-hardening process.

Step-by-step guidelines (1–7) for soft-shell crab farming up to the market-ready stage are given below.

1. Preparation of the farming area

Pond preparation: Small or medium size (1 acre = 4000 m^2 = approximately 80m X 50m) earthen ponds are established close to the nearest source of brackish water intake. The ponds should also have dykes to maintain a water depth of at least 3–4 feet, and have water inlet and outlet gates (wooden or made of PVC).

Ponds are cleaned and dried naturally in the sun until the pond bottom visibly cracks. Usually, this is done during the winter months (November–December) when it is off-season for farming. If the soil is acidic, the pond bottom is treated with calcium oxide (CaO) which is subsequently washed out by tidal water. Finally, the pond is filled with tidal brackish water up to the desired water level.

Pond drying, where the bottom is exposed to direct sunlight.

Pontoon bridges for monitoring: Small-scale farmers monitor the moulting process easily by wading into the ponds, while medium-scale farms usually install pontoon bridges. These structures are generally made of wood or bamboo (approximately 50 metres in length and 1–1.5 metres wide, with or without shed) and are placed about one foot above the pond water level.

Shaded pontoon bridge.

Raft-making: To hold the individual perforated plastic boxes, a floating raft (35 metres long and 1.5 metres wide) is built using PVC pipes tied together. Each raft can carry about 700 boxes, and each acre of pond area can accommodate 22 000-23 000 individual boxes.

Floating raft made from PVC pipes upon which the perforated plastic boxes are placed.

2. Stocking of crabs

Sourcing and selection of crabs: Farmers generally collect hard-shell crabs from natural sources such as rivers, creeks and mangrove areas, or they may purchase these crabs from wild crab collectors or gleaners. Currently, there is no alternative source of hard-shell crabs in the country. Furthermore, in 2024, the Department of Fisheries reported that hard-shell mud crab production from natural sources had declined slightly over the previous six years, from 12 084 tonnes in 2018–19 to 10 782 tonnes in 2023–24.

Healthy and intact hard-shelled crabs are collected for stocking.

Size and quality: The crabs should be healthy and active, each weighing between 60–90g. Farmers usually wash the crabs with pond water to acclimatize them before stocking; they also disinfect the crabs with low doses of chlorine and place them in aerated water before stocking them into the boxes.

Hard-shell crabs put in aerated water before stocking.

Perforated plastic boxes: Each crab is kept in an individual plastic box (25 cm in length, 21 cm in width and 15 cm in height). This "one crab-one box" method aims to prevent cannibalism and stress. The boxes are then placed on floating PVC structures or rafts in the pond or enclosure. As each box contains one crab, monitoring is easy and the crab can be removed after moulting occurs. This design is helpful during crab feeding as well.

(Top): Perforated plastic box used for soft-shell crab farming; (bottom): Individual crab being placed in a perforated plastic box.

3. Water parameters

- Salinity: Coastal tidal water with a salinity reading of 15–30 ppt is suitable for soft-shell crab farming.
- Temperature (°C): As the farming is done in outdoor ponds, temperature depends on natural seasonal changes.Experience shows that extremely high temperatures in summer lead to higher mortality. However, the moulting rates are lower in the winter season.
- Water quality management: The pond water is regularly exchanged with tidal water to maintain optimum brackish water conditions. Generally, no additives are applied to the pond water; however, lime (calcium carbonate and dolomite) is useful to optimise pH and mineral content during the rainy season.

4. Feeding practices

Unlike the large volume of feed used in hard-shell crab fattening, minimal feed is required in soft-shell crab farming. Minced small trash fish (e.g. tilapia) and shellfish (e.g freshwater snails) are provided on alternate days to reduce uneaten food and water pollution. Roughly, the feeding rate is 5–8% of crab biomass every two days, adjusted subject to physical monitoring and weather conditions.

Workers putting the minced tilapia/snails into the perforated plastic boxes as feed.

5. Monitoring the moulted crabs

Frequent monitoring is crucial in soft-shell crab production. The crabs are typically checked every 3–4 hours to catch the moment they moult. Upon moulting, the crabs rapidly absorb water to expand their new, larger shell, increasing their weight by approximately 25–30% compared to the initial stocking size. As the crab shells remain soft only for a short while (hours), harvesting must begin immediately.

Workers have to frequently monitor the moulting process.

6. Post-harvest handling

Once the crabs have moulted, they are quickly transferred to a plastic bowl filled with clean freshwater to slow down the shell-hardening process. Later, they are placed in plastic trays covered by wet towels and transported for processing.

Moulted crabs are placed in fresh water to prevent the shell-hardening process before being transported to the processing facility.

Upon reaching the processing facility, the crabs are cleaned, graded by size (A/B/C grades), blast-frozen (IQF) and packed according to buyers' requirements.

Post-harvest soft-shell crab processing (IQF) and packing

7. Marketing of soft-shell crab

There is little demand for soft-shell crabs in the domestic market. Generally, farmers sell the C-grade crabs (missing most of the legs and comprising about 5% of supply) to local suppliers who sometimes sell these to local consumers. A-grade (with complete legs; 70%) and B-grade (missing some legs; 25%) products are sold to processing factories for export. The price of soft-shell crabs is higher than hard-shell crabs[7] and the value chain is relatively shorter.

[7] *Tavares, C. P. S., U. A. T. Silva, L. Â. Pereira, and A. Ostrensky. 2021.Evaluation of Different Induced Molting Methods in Callinectes ornatus (Crustacea, decapoda, portunidae) as a Tool for the Commercial Production of Soft-Shell Crabs." Anais Da Academia Brasileira De Ciencias 93, no.2: 1-14. http://doi.org/10.1590/0001-3765202120190580*

Many farmers sell soft-shell crabs to nearby processing factories, where they are prepared for export markets in line with international food safety standards and compliance. Major markets include the Republic of Korea, Japan, Europe, the United States and ASEAN countries where soft-shell crabs are considered premium seafood items. Soft-shell crabs are widely consumed as stir-fried, mixed with fried rice, and in sandwiches and noodles.

Raw soft-shell crab being graded at a processing facility.

Final product (master carton) of frozen (IQF) soft- shell crab.

Challenges and constraints

Although soft-shell crab farming has huge prospects and rising global demand, the sector faces some of the following key issues:

- ***Dependency on wild crab stock***

  There is no fully operational and commercial mud crab hatchery in the country to produce megalopa larvae or crablets. Currently, crablets, juveniles and sub-adult crabs are being collected from the wild. This has put immense pressure on wild crab stock, creating challenges for long-term environmental sustainability and consistent supply chains.

- ***Regulatory issues and seasonal fishing bans***

  A 65-day marine fishing ban (April–June) imposed by the Department of Fisheries, and a two-month ban on crab harvesting by the Department of Forestry (generally January and February, which is considered the peak breeding season for crabs) hamper the livelihoods of the coastal communities who are dependent on these fisheries. On the other hand, over-exploitation of wild crabs and declining natural stocks are also threats to the biodiversity and sustainability of the aquaculture sector.

- ***Technical and quality issues***

  Soft-shell crab farming requires careful monitoring and handling, as even a small oversight in timing leads can disrupt moulting cycles. Poor water quality can lead to mortality, and small-scale holders often lack knowledge of proper handling and processing. Hence, factories face major difficulties if quality and standards are not maintained as per export requirements.

- ***Market access and price fluctuation***

  Although export markets are lucrative, volatility in export prices and barriers to market access (e.g. buyers preferring large quantities with consistent supplies) can reduce farmers' profit margins. As soft-shell crabs have little demand in the domestic market, farmers are highly dependent upon international buyers and export markets.

- ***Natural calamities and climate-induced risks***

  Intensified cyclones, tidal surges, flooding and erosion threaten coastal livelihoods every now and then, and present economic risks to farmers through damage to pond dykes, cages and infrastructure.

Prospects and specific recommendations

- With targeted investment in the establishment of commercial crab hatcheries, soft-shell crab farming will emerge as a sustainable alternative for the aquaculture sector.
- Enabling policies for the development of hatchery infrastructure and farms will minimise dependency on wild crab stocks, restore natural populations, and maximise production through a sustainable supply of crablets, juveniles and sub-adult crabs.
- Capacity-building of technical staff and farmers through training could improve the quality and safety of soft-shell crabs, as well as boost production.
- Strengthening investment through public-private partnerships could add value to supply chains including improvements in farming, processing and packaging. It will also help in meeting international quality and safety standards, thus ensuring wider market access.
- The National Framework and Action Plan for Locally-Led Adaptation (LLA) launched recently in Bangladesh should include fisheries and aquaculture to boost climate resilience and mitigate climate-induced risks.

Conclusion

Soft-shell crabs have a savoury flavour as compared to hard-shell crabs as they contain more salts in their bodies and present a nutritionally complete profile (Nutrient Contents in 100g Soft-shell Crab). They are best suited for farming along the coastal and brackish water areas of Bangladesh. The sustainability of soft-shell crab farming relies on the advancement of hatching technology; consistent and responsible supply of crablets, juveniles and sub-adult crabs for fattening; capacity-building through technical training; strengthening investment; and development of infrastructure through enhanced public-private partnerships. Although commercial soft-shell crab farming is relatively new in Bangladesh, it is a viable, high-value, export-oriented, and profitable industry (Cost Benefit Analysis (CBA) of 1 Acre Soft-Shell Crab Farm) within the context of blue economy.

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