

## Scientific Mud Crab Culture Practices in Sundarbans Delta: A Step Towards the Betterment of Sundarbans People

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### Abstract:

Sundarbans means ‘beautiful forest’. This largest mangrove ecosystem is home to a huge species diversity—from mammals to reptiles, birds to fishes, crabs to zooplanktons. This densely populated area becomes increasingly vulnerable due to devastating cyclones, floods, and rising sea levels, which most significantly affect the lives of the people in the Sundarbans. Mud crab farming has become a beacon of hope for those belonging to the Sundarbans. This farming paves the way for employment opportunities, supports the economic lifestyle of the people, and helps establish women’s empowerment in such adverse areas. This small-scale, profitable business has a high market demand in both national and international markets. This farming requires little capital and has low labour costs. If the traditional way of farming can be combined with science-based, improved practices of mud crab culture, it can be highly beneficial for the future. These scientific methods can be instrumental in increasing production rates, elevating the protein value of crab meat, and combating mud crab diseases to reduce mortality rates. Thus, mud crab farming can be a profitable alternative livelihood for the disaster-prone people of Sundarbans, exploiting its underutilized and unutilized brackish water resources by developing appropriate management practices through participatory planning and capacitating the community for implementing the same.

### Introduction:

Sundarbans is the largest delta with a mangrove forest ecosystem formed by the confluence of the Ganges, Brahmaputra, and Meghna Rivers in the Bay of Bengal. This coastal ecosystem is one of the richest biodiversity zones in India (Chakraborty & Ghosh, 2019; Saha & Sarkar, 2022; Biswas et al., 2023). The people of Sundarbans utilize these local bio-resources as their

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livelihood option (Sardar et al., 2016). Around 50% of people live below the poverty line in this delta. Among mud farmers, 41.67% belong to the BPL category (Sil, 2016). Therefore, mud crab farming in Sundarbans serves a foremost function in the livelihood of the local, thriving coastal community. The mud crab, or mangrove crab (scientific name: *Scylla serrata*), is the most commercially traded seafood for aquaculture in mangrove and coastal areas of Sundarbans (Hasanuzzaman et al., 2022). Mud crab culture is a promising self-help industry nowadays because of its high economic value. This is the simplest form of aquaculture practice and shows high potential due to several reasons (Apine et al., 2023). These crabs are known for their nutritional richness of crab meat and their meat-rich chelate legs. Crab meat has high medicinal value to treat protein deficiency diseases, especially in children. Crab meat is also a rich source of minerals that serve as components of bones, soft tissues, and co-factors or co-activators of various enzymes that are essential for human metabolism. Mud crabs have a high tolerance to a wide range of temperatures and salinities. Thus, it shows high potential in the export business (Nanda et al., 2021; Shen & Lai, 1994; Rahman et al., 2017). Mud crab culture turns itself into a profitable business due to high productivity, low labour costs, etc. During the peak season of November to February (83.33%), the majority of crab farmers practiced intensive culture (67.67%) (Sathiadhas & Najmudeen, 2004). Not only the mud crab farmers, but their families also actively participate in mud crab farming. Mud crab culture has become a potential strength and source of income for the coastal communities of Sundarbans. However, the maintenance and cultural processes are still in their primitive stages. Very little effort has been made to understand the biology, morphology, and maintenance of mud crabs and their impact on the socio-economic development of this region (Roy et al., 2021; Rahman et al., 2017).

### **Traditional way of mud crab farming:**

Since 1990, mud crab farming has begun as an alternative livelihood in the Sundarbans Delta. Mud crab farmers mainly follow the fattening method of culture, especially in the three districts of West Bengal—South 24 Parganas, North 24 Parganas, and Purba Medinipur. In these regions, crab fattening locally is known as chamber chas. In this process, the newly moulted crabs, or ‘empty crabs’, are held and reared for a period of about 10–45 days until they are full of meat and of marketable size (Paul, 2022). In the fattening process, newly moulted crabs of weight 550 grams are used. Farmers generally use small tidal ponds or pens for the fattening process. The short and profitable cultural period has made the fattening process more popular (Roy et al., 2021).

### **Scientific culture processes for mud crab farming:**

Mud crab farmers in Sundarbans choose the fattening process over any other longer-culture process due to the high production rate within a short time period. Yet, ICAR suggests some longer culture processes with a duration of 6–8 months to promote economy and product efficiency and to make the farmers aware of and adopt these time-taking processes (Roy et al., 2021).

### Design a suitable nursery:

To grow crablets from megalopae, a suitable nursery building is the most necessary thing. In the Sundarbans, mud crab farmers mostly use earthen ponds with hapa nets as a nursery. Hapa nets are square/ or rectangular net cages with a 1-2 mm mesh opening (Ut et al., 2007). These nets remain submerged in the earthen ponds, with the lower base of the nets attached to the bottom of the ponds. Water depths of 80-120 cm are maintained in those ponds (Ye et al., 2011). Zooplankton populations are established within the pond as a food source for megalopae. Sometimes, earthen ponds without a hapa system are used as nursery grounds for crablets (Antony et al., 2019). These ponds are securely covered with fine nets to stop the crawling of crablets away from the ponds. In recent years, tanks have also been used as a nursery for mud crab farming (Rodriguez et al., 2007). These tanks are rectangular in shape with a flat concrete base and are covered with an overhead shed to protect the crablets from direct sunlight and rainfall (Syafaat et al., 2021).

### Grow-out system:

Grow-out cultures are generally pond-based, lengthy processes. Wild-collected crablets of 50–100g in size are stocked in grow-out ponds. These culture ponds are 0.5-2 ha in size. The juvenile crabs are stocked at a rate of 0.5–0.7 m<sup>2</sup>/s. Trash fish is the primary source of food for the juvenile crabs (Maheswarudu et al., 2008). Sometimes, the trash fish is mixed with fish oil, flour, or probiotics for feeding purposes (Islam et al., 2018). In this system, the crablets grow to a desirable size after 5–6 months. Regular monitoring of the pH, water salinity, and health of crablets is necessary. Low-salinity water (5–12 ppt) may cause a decrease in the survival rate of stocking. Paddle wheel aerators (2 HP) are also used in the ponds to improve water circulation (Liew et al., 2023).

### Box culture method:

Innovative box culture methods of crab farming are expanding rapidly throughout the Sundarbans. This box crab technology has become popular day by day in Haldia and Nayachar along the Haldi River in East Midnapur. Locally, this culture method is called ‘box crab technology’ or ‘box method’. This box crab farming is usually done in freshwater ponds. In this method, male crabs can be cultivated in 10–12 days, whereas female crabs take 25–26 days (Kalidas et al., 2020). A bridge-like structure with some gaps made of bamboo was placed over the pond. The boxes hung in those gaps. Medium-sized plastic boxes are used in this method. Crablets are stocked in these plastic boxes (Lalramchhani et al., 2020). The boxes will be hung in such a way that they remain submerged in the pond water. Only one-time food (trash fish) is fed to crablets as the primary food (Chakraborty, 2019).

### Polyculture:

In polyculture, mud crabs can be successfully cultured with one to three species, including milkfish, tilapia (*Oreochromis* spp.), shrimp, and other marine species (Lalramchhani et al.,

2020). The stocking rate of each species depends on the season. Mollusks, low-value fish, and zooplankton, serving as natural fish, mainly provide mud crabs and shrimp as food sources (Shyne Anand et al., 2018). The growth and survival rates of mud crabs in polyculture are similar to those in monoculture. Close monitoring of pond water and species is necessary in this method to prevent any diseases (Mahmud & Mamun, 2012).

### **Vertical Ras System:**

The vertical RAS system in mud crab farming is a novel technology. This culture method is specially designed for indoor farming. It is also helpful for mud crab farmers who cultivate away from seawater. This vertical RAS system is nothing but a specially designed vertical stacked box within which sand filters, biofilters, and UV filters are placed. Its biosecurity facility helps protect the culture procedure from pathogens. It is also used to minimize water usage. Besides its modernized facilities, the notable disadvantage of this system is that it is very costly to invest in and maintain (Yxtung, 2020).

### **Mud crab farming- a way of women's empowerment:**

In Sundarbans, where the female literacy rate is approximately 14%, and there are no large-scale industries or significant work opportunities, mud crab culture helps women stand on their own feet (Hasanuzzaman et al., 2022). Women directly or indirectly participate in mud crab culture, with most of them involved in feeding crablets, preparing crab foods, and assisting their husbands. Some of them also contribute to pond preparation for culture (Roy et al., 2023). Their participation provides them with an opportunity to be independent, confident and serves as a source of income. Women's involvement also promotes the growth of family income (Ghosh & Sahu, 2016).

### **Conclusion & Discussion:**

In the vast expanse of the Sundarbans, the landscape of mud crab farming is continually evolving, marking new milestones with each passing day. Amidst this dynamic progress, a series of challenges loom on its path. The emergence of various parasitic diseases casts a formidable shadow over the flourishing mud crab farming industry, introducing a substantial threat to its sustained growth. Furthermore, the inadequacy of wild seed collection has the potential to act as a hindrance to the intricate cultural process. A noteworthy constraint is evident in the perceived dearth of proper skills and commercial techniques within the domain of mud crab farming. This deficiency, if unaddressed, may impede the industry's potential for further development. However, on a hopeful note, the integration of improved technologies and innovative cultural methods into the existing practices holds the promise of offering a highly desirable solution. These advancements are not only anticipated to surmount the existing challenges but also to elevate the overall quality of life for the resilient communities inhabiting the Sundarbans region.

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