

# Culturable crabs of coastal West Bengal: an overview

## Abstract

Coastal West Bengal with its congenial coastal, estuarine and brackishwater ecosystems offer suitable environment for culture of crabs. In the present communication, key to the species and prospect of culture of 15 commercially important crabs has been presented with special reference to Sundarban coast. The possible fisheries and aquaculturable areas available in this region are indicated. The habitat ecology and biology of two abundantly available and highly promising culturable species, *Scylla serrata* and *S. tranquebarica*, have been dealt with at length. A model pond techno-ecologically designed for culturing these two brachyuran species and to augment crab farming in the State of West Bengal is recommended herein.

**Keywords:** crab culture, model pond, economic species, key to the species, West Bengal, India

Volume 8 Issue 1 - 2019

MK Dev Roy, NC Nandi

Social Environmental and Biological Association, India

**Correspondence:** NC Nandi, Social Environmental and Biological Association, India, Email nepchndr.nndi@gmail.com

**Received:** March 28, 2018 | **Published:** January 08, 2019

## Introduction

West Bengal coast abounds in innumerable estuaries, creeks, mangrove swamps, tidal mudflats and brackish water *bheries*. It supports about 150 species of crabs.<sup>1-3</sup> A good number of these crabs are edible while most of the other species are used in the fish-meal industries.<sup>4,5</sup> Among the edible species, two widely recognized and abundantly available mud crabs species, *Scylla serrata* Forskål and *Scylla tranquebarica* (Fabricius), popularly known as *Nona kankra*, are considered as the most valued species in this region because of large size and high quality meat content. These two species are known to occur abundantly in brackishwater wetlands, inter-tidal estuaries and mangrove swamps, and are quite adapted to withstand varying salinity and they are able to thrive to some extent on freshwater condition. They are widely cultured in several South-east Asian countries where they are extensively used in crab farming industry.

In general, all crabs belonging to the genus *Scylla* were earlier referred to as *Scylla serrata* in the literature.<sup>5-8</sup> But, presently four

species, viz., *Scylla serrata* (Forskål), *S. tranquebarica* (Fabricius), *S. paramamosain* Estampador and *S. olivacea* (Herbst) as determined by Keenan *et al.*<sup>9</sup> are recognized across the world. Of these, *S. paramamosain* is known from the continental coast of the South China Sea, south into the Java Sea.<sup>9,10</sup> On close examination of morphological distinction of these species, it is now revealed that at least two species, namely, *S. serrata* (smaller, ca. 400gm) and *S. tranquebarica* (larger, ca. 1kg) occur in Sundarban region. The possible occurrence of *Scylla olivacea* in West Bengal needs to be ascertained. Herein, a key to the species of culturable crabs along with an overview of commercially important crab species is presented.

## Culturable species

Based on observations since 1980s and review of literature, a list of 15 economic/ edible crabs of West Bengal and their cultural prospects has been presented in Table 1, out of a total of 150 species occurring in coastal West Bengal.<sup>3</sup>

**Table 1** Edible/ economic species of crabs of coastal West Bengal and their culturable prospects

Name of the species	Habitat	Maximum size (mm)	Status	Utilisation	Cultural Prospect
1. <i>Scylla serrata</i> (Forskål)	Mangroves, estuaries and brackishwater bheries	163.0	Common	Edible	Excellent
2. <i>Scylla tranquebarica</i> (Fabricius)	Same as above	182.0	Abundant	Edible	Excellent
3. <i>Portunus pelagicus</i> (Linnaeus)	Sublittoral muddy bottom	143.0	Occasional	Edible	Fair
4. <i>Portunus sanguinolentus</i> (Herbst)	Same as above	58.0	Occasional	Edible	Fair
5. <i>Charybdis (Charybdis) feriata</i> (Linnaeus)	Same as above	92.0	Occasional	Edible,	Fair
6. <i>Charybdis (Charybdis) helleri</i> (A. Milne Edwards)	Same as above	74.0	Occasional	Edible, Fishmeal	Fair
7. <i>Charybdis (Charybdis) rostrata</i> (A. Milne Edwards)	Same as above	25.0	Occasional	Fishmeal	Very high
8. <i>Charybdis (Charybdis) orientalis</i> Dana	Same as above	42.0	Rare	Fishmeal	Fair
9. <i>Varuna litterata</i> (Fabricius)	Freshwater and brackish water ponds, estuaries	38.0	Abundant	Edible	Excellent
10. <i>Episesarma mederi</i> (H. Milne Edwards)	Mid to Supra-littoral mudflats	60.0	Abundant	Edible	Very high

Table Continued....

Name of the species	Habitat	Maximum size (mm)	Status	Utilisation	Cultural Prospect
11. <i>Muradium tetragonum</i> (Fabricius)	High to supra-littoral mudflats	65.0	Abundant	Edible	Very high
12. <i>Sartoriana spinigera</i> (Wood-Mason)	Beels, baors and freshwater ponds	60.0	Abundant	Edible	Excellent
13. <i>Spiralothelphusa hydrodroma</i> (Herbst)	Beels, ponds and rice-fields	45.0	Common	Edible	Excellent
14. <i>Matuta planipes</i> (Fabricius)	Sandy substratum	39.0	Abundant	Edible, Fishmeal	Fair
15. <i>Matuta lunaris</i> (Forskål)	Sandy substratum	40.0	Common	Edible, Fishmeal	Fair

Of the 15 species, only ten species, namely, *Scylla serrata*, *S. tranquebarica*, *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis feriata*, *C. helleri*, *C. orientalis*, *Varuna litterata*, *Sartoriana spinigera* and *Spiralothelphusa hydrodroma* are consumed, either more or less, in this region and are categorized as edible. Among the edible species, *Portunus pelagicus*, *P. sanguinolentus*, *Charybdis feriata*, *C. orientalis* and *C. helleri* are usually available in minor quantities. The potamonids, viz., *Sartoriana spinigera* and *Spiralothelphusa hydrodroma* are seasonally sold in the local markets. They are found in considerable quantities in ponds, beels, baors and other freshwater bodies throughout the Gangetic plains of southern West Bengal. The varunid crab species, *Varuna litterata*, is available in large numbers during summer (May-June) and are consumed mostly by the poorer section of the society. The remaining five species, viz., *Matuta planipes*, *M. lunaris*, *Episesarma mederi*, *Muradium tetragonum* and *Charybdis rostrata* although occurring in good quantities and taken elsewhere are not consumed in this State of West Bengal. It may be mentioned that in spite of availability of 15 economic species (Table 1), aquacultural attempt in West Bengal is restricted to mud crabs, *Scylla serrata* and *S. tranquebarica*, only for large size and their demand in the domestic and export market. However, there is scope for the other species to be brought under integrated farming activities.

A key to the culturable species of commercially important crabs is given below for recognition and farming purposes.

### Key to the species of the commercially important crabs of West Bengal

1. Buccal frame triangular.....2
  - Buccal frame squarish .....6
2. Carapace much broadened by a pair of clypeiform expansions of the postero-lateral borders beneath
  - which ambulatory legs remain hidden in flexion .....3
    - Carapace circular without any trace of such expansions and armed with a prominent strong spine at the junction of the antero-lateral and postero-lateral borders. .... 4
  3. Clypeous expansions formed of six large lacinated teeth, carapace smooth excepting a few lumps anteriorly and a few scattered granules posteriorly .....*Calappa lophos*
    - Clypeiform expansions made up of five short broad teeth, carapace with 7 longitudinal parallel lines of bullous tubercles .....*Calappa pustulosa*
  4. Carapace uniformly coloured with red dots, outer angle of palm armed with a prominent spine near its articulation with the wrist .....*Matuta lunaris*

Carapace coloured with rings or vermicular line of minute red dots, outer angle of palm tuberculated near its articulation with the wrist .....*Matuta planipes*

5. Carapace transversely oval or somewhat hexagonal, front cut into teeth or lobes ..... 6

Carapace squarish or flattish dorsally, front entire never cut into teeth or lobes .....13

6. Antero-lateral borders cut into nine teeth .....7

Antero-lateral borders never cut into more than six teeth..... 10

7. Carapace smooth without distinction of regions, propodus of chelipeds smooth and inflated..... 8

Carapace roughened, regions well defined, propodus of chelipeds prismatic and costate ..... 9

8. Frontal lobes low with rounded tips cut into teeth, antero-lateral teeth broad ..... *Scylla serrata*

Frontal lobes high with bluntly pointed tips, antero-lateral teeth narrow ..... *Scylla tranquebarica*

9. Carapace marked with three blood-red spots, posterior border of merus of chelipeds without any spine .....*Portunus sanguinolentus*

Carapace devoid of such spots, its surface, however, studded with miliary granules, posterior border of

merus of chelipeds armed with a spine at its distal end ..... *Portunus pelagicus*

10. First spine of antero-lateral border truncated and notched anteriorly, large-sized species measuring

more than 80mm across the carapace .....*Charybdis (Charybdis) feriata*

First spine of the antero-lateral border neither truncated nor notched, small to medium-sized species measuring

less than 80mm across the carapace .....11

11. Middle two frontal teeth much larger than the others, small-sized species measuring less than 30mm across

the carapace .....*Charybdis (Charybdis) rostrata*

Middle two frontal teeth almost equal in size with the others, medium-sized species measuring about 50-75mm across the carapace ..... 12

12. Antero-lateral teeth almost equal in size, carapace breadth usually varying from 65-75mm .....*Charybdis (Charybdis) helleri*

Antero-lateral teeth unequal, second teeth exceedingly short, carapace width measuring 40-60mm .....*Charybdis (Charybdis) orientalis*

13. Carapace depressed, exognath of external maxillipeds broad, terminal joints of legs thin, broad, compressed

and adapted for swimming .....*Varuna litterata*

Carapace thick, exognath of external maxillipeds slender, pterygostomian regions and side-walls

with a sieve-like reticulation, terminal joints of legs not adapted for swimming .....14

14. Upper part of male cheliped with a longitudinal pectinated crest running parallel to its margin, dactylar tubercles swollen, transverse and closely arranged together in a continuous rim .....*Episesarma mederi*

Pectinated crest on male cheliped high and restricted medially being proximally and distally continued by a smooth rim, dactylar tubercles not swollen, neither transverse but longitudinal, triangular and distinctly separated from one another .....*Muradium tetragonon*

## Fishable and aquaculturable areas

Coastal West Bengal has a coast line of 157km., inshore area 777sq. km (up to 10 fathoms), offshore area 1813 sq. km. (from 10 to 40 fathoms) and shelf area 17,094sq. km. (up to 100 fathoms). It comprises of three districts covering Digha-Rasulpur coast in East Midnapore district and Sundarban coast in North 24-Parganas and South 24-Parganas districts. In these areas, crab farming can be practiced by leasing out the coastal inshore areas, estuarine mudflats and in suitable tidal channels for culturing of crabs. In addition to above, aquaculturable brackishwater systems (4,20,000 ha) and freshwater marshes (*beels*) and oxbow lakes (*baors*) (80,000ha) may also be looked into for the purpose of culturing freshwater inhabiting grapsid, varunid, portunid and potamid species.

## Bioecology of mud crab species

**Habit and Habitat:** Mud crabs, *Scylla tranquebarica* and *S. serrata*, are the largest and larger edible crabs respectively. They are commonly found along the coastal West Bengal as well as far inside in the brackishwater areas of the State. They inhabit mangrove swamps, tidal mudflats, brackishwater impoundments as well as in the rice fields of coastal West Bengal and abundantly encountered in Sundarban coast. They are nocturnal, adults usually hiding during day in burrows or remain concealed under logs or other objects. Their colouration usually resembles that of the surroundings. Crabs living within the mangroves are generally dark or dark mottled green in colour, while those of the channels have a brownish hue or olive green. Crabs inhabiting Sundarban mangrove forest sometimes bear barnacles on their carapace. They make ellipsoidal burrows usually with a single external opening (94.17%) which descends downwards either straight or slightly slanted to a depth of 0.7 to 1.45m.<sup>11</sup>

**Food and feeding:** *Scylla* crabs are both a scavenger and cannibal. Their food essentially consists of mollusks and crustaceans (especially the small crabs), fish remains are also occasionally found in the gut. They are found to devour cast out exoskeletons of crustaceans,

both crabs and prawns, and shells of mollusks in the field. Hill<sup>12</sup> undertook a comparative study of the stomach content of this crab in South Africa and Australia. He noticed that specimens of both South Africa and Australia had 50% mollusk remains but gastropods were more in specimens of South Africa. Next to mollusks, crustaceans pre-dominated the food (22.5% in South African crabs and 20% in Australian crabs). Brachyuran crabs and hermit crabs were also reported from the gut of South African crabs. Plant materials were also recorded from specimens of *Scylla serrata* but whether they formed part of the normal diet of the adult crab or were taken along with other food is still to be resolved. However, this crab has been reported to feed on algae, detritus, decaying wood and bamboo sticks.<sup>13,14</sup>

**Fecundity and life cycle:** Sexual maturity attains at a carapace width of 9-11cm. Gravid females of *Scylla* produce about 3,18,720-5, 21,450 eggs depending upon the size (115.0-250.0mm).<sup>15</sup> Similar studies on berried females weighing between 350.0-520.0mm) have been reported to produce 8,00,000-20,00,000 eggs.<sup>6</sup> The eggs usually measuring between 280-380µm in diameter<sup>15,16</sup> are of two types: immature eggs which are milk-white or translucent and mature eggs which are orange red in colour becoming black at hatching.<sup>17</sup> Females migrate offshore to spawn. Larval development occurs in the open sea. In Indian condition incubation period requires 8-15days, while five zoea stages last for 15-20days. Metamorphosis from megalopa to crab stage varies from 8-11 days. Life cycle completes in 35-45 days. High larval mortality is the major constraint in hatchery production and grow out culture.

## Crab culture

**1.1 A model pond for grow out:** A medium sized rectangular pond 1.00-1.50 (1.25ha) with a central island about one-fifth the pond size as prescribed by Nandi and Pramanik<sup>5</sup> is recommended for grow out purpose for a period of 4-6months. The central island is so designed to provide suitable habitat for the crabs to rest and burrow. Mangrove poles especially of *Excoecaria* and *Rhizophora* species or bamboo splits may be used for fencing around the pond to prevent the crabs from escaping. The central island portion may also serve as a feeding place. Feeding with minced trash fish (5-8% of body weight) at central platform island or on the slopes may be adopted. Tidal water is to be flown into the system through wooden box inlet or a sluice gate. The outlet should have closely knit bamboo split screen or obstruction hurdles with a box-trap.

**1.2 Stocking:** Stocking density differs with the size of the crabs and so also the length of cultural operation and harvesting. Crablings (2-3cm) caught from natural habitat can be stocked at the rate of 20,000- 25,000 number/ ha and should be grown till they reach to a marketable size (10.0-14.0cm, 200-400gm. or more).

**1.3 Harvesting:** The ponds may be harvested after 3-6months of grow out culture. Mention may be made that in Philippines, harvesting follows after 90 days of crab culture or crab fattening, in Thailand after 30 days, in Malaysia after 2-14 days, in Australia after 30-45 days and while in Sri Lanka it is done after 115 days depending upon the size used for fattening (Anonymous, 1991). The fattened crabs (200-400gm.) are scooped out using hand nets or by blunt hooks from their burrows manually.

**1.4 Crab fattening:** Small sized brackishwater ponds (0.01ha-0.1ha) without any island inside but may be partitioned into

different chambers with nylon nets, if required, adding external food supply of 7–8% of body weight, are recommended for crab fattening. Semi-intensive stocking of discarded crabs are useful for this purpose. Adequate supply (7–8% of body weight but not in excess) of external food is a must in this type of semi-intensive cultural operation as the crabs are highly cannibalistic under unfed conditions. Use of chopped cuchia fish (*Monopterus cuchia* Hamilton), trash-fish, fish-offal, shrimp heads, mollusk wastes of bivalve species, viz., *Anadara granosa*, *Meretrix meretrix*, *M. casta*, *Crassostrea gryphoides*, *Saccostrea cuculata*, *Dosinia trigona*, *Donax incornatus*, *Macoma birmanica*, *Solen kempfi*, *Pherella javanica*, etc., and gastropod snails which are commonly available in the area is suggested. Feeding may be done once in a day by throwing feed on to the pond and along the margins. Feeding rate varying about 5–8% of wet body weight is recommended. Fattening of the crabs of larger size may also be done in floating net cages.

## Discussion

Aquaculture is a common practice with *Scylla* in Australia and South-east Asia, particularly in Taiwan, Malaysia, Indonesia, Thailand and Philippines.<sup>6,7,13,18,19</sup> In India, attempts are sprouted to culture crabs especially from some States of South India. In West Bengal, the culture (grow out) of *Scylla* species has not yet been aquaculturally initiated although mud crab fattening is augmented in large scale since 2010s. Globally, mud crab workers<sup>9,20–22</sup> have recognized four species of *Scylla*, viz., *S. serrata* (Forskål), *S. paramamosain* Estampador, *S. tranquebarica* (Fabricius) and *S. olivacea* (Dana), Amongst them except *S. paramamosain*, three other species are known to occur in the Indian Ocean regions and possibly also in the Indian Sundarban. As such in crab culture and especially in mud crab fattening species identity is extremely essential for species-specific and cost-effective production of crabs.<sup>23</sup>

Sundarban region is socially-economically a backward area of West Bengal. Here, most of the people of forest fringe areas particularly fishermen communities live below the poverty line, sustaining mostly on forest and fishery resources. Semi-intensive crab culture especially during lean period of agricultural activity will be of immense help to them and to boost up Sundarban's economy. This will also augment avenues for foreign exchange earnings from export of this marine product. From the fishable and cultivable areas of crabs in West Bengal, it is apparent that there is scope for augmentation of crab production in this region particularly through cultural practice.<sup>5,24–26</sup> This is because there is no organized crab fishery in this region and the fishermen communities are also not aware of technical knowhow of crab culture. Thus, the production of mud crabs may be enhanced by way of scientific and organized fishing as well as by semi-intensive farming. However, much caution needs to be taken to avoid over-exploitation from natural sources. Furthermore, as the crab meat is rich in protein which is comparable to marine and freshwater fishes and mollusks,<sup>27</sup> augmentation of crab production may solve the demand for protein requirement in India as well as West Bengal.

## Acknowledgments

None.

## Conflicts of interest

Author declare that there is no conflicts of interest.

## References

1. Dev Roy MK, Nandi NC. Crabs of coastal West Bengal and Andaman Islands—Their recognition and fishery informations. *J. Indian Soc Coastal agric Res.* 1991;9(1–2):69–75.
2. Dev Roy MK, Nandi NC. Crustacean fishery resources of coastal West Bengal and their conservation issues. *J Environ & Sociobiol.* 2004;1(1&2):71–80.
3. Dev Roy MK, Nandi NC. Checklist and distribution of brachyuran crabs of West Bengal, India. *J Environ & Sociobiol.* 2008;5(2):191–204.
4. Nandi NC, Ghatak SS. Crabs of commercial importance from coastal West Bengal. *J Indian So Coastal agric Res.* 1985;3(2): 131–135.
5. Nandi NC, Pramanik SK. *Crabs and Crab Fisheries of Sundarban.* Hindusthan Publishing Corporation (India), 1994. p 192.
6. Anonymous. A BOPP Seminar on Mud Crab culture and trade in the Bay of Bengal region. *Fishing Chimes.* 1991;11(9):7–34.
7. Suresh AV. Crab farming in Thailand. *Fishing Chimes.* 1991;11(4):7–9
8. Nandi NC, Dev Roy MK, Pal S. Biometrical studies on the Mud Crab, *Scylla serrata* Forskål from Sundarban, West Bengal. *Seafd Export J.* 1996;27(6):17–22.
9. Keenan CP, Davie PJF, Mann DL. A revision of the genus *Scylla* de Haan, 1833 (Crustacea: Decapoda; Brachyura: Portunidae). *Raffles Bull Zool.* 1998;46(1):217–245.
10. Estampador EP. Studies on *Scylla serrata* (Crustacea: Portunidae). I. Revision of the genus. *Philip J Sci.* 1949;78(1):95–108,
11. Nandi NC, Dev Roy MK. Burrowing activity and distribution of *Scylla serrata* (Forskål) from Hooghly and Matla estuaries, Sundarban, West Bengal. *J Bombay nat Hist Soc.* 1991;88(1):167–171.
12. Hill BJ. Natural food, foregut clearance–rate and activity of the crab (*Scylla serrata*). *Marine Biology.* 1976;34(2):109–116.
13. Arriola FJ. A preliminary study of the life history of *Scylla serrata* (Forskål). *Philip J Sci.* 1940;73(4):437–455.
14. Prasad PN, Sudarshana R, Neelakantan B. Feeding ecology of the mud crab *Scylla serrata* (Forskål) from Sunker backwaters, Karwar. *J Bombay nat Hist Soc.* 1988;85(1):79–89.
15. Pillai KK, Nair NB. The annual reproductive cycles of *Uca annulipes*, *Portunus pelagicus* and *Metapenaeus affinis* (Decapoda: Crustacea) from the South–west coast of India. *Marine biology.* 1971;11:152–166.
16. Naidu KGRB. The early development of *Scylla serrata* Forskål and *Neptunus sanguinolentus* Herbst. *Indian J Fish.* 1955;2(1): 67–76.
17. Pillai KK, Nair NB. Observations on the breeding biology of some crabs from the South–west coast of India. *J mar biol Ass India.* 1973;15(2):754–770.
18. Bardach JE, Rhyther JR, Mc Larney WO. *Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms.* John Willey and Sons, New York.1972.
19. Harvey M. Mud crab culture in Thailand. *Infofish International.* 1990;6/90:53–54.
20. Estampador EP. *Scylla* (Crustacea: Portunidae). Comparative studies on spermatogenesis and oogenesis. *Philip J Sci.* 1949;78(3):301–353.
21. Serène R. Les especes du genera *Scylla* a Nhatrang (Vietnam). *Proc. Indo–Pacific Fish Coun.* 1952;3(2):133–137.
22. Kathirvel M, Srinivasagam S. Taxonomy of the Mud crab, *Scylla serrata* (Forskål), from India. BOBP/Report/51, p. 127–132. Bay of Bengal Programme, India. 1992.

23. Nandi NC, Pramanik SK, Dev Roy MK. Mud crab culture: Relevance of species identity in production economics with reference to Sundarban Coast. *J Fisheries Sciences*. 2016;10(4):84–89.
24. Nandi NC, Dev Roy MK. Prospect of Mud crab culture in Sundarbans. *Proc Natn Seminar on Front Res And its appl. Coastal agriculture*. 1998:10–11.
25. Pramanik SK, NC Nandi. Crab fattening (*Chamber chas*)—a promising enterprise in Indian part of Sundarban. *J Environ & Sociobiol*. 2012;9(1):78.
26. Nandi NC, Pramanik SK. Wetland economics. Crab production in brackishwater ponds of Sundarban, West Bengal. *Nat Sem on Aquaresources: Care & Concerns*. 2015.
27. Srinivasagan S. On the nutritive values of the meat of portunid crabs. *J Inland Fish Soc India*. 1979;11(2):128–131.