

# MUD CRAB CULTURE: A GUJARAT PERSPECTIVE

(Under Tribal Sub Plan)



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Mud crabs of the genus *Scylla* are extensively farmed in the whole of south east and southern Asia. Commercial mud crab aquaculture in India is an emerging economic activity and is fuelled by the lower success rate and higher production costs encountered by the Indian shrimp industry. Although, productivity and profitability of mud crab culture would be lower than that of shrimp farming from the same unit area, systematic mud crab farming is bestowed with reduced levels of risk and operational ease. Mud crab culture is also an option for diversification in brackishwater aquaculture and commands greater environmental sustainability. The state of Gujarat has abundant resources of brackishwater and low lying salt affected land which is being mostly used for shrimp culture. Mud crab culture can be a supplementary farming practice to shrimp farming in Gujarat especially for regions with poor success rate in shrimp and farmers who are otherwise not capable of making larger investments and still wish to yield substantial revenue. Mud crab culture is also an excellent alternate livelihood option for coastal tribal communities owing to ease of farming practices and low investment requirements.

### Species

There are two species of mud crab available in the Indian coastal waters, under the genus *Scylla* i.e. giant mud crab, *Scylla serrata* and Orange mud crab, *Scylla olivacea* that can be reared under controlled conditions. *S. serrata* is characterised by polygonal markings on chelipeds, swimming, and walking legs and possess two spines on the outer margin of the wrist on the cheliped. Whereas, *S. olivacea* does not possess polygonal markings on its body and is characterised by a single blunt spine on the outer margin of the wrist on the cheliped. *S. serrata* grows to a maximum size of 1.5-2.0 Kg, whereas *S. olivacea* attains a maximum size of 0.5 to 0.7 Kg. Among the two species, *S. serrata* is the species of choice for culture, owing to its faster



*Scylla serrata*



*Scylla olivacea*



growth rate, larger size, higher price, greater suitability for pond culture, lesser aggression and ease of handling. *S. olivacea* demonstrates greater aggressive behaviour and intense burrowing habit that results in damage to the dyke structure, apart from being lower priced and attains a lower individual harvest size.

The estuarine and creek systems in coastal Gujarat is dominated by *S. olivacea*. *S. serrata* is abundantly available in the south east coast of India wherein it is subjected to excessive fishing pressure for export trade and seed stock for aquaculture industry. Excessive wild collection of mud crab juveniles (*S. serrata*) for farming has resulted in depletion of several stocks leading to reduced availability and high price of seed. However, in West Bengal and parts of Orissa wherein wild stocks of mud crab are dominated by *S. olivacea*, the aquaculture industry thrives almost entirely on the farming of this species. Since, Gujarat also possesses abundant resources of *S. olivacea*, the future of mud crab culture in the state would be dominated by this species. Although, high price of seed stock for *S. serrata* coupled with its transportation cost may be a deterrent for the farming of this species in Gujarat, its premium selling price and fast growth rate may offset these issues. Farming practices for mud crab species does not vary significantly and both the species can be reared in coastal regions of Gujarat.

### Site Selection and Water quality

Existing shrimp ponds can be converted to mud crab culture ponds with minor modifications and addition of structures to prevent the escape of crabs. Nevertheless, established criterion for selection of sites for shrimp culture is equally applicable for mud crab culture. Desirable water and soil quality parameters at the site for mud crab culture is shown in the table.

**Table : Optimum water and soil quality parameters for mud crab aquaculture under pond conditions**

Water quality variables			Soil Quality parameters	
Sr. No.	Parameter	Optimum range	Parameter	Optimum range
1	Salinity	15-25 ppt	Soil type	Sandy clay, Clay loam or sandy clay loam
2	pH	7.5 -8.5	Soil pH	6.5 to 7.5
3	DO	>4 ppm	Organic carbon	1.5-2.0%
4	Temperature	23-32°C	Calcium carbonate	>5%
5	Alkalinity	125 to 200 ppm	Electrical conductivity	>4 dS m <sup>-1</sup>
6	NH <sub>3</sub> -N*	<0.1		
7	NO <sub>2</sub> -N*	<0.1		

\*Tolerance range of mud crabs to nitrite and ammonia levels in the water is still higher.

Most coastal regions of Gujarat experience a higher salinity of over 35 ppt that can climb up to 60 ppt at certain sites during peak summer. *S. serrata* can be reared at salinities up to 45 ppt without significant growth reduction, although growth attained would be lower than those obtained at low and intermediate salinities. Wild populations of *S. olivacea* inhabits the hyper saline coastal environments in Gujarat and has greater tolerance to high salinities, thus making them a suitable species for hyper saline regions.

### Seed

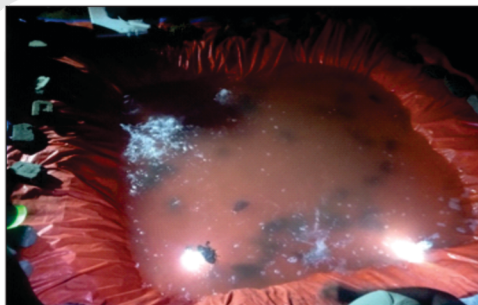
Hatchery technology for production of seed exist for *S. serrata* and hatcheries are able to supply crab instars (CW-0.5-1.0 cm) or crab juveniles (CW 4-5 Cm, BW-3-5 g). Small sized seed has to be subjected to nursery rearing and pre-growout rearing to obtain 50-100g crab juveniles that are suitable for stocking in growout ponds. Alternately, wild caught *S. serrata* juveniles (50-100g) obtained from mud crab fishery along the Indian coast line may be used as stocking material in mud crab growout ponds. Commercial hatcheries do not exist for *S. olivacea* and seed of the species has to be sourced entirely from mud crab fishery. Since, abundant resources of *S. olivacea* exist in Gujarat, seed can be sourced from the local fishery. Large markets dealing with trade and transport of mud crab seed around India exist in Tamil Nadu and Andhra Pradesh. The largest market for mud crab for both aquaculture and export trade exist at Chintadripet, in Chennai, Tamil Nadu.



### Seed Quality, Acclimation, and Stocking

Select seed from wild populations that have been sourced from unpolluted regions and does not have previous history of any major disease outbreak. Mud crab juveniles (50-100 g) are suitable for stocking to growout ponds. Juveniles or sub adult mud crab of body weight less than 350g are called





green local (GL size) in the supply chain and are mostly used for stocking. It is recommended to stock uniform sized mud crab seed in the growout pond to avoid cannibalism. Select mud crab seed with intact chelipeds and complete pair of walking and swimming legs. Mud crab seed with fouling on its carapace, injuries or other disease symptoms on the carapace/abdomen are not suitable for stocking. Minimise transportation time for the seed as prolonged transport periods are directly proportional to mortality rates on transit. Transportation time/period for mud crab seed shall not be allowed to exceed 15 hours. On arrival at the farm, the seed can be stocked to FRP tanks or plastic lined pools filled with pond water. The system shall be aerated and mud crab seed may be subsequently stocked to the ponds after 30 minutes of acclimation. While stocking mud crab seed, care shall be taken to gently remove all rope/twine used to tie the juveniles without causing any damage to the appendages. Acclimation in tanks or pools shall be done in the tied state. It is preferable to stock the seed during early morning or late evening hours.

### **Farming systems**

Mud crab aquaculture comprises of several farming systems such as fattening, monoculture, polyculture of mud crab with brackishwater finfish, box culture and recirculatory aquaculture systems for production of soft shelled crabs. Among the various farming systems, polyculture of *S. serrata* with brackishwater finfish and box culture of *S. olivacea* / *S. serrata* are only relevant to Gujarat based on its location, culture conditions, markets and seed availability.

### **Polyculture of *S. serrata* with brackishwater finfish**

Polyculture of *S. serrata* with Milkfish, *Chanos chanos* would be the best suitable model for mud crab aquaculture in coastal Gujarat wherein hyper saline conditions are widely encountered. Milkfish exhibits high tolerance



to high saline conditions and demonstrate a fast growth rate even under such conditions. Polyculture of *S. olivacea* is not recommended as its intense burrowing habit would damage the dykes and further complicate harvest process.



### Pond design considerations

Existing shrimp ponds or newly constructed ponds may be used for polyculture of *S. serrata*. Rectangular or square ponds may be used to rear mud crab, although rectangular ponds with their longest side aligned to local wind conditions would minimise aeration requirements. Pond of 0.5 to 1.0 acre (2000-4000 m<sup>2</sup>) are suitable for polyculture of fish and mud crab. Fencing using 90-120 gsm plastic film (2-3 feet long) secured with short bamboo or casuarina poles may be provided on the dyke edges to prevent the escape of the crabs. Additionally, a portion of the pond may be separated from the rest of the pond using HDPE netting or PVC netting erected on to the pond bottom using casuarina poles creating a pen-like structure wherein mud crabs would be reared during the grow out. Ensure that both fencing materials continue in to the soil for at least a depth of 20-30 cm. Double crab fencing i.e., one within the pond and one on the dyke is made to prevent the escape of mud crabs which would otherwise escape easily from an earthen pond. Size of the inner pen



erected inside the pond would decide the number of crabs that's can be stocked. Generally, for a 2000 m<sup>2</sup> pond, the size of the inner pen is kept at 1000m<sup>2</sup>. Catwalks from two sides, diagonally opposite to each other extending 3-5 metres in to the inner pen may be erected for the ease of feeding and entry in to the pen.

### Water Depth and Culture Conditions

Depth of water in the pond shall be maintained at a level of not less than 80 cm and water depth shall not exceed 150 cm. Mud crab juveniles (GL size<350 g) may be stocked at densities of 0.5-1.0 ind./m<sup>2</sup> inside the pen and density calculations shall be made on the basis of the pen area and not the pond area. Old PVC pipes (110mm and above), earthen pipes, tiles may be provided in the pen as hideouts for crabs to minimise cannibalism. These structures may be provided at the rate of 50% of the total number of juveniles stocked. Water level in the ponds may be topped up using water from reservoir. Water exchange may be carried out once in 30-45 days based on water quality analysis at the rate of 20-30% of the total pond volume. Nursery reared milkfish fingerlings (TL 5 to 7 cm, BW~1-2 g) or bigger sized seed may be stocked in to the pond at the rate of 1000 nos to 1500 nos per 2000m<sup>2</sup> of pond area. Milkfish shall be stocked 15 days after stocking of crab seed or 30 days before stocking of mud crab juveniles. The pond shall be filled using creek water or coastal saline groundwater that may be disinfected @10ppm active chlorine concentration prior to fertilisation and subsequent stocking. Ponds may be fertilised using organic slurry or commercial plankton booster combinations. After stocking, water and soil probiotics may be applied once every 15 days depending on water quality data and organic juice/plankton booster application may also be carried out periodically.





## Feeding

Commercial formulated feed is not available for *S. serrata*, although specially formulated crab feed is available with ICAR-CIBA which has been delivering optimal results. Commercial mud crab aquaculture depends on



low cost thrash fish obtained from landing centres or other water bodies for feeding. Crabs may be fed using wet or dried thrash fish at the rate of 5-8% of the body weight on alternate days i.e. feeding is carried out only once in two days. However, in case of higher stocking density, feeding may be carried out daily. The entire feed ration may be broadcasted in a single feeding session preferably during late evening or early morning hours. Tilapia, marine eels, sardines and other low value marine fish are excellent feed for mud crab juveniles. Milk fish may be fed using CIBA low cost feed poly plus or other commercial carp/catfish feed at the rate of 2-3% of BW starting from 30 days of stocking.

## Harvest

When *S. serrata* juveniles of 50-100 g size are stocked, cull harvesting shall start from 4 months onwards wherein larger sized crab (>500 g) may be harvested using baited traps. This can be carried out once every 15 days until 6-8 months following which the entire stock can be harvested. In the case of milkfish, it is recommended to stock the fingerlings 30 days before stocking crab juveniles such that fish can be provided with a growing season of 7-9 months.

## Production and economics

Polyculture of *S. serrata* with milkfish is a sustainable business model. Survival rate at harvest observed for *S. serrata* and Milkfish is generally 55-60% and 80-90% respectively. For a 2000m<sup>2</sup> pond with a 1000m<sup>2</sup> pen

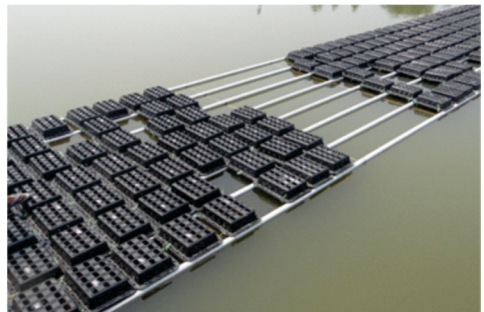



stocked with 500 *S. serrata* juveniles and 1500 milkfish fingerlings, assuming an average survival and size (*S. serrata*~500 g, Milkfish~500g) at harvest, a production of 150 kg of mud crabs and 650 Kg fish is easily achievable. This would transform in to a revenue to the tune of rupees (Rs.) 2.5-2.8 lakhs per unit area (2000m<sup>2</sup>) against an operational cost of approximately Rs. 1.6 lakhs/crop resulting in a net benefit of Rs. 80,000 to 1.1 lakhs per crop.



### **Box culture of *S. olivacea*/*S. serrata***

Rearing of *S. olivacea* directly in ponds under a polyculture system is not recommended due to its intense burrowing habit and aggressive behaviour which can affect dyke stability, harvesting and handling. Culture of *S. olivacea* is therefore, recommended in a box culture system, wherein each crab juvenile is placed in individual HDPE boxes that are floated on a raft structure. The HDPE boxes come in various sizes, although larger sized boxes have shown to deliver better results. The boxes consist of holes on the top for feedings and smaller holes on the sides and bottom for water circulation and exchange of metabolites and faecal matter. Boxes consist of two parts, viz., upper lid and lower body that is immersed in water. The





boxes are rigged on to a PVC floating raft and assembled in a battery structure such that about 3/4<sup>th</sup> volume of the box goes underwater, thus keeping the mud crab juveniles within water in the pond environment. Around 5000-10,000 boxes may be installed in a 4000m<sup>2</sup> pond. Crabs may be individually fed using thrash fish at the rate of 5-8% of BW on alternate days in a single feeding session. Ponds with large number of boxes may be provided with a paddle wheel aerator or sprinkler aerator. The box culture system is equally applicable to both species, although *S. olivacea* being a dominant species in Gujarat with abundant seed stock is the preferred species for mud crab culture in the state.



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