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Assessment of the approach and potential of mud crab aquaculture

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Many crab species have been redistributed outside their natural mangrove habitats. Mud crabs that are found in aquatic and terrestrial environments and even land adapted ones return to the water to release their larvae.Research works in recent time have not been able to satisfactorily separate a number of genera into species. They undergo series of moults during growth but under immediate and long-term threat due to rapid environmental changes. The investigations into mud crab around the globe are focusing on the aquaculture systems for Scylla, Potamon and Eriocheir species. The Scylla species is most widely cultured and the fastest in terms of system development. The culture systems depend so much on wild seed stock. Insufficient supply of crablets generally has been a limiting factor. The reason perhaps was that the use of insecticide in agriculture could reduce the population of various species. They are omnivorous though; larval rearing may be more difficult than the crustaceans, probably due to sensitivity to bacterial and other parameters of water.

Keywords: Evaluation, mud crab, aquaculture, potential, practice.

INTRODUCTION

Mud crabs are found in a variety of microhabitats around mangrove forests. They burrow into the mud commonly at approximately 30^0 to the horizontal, which are often used as refuge for subadults and adults (Shelley and Lovatelli, 2011). Freshwater crabs are distributed throughout the tropic and subtropic, and there are around 1300 species. The total number of species including undescribed ones is up to 65% higher, potentially 2155 species. Most of the additional species are currently unknown to science. They show direct developmental and maternal care of a small number of offspring in contrast to marine crabs, which release thousands of planktonic larvae (Anon, 2013 a).

There is a continuum of terrestriality among the true crabs, and most landadapted ones must still return to water to release their eggs. Some of them can be found many kilometres from the sea, but have to complete annual migration to the sea (Anon, 2013b and Little, 1990). The terrestrial crabs have often evolved from freshwater crabs, since the physiological changes needed for living in the water are pre-adaptions for terrestrial living (Dobson, 2004).

The population is discontinuous and highly fragmented despite the wide distribution of the species and relatively high number of localities. They may nevertheless be under immediate and long-term threat from anthropogenic changes affecting their habitats, such as water diversion, drainage, habitat disturbance, pollution and over harvesting (Cumberildge, 2008).

Moreover, large-scale abstraction for water, alteration of the water environment and riverine hydrology has caused many resources to degenerate and lose food potentials (Ahmed, 1999). The boundary between the mangrove and mud flats has been identified as an area that could support high densities. Although different species may be present in any one location, only few of them are responsible for the dominant percentage of overall population. Considering the long-term and immediate threat of environment, there is needed to review the development indices and some aspects of

Table I: Crab species that are available in some countries

Country	Species	Aquaculture Status	Source
Australia	*Scylla species*	Culture	Fisheries fact sheet, 2013
China	*Eriocheirsinensis* *Scylla species*	Culture Culture	Shelley and Lovatelli, 2011
Greece	*Potamon*	Research	Maurakis*et al,* 2004
Denmark	*Scylla*		Fisheries fact sheet, 2013.
Israel	*Potamonpotamios*		Cumberildge, 2008.
Nigeria	*Potamon*	Research	Akpaniteaku, 2013.
Philippines	*Scylla*	Culture	Business Idea, 2013.
Vietnam	Scylla	Culture	Shelley and Lovatelli, 2011.

production of the small animal. The evaluation is therefore necessary to expose resource capacity, aquaculture potentials and other relevant activities for the enhancement of production.

Biology

The mud crabs appear to have independent relationship with mangrove forest. The loss of mangroves for whatever reason typically would be followed by lower crab catches. They are also found in estuaries without mangroves, so they are not essential for colonization or survival. The Scylla species have three distinct genetic stocks in the West Indian Ocean, Eastern Australia and the Pacific Ocean and North Western Australia. The most widely distributed crabspecies, *S. Serrata* (Table I) is found as far west as South Africa, east to Tahiti, French Polynesia as far north as Okinawa, Japan and South to Sydney, Australia (Shelley and Lovatelli, 2011).

River crabs live in inland water bodies connected to estuaries until they reach sexual maturity, after which they migrate downstream to brackish water estuarine areas to reproduce. The migration starts in October and both male and female usually die after completing reproduction.

They prefer hiding in aquatic weeds or sand and gravels. They hide in their shelters during the day, and move out for feeding during the night. They are omnivorous feeding on prawns, small fish, benthic animals and tender macrophytes (The Fish Site, undated). Growth is not continuous but results from a series of moults that happen when it reaches the size of its current shell. Moulting is triggered by hormone. A new hard protective layer (cuticle) is secreted under the old shell. The crab absorbs water, splitting its shell along suture lines, and backs out of the old shell. Substances stored within the body are rapidly deposited to harden the new cuticle into a large shell. The body fluid is replaced with meat during the period when it feeds voraciously (Fisheries Fact Sheet, 2013).

RESEARCH AND DEVELOPMENT

Results of the recent taxonomic clarification should be assessed with care, because the crab species quoted may no longer be accurate. Investigations may have been undertaken on a number of species, but were either not able to separate them satisfactorily, or only examined limited species from the genera. An improved understanding of the genetics of mud crabs would enable the success of stock enhancement work to be more accurately gauged (Shelley and Lovatelli, 2011). Mud crab diversity in Asia was probably caused by some ecological events around Yellow Sea and East China Sea. The East Asian Islands were connected to Asian continent before the opening of the Okinawa trough, due to collision of tectonic plates. The opening of Okinawa trough might have formed a large lagoon or inner sea during some geographical periods, which increased the complexity of the geographical barriers and might have been a major isolating mechanism for the intertidal organisms (Shih and Suzuki, 2008).

However, methods of culture have evolved with particular set of advantages, drawbacks and challenges that are for the most part directly applicable to the crab culture practices. The extensive aquaculture has little to no environmental impact, but requires large tract of land and significant labour for harvesting. Owing to this reason, it is necessary to assume that areas where land comes at a premium and labour is comparatively expensive are unsuitable for extensive aquaculture. Intensive crab culture can be performed in smaller areas and at greater densities, minimizing land and labour. The environmental impact of the technique can be significant. However, laboratory rearing requirements are the same for each type of aquaculture. The important aspect is the drainage, because improperly designed one will require hours of clean up (Anon, undated).

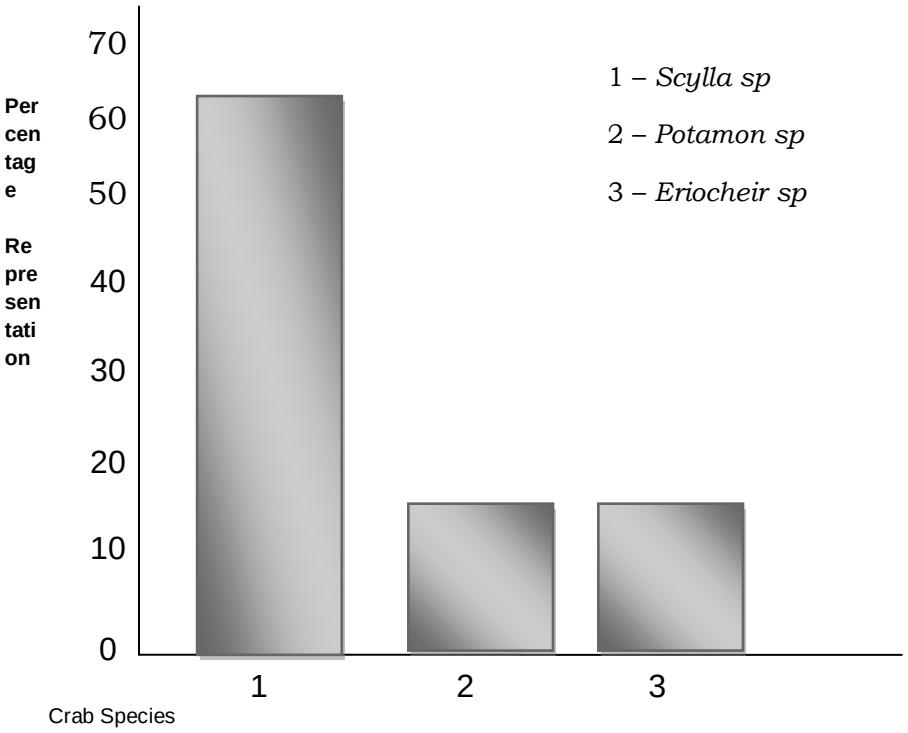

Figure I: Representation of Cultivable Crab Species

Table 2: Crab Production Range in some Countries

Country	Species	Weight at Stocking (g)	Weight at Cropping(g)	Remarks
China	*Eriocheir senensis*	5 – 10	125 – 200	Culture
Philippines	*Scylla serrata*	10 – 250	400 – 500	Culture
Nigeria	*Potamon ebonyicum*	25	43.5	Research

Source: The Fish Site (undated), Business Idea (2013), Akpaniteaku (2013)

A lot of work has been done on different kinds of cultivable crabs (Fig. I). They may struggle to escape from receptacle, especially those from the wild. In intensive culture systems, they might make several attempts at the onset, especially in the night. This may probably indicate that rough-surface enclosures are not suitable for intensive rearing. The capacity to escape may however be attributed to habitat range and feeding behaviour of the animal (Akpaniteaku, 2013). They bore holes along dykes and cause leakage. Coastal ponds with numerous mound sand, and unsubmerged regions are therefore more suitable for their culture. In mangrove and estuarine area, aquaculture techniques have been developed for two species namely, *S.serrata* and *S.oceania*. Trench ponds are suggested with water depth of 1 – 1.5m. Fencing of the inner side of pond with bamboo matting to a height of about 1m can prevent them from escape (Antharjarnam, 2013).

Initial study on mud crab was discontinued to give way to priority shrimp species. The investigation was resumed with various interests to develop seed production and improve farming techniques. Grow-out investigations have tried various stocking densities and polyculture with some fish species. Monoculture trials on tidal flats with existing mangroves were verified in various places. The effects of crab net pen systems on mangrove macroflora, and replacement of dietary fish with low cost pellets have been investigated (SEAFDEC, 2013). The research and culture activities to develop reliable commercial mud crab aquaculture are ongoing (Table 2). The production of crablets for farming systems has already commenced in Vietnam and the Philippines on relatively small scale. In Australia, crabs from hatchery production have been grown out in a commercial prawn farm, and government institutions together with the private sector are working on commercialization of their technology (SPC, 2011).

Constraint

Freshwater crabs have disappeared from many environments probably as a result of the extensive use of DDT and other insecticides during agriculture and campaign against malaria. The use of less harmful insecticides in recent years has seen some recovery of certain population of crab species, but not all population have recovered, and some must be presumed extinct in some areas (Cumberildge 2008). The constraint to the development of mud crab farming is the unrealiable supply of crablets. Commercial scale production of larvae has proven to be more difficult than for other crustaceans. The larvae are particularly sensitive to bacteria and related water quality parameters.

Seed stock for most mud crabs farms are harvested from the wild. Hatchery production has only recently contributed to the seed stock production. The grow-out issues cover such scope as the use of simple, low-cost technology, suitability for small-scale operations, ease of management and possible environmental impact.

CONCLUSION

Many crab species burrow into mud in environments that are some kilometers away from the original habitat. The inability to complete reproduction process on land has indicated that limitation of adaptive trait is of vital importance in aquaculture and field study. Despite the fact that a couple of investigations are ongoing and some regional institutions are working toward popularizing available technologies, the resource for crab aquaculture is yet to be harnessed. Capture strategy could be developed in such a manner that would utilize relevant reproductive behaviour to enhance extensive culture. Gravid females could be encouraged to release larva in pools and flood ponds for extensive culture purposes. The initial seed stock for crab culture should be carefully sourced from the wild. Proper care should be taken to secure crablets in suitable culture systems, and feed adequately with any edible and good-grade stuff.

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