AQUACULTURE EXTENSION MANUAL NO. 28 OCTOBER 1999

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FOREWORD

AQD's Technology Verification Program, launched in 1996, aims to field test various aquaculture technologies in order to hasten technology transfer to various users and address problems of food security in the region.

This manual is a product of those field trials conducted in various places conducted in Jalandoni and Montelibano farms in E.B. Magalona and Gargarita farm in Himamaylan, both in Negros Occidental, Philippines. This particular technology on mudcrab culture has been proven to enhance production and profit without contributing to environmental degradation.

Mudcrab production in brackishwater ponds is now gaining popularity, especially in communities that need to supplement their income.

We hope that this manual would be of use to fishfarmers and aquaculturists, extensionists, and students of aquaculture not only in the Philippines but also in other mudcrab producing countries in Southeast Asia.

ROLANDO R. PLATON, Ph.D.
Chief, SEAFDEC Aquaculture Department

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MUDCRAB, *SCYLLA* SPP, PRODUCTION IN BRACKISHWATER PONDS

Mudcrabs are one of the most edible and widely sought after crustacean species that inhabit the estuarine areas and tidal rivers and creeks of Asia and the Indo-Pacific regions.

Hailed as "food for the gods," mudcrabs are recognized as candidate species for culture in brackishwater ponds and/or other suitable impounded brackishwater environment.

In the past, mudcrabs were a secondary species to fish or penaeid shrimp with seeds entering the pond without intentional stocking by the farmer. Though conceived as a fishpond crop, mudcrabs are considered a nuisance when it deliberately burrows into pond dikes inevitably causing leakages.

Recently, small scale farming of mudcrabs has been progressing rapidly because of its promising profitability.

With the availability of mudcrab juveniles from the wild throughout the year and the recent development in the hatchery techniques and increasing market demand, there is a strong indication that production of mudcrabs in commercial scale could be a lucrative industry.

What are mudcrabs?

Mudcrabs are classified under the genus *Scylla* and are reported to consist of three species – *Scylla serrata, S. oceanica, S. tranquebarica,* and a variety of *S. serrata* var *paramamosain*. Generally, this commodity is known as mud or mangrove crab in Australia, Samoan crab in Hawaii, *alimango* in the Philippines, *tsai jim* in Taiwan, *nokogiri gazami* in Japan, *kepiting* in Indonesia, *kalapu kakuluwa* in Sri Lanka, *haubba kankera* in Bangladesh and *ketam nipah* or *ketam bakau* in Malaysia (Latiff et al. 1995).

In the natural habitat, crabs mainly feed on crustaceans while adults and sub-adults feed on molluscs (Jayamanne & Jinadasa 1991 and Hill 1976). Fish remains are rarely found as it has been concluded that *S. serrata* do not normally catch mobile forms such as fish and penaeid prawns. Mudcrabs usually remain buried during the day, emerging at sunset to spend the night feeding, which occur intermittently even when unlimited food is available (Hill 1976).

Distribution

Mudcrabs inhabit both the marine and brackishwater environments and prefer muddy and sandy clay bottoms. They are found in many countries of the West Indo-Pacific region, South Africa to Hawaii, and from North Australia to Southern Japan.

Grow-out operation in ponds

SITE SELECTION

(1) A typical brackishwater pond designed for the culture of milkfish or shrimp can be used for the farming of mudcrab.
(2) Fishponds (new or partially developed) with water control structures can be used for as long as the required water depth of 80-100 cm can be maintained.
(3) Soil must be sandy clay or clay loam with rich organic matter base and preferably alkaline.
(4) Water of good quality should be adequate all year round, coming directly from the sea or tidal river. The most desirable ranges of water quality are: salinity, 10-34 ppt; temperature 23-30 °C, dissolved oxygen, above 3 ppm; and pH 8.0-8.5.
(5) The farmer should consider an area where seawater is sufficient to fill a depth of at least 60 cm during high tide. When drained even at neap tide, the pond bottom would be exposed completely. Thus, engineering expertise is required to determine pond bottom elevation including dike and gate construction.
(6) To prevent the increase of pond water salinity especially during long summer months, it is advantageous to have a freshwater source. This will enable the farmer to adjust the salinity to a level favorable to the growth of mudcrab.
(7) Other socio-economic factors such as cheap and skilled labor, market accessibility of construction materials and production inputs as well as the peace and order situation in the locality should be considered.

POND SPECIFICATION

(1) Use earthen or concrete ponds preferably rectangular in shape with areas ranging from 250 m^2 to 1.0 ha (Fig. 1).
(2) Water depth should be 80 to 100 cm.
(3) The pond should preferably have a double gate system made either of concrete or wood. Supply and drainage must be separate to facilitate good water exchange.
(4) Pond bottom must be leveled and cleaned to allow easy harvest.

(5) Each one-hectare compartment is provided with about 12 earthen mounds (5 m^3) installed in strategic areas of the pond. These mounds serve as breathing spots where mudcrab could climb during times of low oxygen tension, as well as places where they can burrow. These should be installed in the middle of the pond high enough so that the peaks remain above water even when depth of 80 to 100 cm is reached.

(6) Sawed-off bamboos or used PVC pipes (50 cm long with 15 cm diameter opening at both ends) are added to avoid mortality due to fighting and cannibalism among fellow crabs. These also serve as shelters for moulting and post-moult crabs.

(7) To prevent the crabs from escaping, the area is fenced in either by bamboo or nylon net (1-2 cm mesh size) fence extending about 30 cm above the waterline. The fence is kept in place by supporting it vertically with bamboo or wooden posts and horizontally with some bamboo splits embedded about 50 to 70 cm along the base of the dike (Fig. 2). Plastic strip/sheet of about 30 cm wide should be installed along the top edge of the net fence to prevent mudcrab from climbing over the top. For concrete-lined ponds with relatively steeper slopes, a nylon net fence is no longer necessary.

(8) Catwalks and feeding trays may be provided for feed monitoring and stock sampling.

(9) Life support systems like water pump (axial or centrifugal), and paddlewheel aerators may be necessary for emergency water change and aeration especially during neap tide cycle and the latter during windless days or nights or when water condition so requires.

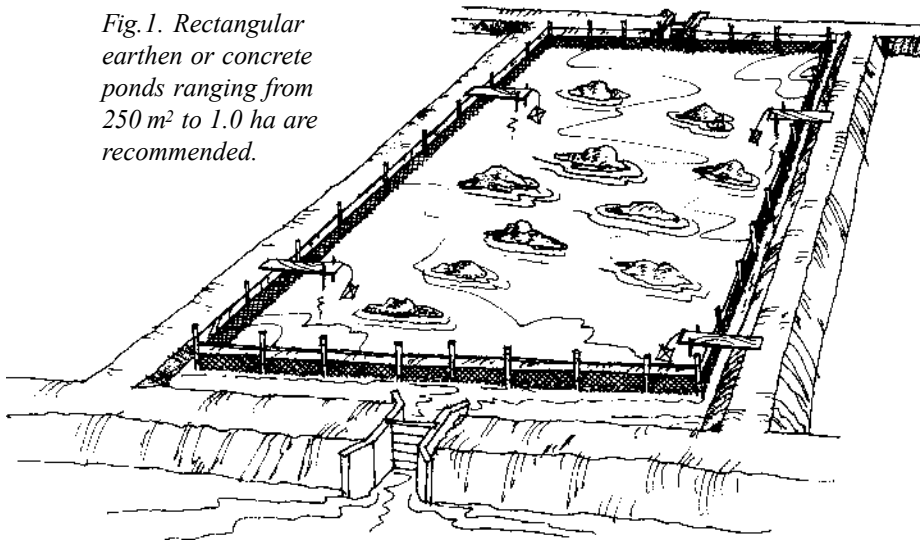

Fig.1. Rectangular earthen or concrete ponds ranging from 250 m^2 to 1.0 ha are recommended.

Fig.2. Plastic sheet should be installed at the top edge of the net fence to prevent crabs from escaping.

POND PREPARATION

Preparation of the pond for the culture of mudcrab is not complex. Growing of natural food is not necessary. However, prior to stocking, installation of net enclosures must be undertaken.

(1) Ensure that the net fence, earthen mounds and other physical requirements are properly installed.
(2) Ponds should be drained completely and the bottom be allowed to dry until it cracks for about a week or two (Fig. 3).
(3) Pest and predators must be eradicated during the pond preparation stage. This may be done by the application of teaseed powder at a recommended rate of 15 to 30 ppm depending on water salinity or a combination of hydrated lime ($Ca(OH)_2$) and ammonium sulfate fertilizer (21-0-0) at the ratio of 5:1. Other environment-friendly organic pesticides such as tobacco dust, and derris root extracts are also recommended.
(4) Fill the pond water to a depth of not less than 80 cm.

Fig.3. Pond should be drained and the bottom be allowed to dry until it cracks for about two weeks to eradicate pests and predators.

SOURCE OF JUVENILES

In the Philippines, mudcrab juveniles (10-40 g or 5-20 cm carapace breadth) are available throughout the year, peaking during the months of May to September. Most crab juveniles from the wild are from the provinces of Iloilo, Capiz, Aklan, Negros Occidental, Bataan, Lanao, Zamboanga, Misamis, Palawan, Samar, and the Bicol Region particularly Masbate and Sorsogon. They are caught in sizeable quantities in marshlands and estuarine areas.

Common collecting gears used are crab lift nets *(bintol)*, bamboo cage trap *(panggal* or *bobo)*, tube traps *(patibong)* and crab hook *(panukot)* (Motoh, 1983). Mudcrabs are also caught using fish corral *(baklad)* and baited line with scoop net oftentimes with bare hands (Fig. 4). Depending on size, quantity, sex and species, crab seeds are available to the farmer when collectors are notified in advance. This would give ample time for collection, handling, storage and transport. Hatchery-reared crab juveniles may soon be available although the technology is still being refined by researchers of SEAFDEC/AQD in Tigbauan, Iloilo, Philippines.

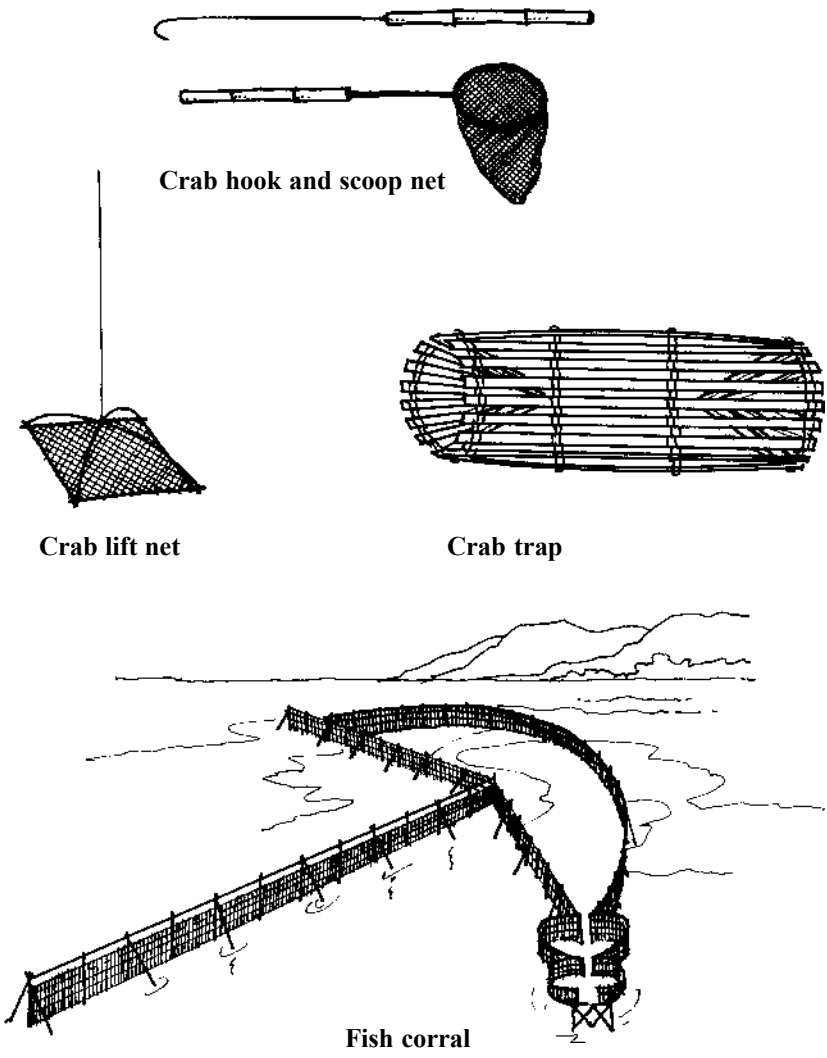

Fig.4. Common collecting gears used in catching crabs including market sized ones in Southeast Asia.

TRANSPORT AND STOCKING OF JUVENILES

Newly arrived single or mixed species *S. serrata* or *S. tranquebarica* juveniles in monosize or mixed-sized group (depending on the needs and availability) are normally contained in cardboard boxes, palm baskets *(bayong)* or bamboo wicket baskets. About 300 to 500 juveniles (chelipeds or pincers untied or tied with plastic straw or palm, *buri* leaves) are placed in each basket. Fronds of *Rhizophora* spp. *(pagatpat)* or *vicennia* spp. *(bungalon)* are provided inside the basket to keep the temperature cool and to minimize fighting among crabs. It is recommended that quality juveniles must be selected, e.g., active, healthy and with complete body parts. Juveniles without these requirements must be discarded outright.

Stocking maybe done during early morning or late afternoon, preferably at night when the temperature is cool. During stocking, tied pincers are freed, and crabs are released directly into strategic areas of the pond at a density of 5,000 to 10,000 juveniles per hectare (Fig. 5).

It is advisable to stock monosize mudcrabs to obtain a relatively uniform size at the end of the rearing period (Fig. 6).

Fig. 5. Stocking should be done during early morning or late afternoon, but the best time is at night when the temperature is cool.

Fig. 6. Stock monosize mudcrabs to obtain uniform sizes at the end of the rearing period.

CARE OF POND AND STOCK

After stocking, it is essential to maintain good water quality favorable to mudcrabs. When a considerable number of mudcrabs start to crawl on top of the earthen mounds or cling to the bamboo fence, it is an indication that water condition is not favorable. It is advisable, therefore, to change at least ⅓ of the pond water especially during spring tide. An irrigation pump maybe necessary in case water change is needed during neap tide.

Dikes, gates and net fences should be regularly inspected for possible leakages and dilapidation.

FEEDS AND FEEDING

Trash fish normally costs about P8.00 to P12.00 per kilo. Animal entrails or hides, snails and other locally available and cheap protein sources maybe given other than those derived from trash fish. Trash fish maybe chopped, dried and stored.

Feeding is by broadcast. It is done two times every day at an initial rate of 10% of the total mud crab weight. Every 30 days thereafter, feeds are adjusted to 8% then to 5%. For example, 5,000 juveniles with an average weight of 20 grams each will have a total weight of 150 kilograms. Hence, the required amount of every other day feeding at 10% is 15 kilograms. One half of the feeds is given in the morning and the other half in the afternoon (Fig. 7).

Filamentous-green algae or *lumut* or *gulaman* (*Gracilaria* spp.), when readily available may be given as supplemental feed.

Fig. 7. Chopped trash fish, animal entrails or hides are fed to mudcrabs two times a day.

HARVEST

1. Baited traps or hand lines with scoop nets (partial/selective harvesting). This is a way of inducing mudcrabs to swim against the current. In the Philippines, it is commonly known as *pasulang* method. This is done during spring tide after about 45-60 days when it is normal to catch crabs weighing 200 to 250 grams and above, depending on the initial size at stocking. The pond is partially drained (50%) during low tide and at high tide, new seawater is admitted thereby causing the stock to swim against the current and towards the catching pond. Majority of the catch using this technique are females with maturing eggs *(aligue)* as the marine phase of life or spawning stage of the animal is about to begin. While swimming against the current and concentrating along the gate, the crabs are caught with scoop nets and the pincers are then securely tied using strips of soaked coconut sheath *(suwak)* or plastic straw (Fig. 8). Care, coupled with skill in tying the pincers will safeguard someone from the likelihood of being severely pinched.

Baited traps *(bintol)* or baited hand lines can also be used if selective harvesting falls on the ebb or neap tide.

Selective harvest minimizes competition for food and space of the remaining stock and likewise reduces the incidence of cannibalism, thereby allowing smaller ones to grow faster. Partial harvesting is done every 15 days thereafter, until final harvest.

2. Total drainage (total harvest) This is done during low tide when remaining crabs are collected by hand after total drainage (Fig. 9). Earthen mounds are examined for complete retrieval of crabs. Normally, this lasts for a day or two with the help of five persons.

Fig. 8. Pincers should be tied securely using soaked "suwak" or plastic straw.

Fig. 9 (below). Remaining crabs are collected by hand picking after total drainage.

POST HARVEST

Newly-harvested mudcrabs mixed or sorted by size are always tied in bunch either by kilo or by dozen pieces. Sometimes the females with maturing eggs are sorted from the males with big pincers for delivery to discriminating customers. For long distance travel, they are kept inside wooden or styrofoam boxes, and bamboo *(tiklis)* or palm *(buri* or *pandan)* baskets (Fig. 10). Mudcrabs are sturdy species and can stay alive for a week by simply sprinkling them occasionally with water. Prolonged holding period, however, will lessen the weight *(hagas)* or eventually cause death. Price varies by region. Mudcrabs weighing 150 to 200 g fetch P120-P180 pesos per kilo while bigger sizes (200 grams and above) reach P160-250 per kilo. Generally, female crabs with developing gonads are more expensive than males. Demand for mudcrabs remain high both here and abroad.

Fig. 10. "Tiklis" is a sturdy crab container for long distance travel.

Production and profits

A series of technology verification runs on the culture of mudcrab, *Scylla* spp. in brackishwater ponds have been conducted in Jalandoni and Montelibano Farms in E.B. Magalona and Gargarita farm in Himamaylan, all in Negros Occidental. Stocking density used was 1/m^2 using nylon net enclosures in 0.5 hectare ponds. Encouraging results showed an average production of 724.7 kg after a series of selective harvests during an average 130 culture days. The survival rate ranged between 63 to 72% and average body weight (ABW) at harvest ranged from 192 to 251 g. Average total feed consumed using chopped trash fish was 3,489 to 3,956 kg with feed conversion ratio of 4.9:1 to 5.4:1 (Table 1).

Table 1. Production data in SEAFDEC/AQD's three verification sites for mud crab culture in brackishwater ponds.

Technical Description	Farm no. 1	Farm no. 2	Farm no. 3
Pond area per compartment	0.5 ha	0.5 ha	0.5 ha
Stocking rate	5,000 pcs	5,000 pcs	5,000 pcs
ABW @ stocking	10.6 g	11.7 g	18.9 g
Culture period	145 days	130 days	122 days
Survival rate	63%	66%	72%
ABW @ harvest	251	202	192
Yield	792 kg	669 kg	713 kg
FCR	4.9:1	5.4:1	5.4:1

TABLE 2. COST AND ANALYSIS

Technical basis		
Pond area	0.5 hectare	
Culture period	5 months	
Crops per year	2	
Stocking rate / run	5,000 pcs	
Survival rate	67%	
Yield per run	724 kg	
FCR	5.2:1	
Investment requirements		
Pond development	P 100,000.00	
Net Enclosure	19,450.00	
Working capital	75,000.00	
Costs and returns		
Return	Sales (724 kg x 2 x P180.00/kg)	246,160.00
Costs	Pond preparation	1,000.00
	Seeds (10,000 pcs x P7.00/pc)	70,000.00
	Feeds (3,765 kg x 2 x P8.00/kg)	60,240.00
	Amortization cost of pond development	2,000.00
	Depreciation of pen	3,890.00
	Wages of laborer	24,000.00
	Maintenance and repair	3,600.00
		164,730.00
Net profit		81,430.00
Return on investment		49%
Payback period		2.0 years

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The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional treaty organization established in December 1967 for the purpose of promoting fisheries development in the region. Its Member Countries are Japan, Malaysia, the Philippines, Singapore, Thailand, Brunei Darussalam, and the Socialist Republic of Viet Nam.

Representing the Member Countries is the Council of Directors, the policy-making body of SEAFDEC. The chief administrator of SEAFDEC is the Secretary-General whose office the Secretariat, is based in Bangkok, Thailand.

Created to develop fishery potentials in the region in response to the global food crises, SEAFDEC undertakes research on appropriate fishery technologies, trains fisheries and aquaculture technicians, and disseminates fisheries and aquaculture information. Four departments were established to pursue the objectives of SEAFDEC.

- The Training Department (TD) in Samut Prakan, Thailand, established in 1967 for marine capture fisheries training
- The Marine Fisheries Research Department (MFRD) at Changi Fisheries Complex, Singapore, established in 1967 for fishery post-harvest technology
- The Aquaculture Department (AQD) in Tigbauan, Iloilo, Philippines, established in July 1973 for aquaculture research and development
- The Marine Fishery Resources Development and Management Department (MFRDMD) in Kuala Terengganu, Malaysia, established in 1992 for the development and management of the marine fishery resources in the exclusive economic zones (EEZs) of SEAFDEC Member-Countries.