

# Mudcrab

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# FOREWORD

This volume is one of AQD's manuals resulting from the Technology Verification Project (TVP) launched in mid-1996. The others are on grouper culture in brackishwater ponds, modular method of milkfish pond culture, and mudcrab pen culture in mangroves.

TVP aims to field-test specific culture systems in selected farm sites, and to package technologies that are found to enhance productivity and/or profitability. These verification studies consider site-specific conditions such as socio-economic, environmental, biological, anthropological and other related aspects. An important feature is the active participation of fishfarmers, fisherfolk, and local government units.

This volume on mudcrab shows AQD's emphasis now on transfer of technology to the general public as it puts together research results conducted in the past 15 years. It addresses the current problems of mudcrab growing in an effort to push the industry from its present lethargic state to an industry that is projected to reach lucrative levels.

We hope this manual will 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**  
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# GENERAL INFORMATION

Mudcrab is an aquaculture commodity which is well liked for its taste, texture and nutritive value. It has a high potential for commercial aquaculture production in the Indo-Pacific region.

Mudcrab culture is a promising alternative to the weakening prawn farming in the country. With high market demand and lucrative domestic and export price of live mud crabs coupled with available technology and adequate capitalization, opportunities for a profitable mudcrab farming are very encouraging.

Studies at SEAFDEC Aquaculture Department have addressed constraints in the management of mudcrab culture. Management and operations described in this manual are the results of such studies, either funded by SEAFDEC/AQD alone or by SEAFDEC/AQD in collaboration with Australian Centre for International Agricultural Research.

This manual is a guide for mudcrab growers in modifying their activities to suit the immediate requirements of their mudcrab farm.

## SPECIES OF COMMERCIAL VALUE

*Scylla serrata* (Forskal)



Locally called “giant crab”, this species is greenish with white polygonal markings on the swimming and walking legs, chelipeds, carapace, and with orange claws. It has deep serrated and pointed frontal spines at the dorso-posterior side of the merus.

*Scylla tranquebarica* (Fabricius)



This species (locally named *Manginlawod* or *Lawodnon*) has almost similar features with the *serrata* species except that the polygonal markings are only prominent at the chelipeds and swimming legs and gradually fade towards the anterior walking legs. It has shallow serrated and blunt frontal spines, and the spines at the dorso-posterior side of the merus are not as prominent as the *serrata* species. These differences cannot be identified while at the juvenile stage. Only when their size reach sub-adult or >90 g can the species *S. serrata* be differentiated from the *S. tranquebarica* species. Sex can be identified even at juvenile stage.

*Scylla olivacea* (Herbst)



Locally named *pulang alimango* or *native*, this species has deep green to grayish green color of the carapace, rusty brown chelipeds, swimming, and walking legs.

## SOURCES OF SEEDS

### Natural Habitat

The life cycle of mudcrab indicates that adult crabs mate in estuaries and fully roed females migrate to the sea to spawn. The larvae (megalopa stage) are drifted back to estuaries and mangroves where they grow to adult, hence, they are sometimes referred to as mangrove crabs. Mudcrabs feed on sessile and slow moving animals and prefer molluscs, small crabs, and other crustaceans.

### Catching gears

Crab collectors set the catching gears (crab pots) in mangroves and estuaries at night during low tide and retrieve them in the morning at succeeding low tide. Crab pots or bamboo traps are, however, commonly used for catching adult crabs. Juvenile crabs are caught by push nets operated inside mangroves or by barricade nets set at fringes of mangroves during high tide. Trapped crabs are collected during low tide.

### Species distribution

To date, mudcrab culturists still depend on crabs caught from the natural habitat for pond stocking. Native crabs are widely distributed in mangroves and in estuaries in the country. On the other hand, giant crabs come mostly from provinces facing the Pacific Ocean, the reason, perhaps, why mudcrab growers believe they are oceanic species. Although crab growers in Panay Island buy the giant crab juveniles from a sub-dealer in Capiz, the juveniles actually come from Samar. There are unpublished reports of occurrence in Quezon province and other coastal provinces in eastern Luzon as sources of juveniles for mud crab growers in Bulacan and nearby provinces. Mindanao crab growers get their supply of giant crab juveniles from Surigao.

### Hatchery

SEAFDEC/AQD has successfully spawned *S. serrata* in captivity in 1996. However, mass production of juveniles is still hampered by the low and inconsistent larval survival and production of megalopae in the hatchery. Scientists involved in the mudcrab broodstock and larval rearing projects have identified problems and developed larval rearing protocols. Such protocols are now being refined on a large scale. Recent improvements indicated a 1-15% survival from hatching to crablets stage which is economically feasible considering that a female crab releases about 2 million eggs per spawning. Given time, crab growers may be able to obtain their juveniles from the hatchery.

### SITE SPECIFICATION

#### Soil

Silty clay, clay loam or clayey soil with enough layer of clean mud is appropriate. These kinds of soil can respond well to the biological requirements of mudcrabs while moulting or in their post-moult soft stage or while feeding. It is also the kind of soil that can retain desirable water depth for mudcrabs.

#### Environmental Conditions

Mudcrabs are generally tolerant to a wide range of temperature and salinity. They can withstand water temperature from 12-35°C but their activity and feeding fall rapidly when temperature is below 20°C. They are able to survive in a salinity range of 2-43 ppt. Crabs have the ability to exploit oxygen from the air. Under severe conditions of hypoxia, they leave the water and breathe air. But when they moult they are unable to leave the water that is depleted with oxygen, consequently the crabs die.

The optimum water condition required of mud crabs are:

Water temperature (°C)	23-32
Water salinity (ppt)	15-30
DO concentration (ppm)	≥ 4
pH	8.0-8.5
Water depth (cm)	≥ 80

#### Others

Other factors to be considered:

- Available source of stocking materials.
- Free from pollution.
- Sufficient supply of cheap trash fish or brown mussel meat.
- Available storage facilities for fresh unprocessed feed.
- Secured from poachers.

## DESIGN AND CONSTRUCTION OF PONDS AND PENS

### Ponds

Most prawn ponds can be used to rear mudcrabs. However net enclosures have to be installed along the inner side of the pond dike to prevent crab stocks from escaping (Fig. 1).

#### Procedure 1

- a. Use a green net, 12 mm mesh size and 2 mm twine diameter, with bamboo as structural framework.
- b. Bury the lower end of the net to about 60 cm below pond bottom surface to prevent the escape of crabs through burrows.
- c. Line the inner side of the upper end of the enclosure with 30 cm wide thick plastic sheet to prevent crabs from escaping over enclosure.

In the polyculture of crabs with milkfish, milkfish ponds can be renovated to suit the requirements of both species. Lablab which serves as the natural food for milkfish cannot be grown abundantly at water depth higher than 50 cm. Since water depth of 80-100 cm is required by crabs, ponds may be provided with 100 cm wide x 50 cm deep peripheral and central canals (20-30 % of the total pond area). When the pond is filled with water to a depth of 50 cm the water level in the canals by then is 100 cm. Crabs can seek refuge for cooler temperature in these canals if the water temperature in the pond goes beyond 32°C.



Figure 1. Net enclosure installed in pond showing plastic sheet (about 30 cm) fitted on the inner side of the top end of the net.

### Pens

SEAFDEC/AQD has developed a system designed for aqua-mangrove integrated culture that preserves the vital role of mangroves as nursery grounds for finfishes and crustaceans. The design allows flooding of the culture area at high tide. Structures are installed to prevent siltation of canals and maintain the required water depth for the cultured species.

The construction of pens as indicated is for the aqua-mangrove integrated farming: the culture of aquatic species in tidal flats with existing mangroves. The area recommended is a minimum of 200 sq m or a maximum of 1,200 sq m to enable all households in a fishing village to avail of mangroves adjacent to or near the village.

### Procedure 2

- a. Follow Procedure 1a and c.
- b. Height of enclosure should be 30-40 cm above highest high tide.
- c. Allocate 20-30 % of total area of pen to 100 cm wide x 50 cm deep peripheral and central canals.
- d. Dig canals between mangroves without damaging main roots. Canals are intended to retain 50 cm water during lowest tide.
- e. Install 50-60 cm wide and 50 cm high dike surrounding the enclosure to retain additional water level of 50 cm during lowest tide, thus, meeting the optimum water depth requirement of mud crabs and their refuge for cooler temperature during lowest tide. The set up is intended to be inundated during highest tide.
- f. Install 50-60 cm wide and 50 cm high wooden gate (made of wood and marine plywood) to drain water every 7 days (for 3 continuous days) during night time only to allow exposure of mangrove roots. Continuous submergence of mangrove roots will lead to the death of mangroves.
- g. Install fine-meshed nylon screen with bamboo framework surrounding the dike to minimize if not totally prevent siltation of canals. Use B-net set half round (*bulon*) fronting gate (Fig. 2).



Figure. 2. Pen design allows flooding of the culture area. Finemeshed net surrounds the dike to minimize siltation in the pen canals.

## TRANSPORT, STOCKING AND ACCLIMATION

### Transport

#### *Packing and transport of mud crab juveniles*

Mud crab juveniles are normally transported in wicker baskets (*bakag*) or in straw bags (*bayong*) from dealer to pond/pen site for stocking. Cartons lined with moist cheese cloth (*katsa*) is also a usual practice.

#### **Procedure 3**

- a. Use transport containers with mangrove fronds.
- b. Remove chelipeds (*sipit, kagat*) of crabs weighing <30 g. Do not remove chelipeds when weight is >30 g. Chelipeds of the latter will regenerate but no longer of equal size.
- c. Place 500 crab juveniles, chelipeds removed, in a big transport container.
- d. Pour seawater frequently into container while in transport to keep crabs moist.

#### *Packing and transport of lean mudcrab*

#### **Procedure 4**

- a. Buy lean crabs (native crab: 100-150 g females, 200-250 g males; giant crab: 300-350 g females, 350-400 g males) by contracting on site crab collectors or buy them in the local market.
- b. Tie crab chelipeds firmly while in transport (Fig. 3).



Figure 3. Chelipeds are firmly tied to prevent fighting among crabs.

- c. Place 150-200 lean crabs in big transport containers (*bakag* or *bayong*).
- d. Pour seawater frequently into the container while in transport or while waiting for additional crabs to be bought.

### **Stocking and Acclimation**

Mudcrabs need to be acclimated before they are released in ponds to prevent death due to thermal and salinity shock.

#### ***Stocking and acclimation of crab juveniles for grow-out culture***

##### **Procedure 5**

- a. Sort crab juveniles according to size and sex, and count according to desired stocking density for each pond/pen.
- b. Before stocking, acclimate crab juveniles to pond water temperature and salinity by placing them in plastic basins. Moisten crabs then gradually pour pond water into the basin until crabs are soaked.
- c. Stock crab juveniles early in the morning or late in the afternoon.
- d. Stock males separately from females (monosex culture) at 1.5 crab juveniles (7-11 g or 16-20 g) per sq m.
- e. Release crab juveniles in ponds or pens by floating the basin with crabs for 5-10 minutes. The basin is then tilted to allow the crabs to crawl.

#### ***Stocking and acclimation of lean mudcrab for fattening***

##### **Procedure 6**

- a. Follow Procedure 5a-c.
- b. Stock male and female lean crabs of the same species at two crabs per sq m. Male native crab should weigh 200-250 g, and female 100-150 g. For giant mud crab, the male should weigh 350-400 g and female 300-350 g.
- c. Remove the movable part of the mud crab claw and apply Povidone-Iodine (Betadine) to the injured part to prevent infection.
- d. Further acclimate crabs by floating the basin with crabs in ponds or pens for 5-10 minutes. Remove cheliped ties as individual crab is released.

### **WATER MANAGEMENT**

Water quality has to be maintained during the culture period

##### **Procedure 7**

- a. Monitor water parameters like temperature, salinity, DO concentration, pH, water color, and transparency daily.



- b. Take note of crab conditions in pond/pen like feed consumption, signs of disease, swimming behaviour, mass climbing in net enclosures, etc.
- c. Inspect water depth (install depth gauge) and net enclosures daily for possible leakages and holes in nets.
- d. Change water in pond for 3-4 continuous days every spring tides to about 30% of the pond water volume on the first month, 40% - 2nd month. 50% - 3rd month, and 60% on the 4th month onward of the culture period.
- e. Drain pen every 7 days for 3-4 continuous days at night time during the lowest tide to allow exposure of mangrove roots but leave canals always filled with water.

## FEEDS AND FEEDING

Feed comprises 40-60% of the total cost of production. The use of cost effective feeds and the right amount will prevent feed wastage and pollution in ponds.

### Procedure 8

- a. Feed crabs with fresh or frozen trash fish. If cheap brown mussel meat is available, use a mixed diet of 75% brown mussel meat and 25% trash fish instead. Crabs given fresh brown mussel-based diet attain better performance.
- b. Feed mud crabs in the grow-out culture at the rate of 10% of the crab biomass/day when carapace length is <6 cm and 5% when carapace length is 6 cm or more.
- c. Feed crabs in the fattening culture at the rate of 10% of the crab biomass per day. Give the same amount of daily ration throughout the culture period.
- d. Crab biomass is calculated as follows:

$$B = ES \times \text{number of crabs stocked} \times ABW$$

where :

B = total weight of crabs in pond

ES = estimated survival based on a linear decrease in survival from 100% at stocking to 70% one month before harvest

ABW = average body weight of the estimated survival in the pond

- e. The total amount of feed per day is calculated as follows:

$$\text{Total feed ration per day} = B \times \text{Feeding rate}$$

- f. Feed 40% of the daily feed ration at 7:00 AM and 60% at 5:00 PM.
- g. Take 20-25 crabs from each pond monthly for weight and carapace length measurement and adjust daily feed ration monthly based on the stock sampling.

# GROW-OUT CULTURE

## MUDCRAB MONOCULTURE IN POND

### Pond Preparation

Pond preparation prior to stocking of crabs is necessary for pond conditioning and culture of *Gracilaria* or other macrophytes that can serve as shelter for the mudcrabs.

#### Procedure 9

- a. Drain water in the pond. Close pond gate and seal with soil. Dry pond bottom for 5-7 days or until the soil cracks.
- b. Apply hydrated lime at the rate of 1 ton per ha. Immediately after liming apply ammonium sulfate at the rate of 2 g of ammonium sulfate for every 10 g of hydrated lime in 1 sq m of undrained area (usually near the drain gate) with 5 cm water depth to eradicate unwanted species.
- c. Apply organic fertilizer at the rate of two tons per ha. Top dress with inorganic fertilizer at the rate of 75 kg per ha using urea (45-0-0) and ammonium phosphate (16-20-0) at a ratio of 1:2.
- d. Fill the pond with water from the incoming high tide to about 10 cm deep. Close the pond gate and seal with soil.
- e. Plant *Gracilaria* using the rice planting method. A plant hill weighs about 10 g of vegetative parts. Each hill is spaced about 10-20 cm.
- f. Fill pond gradually with additional 5-10 cm water level daily until water level of about 60 cm is attained. When luxurious growth of *Gracilaria* is noted, increase pond water level to 100 cm. The pond is ready for stocking. *Gracilaria*, however, grows well only during dry season, henceforth, if mudcrab culture is done during rainy season, proceed from Step d to g.
- g. Note the color of the pond bottom. A thin green film on pond bottom indicates *lablab* growth. When a prominent green color appears, fill pond gradually with additional 5-10 cm water level daily until a depth of 80-100 cm is reached. As the water level increases, *lablab* mats thicken. But when water level reaches 60 cm and sunlight no longer penetrates the pond bottom, *lablab* growth is suppressed and *lumut* starts to grow. *Lumut*, occupying about 40-60% of pond area, could serve well as shelter for crabs. Other macrophytes like *kusay-kusay* (*R. mauritima*), and *digman* (*N. graminea*) could also serve as shelter. The pond is then ready for stocking.

### Selective/Progressive Harvesting

Progressive harvesting is defined as the removal of harvestable size and fat mudcrabs in ponds or pens several times during the culture period. The removal of bigger and fat crabs minimizes competition for food and space and reduces the incidence of cannibalism by maintaining a more homogenous size range of crabs in ponds. This also allows smaller crabs to grow faster thus shortening culture duration.

#### Procedure 10

- a. Select and remove marketable size and fat crabs (150 g or more for female and 250 g or more for males of native crabs); (350 g or more for female and 400 g or more for males of giant crab) simultaneous with stock sampling starting from the end of the second month of culture by current or by lift net method (Fig. 4).
- b. Marketable size, fat crabs go against the current and congregate near the gate as water enters the pond. Catch them by using a scoop net. Use a lift net to catch crabs (lift net method) immediately after water in ponds level off.

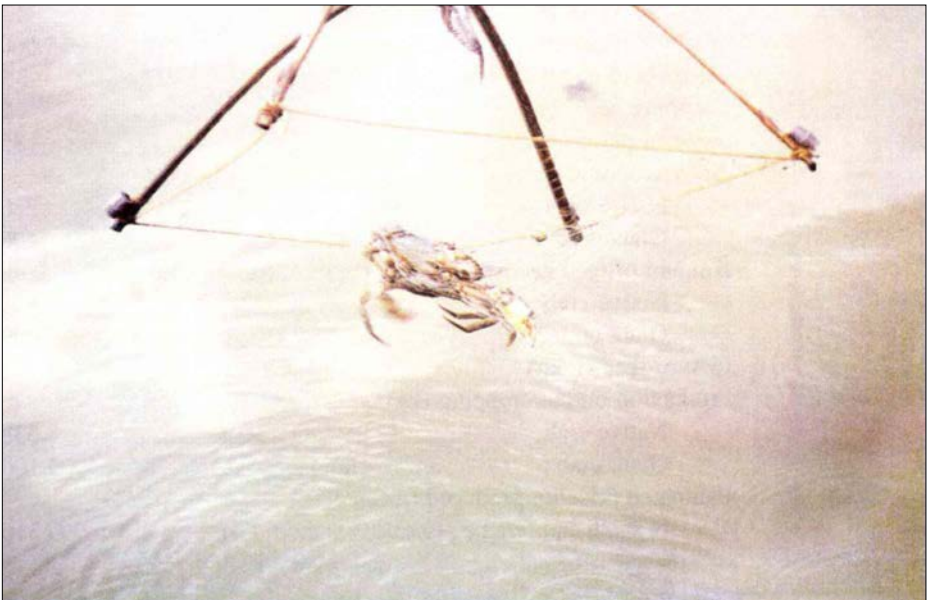


Figure 4. Lift net used for stock sampling and selective harvesting done several times during the culture period.

### Total Harvesting

Crabs may be harvested at the end of 120-150 days culture.

#### Procedure 11

- a. Harvest by current and lift net method.
- b. Drain pond totally to manually catch the remaining crabs.
- c. Be careful not to damage crabs during harvest (Fig. 5). Loss of appendages will reduce the market value of crabs.
- d. Keep crab harvest moist by placing mangrove fronds in the harvest container and frequently pouring pond water into it (Fig. 6). Do not expose crabs to heat. Do not hang crabs as this will reduce the turgidity of the muscles.

### Financial Feasibility Projections

Assumptions on a per ha pond mudcrab monoculture per cropping basis.

#### *Technical*

Species intended for culture	
Native or giant crab	
Stocking requirement per run (pc)	15,000
Duration of culture (mo)	4-5
Cropping per year	2
Survival per cropping (%)	85
ABW/cropping (g):	
Native crab	250
Giant crab	400
Amount of feed needed/cropping (kg):	
Native crab	2,678
Giant crab	14,000
Cost of feed (P/kg)	10
Production output/cropping (kg):	
Native crab	<b>3,188</b>
Giant crab	5,100
Estimated price/kg produced (mean of male and female price)	310

#### *Financial*

Miscellaneous costs are estimated at 2% of variable costs

Caretaker's salary at 1000/mo.

Interest rates on investment is 8% per year

Sales tax is 1% of revenues  
 Pond rent is in accordance with FLA rate

	Giant crab	Native crab
Development costs		
Construction of enclosure (pond development costs were assumed that pond already existed)	27,445	27,445
Operating capital		
1). Variable costs		
Crab juveniles	142,500	75,000
Feeds	140,000	26,780
Seaweeds	5,000	5,000
Hydrated lime	1,250	1,250
Chicken manure	2,200	2,200
Inorganic fertilizer: 16-20-0	315	315
45-0-0	148	148
Caretaker's salary	5,000	5,000
Miscellaneous cost	5,928	2,214
Total variable cost	302,341	117,907
2). Fixed costs		
Pond rent (FLA)	500	500
Interest on capital investment	2,196	2,196
Total fixed cost	2,696	2,696
TOTAL OPERATING CAPITAL	305,037	120,603
TOTAL INVESTMENT	362,482	148,048
<i>Cost-return Analysis (P)</i>		
Sales: Crabs	1,581,000	988,280
Less: Operating capital	305,037	120,603
Net income before tax	1,275,963	867,677
Less: Sales tax	15,810	9,883
NET INCOME AFTER TAX	1,260,153	857,794



*Figure 5. Crab caught by lift net being restrained. The claw of one crab is ready to cut the swimming legs of another. Separations of the claw must be properly handled to prevent damage on appendages of the other crab.*



*Figure 6. Harvested crabs (weighed) are placed in "bakag" provided with mangrove fronds to keep them cool and moist during transport. The males are already separated from females before they are brought to export buyers.*

## **MUDCRAB POLY CULTURE WITH MILKFISH IN PONDS**

Mudcrabs dwell at pond bottom while milkfish occupy the water column. They also compliment each other in their food needs. Mudcrabs are carnivores while milkfish are herbivores. Stocking together complementary species in one pond has been found to enhance the overall production of the pond per unit area.

### **Pond Preparation**

Aside from pond conditioning, ponds used for the polyculture of mudcrab with milkfish are prepared for the production of lablab as natural food base for milkfish. To prepare the pond, follow Procedure 9a-d and g.

### **Stocking Density and Water Change**

#### **Procedure 12**

- a. Follow Procedures 5a-e.
- b. Stock milkfish fingerlings at 0.25 per sq m.
- c. If milkfish fingerlings are not available, use milkfish fry by stocking them in milkfish nursery pond 30 days ahead of stocking crabs.
- d. Change water for 3-4 continuous days every spring tide to about 30, 40, 50, and 60% of the pond water volume on the 1st, 2nd, 3rd, and 4th month onward of the culture period, respectively. Apply inorganic fertilizer at the rate of 1/2 the basal rate (urea - 12 kg/ha, ammophos-25 kg/ha) applied during pond preparation at the last day of the 3-day water change for the maintenance of natural fish food growth in pond.

### **Selective/Progressive Harvesting**

Follow Procedure 10.

### **Total Harvesting**

Crabs and milkfish go against the current. Total harvesting of milkfish would be the same for the crabs.

#### **Procedure 13**

- a. Harvest by current and lift net method.
- b. Drain pond totally and catch the remaining crabs and milkfish manually.

**Financial Feasibility Projections**

Assumptions on a per ha pond mud crab - milkfish polyculture per cropping basis.

*Technical*

Species to be cultured: native crab or giant crab with milkfish		
Stocking density requirement:		
Crab (1.5 per sq m)		15,000
Milkfish (0.25 per sq m)		2,500
Duration of culture (mo)		4-5
Cropping per year		2
Survival (%)		
Crab		80
Milkfish		90
ABW (g):		
Native Crab		200
Giant crab		400
Milkfish		250
Total amount of feed needed (kg):		
Native Crab		7,875
Giant crab		12,600
Milkfish		none
Estimated price per kg feed for crabs		10
Production output (kg):		
Native Crab		2,400
Giant crab		4,800
Milkfish		563
Estimated price per kg produced:		
Crabs		310
Milkfish		60

*Financial*

Miscellaneous costs are estimated at 2% of variable costs.

Caretaker's salary at P1,000 per mo.

Interest rates on capital investment is 8% per year.

Sales tax is 1% of revenues

	Giant crab	Native crab
Development cost		
Construction of pond enclosure, earthwork for construction of canals not included.	27,445	27,445



## Operating capital

1). Variable costs		
Crab juveniles	142,500	45,000
Milkfish fingerlings	5,000	5,000
Feed for crabs	126,000	78,000
Hydrolex lime	1,250	1,250
Chicken manure	2,200	2,200
Inorganic fertilizer:		
16-20-0	945	945
45-0-0	590	590
Caretaker's salary	5,000	5,000
Miscellaneous costs	5,670	2,375
Total variable cost	288,655	141,110
2). Fixed costs		
Pond rent (FLA)	500	500
Interest on capital investment	2,196	2,196
Total fixed cost	2,696	2,696
TOTAL OPERATING CAPITAL	291,351	143,806
TOTAL INVESTMENT	318,796	171,251

*Cost-return Analysis (₱)*

Sales:		
Crabs	1,488,000	744,000
Milkfish	13,780	13,780
Total sales	1,501,780	757,780
Less: Operating capital	291,351	143,806
Net income before tax	1,210,429	613,974
Less: Sales tax	14,880	7,440
NET INCOME AFTER TAX	1,195,549	606,534

### MUDCRAB MONOCULTURE IN TIDAL FLATS WITH EXISTING MANGROVES

Fishing villages in the Philippines are located in arable land plains along fringes of coastal lines with the sea as their main resource. Adjacent to or near them are large areas of tidal flats with existing mangroves which are potential areas for aqua-mangrove integrated farming. The utilization of these mangroves for the culture of mud crabs can provide fishers with alternate livelihood or as source of additional income.

#### Pen Preparation

##### Procedure 14

- a. Apply agricultural lime at 1 ton per ha during lowest tide.
- b. Plant *Gracilaria* during dry season or other macrophytes that grow well in the site during rainy season. Aside from roots of mangroves, macrophytes serve as additional shelter for crabs.
- c. Pen is ready for stocking after luxurious growth of macrophytes is noted (See section on pen design).

#### Stocking Density and Water Change

##### Procedure 15

- a. Sort out crab juveniles according to size and sex and count them according to stocking density desired.
- b. Stock 7-11 g or 16-20 g crab juveniles at 2.0 per sq m.
- c. Stock males separately from females (monosex culture).
- d. Acclimate crabs to pen water salinity and temperature before stocking.
- e. The pen design would allow a change of water twice per day (24 h) because the area would be inundated during high tide.
- f. Drain water for 3 consecutive days after every 7 days to allow exposure of mangrove roots but leave canals always filled with water. Do this at night during low tide.

#### Selective/Progressive Harvesting

##### Procedure 16

- a. Harvest marketable size and fat crabs, 150 g or more for female and 250 g or more for male native crab, 350 g or more for female and 400 g or more for male giant crab. Do this simultaneous with stock sampling starting from the end of the second month of culture using lift net or select and remove by hand picking them during the weekly draining that falls towards the end of every month.

**Total Harvesting**

**Procedure 17**

- a. Harvest by lift net method at high tide.
- b. Drain pen totally at lowest tide and catch remaining crabs manually (Fig. 7).

**Financial Feasibility Projections**

Assumptions on a per 200 sq m pen mudcrab monoculture per cropping basis.

*Technical*

Species : Native or Giant crab	
Stocking density requirement (2 per sq m)	400
Duration of culture (mo)	4-5
Cropping per year	2
Survival (%)	85
ABW (g):	
Native crab	250
Giant crab	400
Total amount of feed needed (kg)	
Native crab	255
Giant crab	375
Production output (kg):	
Native crab	85
Giant crab	136
Estimated price/kg produced	310

*Financial*

Miscellaneous costs are estimated at 2% of variable costs.  
 Caretaker's salary (family labor) at 100 per mo (basis: 2 ha farm for every 1 caretaker paid at 5,000 per mo).  
 Interest rates on capital investment is 8% per year.  
 Sales tax is 1% of revenues.

Development costs	Giant	Native
Construction of pen	crab	crab
(include pen enclosure materials only.	5,275	5,275
Labor for construction and earthwork is to be provided by family labor)		

Figure 7. The pens are totally drained at termination of culture and remaining crabs are picked-up manually.



Operating capital		
1). Variable costs		
Crab juveniles	3,800	1,200
Feed	3,750	2,550
Seaweeds	250	250
Agricultural lime	85	85
Caretaker's salary	500	500
Miscellaneous costs	168	92
<b>Total variable cost</b>	<b>8,553</b>	<b>4,677</b>
2). Fixed costs		
Interest on capital investment	211	211
<b>Total fixed cost</b>	<b>211</b>	<b>211</b>
<b>TOTAL OPERATING CAPITAL</b>	<b>8,764</b>	<b>4,888</b>
<b>TOTAL INVESTMENT</b>	<b>14,039</b>	<b>10,163</b>
<i>Cost-return Analysis (₱)</i>		
Sales: Crabs	42,160	26,350
Less: Operating capital	8,764	4,888
Net income before tax	33,396	21,462
Less: Sales tax	422	264
<b>NET INCOME AFTER TAX</b>	<b>32,974</b>	<b>21,198</b>

# FATTENING CULTURE

The roe of female mudcrabs and the meat in the chelipeds of male crabs are sought after by consumers. Lean mudcrabs do not possess these conditions demanded for by consumers, hence, the domestic price is low and the export market rejects it. Fish farmers fatten lean crabs before they are sold for export. Fattening culture of mudcrab takes a minimum of 15 days and a maximum of 30 days.

One of the common features for mudcrab fattening culture in pond or mangrove is selective or progressive harvesting and restocking.

## Procedure 18

- a. Harvest fat female native crab weighing  $\geq 150$  g, and male  $\geq 250$  g; fat female giant crab  $\geq 350$  g, and male  $\geq 400$  g twenty days after stocking. About half of the crab population fatten in 15-20 days.
- b. Immediately replace harvested fat crabs with lean crabs. Acclimate lean crabs following Procedure 5b and cut movable part of their claws following Procedure 6c before they are released in pond per pen.
- c. Harvest fat crabs and replace them with lean ones every 10 days after the first harvest (20 days after stocking). Each time, about 30% of the crab population fatten. A total of 14 partial harvest and 12 replacements per restocking can be attained in 150 days. Do not replace harvested fat crabs 20 days before the total harvest.
- d. Harvest by current method and lift net. Mudcrabs that go against the current and congregate around the pen gate are 98% fat. Catch them with a scoop net.

## MUDCRAB FATTENING MONOCULTURE IN POND

### Pond Preparation

Recommended area: 200 sq m

Prepare ponds according to Procedure 9.

### Total Harvesting

Harvest all crabs at the end of the 120 or 150 days of culture by draining the pond totally and pick remaining crabs.

### Financial Feasibility Projections

Assumptions on a per 200 sq m pond mudcrab fattening monoculture per 5 months continuous cropping basis.

*Technical*

Species: Native and giant crab

Stocking requirement (2 per sq m initial stock) 2,098

Duration of culture 5  
(with progressive harvesting and restocking)

1st harvest and restocking is 20 days after stocking; subsequent harvest run-on and restocking is every 10 days.

Cropping per year 2

Survival (%) 85

ABW at harvest (g): Native crab 200

Giant crab 400

Amount of feed needed (kg)

Native crab 1,070

Giant crab 2,120

Cost of feed (P per kg) 10

Production output (kg):

Native crab 357

Giant crab 713

Estimated price per kg produced (P) 310

*Financial (P)*

Giant crab

Native crab

Development costs

Construction of pond enclosure (include materials only. Labor for construction is to be provided by family labor).

5,275

5,275

Operating capital

1). Variable costs

Crab juveniles 41,960 20,980

Feed (kg) 21,200 10,700

Chicken manure 40 40

Inorganic fertilizers 63 63

Seaweeds 250 250

Hydrated lime 85 85

Caretaker's salary 500 500

Miscellaneous costs	1,282	652
Total variable cost	63,380	33,270
2). Fixed costs		
Interest on capital investment	211	211
Total fixed cost	211	211
TOTAL OPERATING CAPITAL	65,591	33,481
TOTAL INVESTMENT	70,866	38,756
<i>Cost-return Analysis</i>		
Sales	221,030	110,670
Less: Operating capital	65,596	33,481
Net income before tax	155,439	77,189
Less: Sales tax	2,210	1,107
NET INCOME AFTER TAX	153,229	76,082

## MUDCRAB FATTENING MONOCULTURE IN MANGROVES

### Pen Preparation

Recommended area: 200 sq m

Prepare pens according to Procedure 14.

### Total Harvesting

Drain pen totally and pick up remaining crabs manually at the end of 150 days of culture.

### Financial Feasibility Projections

Assumptions on a per 200 sq m mangroves pen mudcrab fattening monoculture per 5 months continuous cropping basis.

#### *Technical*

Species: Native and giant crab

Stocking requirement:

Initial stocking = 400

Total (include restocking)	2098
Duration of culture (mo)	5
(with progressive harvesting and restocking:	
1st harvest = 20 days after stocking ; subsequent harvest and restocking = every 10 days)	
Cropping per year	2
Survival (%)	85
ABW at harvest (g):	
Native crab	200
Giant crab	400
Amount of feed needed (kg)	
Native crab	1,070
Giant crab	2,120
Cost of feed (₱ per kg)	10
Production output (kg)	
Native crab	357
Giant crab	713
Estimated price per kg produced	310

*Financial*

Miscellaneous costs are estimated at 2% of variable cost.  
 Caretaker's salary (family labor) at 100 per mo.  
 Interest rates on capital investment is 8% per year.  
 Sales tax is 1% of revenues.

	Giant crab	Native crab
Development costs		
Construction of pen enclosure (materials only)	5,275	5,275
Operating capital		
1). Variable costs		
Crab juveniles	41,960	20,980
Feed (kg)	21,200	10,700
Agricultural lime	85	85
Seaweeds	250	250
Caretaker's salary	500	500
Miscellaneous costs	1,280	650



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Total variable cost	65,275	33,165
2). Fixed costs		
Interest on capital investment	211	211
Total fixed cost	211	211
TOTAL OPERATING CAPITAL	65,486	33,376
TOTAL INVESTMENT	70,761	38,651
<i>Cost-return Analysis</i>		
Sales	221,030	110,671
Less: Operating capital	65,486	33,376
Net income before tax	155,544	77,294
Less: Sales tax	2,210	1,107
NET INCOME AFTER TAX	153,334	76,187

### MUD CRAB FATTENING IN CAGES

#### Cage Design (adopted from BFAR with some innovations), Construction, and Preparation

##### Procedure 19

- a. Construct cage with a dimension of 0.25 x 0.7 x 2 m. Use bamboo as structural framework. Use green nylon net 12 mm mesh size and 2 mm twine diameter for side walling, bottom flooring and top movable cover of the cage (Figure 8).  
Divide cage into 3 main divisions, each is further divided into eight cells using bamboo slats nailed closer to each other such that appendages of crabs could not pass through the division. Reinforce nails with nylon monofilament. A cage will have a total of 24 cells. Provide cage with floats and rings in 4 corners.
- b. Set cage at fringes of water at lowest tide such that about 3/4 of cage height is submerged in water. Cover cage with coconut fronds to shelter crabs from heat of the sun during lowest tide. The cage settles at the bottom at lowest tide and floats at highest tide. Small bamboo poles holding the cage in place through the cage rings should have a stopper at about 0.8 - 1 m from the water surface at highest tide. At this point cage is submerged 0.8 - 1 m below the water surface.

#### Stocking and Acclimation

##### Procedure 20

- a. Stock lean marketable size crabs (Native crab: 100-150 g females, 200-250 g males; Giant crab: 300-350 g females, 350-400 g males) at 1 crab per cell. There would be a total of 24 crabs per cage. Stock crabs without cutting movable claws.
- b. Acclimate crabs and remove cheliped ties before releasing them in their individual cell.

#### Feeds and Feeding

Feed crabs with trash fish or a mixed diet of 75% brown mussel meat and 25% trash fish at 10% of the crab biomass per day. Divide the daily ration into 2 feeding schedules, 40% at 7:00 AM and 60% at 5:00 PM. Drop feed into holes of each cell cover.

**Progressive Harvesting and Restocking**

Follow Procedure 18

**Total Harvesting**

Harvest remaining crabs totally at the end of the 150 days of culture.

**Financial Feasibility Projections**

Assumptions on a per cage (24 cells) mud crab fattening monoculture per 5 months continuous cropping basis.

*Technical*

Species: Native and giant crab	
Stocking requirement	124
Duration of culture (mo)	5
Cropping per year	2
Survival (%)	95
ABW at harvest (g):	
Native crab	200
Giant crab	400
Total amount of feed needed (kg):	
Native crab	72
Giant crab	144
Estimated cost of feed (₱ per kg)	10
Production output (kg):	
Native crab	24
Giant crab	47
Estimated price per kg produced	310

*Financial*

Miscellaneous costs are estimated at 2% of variable cost

Caretaker's salary is to be provided free by the family

Interest rates on capital investment is 8% per year.

Sales tax is 1% of revenues

	Giant crab	Native crab
Development costs		
Construction of cage, 0.25 x 0.7 x 2 m (labor to be provided by the family)	612	612

## Operating capital

## 1). Variable costs

Crab juveniles	1,178	372
Feed	1,440	720
Miscellaneous costs	52	22
Total variable cost	2,670	1,114

## 2). Fixed costs

## Interest on capital

Investment	49	49
Total fixed cost	49	49

TOTAL OPERATING CAPITAL 2,719 1,163

TOTAL INVESTMENT 3,331 1,775

*Cost-return Analysis*

Sales	14,570	7,440
Less: Operating capital	2,719	1,163
Net income before tax	11,751	6,277
Less: Sales tax	146	74
NET INCOME AFTER TAX	11,605	6,203

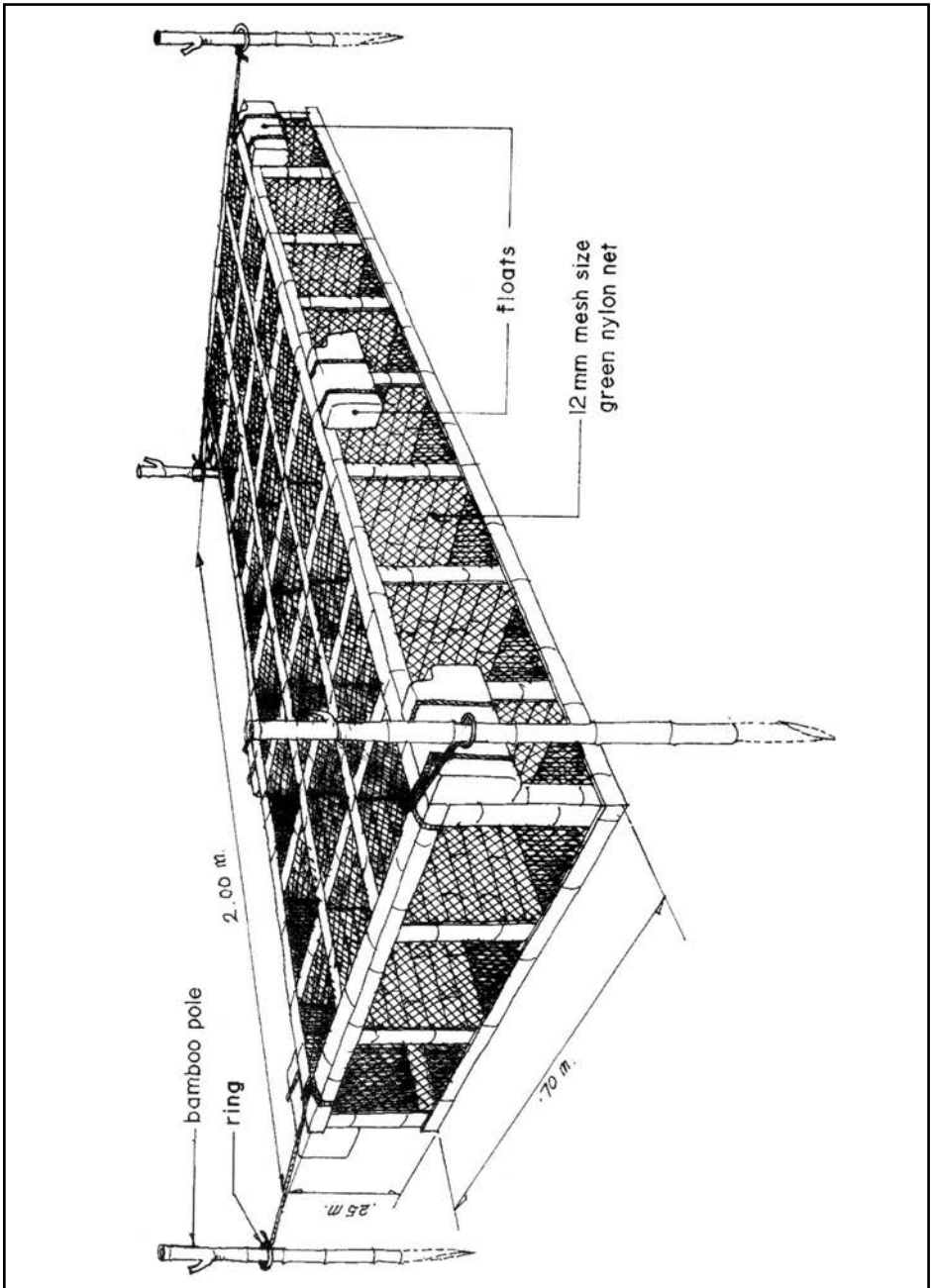


Figure 8. Cell type crab fattening cage

# MUDCRAB COOKING

## **Alimango at Langka sa Gata**

(crab with jackfruit in coconut cream)

- 600 ml fresh coconut milk
- 400 g jackfruit meat, flaked
- 60 g ginger, cut in small pieces
- 8 pieces lemon grass, white part only, cut crosswise
- 1 big onion, sliced
- 2 tbsp minced garlic
- 1.5 kilo crabs, quartered
- 600 ml fresh coconut cream
- 100 g long green chilies

Place the fresh coconut milk, jackfruit, onion, ginger, lemon grass and garlic in a casserole and boil over moderate heat for 15 minutes. Add the crabs and season to taste with salt and pepper. Reduce heat, cover and allow to simmer for another 10-15 minutes. Set aside and keep hot. Meanwhile, in a separate pan, bring the fresh coconut cream to boil and cook, stirring continuously, until the cream is thick enough to coat the ladle. Pour the cream over the crab mixture, then serve immediately.

## **Bicol Express**

(crab meat in spicy shrimp sauce)

- 1 kilo cooked crab meat in soda pop (Sprite or 7-up)
- 2 tbsp minced ginger
- 1 tbsp minced garlic
- 2 tbsp minced onion
- 2 stalks lemon grass, white part only, pounded
- 2 bay leaves
- 100 ml vinegar
- 2 tbsp soy sauce
- 700 ml fresh coconut milk
- 15 hot chili peppers, finely diced
- freshly ground black pepper
- 80 g *bagoong alamang* (shrimp paste)
- 100 g chili peppers
- 300 ml fresh coconut cream

Place the crab meat, onion, ginger, garlic, lemon grass, bay leaves, soy sauce, vinegar, fresh coconut milk and pepper in a saucepan and bring to boil. Cover and continue to boil for 20 minutes, then reduce the heat and allow to simmer further for 20 minutes.

Add the hot chili and shrimp paste and cook until the liquid is reduced by half. Add the coconut cream and chili peppers and continue to simmer until the oil separates from the cream, then transfer to a bowl and serve immediately.

### **Crab meat with *Laing***

(crab meat with taro leaves in coconut cream)

- 500 g *gabi* (taro) dried leaves, shredded
- 300 g taro stalks, remove outer skin and cut into 5 cm lengths (air dried).
- 300 g pork belly, boiled for 10 minutes and diced
- 300 g fresh shrimp
- 2 pcs onion, chopped
- 4 tbsp chopped ginger
- 120 g *bagoong alamang* (shrimp paste)
- 6 hot chilis, seeded and cut into small pieces
- 100 g chili peppers
- 1 tbsp freshly ground black pepper
- 1 liter fresh coconut milk
- 300 ml fresh coconut cream

Arrange a layer of the air dried *gabi* leaves and stalks in a deep pan. Mix together pork, shrimp, onion, ginger, hot chili, shrimp paste and fresh coconut milk and pour into the pan. Cover with remaining leaves and stalks and season with freshly ground pepper. Bring to boil, then reduce heat and allow to simmer, without stirring, for 30 minutes. Add the chili peppers and fresh coconut cream and simmer for another 10 minutes, until the oil separates from the cream. Serve immediately.

### **Kinunot na Alimango**

(cooked crab meat in hot spices)

- 1 kilo cooked crab meat in soda pop (Sprite or 7-Up)
- 1 stalk celery
- 1 bay leaf
- 1 tbsp black peppercorns (whole)
- 3 tbsp olive oil
- 150 g chopped onion
- 1 tbsp minced garlic
- 1 tbsp chopped ginger
- 1 tbsp chopped chili pepper
- 125 ml vinegar
- 125 ml fresh coconut cream
- salt to taste

Heat the oil in a pan and saute the garlic for 2 minutes, then add the cooked crab meat, chopped onion, ginger, chili pepper and vinegar. Simmer for 5 minutes. Add the remaining spices and add the fresh coconut cream. Bring to boil, then remove from heat and transfer to a serving dish.

### **Pinais na Alimango**

(stuffed crab broiled in banana leaves)

1 kilo fat crabs  
2 tbsp cooking oil  
1 tbsp minced ginger  
75 g chopped onion  
1 tbsp minced garlic  
2 tbsp finely chopped chili pepper  
200 g *buko* (young coconut) meat, cut into fine strips  
200 ml fresh coconut cream  
*patis* (fish sauce) to taste  
freshly ground black pepper  
banana leaves

Steam the crabs, allow to cool and then flake the meat. Reserve the shells. Heat the oil in a pan and saute the garlic, ginger and onion for 3 minutes, then add the chili, coconut strips and cream and bring to boiling. Immediately reduce heat and allow to simmer, stirring continuously until the sauce thickens. Add the crab meat and season to taste with fish sauce and pepper, then stuff mixture into the shells. Wrap in banana leaves and tie securely, then broil until the leaves are seared. Transfer to a platter and serve immediately.

### **Crab Meat Sandwiches**

800 g finely chopped cooked crab meat in soda pop (Sprite or 7-up)  
1 tbsp butter  
1 tbsp cream  
1 egg, beaten  
1 tbsp fine bread crumbs  
salt and pepper to taste

Stir all the ingredients over low heat for 5 minutes. Turn the preparation into a mould and then cold slice thinly. Serve between very thin slices of buttered bread.



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## MUDCRAB

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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 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 to respond to the global food crisis, 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
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