STATUS OF MUD CRAB CULTURE IN PANGUIL BAY*

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Abstract

A survey was conducted to gather information on the ststus of mudcrab culture in Panguil Bay. The respondents were mudcrabbers, mudcrab growers and crab shippers. Salient features of the two basic techniques of growing mud crabs were described. Culturing mudcrabs is confirmed profitable but scarce seedstock from the wild is a major limiting factor to any plan for production expansion. The problems associated with seedstock scarcity are presented, and mudcrab resource management options are proposed.

The mud crab of the genus *Scylla* is a major commercial crustacean resource in Panguil Bay. This is clearly shown in the results of the recent studies on the resource and ecology of the Bay. Over 40 per cent of the 1991 recorded fishery production were crustaceans composed of crabs and shrimps. Of this figure 44 per cent or 155,883.59kg were mud crabs. In comparison, the combined volume of other four crab species was only 19 per cent; the major shrimp species was about 37 per cent (Destajo et. al, 1993).

Live mud crabs that are shipped out from Panguil Bay come from capture fishery and from fishponds, pens and floating cages. Crab buyers have claimed that the bulk of marketable mud crabs comes from the Bay's rich fishery but the contribution of cultured mud crabs to the total crab production has markedly increased. The increase is mainly due to the

widespread practice of stocking and growing them as a major crop in ponds, floating cages and pens in recent years.

The present study is a survey on the status of growing mud crabs as practiced in Panguil Bay. The need for this survey was identified after the Agribusiness and Credit Monitoring Committee of Panguil Bay Development Task Force submitted three consecutive dismal reports on the poor collection rate (3.42%) of loan repayments from fishermen associations who were given loans for mud crab production projects from the funds of Livelihood Enhancement for Agricultural Development (LEAD) Program of the Department of Agriculture (Minutes of the Monthly Meetings of the Panguil Bay Development Task Force, August-October, 1992). The Committee Chairman explained that the production programs of these LEAD-assisted projects were adversely affected by scarce and unpredictable supply of mud crab seedstock from the fishery.

OBJECTIVES

The objectives of the study are to describe the technique for growing crabs as practiced in Panguil Bay and the current obstacles in crab production; identify researchable problem areas; and to recommend resource management options for crab fishery to foster this form of aquaculture.

METHODOLOGY

A survey questionnaire (Appendix Tables A1-A5) was used as guide in gathering information from the respondents who were mud crabbers (bintoleros and other mud crab fishermen), crab growers, and crab buyers/ shippers. The number and selection of respondents were determined with no particular consideration other than for the purpose of gathering as much information as possible under a situation of time and budgetary constraints. Secondary information were also obtained from municipal agricultural officers, the DA Regional Offices of Regions 9, 10, and 12 and from the Secretariat of Panguil Bay Development Task Force.

RESULTS AND DISCUSSION

Respondents

Our pre-survey sources of information roughly estimated that over a thousand individuals have been engaged directly or indirectly in crab production at one time or another but that among the growers group, many have stopped when crab seedstock became scarce and its price soared.

For the present study, 93 respondents were interviewed which included LEAD-borrower members of cooperatives and fishermen's associations (Appendix Tables B1-B2, C1-C2, and D). They were interviewed in the barangays bordering Panguil Bay in Lanao del Norte, Zamboanga del Sur and Misamis Occidental. Interviews were also extended to crab exporters based in Pagadian City who were getting from Panguil Bay about 80% of their daily live crab shipment. The respondents were interviewed in farm sites, residences, buying stations and, in the case of some mud crabbers, even in the crab grounds while fishing.

A large part of the data gathered from interviews were gleaned from memory by respondents who normally do not keep adequate written records of their financial transaction and production output. Another limitation encountered in gathering field data was lukewarm respondents who were reluctant to be interviewed by MSU researchers or anybody else who could not guarantee them additional or fresh loans afterwards.

Desirable Seedstock for Culture

It is a common knowledge that mud crabs in the Bay are of two types: the red and green varieties (Fig.1). The external feature of two varieties are morphologically the same. But the body coloration of reddish crab appears to fit the physical description for Scylla serrata while the green colored ones are quit similar to the Scylla *serrata oceanica* Dana described by Estampador (1969) in his report on three species and one variety of mud crab of the genus Scylla.

The red crabs, specifically the female, are preferred for culture because, among other reasons, this variety can grow fat faster and survive with high percentage under captivity and during market transport. A list of desirable characteristics of culturable mud crabs is reported by respondents are enumerated in Table 1.

Despite the growers' preference for the red female variety, mixed stocking of red and green crabs or male and female crabs are often resorted to especially when supply of suitable seedstock is scarce. The mixed stock, upon harvest, is classified such that the female and male green crabs are placed in one transport container together with the male red crabs and consigned to local restaurant and other market outlets. Sexually mature and fat red females are separated in another shipping container for delivery to hotels, restaurant and other high-class outlets in Manila or for export to international markets where fat female crabs command higher price.

A sexually mature female crab has a bell-shaped abdominal flap or apron with a tapering tip while a mature male has an abdominal apron in the shape of an isosceles triangle (Fig.2). Mature female crabs are called fat when their ovaries or 'aligue' are developing or have developed. A good-size ovary can weigh as much as 20% of the total body weight. The ovary, which is actually a mass of developing eggs, can be seen through the protogastric and branchial regions of the carapace or by looking at a slightly opened suture between the base of the abdominal flap and carapace (Fig.3).

Mudcrabbers, the main supplier of seedstock for culture, noted that red crabs are often caught abundantly during spring tides in the inner Bay within the mangrove areas and along estuarine creeks and river mouths in Bonifacio, Misamis Occidental and Lala, Lanao del Norte. Mature and juvenile green crabs are found in the open area of the Bay and in the coastal waters of Lapinig and Taguitic and are caught in abundance during neap tide. Peak season for both varieties is observed from May to November (Destajo et.al, 1993) which coincides with the seasonal northeast monsoon wind that generates waves with whitecaps and turbulent waters along the southern part of the Bay (Gorospe and Prado,1993). Crab fishermen use 15 gears types (Fig. 4) and, among them, the crab lift net (bintol) is found to be the most effective in terms of volume of catch (Destajo et al., 1993).

Farm Sites

The farm sites for growing mud crabs are spread practically throughout the Bay area but are concentrated in the interior half of Panguil Bay where the water salinity is kept brackish by the freshwater outflows from major tributaries (Fig.5). Specifically, most farms are located in the estuarine waters of Lala and Kapatagan of Lanao del Norte; Aurora and Tambulig of Zamboanga del Sur; and Bonifacio, in Misamis Occidental (Table 2). The substrates of farm sites are characteristically acidic, contain a small amount of organic matter and are low in phosphorus (Table 3 and 4).

Culture Systems

Mud crab farming in Panguil Bay may be categorized into two production systems:mud crab culture or growing-out and mud crab fattening. To an extent the two systems differ but both depend entirely upon natural reproduction of mud crab wild population for seedstock.

Culture in Ponds. Growers in earthen ponds represented 7.30 per cent of the interviewed crab growers or 6.4 per cent of total respondents. The respondents operate farms in the Misamis Occidental, Lanao del Norte and Zamboanga del Sur side of the Bay. The pond sizes for growing mud crabs, especially for monocropping, are smaller than those used for sugpo (*Penaeus monodon*) or milkfish (*Chanos chanos*) production and vary from 105 m2 to 77,500 m^2.

Fishpond owners recalled that mud crabs were traditionally grown as early as three or four decades ago. In the traditional method, wild mud crabs, regardless of size and variety, would enter into the milkfish pond with the tidal flood during periodic water exchange. The fishponds were not provided with any modification for mud crabs. In addition, the crabs were left to fend for themselves until they attained harvestable size. During harvest the mud crabs produced from this traditional practice were considered incidental fishpond products.

Unlike the traditional method, the present practice of mud crab growing involves deliberate stocking and growing of "bayot" mud crabs at initial sizes ranging from 55-70g or 15-18 pieces to a kilo (Fig.2). "Bayot" refers to the sub-adult female mud crab that turns into a sexually mature female after a molt or two.

"Bayot" crabs are either captured by bintoleros from estuaries and stocked in fishponds or they enter into the fishpond with the tidal flood during regular water management. These young female mud crabs with partially developed aprons are grown in ponds to marketable size of 250g or more either in combination with milkfish or sugpo or as a monocrop.

Polyculture. Mud crabs in large ponds that are polycultured with milkfish or with sugpo are stocked at varying densities. One fishpond owner reported a stocking density of 5,400 pieces of sub-adult mud crabs in a hectare of pond containing 30,000 pieces of sugpo in a 2-hectare pond.

The crabs in polycultured ponds are left to feed on whatever suitable natural food growing in the pond. In some cases, however, they are fed 'trash fish' intermittently but often partake of the feed, such as prawn pellets, given to prawns or other food items for the major cultured species.

Mud crabs that attain marketable size (250g and over) during harvest are sold together with the major crops; the undersized are restocked in another pond compartment for further growing, while lean but mature mud crabs, especially red females, are often transferred to pens or floating cages and fed to fatten in 10-15 days.

Monoculture. As a monocrop,mud crabs are usually grown in small pond areas which are modified to provide earth mounds and other additional features ass crab refuge area (Baliao, 1983). Bamboo slats, bamboo mattings or worn-out fishing nets are also installed to fence in the pond and to prevent mud crabs from escaping (Fig. 6a-b). In a monocrop crab pond, a stocking density of 10,000 pieces mud crabs per hectare is commonly noted. The crabs are fed kuhol, trash fish, prawn feed, roasted dried fish or whatever food material is available.

In the survey, not a single respondent showed any record on feeding rate for all feed materials except for kuhol or golden snail. Kuhol is given in combination with other feeds and is reportedly broadcasted in the pond during high tide or morning and afternoon at the rate of 10kg for a stock of 30kg of mud crab. Consequently, estimates on feed conversion ratio (FCR) was quite difficult to compute. In experimental earthen ponds, Baliao (1983) used trash fish (fresh or frozen) as mud crab feed and obtained an average FRC of 1.72. This figure is not far from FRC values (1.2-1.3) obtained for sugpo in commercial ponds.

In the present survey only one respondent claimed a survival rate of 95 per cent when sub-adult mud crabs were kept as monocrop in ponds for two to three months of culture. Majority of the respondents stated that the continuous addition of a few crabs,which they usually do each time the pond water is changed twice a month, would make impractical any attempt to account for survival rate at harvest.

Crab Fattening. Many growers admitted that the knowledge of the technique for fattening mud crab in floating cages and pens was learned from earlier mud crab buyers who were non-residents of Panguil Bay. Accordingly, the technique evolved from the necessity to transport specified volumes of live mud crabs, say, five hundred kilos, to enable the buyer to pay for his trip and still make business.

The evolution of the crab fattening technique was described as follows: In the past, a buyer usually would stay for three to seven days in a fishing village to purchase and accumulate the daily crab catch. The mud crabs purchased from the first day and onwards were kept in small makeshift boxes which were partially submerged in the shallow waters in Panguil Bay. In these boxes the mud crabs were kept alive by feeding them trash fish. It was found that mud crabs did not only survive well in holding boxes; they also gained weight or developed *aligue*. This serendipitous discovery was shared with the people in the fishing village.

The present practice of fattening mud crabs used by 82 per cent of the respondents or 92.7 per cent of the crab growers is different from fishpond culture in terms of the type of structures used for growing, the size of seedstock and the culture period.

Structures for Culture. The structures used in fattening crabs are bamboo floating cages and bamboo pens. About 30.4 per cent of the growers culture mud crabs in pens, while 62 per cent of them use floating cages. The pens and floating cages are placed at a depth of one meter or deeper either inside the pond compartments or in the pond supply canal; or in the estuaries at the 'front and back yards' of fishermen's stilt huts or under these huts (Figs. 7a-7e). The sizes of culture structures vary. For pens, the common dimensions are 2 x 2 x 2m; 3.5 x 3 x 2m; and 15 x 10 x 2m. Cages commonly measure 1 x .75 x 1m; 1.5 x 2 x 1.5m; and 2 x 2 1m.

Seedstock. The seedstock are crabs that are sexually mature but are thin and weigh light. Most are recently molted and their lean weight range from 150-200g or 5-7 pieces to a kilo.

The main source of seedstock is the bintol catch. There is no statistical record on the proportion of lean mud crabs from a day's catch, but according to seven bintoleros, as many as 100 pieces of crabs of mixed sizes can be trapped in 30 lift nets in five hours of fishing. Of the usual catch only 4 to 10 crabs are classified as *payat* or lean mud crabs and half of the catch are sub-adult.

The stocking density which largely depends on available seedstock also vary. The maximum recorded density is 27 mud crabs/m^2 in a floating cage or an equivalent stocking density of 270,000 pieces of crabs per hectare (Fig.8). In pens, the reported common density is much lower at 2 mud crabs/m^2 or 20,000 crabs per hectare. To minimize or prevent cannibalism among mud crabs in high density stocking, the movable segment of the claws are pinched off with a pair of mechanical pliers (Figs. 9a-b).

The crabs in pens and floating cages are fed locally available trash fish such as those sifted from 'pinukutan' (gill net catch) and 'sinudsuran'

(catch from push netting). In many instances, however, other food materials are also used as main diet for crabs (Table 5).

As in the case of crab production in ponds, the data on feeding practices in floating cages and pen culture of mud crabs n Panguil Bay is such that computing for feed conversion ratio (FCR) is difficult. The only available feed conversion data are those from 15-day laboratory floating cages culture studies conducted at MSU Naawan. By using fish flesh, Perpetua (1992) obtained an average FCR value of 22 for green and red crabs. A similar study using fish meat, coconut meat and prawn pellet reported a mean FCR value of 18 for green crabs and 15 for red crabs (Bongo, 1992). In both studies the exprimental crabs were fed to satiation. The feed conversion ratio is very poor.

Culture Period. The culture period in pens and floating cages ranges from 10-30 days, but 60 per cent of the crab fatteners claimed that mud crabs usually become fat after 11-15 days of culture. With this culture period a survival rate of 100 per cent is ordinarily obtained.

Crabs that are "overly fattened" were commonly observed to die easily. For this reason fatteners regularly inspect their stocks to cull out crabs that are about to become overfat. From experience, crab growers have established that the acceptable degree of fatness is indicated by the presence of yellow-orange, orange or red orange `aligue' or mass of developing egg in the ovary (Fig. 10) that partially filled up the protogastric and branchial cavities in the crab. The egg mass can be seen by slightly opening the suture between the carapace and the base of the abdominal flap (Fig. 3). Ovaries that are ripe for spawning and fully fill up the cavities are considered an alarming indicator of "overfatness." The occurrence of mortality among "overfat" crabs in brackishwater seems to be associated with the spawning behavior since natural spawning of crabs requires open sea water salinity (Ong, 1964). Perhaps the crabs with ripe ovaries and are ready to spawn are extremely stressed when they are unable to migrate to more saline water as in the case of those confined in floating cages and pens in brackishwater areas.

Economic Analysis of Crab Farming

All respondents asserted that growing mud crabs in ponds or fattening them in floating cages and pens is always highly profitable and yet the capital requirement is relatively low. As one respondent explained, one can start with 250.00 initial investment for seedstock and culture structure and from there produce crabs continuously which can be sold between 250-400 per kilo.

However, a well-founded analysis of economic viability of crab culture as a business venture in Panguil Bay can hardly be shown, considering the difficulty in obtaining complete and reliable data on annual production input and output. The difficulty, as earlier pointed out, arose from inadequate record keeping on the part of the crab growers; the unwillingness of some mud crab growers to share information; and discontinuous production operations caused by scarce supply of seedstock. Nevertheless, an economic analysis based on sporadic production data appears to agree with the general claim of how profitable mud crab culture can be. The economic evaluation using cost and return analysis to determine the operating profit margin (OPM) and return on investment (ROI), an undiscounted economic indicator, gives relatively high computed values ranging from 28.08-89 for OPM and 9.84-195 for ROI or an average value of 54.30 and 43.99, respectively, for OPM and ROI (Tables 6a-p). On the average, however, these OPM and ROI values are lower compared to those reported by Lapie and Librero (1979) and Agbayani et al. (1990).

Problems and Researchable Areas

Problems in Pond Culture. The problem of seedstock supply is not a popular complaint among the pond growers. Of the respondents only very few declared that crab seedstock has significantly declined to the scarcity level.

On the assessment of production technique, 23 per cent of the pond growers commented that the present practice needs improvement through research. The research need is identified in the aspect of feed formulation

to produce crab feeds that can promote better growth in the shortest possible culture period and with minimum feed input. The same group of respondents also specified that crab feed production technology that the research may develop must make use of economical and locally available feed materials and should require less sophisticated and less expensive gadgetry.

Problems in Crab Fattening. The most affected by scarce seedstock are the mud crab fatteners. In the survey, it was found that majority of them share the common view that the supply of lean mud crabs has dwindled significantly. According to the most articulate respondents, the main cause of lean crab scarcity is the crab fattening activity that has increased suddenly in terms of number of persons and number of culture structures.

Mud crab fattening in pens and floating cages was once a small-time activity by a handful of fishermen who learned from the early ingenious mud crab buyers. Encouraged by the good profit from fattened crabs, these pioneering crab fatteners expanded their production facilities. Meanwhile, many bintoleros and other mud crabbers realized they could get added income if they fattened lean crabs themselves and decided to keep their daily catch of lean crabs for 15 days or so in cages and pens instead of selling them right away. Very soon mud crab fattening spread like wildfire and the demand for lean mud crabs soared. The effect of high demand coupled with the downtrend catch from the Bay's mud crab fishery caused the price of lean mud crab to leap from 15.00/kg to 30.00/kg and finally to 70.00-150.00/kg.

This situation is exacerbated by alleged rampant 'smuggling' of lean crabs for fattening in places outside of Panguil Bay. A municipal official reported that mud crab smugglers are outside shippers from Cebu or Manila or their well-financed local agents who offer higher prices for lean mud crabs.

Problem of Declining Crab Catch. All respondents noted that there has been a downtrend in the catch from mud crab fishery and this is being specifically attributed to a number of factors. Frequently mentioned are: too many mud crabbers are fishing in the Bay; catching of gravid

female mud crabs; catching and selling of sub-adult crabs for local consumers or for pond culture, catching by motorized *sudsud* of juvenile mud crabs as small as a two-peso coin or less, which are either shipped live in crates for further growing in other places or cooked and bartered with cassava, camote, banana and bread in local markets. Other factors of ecological importance are the continuing operation of illegal fishing such as the motorized *sudsud* that causes damage to the muddy habitat of fry and juvenile crabs; the conversion of mangrove areas, which are crab habitat, into fish farms, human settlement and sites for other urban developments; and the unrestricted discharging into the Bay of pesticide residues (Daitia, 1989; Daitia 1993) and other effluents from rice paddies and fishpond that are believed toxic to eggs and young stages of mud crabs.

Other Problems. Aside from the problem of seedstock supply, another concern worth mentioning is the problem of poaching and fluctuating market price. Of the respondents, 21 per cent reported that poaching is a serious problem in their production operations. Incidence of poaching in the past victimized pens
and floating cages that were installed some distance away from fishermen's houses.

The buying price of fattened crabs in Panguil Bay is unstable, sometimes fluctuating in a matter of days. Majority of the marginal crab growers experienced some loss in culture operations and claimed they did not understand why prices could fluctuate widely in so short a time.

SUMMARY AND RECOMMENDATION

In summary, the results of the survey that we have presented described the situation of mud crab culture in Panguil Bay. There are two culturable varieties of mud crabs in the Bay and the red variety, especially the female ones, is preferred. The crabs are cultured in fishpond for two to three months and in pens and floating cages for 11-15 days, using seedstocks of subadults and lean mature crabs, respectively, that come wholly from the wild population. The crabs are fed various feed materials that are locally available. Some respondents cited the need for research to improve crab culture, especially in feed formulation, but the majority expressed that the

current cultural practices is sufficient for profitable production of mud crabs in fishponds, pens and floating cages. A number of problems were encountered but the primary obstacle to production is the scarce and unpredictable supply of seedstock from the fishery. The respondents attributed the scarcity of seedstock mainly to overfishing, to too many crab growers and the destruction of the crab natural habitat.

Indeed, under the current situations, the major obstacle to the development of mud crab culture into a stable and largescale aquaculture industry is technical and related to the complete dependence upon the wild population for seedstock. Any plan to expand production capacity will be severely limited by the seedstock supply from the wild, which is unpredictable.

To make the present practice of growing mud crab become independent from natural stock and to foster the full development of crab culture in Panguil Bay into a truly aquaculture industry, it is recommended that research on the aspect of crab biology related to seedling production should be intensified to generate, verify and pilot technologies for crab breeding hatchery and nursery. . Research is also recommended for the development of culture and transport technologies for green mud crabs. To further support this strategy, it is essential that the natural population of the mud crab and its habitat be protected. Pertinent recommendations involve formulation and implementation of resource management tools, such as protection of natural habitat by establishing crab sanctuaries; replanting mangrove areas; putting a stop to illegal fishing and regulating the sale of young, juvenile and berried mud crabs; careful evaluation of urban development in estuarine areas; and monitoring and regulating discharges from fish farms and rice paddies.

A short-term solution to the problems faced by mud crab growers of Panguil Bay may be the strict enforcement of existing laws against illegal fishing practices; promulgation and implementation of new ordinances to regulate the transport of crab seedstock from Panguil Bay; and the promotion of crab fattening and crab culture only as a backyard, smallscale livelihood activity specifically for bintoleros and marginal fishermen who are LEAD borrowers.

However, there are inherent weaknesses in these measures. Firstly, there are practical difficulties associated with law enforcement which is typical in our law enforcement agencies that are undermanned, underpaid and inadequately equipped. Secondly, it is next to impossible to prevent current growers or anyone else from engaging in this highly profitable venture. For these reasons, it might be better if the backyard crab growers be encouraged to supplement their income from mudcrabbing and crab growing with alternative non-fishing and land-based livelihood.

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Table 1. Distinct Characteristics of Green and Red Crabs.

Crab Variety	Observed Characteristics
Red Crabs	Easy to fatten High domestic and export price Short fattening period Fat lingers on even they are unfed for 2 days
Green Crabs	Easily die in captivity Hard to fatten Pincers easily broken Die when exposed to air Die when out of the water Less hardy than red crab Growth takes one-month Fat melts after 2 days without feed Loss in feed

Table 2. Sites of Crab Farms in Panguil Bay.

Province	Municipality	Coastal Barangay
Lanao del Norte	Kolambugan	Mukas
	Baroy	Baroy Dacu
		Baroy Poblacion
	Lala	Pacita
		Daromawang Bucana
	Kapatagan	Lapinig
Zamboanga del Sur	Aurora	Anonang
		Gubaan
		Balas
		Tagolalo
	Tambulig	Angeles
		Cabgan
		Sumalig
Misamis Occidental	Bonifacio	Migpangi
		Bagumbang
	Tangub City	Silanga
		Maquilao
		Maloro
		Aquino
		Migcanaway
		Lorenzo Tan
	Ozamiz City	Ozamiz City

Table 3. Ranges of Water pH and Salinity levels of Nine Selected Crab Farms in Panguil Bay.

Water Sample	pH	Salinity
Crab Farm #1	7.50	12 ppt
Crab Farm #2	7.58	7 ppt
Crab Farm #3	8.23	5 ppt
Crab Farm #4	8.01	5 ppt
Crab Farm #5	7.93	12 ppt
Crab Farm #6	7.94	12 ppt
Crab Farm #7	7.61	12 ppt
Crab Farm #8	7.63	18 ppt
Crab Farm #9	8.03	18 ppt

Table 4. Soil Characteristics of Crab Selected Farm Sites.

Soil Sample	pH	Organic Matter	Grain Size	
Mud Crab Farm #1	5.79	6.761	41.0004 % coarse sand 1 27.5662 % fine and 1 7.0958 % very find sand	23.0924 % coarse sand 2 1.6876 % fine sand 2
Mud Crab Farm #2	6.05	6.530	32.9884 % coarse sand 1 28.4480 % fine sand 1 8.6670 % very find sand	24.2850 % coarse sand 2 1.9590 % fine and 2
Mud Crab Farm #3	6.76	6.770	36.9884 % coarse sand 1 27.0114 % fine sand 1 7.7455 % very find sand	26.5861 % coarse sand 2 1.6658 % fine and 2
Mud Crab Farm #4	6.41	6.410	37.4537 % coarse sand 1 27.5880 % fine sand 1 7.0713 % very find sand	26.0617 % coarse sand 2 1.8253 % fine and 2
Mud Crab Farm #5	3.82	6.730	36.4000 % coarse sand 1 29.2490 % fine sand 1 9.7000 % very find sand	21.3504 % coarse sand 2 2.3081 % fine and 2
Mud Crab Farm #6	3.63	6.731	21.8387 % coarse sand 1 36.0341 % fine sand 1 13.6553 % very find sand	24.7675 % coarse sand 2 2.3377 % fine and 2
Mud Crab Farm #7	3.08	6.746	49.6287 % coarse sand.1 24.1413 % fine sand 1 5.0988 % very find sand	19.4507 % coarse sand 2 1.6806 % fine and 2
Mud Crab Farm #8	6.67	6.469	40.3631 % coarse sand 1 13.0379 % fine sand 1 2.0182 % very find sand	14.5919 % coarse sand 2 0.6775 % fine and 2
Mud Crab Farm #9	3.80	6.700	36.3994 % coarse sand 1 29.2794 % fine sand 1 9.6973 % very find sand	22.3517 % coarse sand 2 2.3081 % fine and 2

Table 5. Food Materials Used as Feed for Mud Crabs

Trash Fish (dried or fresh)	Kitchen Refuse
Golden Kuhol	Visceral Organs of
Coconut Meat	terrestrial animals
Brown Mussel	Frogs
Acetes (Uyap)	Prawn Feed
Lumut	Lablab
Rice and Corn	Cassava

Table 6a. Production Data and Computed OPM and ROI (Pen Culture)

Name	Investment	Size Area/m^2	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Undang	202.33	6	10	1400	1000	75		8.43	316.55		
Rivera	600.00	9	12	540	300	105		25.00	110.00		
Colina	4167.00	12	10	1700	1000	18.75		57.87	623.38		
Montañes	1004.00	120	13.4	2600	804	225		13.94	1557.00		
Total	3973.33	147	45.4	6240	3104	423.75		105.24	2606.93		
Average	1493.33	36.75	11.35	1560	776	105.94		26.31	651.73	**41.74**	**43.64**

$$\text{Operating Profit Margin (OPM)} = \frac{\text{Profit before interest + Taxes}}{\text{Sales}} = \frac{651.73}{1560} = \mathbf{41.78\ \%}$$

$$\text{Return of Investment (ROI)} = \frac{\text{Net Income}}{\text{Equity}} = \frac{651.73}{1493.33} = \mathbf{43.64\ \%}$$

Table 6b. Production Data and Computed OPM and ROI (Pen Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Ubas	800	6	5.15	706	209.85	50		43.84	402.31	**56.98**	**50.29**

Table 6c. Production Data and Computed OPM and ROI(Pen Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Galusan	4000	50	17.5	2100	1750	450		112.50	212.50		
Undang	400.65	16	20	2800	2000	150		16.86	633.14		
Barte	2600	32	20	2880	1000	150		10.83	1719.17		
Jayme	4500	117	20	4000	500	1600		41.67	1858.33		
Sapang	700	5.95	20	1800	1400	196		29.17	174.83		
Bate	1000	18	20	2100	495	442.50		15.12	1147.38		
Buyos	16500	50	24	6240	1680	360		137.50	4062.50		
Total	29704.65	288.95	147.5	21920	8825	3348.50		363.65	9382.85		
Average	4243.52	41.28	20.21	3131.43	1260.71	478.36		51.95	1340.41	**42.81**	**31.59**

Table 6d. Production Data and Computed OPM and ROI(Pen Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Electricity Meal	Depreciation	Profit	OPM (%)	ROI (%)
Elesio	433	30	30	4800	2100	190	350	285	22.54	1852.46		
Feridin	1100	100	30	3000	600	250			10.19	2139.81		
Romo	25000	107	30	6000	3000	1350			208.33	1441.67		
Santos	1500			30	1890	750	187.50		62.50	890		
Biaño	844.50	36	30	5000	2800	525			75.19	1639.81		
Total	28877.50	273	150	20690	9250	2502.50	350	285	338.75	7963.75		
Average	5775.50	68.25	30	4138	1850	500.50			62.75	1592.75	**38.4**	**27.58**

Table 6e. Production Data and Computed OPM and ROI(Pen Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Electricity Meal	Depreciation	Profit	OPM (%)	ROI (%)
Bravo	420	16	50	8000	2250	225			17.50	5507.50		
Ramos	8994	56	50	10000	5000	300		2440	74.95	2185.05		
Pascucano	1000	150	60	10260	4200	200			27.78	5832.22		
Total	10414	222	160	28260	11450	725		2440	120.23	13524.77		
Average	3471.33	74	53.33	9420	3816.67	241.67			40.08	4508.26	**47.86**	**129.87**

Table 6f. Production Data and Computed OPM and ROI(Pen Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Electricity Meal	Depreciation	Profit	OPM (%)	ROI (%)
Saguin	1000	5	80	8800	5600	1200			41.67	1958.33		
Pansa	2000	2000	85	18000	2125	840	500		83.33	14451.67		
Mabate	3835	100	100	8000	4500	1050			106.53	2343.47		
Bucar	3835	100	100	8000	4500	1850			53.26	1646.74		
Ramos	8994	37.5	110	7000	11000	300		2040	74.95	6414.95		
Total	19664	2242.5	475	49800	27725	5240	500	2040	359.74	13985.26		
Average	3932.80	448.5	95	9960	5545	1048			71.95	2797.05	**28.08**	**71.12**

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Colina	4167	12	136	2000	3400	306		83.33	1789.30	**89.47**	**42.94**

Table 6h. Production Data and Computed OPM and ROI (Pond Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Montañes	7000	200	4	1000	240	67.17		4.17	688.66	**68.87**	**9.84**

Table 6i. Production Data and Computed OPM and ROI (Pond Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Antida	4000	20000	20	8000	400	1450		16.67	6133.33		
Arboladora	4000	255	20	3200	1000	450		16.67	1733.33		
Anonang	20000		30	4800	1050	1000		83.33	2666.67		
Total	28000	20255	70	16000	2450	2900		116.67	10533.33		
Average	988.33	10127.5	23.33	5333.33	816.67	966.67		38.89	3511.11	**65.83**	**37.62**

Table 6j. Production Data and Computed OPM and ROI (Pond Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Borinaga	46000	77500	300	143000	7500	44833.33		766.67	89900	**62.87**	**195.43**

Table 6k. Production Data and Computed OPM and ROI (Cage Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Lanaja	150	8	1.6	252	120	27		12.50	92.50		
Antida	100	13	1.8	195	58.50	10.40		4.16	121.94		
	93.33	10	2	333.33	140	24		3.89	165.44		
Belano	50	10	2	456	264	40		2.74	149.26		
Macalitong	75.40	15	3	330	45	180		3.14	101.86		
Total	468.73	56	10.4	1566.33	627.50	281.40		26.43	631.00		
Average	93.75	11.2	2.08	313.27	125.50	56.20		5.29	126.20	**40.28**	**134.61**

Table 6l. Production Data and Computed OPM and ROI (Cage Culture)

Name	Investment	Size Area/m^2	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Sanchez	15	.09	.6	129	54	15		0.63	59.37		
			1.4	224	70	10.50			143.50		
Sanchez	5	.35	2	430	180	50		0.21	199.79		
Biaño	15	1.5	2	220		30		0.63	189.37		
Gadgade		1.5	3.15	57.50	78.75			78.75			
Sanchez	123	1.85	4	860	360	50		5.13	444.87		
Almojallas	600	2.98	4	295	175	30		25	65.00		
Tibook	180		4	480	100	52.50		7.50	320.00		
Papha	50	2.25	4	400	100	37.50		2.08	260.42		
Total	988	10.52	25.15	3195.50	1117.7	275.50		41.18	1761.07		
Average	141.14	1.50	2.79	355.06	139.72	34.44		5.88	195.67	**55.11**	**138.64**

Table 6m. Production Data and Computed OPM and ROI (Cage Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Montañes	300	3	6.13	1532.5	275.85	22.50		12.50	1221.65		
Antida	300	1.11	7	600	210	36.75		8.33	344.92		
Arboladora	1000	1.82	8	1280	400	90		41.67	748.33		
Jayme	700	2	8	1250	525	90		29.17	605.83		
Total	2300	7.93	29.13	4662.50	1410.85	239.25		91.67	2920.73		
Average	575	1.98	7.28	1165.63	352.71	59.81		22.92	730.18	**62.64**	**126.99**

Table 6n. Production Data and Computed OPM and ROI (Cage Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Serrano	500	4	16	840	400	310		27.50	102.60		
Tumapon	800	3	20	2730	400	375		33.33	1921.67		
Total	1300	7	36	3570	800	685		60.73	2024.27		
Average	650	3.5	18	1785	400	342.50		30.37	1012.14	**56.70**	**155.71**

Table 6o. Production Data and Computed OPM and ROI (Cage Culture)

Name	Investment	Size Area/m²	Stocking Density(kg)	Sale	Payat	Feed	Salary	Depreciation	Profit	OPM (%)	ROI (%)
Lanaja	1500	10	30	4200	3000	810		87.50	302.50		
Tabalbag	520		40	3400	1000	876.44		115.56	1408.00		
Bravo	420	8	50	8000	2250	225		17.50	5507.50		
Total	2440	18	120	15600	6250	1911.44		220.56	7218.00		
Average	813.38	9	40	5200	2083.33	637.15		73.52	2406	**46.27**	**295.82**

Appendix Table A1

Project : [ ] Pond Culture [ ] Pen Culture [ ] Cage Culture

Name of Grower(s):_____Age _____
Address: _____Civil Status_____
Name of spouse: _____ Age_____
No. of Children: _____ School level_____
[ ] Primary [ ] High School [ ] College

Farm location _____
Type of ownership of project site
[ ] Owned [ ] Leased No. of Years _____
Type of ownership of the project
[ ] family [ ] Private Corporation [ ] Cooperative
Managed by: Owner-Operator _____
Part time Operator _____ Overseer _____
Training and experience of Operator _____
Number of workers needed casual/contractual___Permanent____
Number of cages/pens/ponds one worker can manage [ ] one
[ ] two [ ] three [ ] more than three

Sources of financing [ ] Loan [ ] Owner's equity
Amount of loan _____
Date of payments _____
Interest rate _____
Grace period: capital investment _____
Term _____
Amortization interval _____
Cost of Capital _____
Total cost of initial investment _____

Pond Culture System

A. Characteristics of pond site(s) as described by the crab grower:
- o Water depth is at least _____ m.
- o The site is free from floating objects and drifting vegetation.

Appendix Table A2

- The nature of the site's bottom substrate is _____.
- The site is free from poaching.
- The site is free from predators.
- The site is free from strong tidal waves; site is located in protected lagoons.
- The site is near the source supply of lean crabs.
- The site is close to the market for live and fresh selling of fattened crabs.
- The site has available cheap labor.
- The site has an easy access for regular monitoring visits.
- The site is not within navigational pathway of fishing boats.
- The pond layout is _____.
- The depth of pond water at regular high tide is _____ .
- The type of gate is _____.
- The area of the pond is _____.

B. Criteria Used in selecting the lean crabs for stocking

- Species
- Sex
- Size in carapace length and body weight ____.
- Value of the crab and market demand.
- Hardiness (in terms of ability to adjust to high density culture, disease and handling).
- Ready supply of seed or juveniles for stocking.
- Fast growth in confined conditions.
- Available suitable feed.

C. Feeds and Feeding

- Types of feed: [ ] simple diet of single ingredient [ ] simple diet formulated out of locally-available sources [ ] chicken ration [ ] prawn pellets [ ] terrestial animals [ ] animal hide [ ] amphibians [ ] viscerated organs of animals.
- Time of day at which crabs take in feed: [ ] am [ ] pm
- Feeding rate, frequency and time
- Manner of feeding

D. Production Data

- The underlying assumptions for planning the production targets are:
  - Stocking density _____
  - Culture days_____
  - Survival rate at farming_____

Appendix Table A3

Size of crab at harvest_____

Crab production per cropping per unit of culture s y s - tem_____.

E. Marketing aspect

o Marketing of the product

Target Market

[ ] High-income consumers
[ ] Wholesalers
[ ] Retailers
[ ] General consumption
[ ] Others please specify

o Marketing arrangement

Selling arrangement

[ ] Ex-farm
[ ] Written contract/negotiated
[ ] Thru' middlemen
a} fish auction market - please indicate address
[ ] Per Kilo
[ ] By volume
[ ] Suki system
[ ] Others

Terms of Sale

[ ] Cash
[ ] COD
[ ] Credit
[ ] Others

Marketing Scheme/Promotional activity. If thru agents, please indicate remuneration arrangement.

[ ] Personal selling
[ ] Thru' agents
[ ] Advertising

Product Line

[ ] Crab alone
[ ] Mixed species
[ ] Others

Appendix Table A4

Product features
[ ] Sizing/grading
[ ] Sexing
[ ] Mixed
[ ] By species (color)
[ ] Others

o Price System
Method of setting price
[ ] Based on cost of production
[ ] Prevailing price
[ ] According to size, sex and species
[ ] Dictated by buyers
[ ] Based on quality volume
[ ] Others
Price policies and strategies
[ ] Providing discounts
[ ] Uniform price regardless of size, sex and customer
[ ] Suki system (by arrangement)
[ ] Depends on prevailing practice

F. Problems and Remedial Measures
o Poaching
o Other problems
o Some remedial measures

G. Prospect for Crab Culture in Panguil Bay
o Is the source of lean female crabs stable and abundant such that it can supply the requirement for increased croppings or for additional culture areas?
o Is there sufficient supply of suitable and economical feed materials for additional culture activities?
o Are there any competing use now or in the future of areas suitable for the expansion of crab culture farm sites?
o What is the possibility of future market glut?
o Do we have alternative market outlets for fattened crabs?
o Are there alternative culturable crab species to enable us to diversify crab culture?

Appendix Table A5

o Do we have locally available material source for the construction of pen and cage culture facilities?
o Are there any organizational structures to cope with unforeseen debacles in crab culture?
o Is the current technique amenable to research for improving the economics of production?

Research Programme to Develop Crab culture

Use of fast growing crab species.
Studies on the alternative crab species such as lambay for culture.
Studies on alternative nutrient sources for crabs.
Research on improving the management techniques for all culture systems.
Development of Seed Production Technology.
Manipulating Sex determination of larval crabs.
Nursery rearing of 2-8 cm to stockable size.
Fattening of male crabs to augment production of marketable fattened crab .
Engineering studies on Cage and Pen construction.

Cage Culture System

A. Characteristics of Cage farm site(s) as described by the crab grower:

o Criteria Used in selecting the lean crabs for stocking
o Cage Design: [ ] circular [ ] rectangular [ ] square
o Feeds and Feeding
o Production Data
o Marketing aspect
o Problems and remedial measures
o Prospect for Crab Culture in Cages

Pen Culture System

(Same As For Cage Culture System)

Appendix Table B1. Partial List of Mudcrabbers and Mudcrab Growers in Panguil Bay.

Name	Culture System / Gear Used	Address
Filomeno Romero	Fishpond	Ozamiz City
Evangelisto Sebandal*	Cage	Lorenzo Tan, Tangub City
Maloro Multipurpose Cooperative	Cage	Maloro, Tangub City
Aquino MPC	Cage	Aquino, Tangub City
Juvy Casile*	Cage	Maquilao, Tangub City
Francisca Lopez	Fishpond	Migcanaway, Tangub City
Silanga Research Station	Cage	Silanga, Tangub City
Clemente Ramirez*	Cage	Migpangi, Bonifacio, Misamis Occidental
Rogelio Secretario*	Fishpond and Cage	Migpangi, Bonifacio, Misamis Occidental
Leonida Bautista	Fishpond	Migpangi, Bonifacio, Misamis Occidental
Laurencia Cordovan	Fishpond	Migpangi, Bonifacio, Misamis Occidental
Nicanor Gabo	Fishpond	Migpangi, Bonifacio, Misamis Occidental
Henry Lanaja*	Cage	Migpangi, Bonifacio, Misamis Occidental
Danny Belano*	Cage	Migpangi, Bonifacio, Misamis Occidental
Andres Abon*	Pen	Bagumbang, Bonifacio, Misamis Occidental
Romulo Undang*	Pen	Angeles, Tambulig, Zamboanga del Sur
Herminio Sanchez*	Cage	Angeles, Tambulig, Zamboanga del Sur
Ramon Bate*	Pen & Cage	Cabgan, Tambulig, Zamboanga del Sur
Joel Antida*	Cage & Pond	Cabgan, Tambulig, Zamboanga del Sur
Tranquilino Antida*	Cage	Cabgan, Tambulig, Zamboanga del Sur
Alberto Cabisano*	Pen	Cabgan, Tambulig, Zamboanga del Sur
Zosimo Jayme*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Nathaniel Feralin*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Romeo Romo*	Pen & Cage	Sumalig, Tambulig, Zamboanga del Sur
Andres Borinaga*	Pond	Sumalig, Tambulig, Zamboanga del Sur
Ferrolino*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Ruben Rafols*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Rong*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Morales*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Capitan*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Sino*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Barrido*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Dodong*	Floating Cage	Sumalig, Tambulig, Zamboanga del Sur
Pila*	Floating Cage	Sumalig, Tambulig, Zamboanga del Sur
Faith Pasau	Cage	Sumalig, Tambulig, Zamboanga del Sur

Appendix Table B2. Partial List of Mudcrabbers and Mudcrab Growers in Panguil Bay.

Name	Culture System / Gear Used	Address
Junior Pasculado*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Aning Pasculado*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Porboy*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Iding*	Floating Cage	Sumalig, Tambulig, Zamboanga del Sur
Nestor*	Floating Cage	Sumalig, Tambulig, Zamboanga del Sur
Simoy*	Floating Cage	Sumalig, Tambulig, Zamboanga del Sur
Ayang	Pen	Sumalig, Tambulig, Zamboanga del Sur
Diego Antoba*	Pen	Sumalig, Tambulig, Zamboanga del Sur
Gerry Macalitong	Pen & Pond	Sumalig, Tambulig, Zamboanga del Sur
Romy Lanaja*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Rico Lanaja*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Edito Balasabas*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Loloy Daulong*	Cage	Sumalig, Tambulig, Zamboanga del Sur
Leonardo Romo*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Jojo Romo*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Diosdado Benis*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Anecito Bernal, Jr.*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Elde Maribao*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Christopher Pitallar*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Dodo Tarug*	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Feliciano Panilag*	Cage	Matin-aw, Tambulig, Zamboanga del Sur
Brando Dag-uman*	Cage	Matin-aw, Tambulig, Zamboanga del Sur
Diego Histopa*	Cage	Matin-aw, Tambulig, Zamboanga del Sur
Ayang Burinaga*	Cage	Matin-aw, Tambulig, Zamboanga del Sur
Maximillano Pabatao	Bintol	Sumalig, Tambulig, Zamboanga del Sur
Leonardo Jayme*	Cage	Anonang, Aurora, Zamboanga del Sur
Frank & Jinky*	Pond	Anonang, Aurora, Zamboanga del Sur
Montano Bravo*	Pen & Cage	Balas, Aurora, Zamboanga del Sur
Virgie Saguin*	Pen in Pond	Balas, Aurora, Zamboanga del Sur
Romeo Ubas*	Pen	Balas, Aurora, Zamboanga del Sur
Roger Fernandez*	Pen & Cage	Gubaan, Aurora, Zamboanga del Sur
Wilfredo Basilio*	Cage	Gubaan, Aurora, Zamboanga del Sur
Juan Bade*	Cage	Gubaan, Aurora, Zamboanga del Sur
Generie Flores*	Pen	Gubaan, Aurora, Zamboanga del Sur
Rolando de los Santos*	Pen, Pond	Gubaan, Aurora, Zamboanga del Sur

Appendix Table B3. Partial List of Mudcrabbers and Mudcrab Growers in Panguil Bay.

Name	Culture System / Gear Used	Address
Liling Mabate*	Pen	Gubaan, Aurora, Zamboanga del Sur
Carlos Bucan*	Pen	Gubaan, Aurora, Zamboanga del Sur
Jeremias Macalitong	Cage	Gubaan, Aurora, Zamboanga del Sur
Luciano Barte*	Pen and Pond	Tagolalo, Aurora, Zamboanga del Sur
Luciano Biano*	Cage	Tagolalo, Aurora, Zamboanga del Sur
Juaning Billones*	Pen	Tagolalo, Aurora, Zamboanga del Sur
Rosito Biano*	Pen	Tagolalo, Aurora, Zamboanga del Sur
Anecita Go	Cage	Lapinig, Kapatagan, Lanao del Norte
Alexander Cayud-bog	Cage	Lapinig, Kapatagan, Lanao del Norte
Allan Padta*	Cage	Daromawang, Lala, Lanao del Norte
Toto Paladas*	Cage	Daromawang, Lala, Lanao del Norte
Joy Paladas	Cage	Daromawang, Lala, Lanao del Norte
Romeo*	Cage	Daromawang, Lala, Lanao del Norte
Alfredo Tibook*	Cage	Daromawang, Lala, Lanao del Norte
Federico Papha*	Cage	Daromawang, Lala, Lanao del Norte
Romeo Galgade*	Cage	Daromawang, Lala, Lanao del Norte
Linda	Cage	Daromawang, Lala, Lanao del Norte
Lily*	Cage	Daromawang, Lala, Lanao del Norte
Celyn*	Cage	Daromawang, Lala, Lanao del Norte
Fredo	Cage	Daromawang, Lala, Lanao del Norte
Babie Rivera*	Pen in Ponds	Daromawang, Lala, Lanao del Norte
Franklin Sapong*	Pen	Daromawang, Lala, Lanao del Norte
Felix Almojallas*	Cage	Pacita, Lala, Lanao del Norte
Nilo Serrano*	Cage	Pacita, Lala, Lanao del Norte
Tarcilo Tabalbag*	Cage	Pacita, Lala, Lanao del Norte
Porferio Elenio*	Pen in Pond	Pacita, Lala, Lanao del Norte
Narciso Alboradora*	Pond & Cage	Pacita, Lala, Lanao del Norte
Rodulfo Montanes*	Pen, Pond & Cage	Pacita, Lala, Lanao del Norte
Dodong Bugo*	Pen	Baroy, Daku, Lanao del Norte
George Ramos*	Pen in Pond	Pob. Baroy, Lanao del Norte
Jimmy Tumapon*	Cage	Mukas, Kolambugan, Lanao del Norte
Timong Malales	Cage	Mukas, Kolambugan, Lanao del Norte

* Respondents

Appendix Table C1. Partial List of and Addresses of Crab Dealers/Buyers in Panguil Bay.

Gaspar Benedecio	Crab Buyer/Dealer/Shipper	Ozamiz City
Sita Harry	Crab Buyer/Dealer/Shipper	Ozamiz City
Sunny Ceniza	Crab Buyer/Dealer/Shipper	Ozamiz City
Ricson Sabado	Crab Buyer/Dealer/Shipper	Ozamiz City
Jun Sabado*	Crab Buyer/Dealer/Shipper	Ozamiz City
Jerry Sabado	Crab Buyer/Dealer/Shipper	Ozamiz City
Jenny Sabado	Crab Buyer/Dealer/Shipper	Ozamiz City
Jimmy Tan	Crab Buyer/Dealer/Shipper	Ozamiz City
Arnel Cortes	Crab Buyer/Dealer/Shipper	Ozamiz City
Wenefredo Beniga	Crab Buyer/Dealer/Shipper	Ozamiz City
Merlyn Desierto	Crab Buyer/Dealer/Shipper	Ozamiz City
Jude Boreros	Crab Buyer/Dealer/Shipper	Ozamiz City
Tommy Arcega	Crab Buyer/Dealer/Shipper	Ozamiz City
Sidney Tagaloguin	Crab Buyer/Dealer/Shipper	Ozamiz City
Dodong Oro	Crab Buyer/Dealer/Shipper	Ozamiz City
Junior Benlut	Crab Buyer/Dealer/Shipper	Ozamiz City
Ariel Cusi	Crab Buyer/Dealer/Shipper	Ozamiz City
Helen Lugagay	Crab Buyer/Dealer/Shipper	Ozamiz City
Jaime Benaso	Crab Buyer/Dealer/Shipper	Ozamiz City
Calvo Villanueva	Crab Buyer/Dealer/Shipper	Ozamiz City
Andring Munoz	Crab Buyer/Dealer/Shipper	Ozamiz City
Loloy Ebarle	Crab Buyer/Dealer/Shipper	Ozamiz City
Rosa Libosada	Crab Buyer/Dealer/Shipper	Ozamiz City
Gemma Ong	Crab Buyer/Dealer/Shipper	Ozamiz City
Lito Ebarle	Crab Buyer/Dealer/Shipper	Ozamiz City
Tata Lim	Crab Buyer/Dealer/Shipper	Ozamiz City
Renante Astellero	Crab Buyer/Dealer/Shipper	Tangub City
Armando Marie	Crab Buyer/Dealer/Shipper	Tangub City
Rodulfo Enriquez	Crab Buyer/Dealer/Shipper	Bocator, Tangub City
Regina Evedientes	Crab Buyer/Dealer/Shipper	Lorenzo Tan, Tangub City
Paulina Ramayrat	Crab Buyer/Dealer/Shipper	Maloro, Tangub City
Doring Alvarico	Crab Buyer/Dealer/Shipper	Mantic, Tangub City
Juanita Telmo	Crab Buyer/Dealer/Shipper	Mantic, Tangub City
Procolo Delosa	Crab Buyer/Dealer/Shipper	Maquilao, Tangub City
Danny Ramayrat	Crab Buyer/Dealer/Shipper	Maquilao, Tangub City
Gregoria Catane	Crab Buyer/Dealer/Shipper	Maquilao, Tangub City
Neneng Aguaviva	Crab Buyer/Dealer/Shipper	Maquilao, Tangub City
Eddie Gaso	Crab Buyer/Dealer/Shipper	Maquilao, Tangub City
Juvy Casile	Crab Buyer/Dealer/Shipper	Maquilao, Tangub City
Francisca Lopez	Crab Buyer/Dealer/Shipper	Migcanaway, Tangub City
Margarita Mendes	Crab Buyer/Dealer/Shipper	Panalsalan, Tangub City

Appendix Table C2. Partial List of and Addresses of Crab Dealers/Buyers in Panguil Bay.

Roland Manlangit	Crab Buyer/Dealer/Shipper	Panagbuan, Tangub City
Mary Sarmiento	Crab Buyer/Dealer/Shipper	Silanga, Tangub City
Rolly Serafin	Crab Buyer/Dealer/Shipper	Bonifacio, Misamis Occidental
Isagani Gabo*	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Alice Roble	Crab Buyer/Dealer/Shipper	Talisay, Pangabuan, Tangub City
Alde Arado	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Medardo Quendao*	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Elsa Responso	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Danny Palumar	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Myrna Yecla	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Josephine Bayawa	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Salvador Quimno	Crab Buyer/Dealer/Shipper	Migpangi, Bonifacio, Mis. Occ.
Felix Anduhar	Crab Buyer/Dealer/Shipper	Baybay, Bonifacio, Mis. Occ.
Herminio Sanchez*	Crab Buyer/Dealer/Shipper	Angeles, Aurora, Zamboanga del Sur
Marilou Regencia	Crab Buyer/Dealer/Shipper	Pagadian City
H & L Corporation*	Crab Buyer/Dealer/Shipper	Pagadian City
Monica Besina	Crab Buyer/Dealer/Shipper	Pagadian City
Neneth Jori	Crab Buyer/Dealer/Shipper	Pagadian City
Jason Damasco	Crab Buyer/Dealer/Shipper	Pagadian City
Mario Esco	Crab Buyer/Dealer/Shipper	Pagadian City
Robert Aligase	Crab Buyer/Dealer/Shipper	Pagadian City
Recoleto Sabado*	Crab Buyer/Dealer/Shipper	Pagadian City
Jun Sabado*	Crab Buyer/Dealer/Shipper	Pagadian City
Roel Concepcion	Crab Buyer/Dealer/Shipper	Pagadian City
Jeremias Macalitong*	Crab Buyer/Dealer/Shipper	Gubaan, Aurora, Zamboanga del Sur
Francis Juros	Crab Buyer/Dealer/Shipper	Sumalig, Tambulig, Zambo. del Sur
Thelma Zulueta	Crab Buyer/Dealer/Shipper	Sumalig, Tambulig, Zamboanga del Sur
Jerry Macalitong*	Crab Buyer/Dealer/Shipper	Taguitic, Lanao del Norte
Ronie Larobes*	Crab Buyer/Dealer/Shipper	Maranding, Lanao del Norte
Bebot Abiso	Crab Buyer/Dealer/Shipper	Maranding, Lanao del Norte
Allan Abiso	Crab Buyer/Dealer/Shipper	Maranding, Lanao del Norte
Diamond Exporter*	Crab Buyer/Dealer/Shipper	Daromawang, Lala, Lanao del Norte
Roberto Tillo	Crab Buyer/Dealer/Shipper	Pacita Lala, Lanao del Norte
Marcelino Sandiego	Crab Buyer/Dealer/Shipper	Maigo, Lanao del Norte

Appendix Table D. List of Names of Fishermen's Association Engaged in Crab Culture in Panguil Bay.

PROJECT SITE	PROPONENT	BENEFICIARIES	PROJECT TITLE	APPROVED FUNDING	DATE RELEASED
Migpangi, Bonifacio, Misamis Occidental	Migpangi Crab Fattening in Cages Association	25	Crab Fattening in Cages	P 50,000.00	March 1990
Migpangi, Bonifacio, Misamis Occidental	Migpangi Crab Fattening in Ponds Association	5	Crab Fattening in Ponds	46,340.00	November 1990
Mucas, Manga & Simbuco, Lanao del Norte	NMS Fishermen's Association	15	Crab Fattening	50,000.00	January 1991
Cabgan, Tambulig, Zamboanga del Sur	Cabgan Fishermen's Association I	25	Crab Fattening	100,000.00	July 1990
Cabgan, Tambulig, Zamboanga del Sur	Cabgan Fishermen's Association II	25	Crab Fattening	100,000.00	July 1990
Sumalig, Tambulig Zamboanga del Sur	Sumalig Fishermen's Association I	25	Crab Fattening	100,000.00	July 1990
Anonang, Aurora, Zamboanga del Sur	Anonang Small Fishermen's Association	25	Crab Fattening	100,000.00	July 1990

Source: PBDTF Agribusiness and Monitoring Committee.

Fig 1. The Red and Green Varieties of Mud Crab from Panguil Bay.

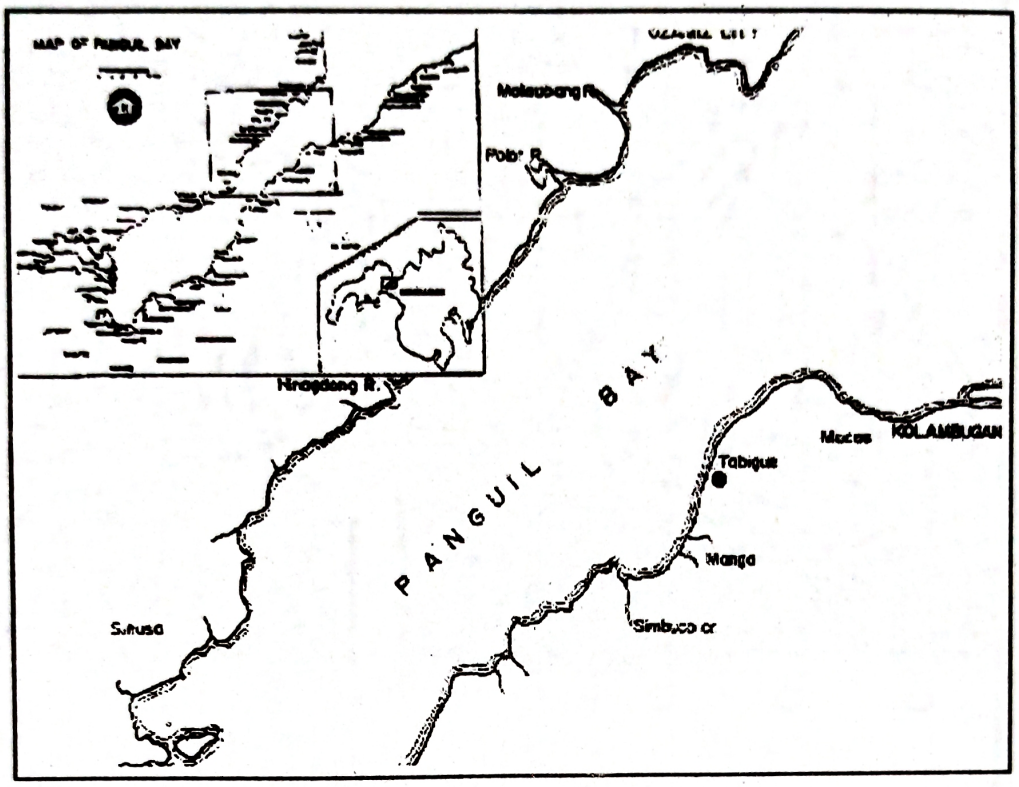

Fig. 2. Male, Female and 'Bayot' Mud Crab with their Distinct Abdominal Flaps.

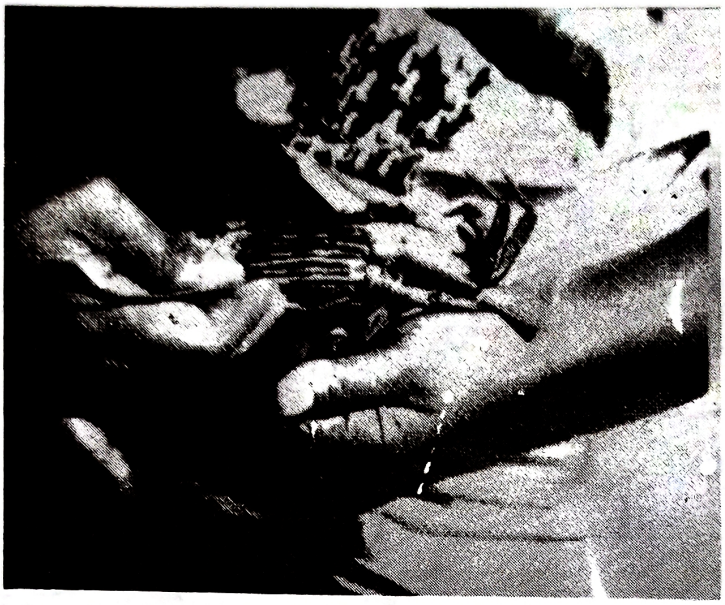

Fig. 3. Slightly Opened Suture at the Carapace-Abdominal Flap Junction of Mud Crab.

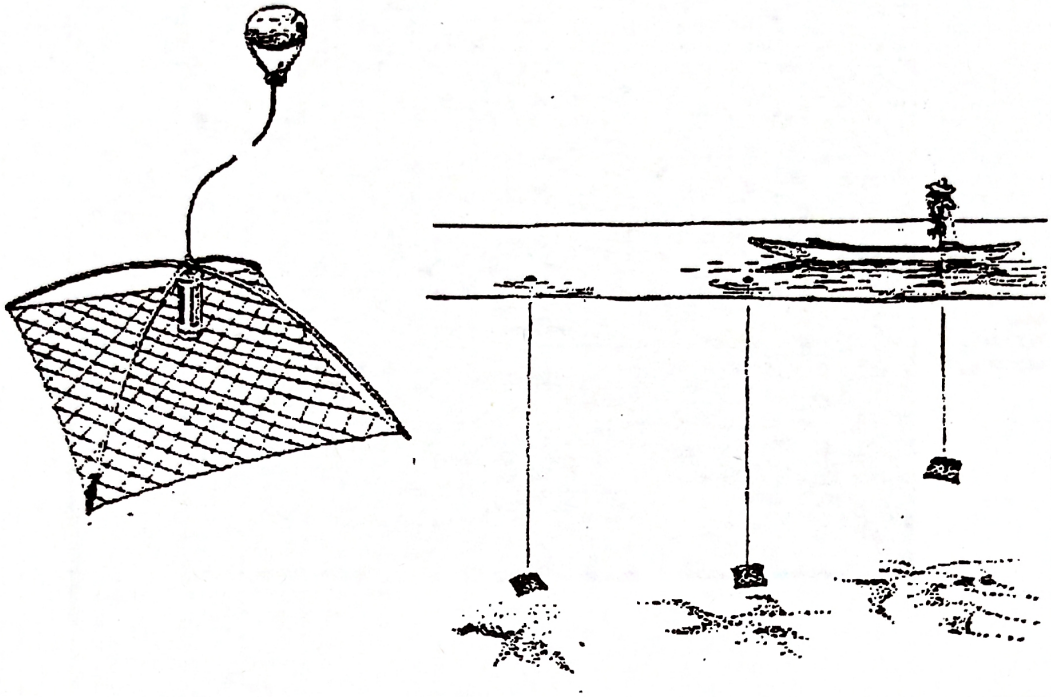

Fig. 4. Lift Net or 'Bintol', an effective Gear for Catching Mud Crab.

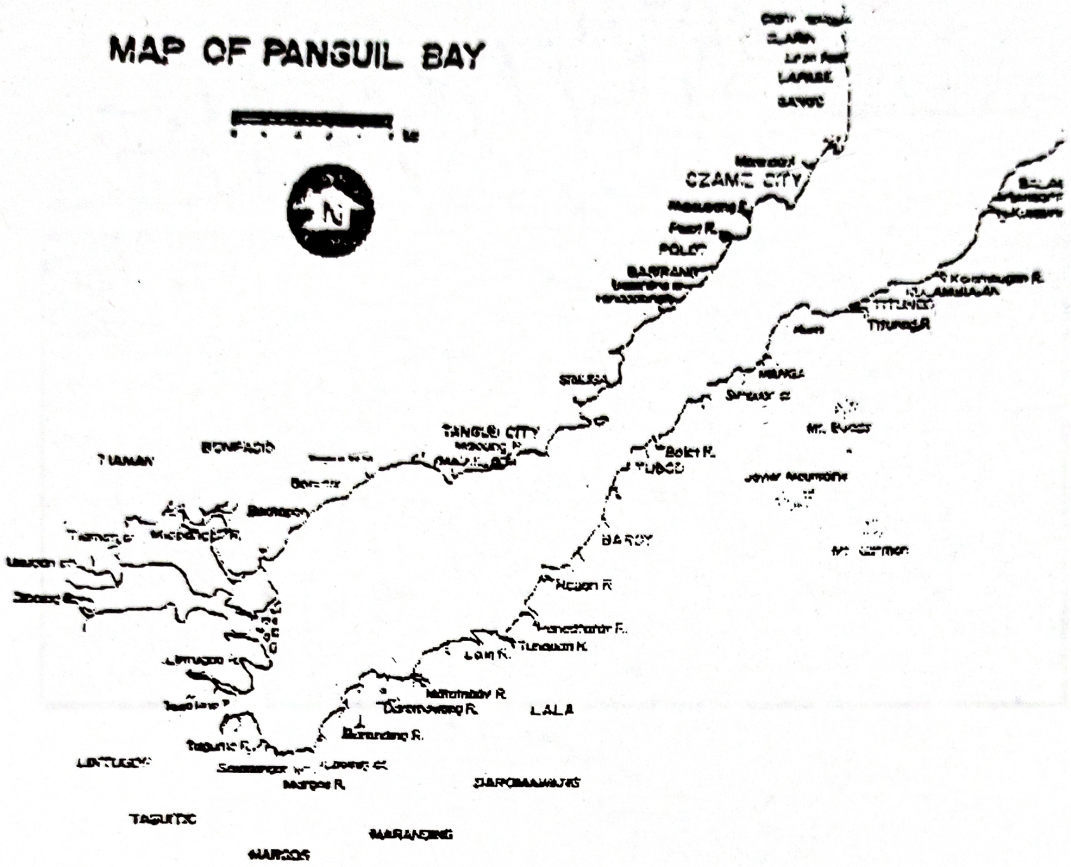

Fig. 5a. Map of Panguil Bay.

Fig. 5b. Inner Part of Panguil Bay as viewed from Aurora.

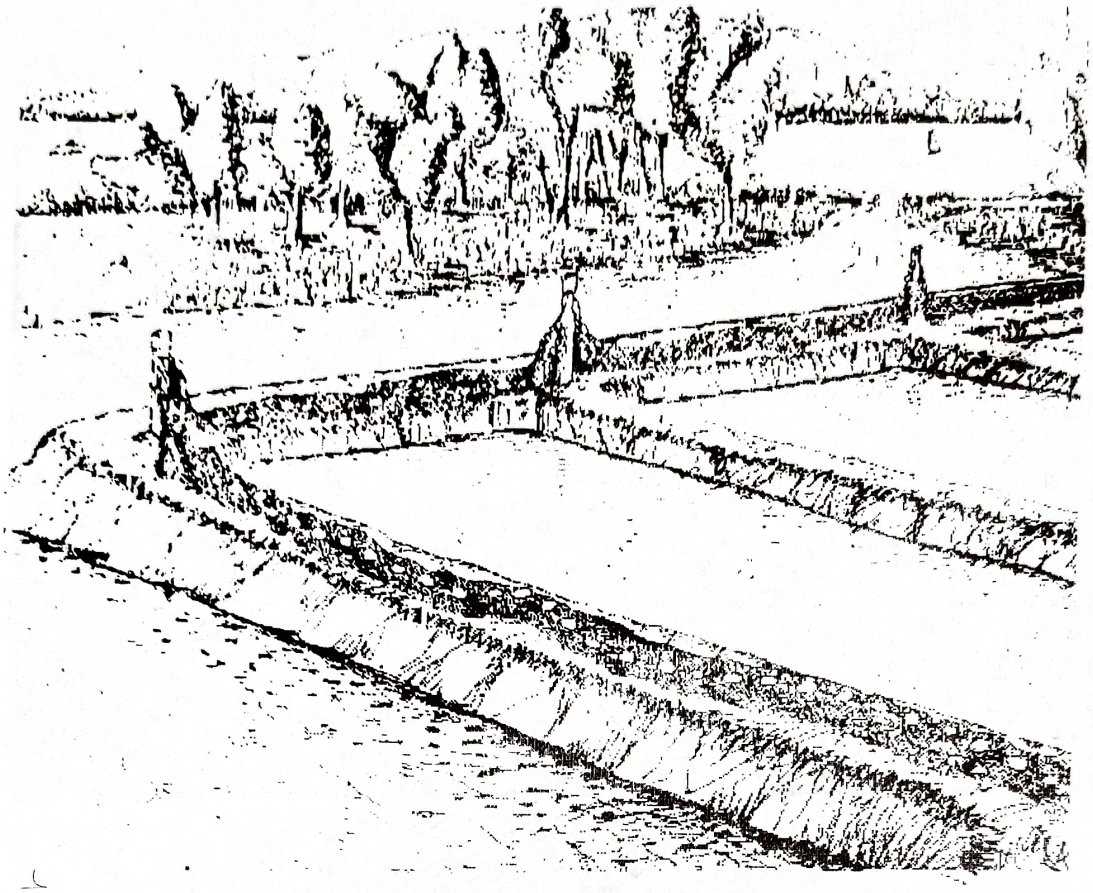

Fig. 6a. Mud Crab Pond Fenced in With Worn-out Fishing Net.

Fig. 6b. Mud Crab Pond with Bamboo Slat Fence.

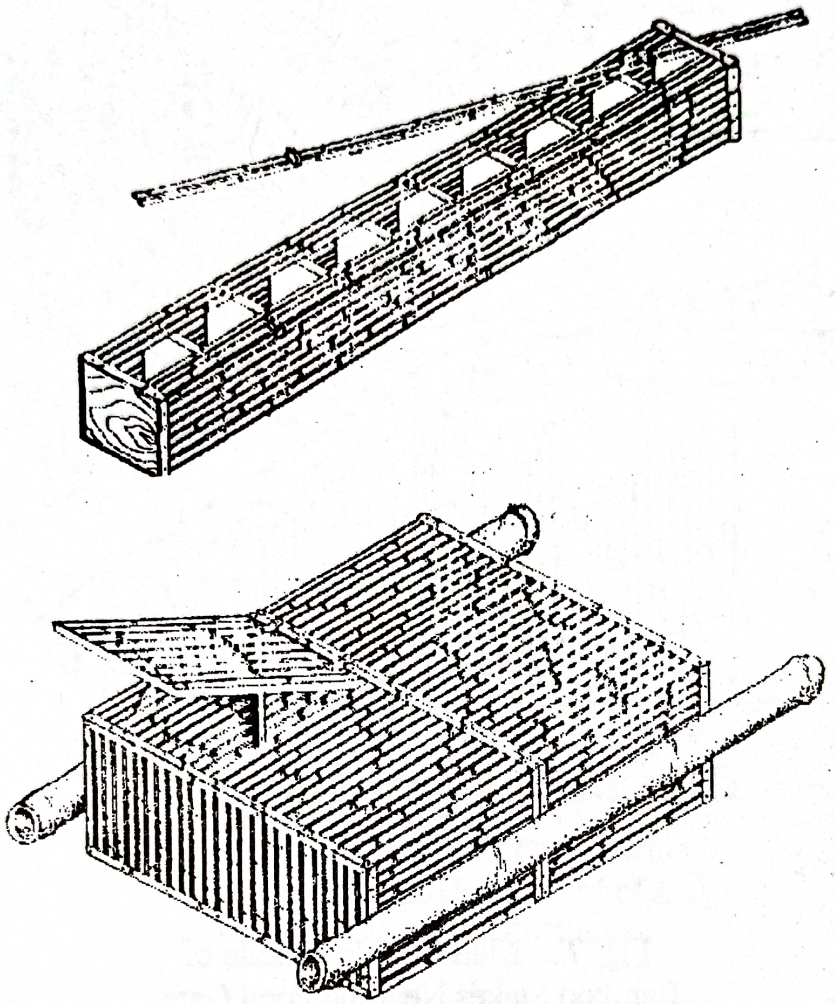

Fig. 7a. Two Designs of the Bamboo Cage.

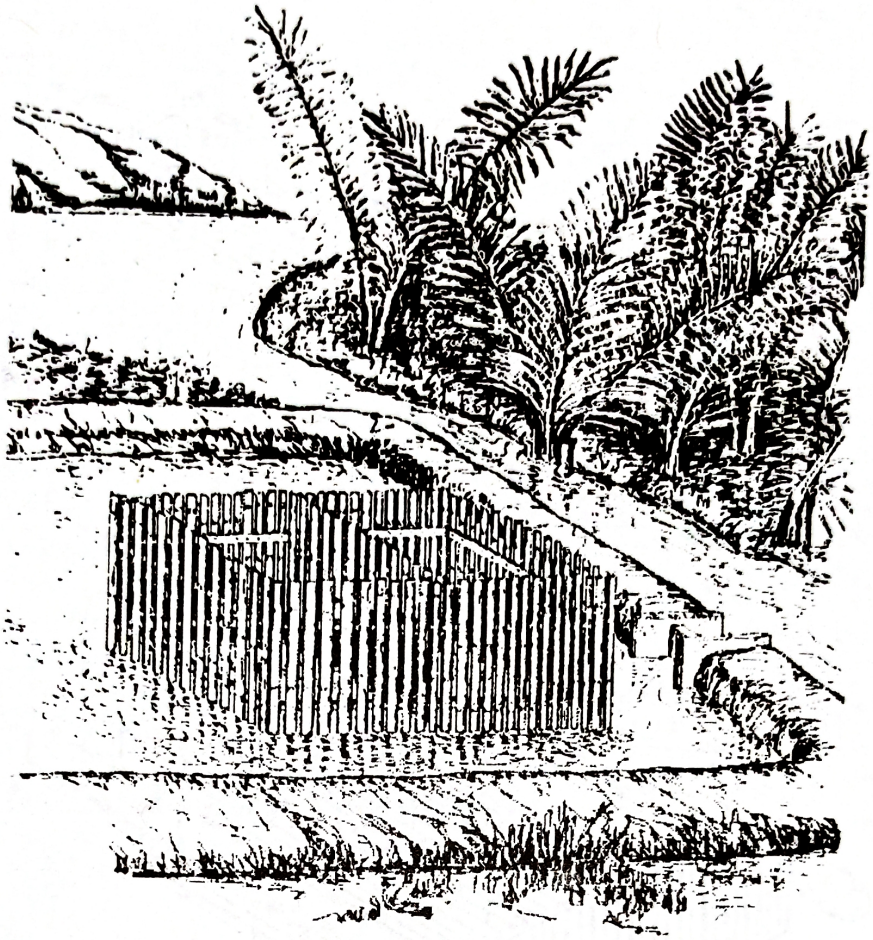

Fig. 7b. Mud Crab Pen made of Bamboo Stakes Near the Pond Gate.

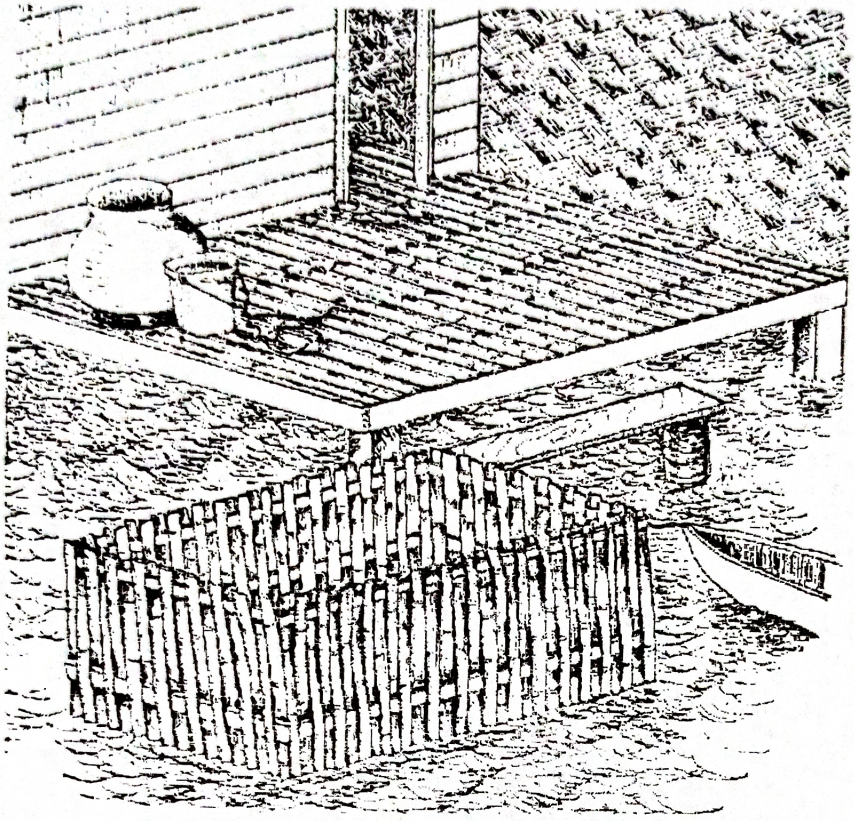

Fig. 7c. Mud Crab Pen of Bamboo Stakes in the Front Yard of a Fisherman's Stilt House

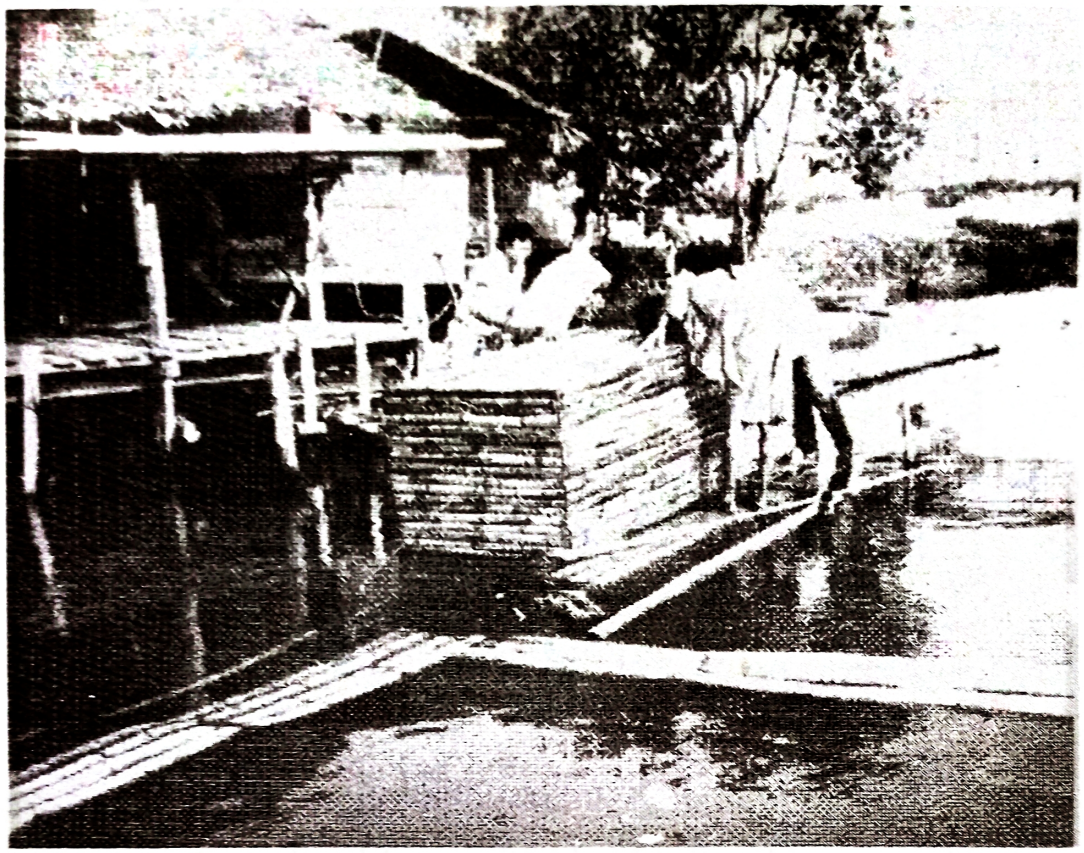

Fig. 7d. Bamboo Cage Taken Out of the Water.

Fig. 7e. Bamboo Cage Floating in the Water.

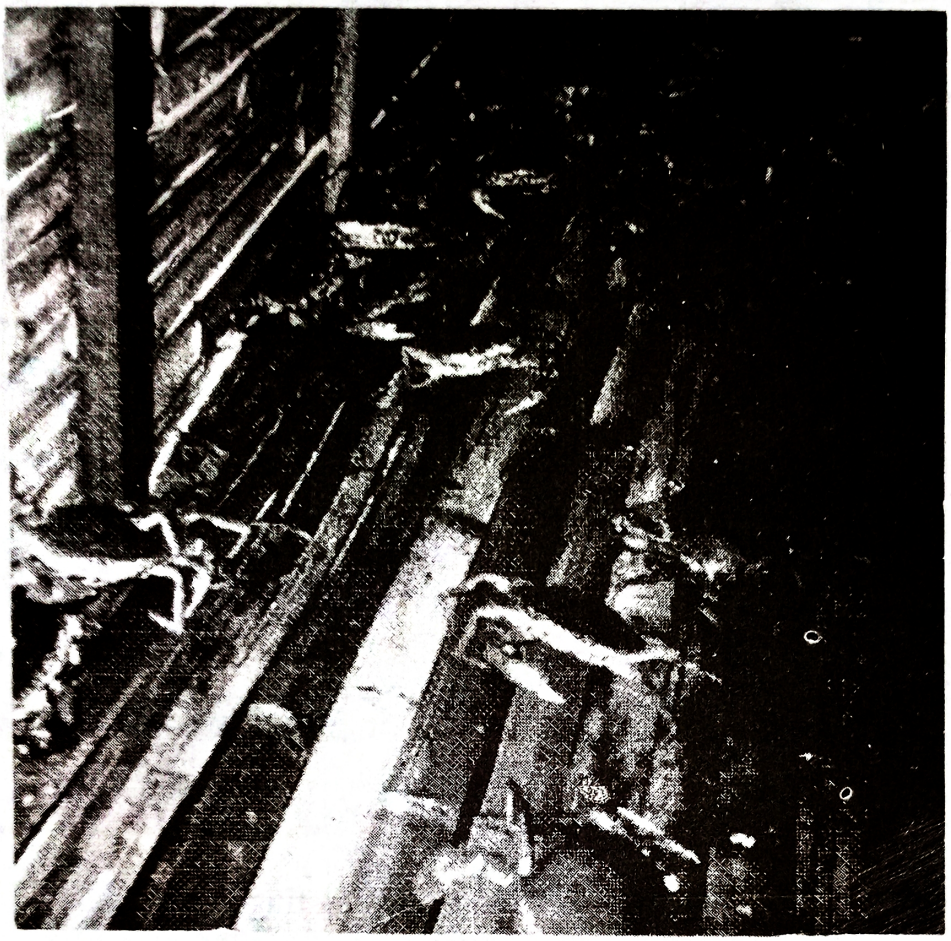

Fig. 8. Densely Stocked Mud Crab in a Bamboo Cage.

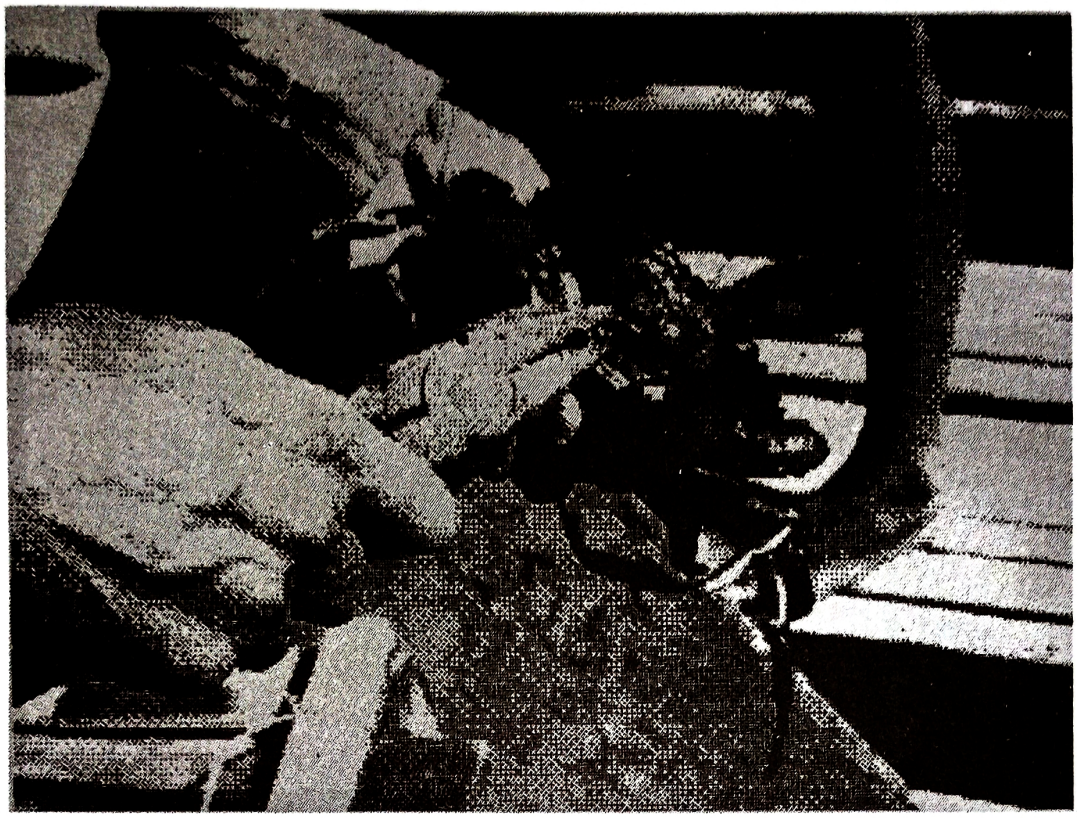

Fig. 9a. Removal of a Claw of the Mud Crab by use of Pliers.

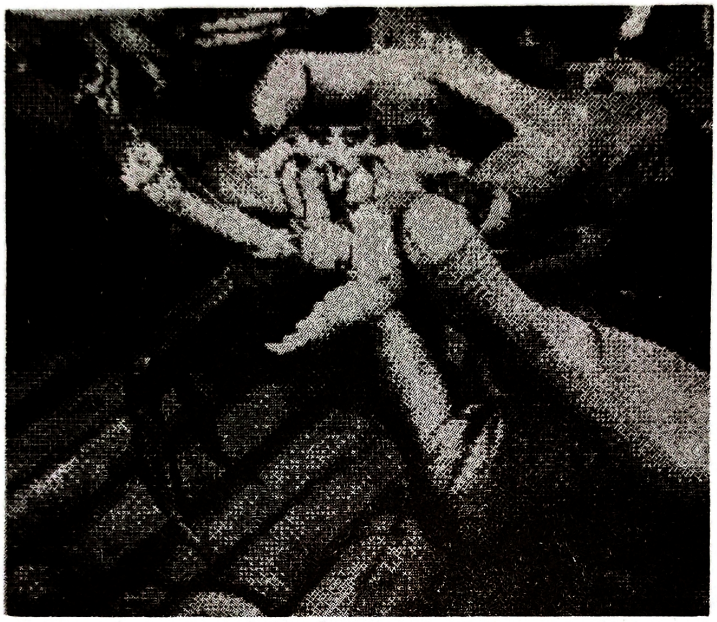

Fig. 9b. Mud Crab With a Pinched-off Claw.

Fig. 10. 'Opened' Mud Crab to Show the Developing 'Aligue' or Ovary