PHILIPPINE ENVIRONMENTAL GOVERNANCE 2 PROJECT (EcoGov 2)

An Investigation on the Potentials for Aquaculture Development in Illana Bay, Zamboanga del Sur

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An Investigation on the Potentials for Aquaculture Development in Illana Bay, Zamboanga del Sur Area

by:

Elvira Y, Adan
William R. Adan
Jocelyn N. Gorospe
Gil J. Lumasag

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The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

EXECUTIVE SUMMARY

Illana Bay is a veritable fishing ground and a potential haven for mariculture. With the advent of export-oriented economy in the 1980s, some 5,111 hectares of fishponds have been developed out of its swamps and mangrove forests while some 3,194 hectares of its coastal waters have been farmed with seaweeds in the late 1990s. In addition, a number of cages, stocked with highly commercial fish species, were established to demonstrate the feasibility of fish cage culture as an alternative livelihood activity. The implication of these developments on the economy in dollar terms is immense.

Fishpond development, however, have eroded the productivity of the bay and diminished its role as one of the main supplier of fish in the region. The race to establish seaweed farms also created social and ecological problems—conflict in resource use, expansion of seaweed farms into coral reefs and sea grass beds, and the degradation of coastal waters. In view of this situation, USAID–EcoGov provided technical assistance towards the improvement of the management of aquaculture activities in the Illana Bay Zamboanga del Sur area. The Mindanao State University at Naawan Foundation was contracted to identify and assess existing and potential aquaculture activities along the bay, and to recommend potential aquaculture ventures and a set of actions necessary to counter the potential constraints to sustainable fisheries production in the region.

This report is the product of a series of focus group discussions, key informant interviews and site surveys conducted by specialists in aquaculture, socio-economics and policy analysis in the municipalities of Tabina, Dimataling, Dinas, San Pablo, Dumalinao, Labangan and Tukuran, and the City of Pagadian.

Seaweeds form the bulk of mariculture production from Illana Bay. Production was estimated at 16 mt to 20 mt per hectare per year, or a total of 50,000 mt to 60,000 mt worth at least P1.7B for the whole area. There was never an excess in the seaweeds market and growers attest that their investment could be recovered in less than a year of operations. On the other hand, the culture of fish and prawns in ponds is facing tough times due to inflation. Oftentimes, operators used a mix of commercial and cultured feeds to cut on costs. Sometimes, they shifted back to traditional methods where cultured organisms are simply left to feed on what are naturally available. Despite these problems, returns on operating costs remained positive.

The improper management of fishponds and the lack of proper supervision of their operations were also considered as significant factors in the production and profitability of pond operations. Fish producers think that the natural stock of prawns and other commercially important crab and fish species are declining.

Fish cage operation in Illana Bay is still in its infant stage. Fish cage operations in the bay were generally pilot operations to determine the adaptability and profitability of fish cage operations using endemic fish species. Demonstration cages were initially stocked with *siganid* fingerlings from the MSU Naawan Hatchery; afterwards, these were stocked with other species, to include groupers, sea hare, lobster, abalone, sea cucumber, squid, and sea urchin. Although cage operations were done by trial and error and stocking rates and feeding regimes have yet to be standardized, those who were involved in it were optimistic that when trained on appropriate aquaculture technologies, they could significantly increase their production. The performance of the initial runs proved the adaptability of the cultured species to cage culture and the high profitability of said operations.

The prospect for aquaculture in Illana Bay is immense. There are areas that could be tapped for seaweed culture and fish cage operations. Existing fishponds are also potential sources of millions of pesos worth of prawns and milkfish if properly developed and managed.

There is an apparent reluctance, however, among LGUs to become involved in the operation of fishponds in their jurisdiction. Many LGUs were unprepared for the sudden and fast development of the seaweed industry. Most do not have any policy to earn appropriate revenues from seaweed operations and support its sustainability. It is high time for fisheries laws to be seriously implemented and for local legislations to be enacted not only to sustain fish production but also to conserve biodiversity, preserve ecological balance, and maintain environmental integrity in the bay.

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CHAPTER I
INTRODUCTION

Illana Bay in Zamboanga del Sur has been identified as a major growth area for aquaculture development. Endowed with a relatively wide expanse of coral reefs and seagrass meadows and waters that are continuously replenished and enriched by rhythmic tidal movements, Illana Bay is a veritable fishing ground and a potential haven for mariculture**.**

Illana Bay contributes greatly in supplying fish in Mindanao. Since the second half of the 1990s, seaweed farming has made successful inroads into the coastal zones of Zamboanga del Sur, providing new livelihood and source of income to a number of people living in coastal areas. However, the ever increasing demand for fish protein, the unsustainable fishing practices employed, and the massive conversion of mangroves into fishponds, have eroded the productivity of the bay and diminished its role as a major source of fish in the region. The race to establish seaweed farms also created new social and ecological problems such as conflicts in resource use, expansion of seaweed farms into coral reefs and seagrass beds, and the degradation of coastal waters.

The potential to expand aquaculture development around the area of Illana Bay holds great promise. However, to compensate for the reduction in captured fisheries, the expansion of fish production in aquaculture systems should be complemented with efforts to prevent environmental impacts to make fish production sustainable. The management challenge is how to protect and conserve the resources of the bay without sacrificing the economic interest of the people who depend on these resources for survival. There is a need for a critical evaluation of aquaculture in relation to its potential contribution to fish production.

The EcoGov project in Region 9 aims to empower LGUs and their constituent communities through various strategic capacity building activities on fisheries and coastal resource management. The initiatives of the project are initial steps towards more lasting effort to harmonize concerns for marine ecosystem protection, biodiversity conservation and sustainable aquaculture, and fisheries utilization. This study is proposed to generate information towards these ends.

1.1 Objectives

The project aimed to:

Identify, locate, and characterize the different mariculture activities in the Zamboanga del Sur side of Illana Bay;

Evaluate existing mariculture activities vis-à-vis their economic feasibility, acceptability, and their impacts on the environment and the community;

Identify potential mariculture activities for expansion and development;

Identify and evaluate existing policies, policy implementation and institutions in support of the mariculture sector.

1.2 Methodology

The study covered the seven coastal municipalities of Tabina, Dimataling, Dinas, San Pablo, Dumalinao, Labangan, Tukuran and the City of Pagadian in the Zamboanga del Sur side of Illana Bay (figures 1 and 2).

The primary data on the perspectives of aquaculture practitioners and their insights on the status, potentials and constraints of aquaculture in the region were collectively generated through focus group discussions (FGDs) and key informant interviews. The participants of the FGDs and the respondents of the interviews included representatives from the fishpond, fish cage and fish pen operators, seaweed growers, and fish and seaweeds wholesalers and traders. In all, a total of 146 respondents participated in the FGDs, and a total of 24 operators and seaweeds growers were interviewed as key informants.

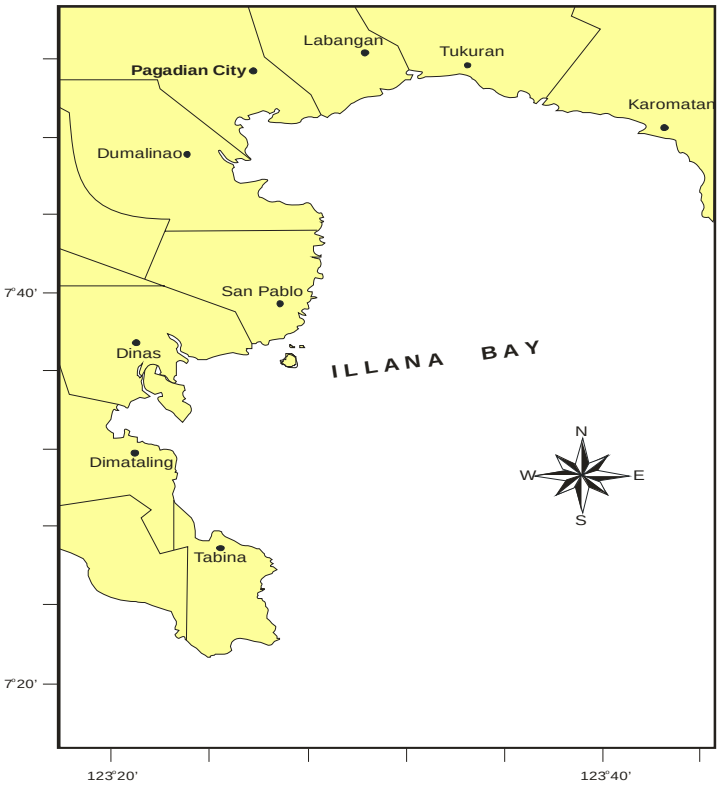


Figure 1: The eight municipalities in the Zamboanga del Sur side of Illana Bay covered in the study

The primary data gathered through the FGDs and key informant interviews were enhanced by data from secondary sources and from in-site observations of existing and potential aquaculture project sites. The presence and location of tributaries that directly affects aquaculture projects during the rainy months and water salinity were also noted. In addition, geographic positioning system (GPS) readings, Secchi disk water transparency levels and the direction of flow of surface water current were recorded in areas identified as having potential for aquaculture development.

Figure 2. Local government units of Zamboanga del Sur bordering Illana Bay
(Satellite map from Google.com)

CHAPTER II

STATUS AND PROSPECTS OF THE AQUACULTURE INDUSTRY IN ILLANA BAY, ZAMBOANGA DEL SUR AREA: A PROVINCIAL PROFILE

During the last three decades, the culture of fish for commercial production, and more particularly for export, was virtually non-existent. However, the successful breeding of shrimp fry in hatcheries broke the pattern of growing wild fry in watered enclosures into a more sophisticated technology with developed standards. This development gained a grip in the coastal areas of Zamboanga de Sur, particularly in its southern shores.

Aquaculture in the region consisted of growing finfishes in ponds, pens and cages, and the farming of seaweeds in coastal waters. At the moment, some 5,111 hectares of fishponds and more than 3,194 hectares of seaweed farms are operating in the 8 coastal municipalities considered in the study (table 1). Seaweed farming involves 95% of the coastal households. In addition, a number of cages stocked with a variety of finfishes, from *siganids* to groupers, lobsters and sea hares, were established to demonstrate their feasibility as alternative livelihood projects.

Table 1. Areas of seaweeds farms in Zamboanga del Sur, 2007

Municipality	Area of Seaweed Farms
Tabina	65 has (approximately 65 households)
Dimataling	700 has (1,500 households)
Dinas	>1,000 has (95% of barangay households, 2,000 has potential for expansion)
San Pablo	37 has, 93 households
Dumalinao	85 has (as of 2003), 100 households
Pagadian	299 has, (881 households)[1]
Tukuran	43 has (120 households)
Labangan	965 has (100 has in Bulanit, 400 has in Combo(80% of total hhs)), 606 farmers
Total	> 3,194 hectares

2.1 Seaweed Production

The bulk of aquaculture production in Region IX is mainly from seaweed production. Seaweed farming on a commercial scale is a recent development in Illana Bay; having been introduced in late ‘80s and peaked in the ‘90s. The successes of the first growers triggered an increase in the number of seaweed growers. At present, between 80% to 95% of coastal households and fishermen are involved in the industry in areas where they proved feasible. In Dimataling, the area planted with seaweeds have increased by three-folds from 2000 to 2005, and while the total area of seaweed farms in the Zamboanga del Sur side of Illana Bay is estimated to be 3,194 hectares, the actual area could be much more. Pagadian, for example, reportedly has only 299 hectares but seaweeds are grown in almost all

[1] Office of City Agriculturist, Pagadian City

of the city's coastal barangays and more than a thousand households are actively engaged in its culture.

The seaweed farms are generally located in the more sheltered areas of the bay which are not exposed to strong wave actions. Usually, the whole length of coastal waters is planted with seaweeds; in Tarakan, Dinas, the farms even extend some six km from the coastline. This made Dinas the municipality with the biggest area devoted to the culture of seaweeds among the eight municipalities considered in the study.

In almost all municipalities, farm ownership was generally acquired by simply claiming and staking a particular area where the prospective grower wanted to establish his culture lines, provided the chosen area did not overlap with existing farms. By general agreement among coastal residents, a family is allocated at least one hectare of farm area. However, some families who only depend on family labor shared their area with others as they can not fully manage their one-hectare allocation.

The more commonly cultured species in the eight municipalities include variants of the *Kappaphycus cottonii*, known locally as *pulotan*, and *Eucheuma spp.* which are variously called *polutan, "giant"*, or *cottonii* by growers. Since *K. cottonii* was considered by most growers as the more hardy species, it was preferred by most growers.

The farmers generally use the long-line method—the lengths of the lines vary according to location. In Dumalinao and Tabina, the lines are generally shorter (from 55 m to 140 m), in other areas where seaweeds are grown in deeper waters, the lines are from 90 m to 200 m long. Since shore lines are not heavily affected by wave actions, lines are spaced less than a meter apart, sometimes only a foot apart from each other as they,. While those located in deeper offshore waters are spaced far between, up to 5 m between lines, to prevent the plants from touching each other due to wave actions.

Farmers engaged in intensive seaweed farming establish their culture lines 1 to 2 feet apart, while other growers from Pagadian City with limited areas used spider web-like culture lines to maximize area utilization. The more enterprising growers operate from 25 lines to 100 lines, the lengths of the lines notwithstanding.

The seedlings are planted at the rate of 3 to 5 seedlings per meter; and every cutting weighs between 200 gm to 500 gm each. Every cutting yields 2 ½ kg to 3 kg at harvest time, or after 45 to 60 days of culture. Although seaweeds could be grown year-round, the growers plant between 2 to 3 croppings per year on the average. Peak season is during the northeast monsoon, between the months of April and November, when the sea is relatively calm and water movement is considered sufficient for the growth of seaweeds. Farmers avoid incurring losses by not planting during the southwest monsoon, or *habagat*, because the probability of occurrence of the "ice-ice" disease is high during this season.

The farmers get their seedlings from nearby BFAR-established nurseries, from other private nurseries, or from their own production. The commonly identified nurseries are the BFAR nurseries in Barangay Buburay in the municipality of Dimataling; Pagadian; Tukuran; Sindangan; Barangay Rebokon in the municipality of Dumalinao; Barangay Tarakan in the municipality of Dinas; Tabina; and in Margosatubig Igat Island, all in Zamboanga del Sur. The other sources of seaweed stocks identified were the nurseries located in Baroy in Lanao del Norte and nurseries in far away Jolo.

Other growers reserve from 10% to 20% of their harvest as starter stock for their next cropping. A number of growers specialize in nursery operations and supply the stock requirements of growers throughout Zamboanga del Sur.

Start up Capital

To fully operate a one-hectare seaweed farm, a farmer should initially have P14,250 to P40,600 start-up capital inclusive of operating costs and a wooden boat without outriggers. A small wooden boat is enough for near shore operations while 6 to 7 hp motorized boats costing P18,000 to 25,000 are necessary to set out the culture lines in deeper waters during harvest and transport of harvested plants to the buying station. The more enterprising growers of Dinas and Labangan invest between P20,000 and P200,000 depending on the number of lines, the area being operated, and the distance of the culture lines from the shoreline.

Production Costs

The major cost items in seaweed production are the establishment of the culture lines and the procurement of seed stocks. The total construction cost of the culture lines averages at P3,000 per 100 m line. However, beginners and small-scale growers simply make do with shorter lines or they rent out culture lines whenever these are available; for sinkers they used big stones or bagged sands and for floaters they used Styrofoam boxes or empty mineral water plastic bottles.

The cost of labor is generally not considered in determining the profitability of the endeavor. To minimize the cost of production, family labor is usually utilized. When the stock is beyond the capability of the grower to handle, he hires laborers to assist him. The cost of tying cuttings in the line is P2 per *dupa*, the cost of cleaning the plants is P100 to P150/day, and the cost of labor and transporting harvested seaweeds to the wholesaler is P40 to P50/sack. Full time caretakers are paid up to 1/3 of the net income or P6,000/hectare/cropping.

Growers claim they spend between P4,000 and P5,000 as operating costs per hectare per year, implying the rampant use of family labor in many aspects of production.

The cost of seed stock remains the biggest cost item and the most expensive input to seaweed production. BFAR reports that for a one-hectare seaweed farm, some 6,000 kg of seaweeds stock is needed. In Illana Bay, seedlings from one culture line measuring 60 to 80 *dupa* would cost between P4,800 to P6,400, or these are retailed at P35 to P50 per *dupa* of mature plants.

Survival rate is high, from 80% to 100% of the total seedlings planted except during the incidence of the “ice-ice” disease when the quality of the product is adversely affected.

Production ranges between 1 to 3 sacks or 750 kg to 1,500 kg fresh seaweeds per 100 m line or from 80 to 100 kg dry when dried. This translates to some 16 mt to 20 mt per hectare per year which is comparable to the national average production. For the Illana Bay municipalities in the province, total estimated production is between 51,000 and 60,000 mt worth at least P1.7 billion.

Marketing

The demand for seaweeds in the world market is so high and always exceeds supply. There is never a glut in the market. However, while farmers admit that they do not have any problem marketing their product, they are forced to sell at a price that is not determined by demand

and supply factors but by the dictates of local *compradors* who are in turn dictated by the processors and exporters. The *compradors* are either independent traders, or are middlemen or agents of exporters and processors. The local comprador is mostly patronized by local growers (approximately 85% of all growers) who have limited means to deliver their products to Pagadian, while the wholesalers based in Pagadian are patronized by the large scale growers who have the means to transport their produce to the city

The seaweeds bought by *compradors* are stored in warehouses in Pagadian City, accumulated, then shipped to Zamboanga City or Cebu City for processing. The greater bulk, however, is shipped to Cebu City where the biggest seaweeds processor, the Shemberg Marketing Corporation, is located. One seaweed comprador reported that from 30 tons to 100 tons of seaweeds are shipped to Cebu weekly.

Compradors from Pagadian offer more or less uniform prices for seaweeds regardless of source. Dried seaweeds are priced between P26 and P38 per kilo while fresh ones are priced P4 to P5 per kilo. Given this price difference, majority of growers sell their produce in dried form where they get higher net returns. The longer the marketing chain, however, the lesser the amount received by the growers. For dried seaweeds, the difference between farm price and the comprador's price to the wholesaler ranges from P1 to P5 per kilo; from the wholesaler to the processor the mark-up is higher.

In times of low supply, the price of seaweeds is generally low which runs counter to the law of supply and demand. The discrepancy is attributed to low quality seaweeds resulting from "ice- ice" disease.

An analysis of the effect of drying seaweeds on the income of growers substantiates the practice of most growers of first drying the seaweeds for at least three days to one week before selling the same. Analysis shows that drying significantly increases revenue by 25% to 53%.

ROI and Payback Period

On the average, a grower earns between P1,000 and P1,500 per line per crop or from P7,000 to P30,000 every 3 to 5 months. The amount depends on the area and number of lines a grower operates, the growth performance of the planted stock, and on weather conditions. The more lines he operates and the longer the lines, the more hardy the planted stock and the more favorable the weather conditions, the greater would be the income of the grower.

The continued operation and the increasing number of seaweeds growers attest to the profitability of seaweeds culture in the province. A number of rice farmers and fishermen turned to seaweed farming not only to augment their incomes but also as their major economic activity. Seaweed farming has higher ROI, from 50% to 600%, than all their other production activities.

One grower grossed P40,000 out of a P6,000-investment; another grower reported a gross of P20,000 from a mere P1,000 initial capital; while another grower reported a gross of P70,000 from a mere P4,000 initial capital. According to growers, their investments could be recovered in only 1 to 2 operations during good harvests, or in less than a year of operation. Payback period is shortened when weather conditions are favorable.

The increase in farm area consequently leads to increased seaweed production.

Backward and Forward Linkages

The seaweed industry has a multiplier effect in the sense that it not only increases the income of the family but it also creates a number of livelihood opportunities to others. The need for a continuous supply of seed stock has engendered a new set of growers specializing in the culture of seaweeds seedlings. The players (figures 3 and 4) all play together to satisfy the market demands for products needing seaweeds as one component.

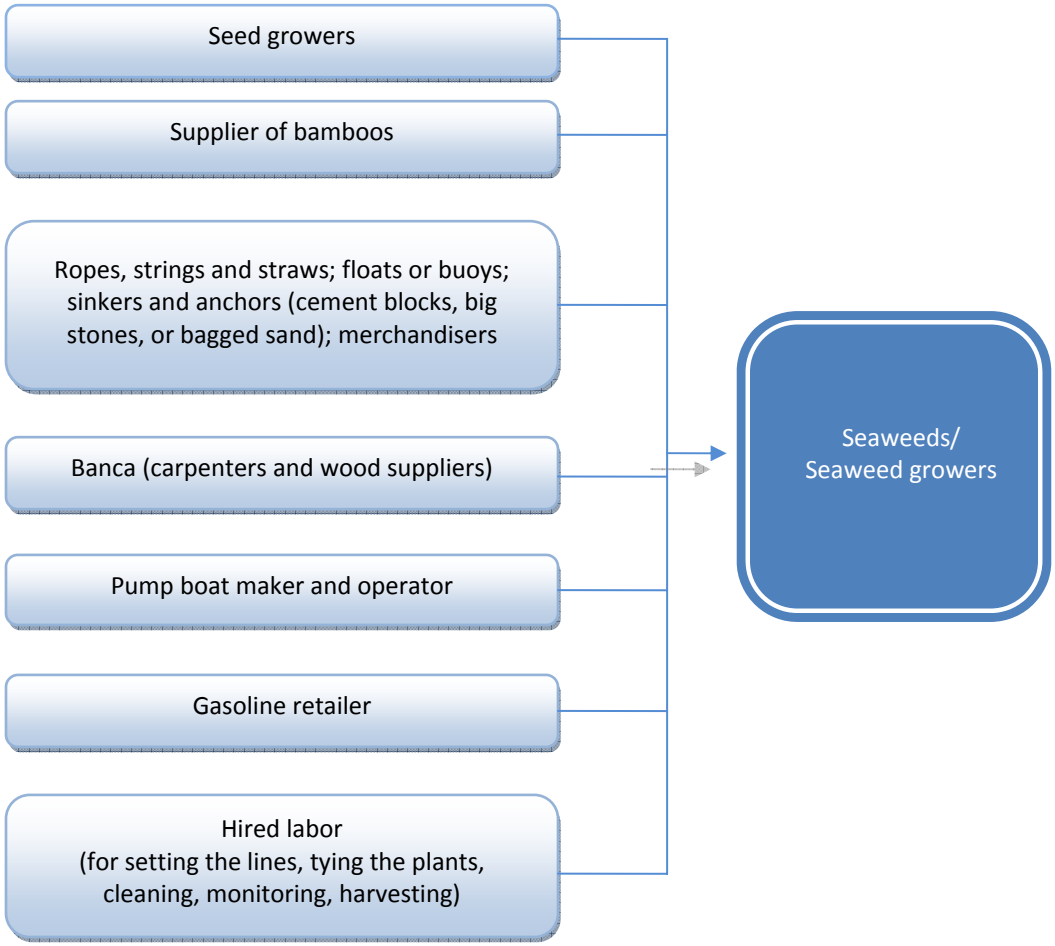


Figure 3. Backward linkages, inputs and input suppliers of seaweed farming in Illana Bay area

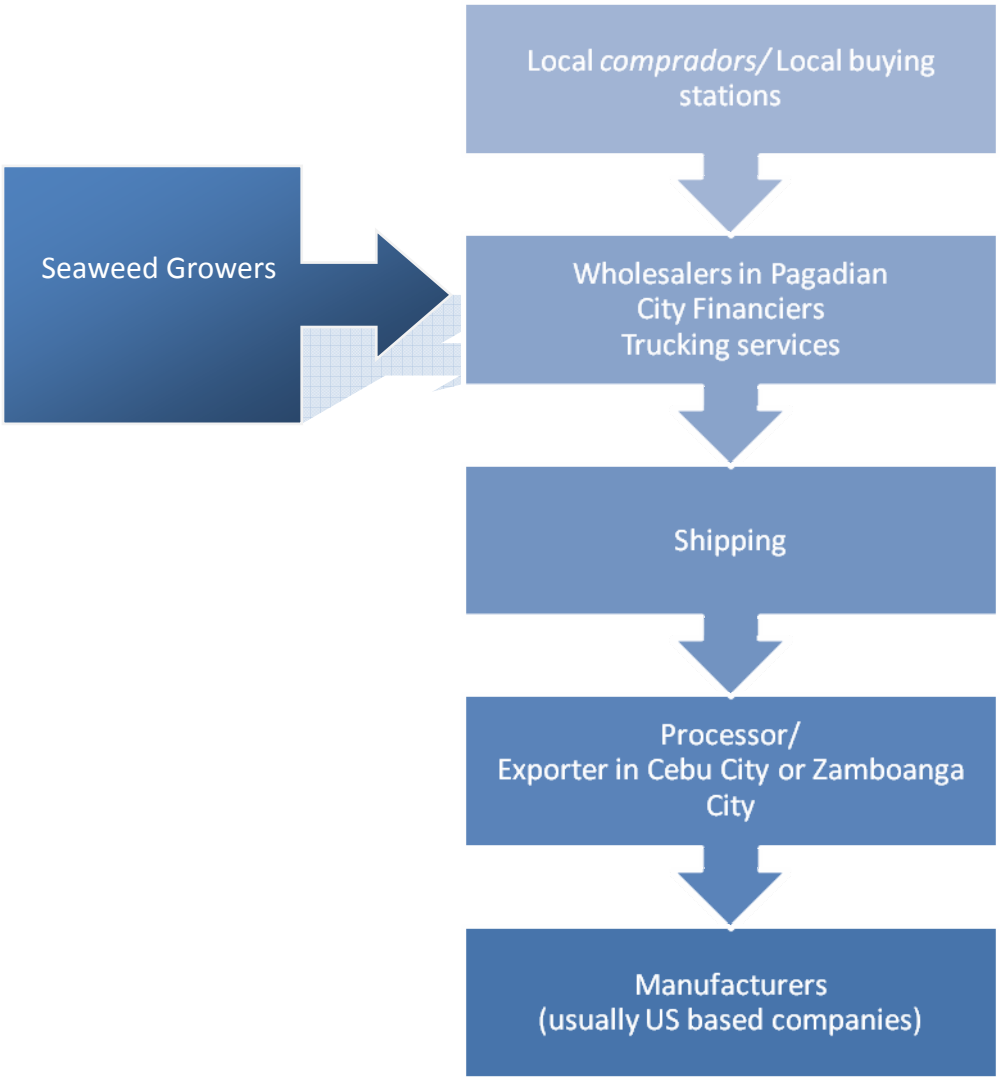


Figure 4. Forward linkages in the seaweed value chain

2.2 Fishponds

The whole coastline of Zamboanga del Sur is dotted with fishponds of various sizes. A total area of 5,111.25 hectares of fishponds was estimated to have been developed between Tukuran in the west to Tabina in the east coast of Illana Bay (table 2). Of this total area, 60% are located in the municipality of Dinas.

Table 2. Fishpond areas along the Zamboanga del Sur side of Illana Bay, by municipality, 2007

Municipality	Fishpond Areas
Tabina	70 has (1 operator)
Dimataling	619.42 has (47 operators)
Dinas	3,000 has (60% of the total)
San Pablo	58.3 has
Dumalinao	76 has (1 operator with 45 has)
Pagadian	190 has
Tukuran	167 has
Labangan	957.53 has
Total	5,111.25 has

The culture of fish in fishponds was introduced to the residents of Zamboanga del Sur by immigrants from Iloilo and the Ilocos as early as the 1950s. However, most of the fishponds currently in operation were developed in the late '70s and early '80s; the culture method was traditional and extensive, and milkfish and *sugpo* were the commonly cultured species. By the 1980s production peaked when semi-intensive culture methods were applied. Nowadays, to cut on losses, stocking is extensive.

Economic Feasibility of the Fishpond Industry Along Illana Bay

Inputs

The major inputs to pond operations are: (1) fry and fingerlings, (2) feeds, either grown naturally or introduced in pellet forms, and (3) labor. Prawn fry and milkfish fingerlings are acquired from Cotabato City, and locally from Pagadian, Tukuran and the nearby municipalities. Though prawn fries are locally available, there were times when the supply was insufficient. The more enterprising operators get their prawn fry from Iloilo or from Tukuran hatcheries in bulk and in the same sizes.

Milkfish fingerlings are sourced from local fry collectors. The coastal waters of Tabina and Tukuran have long been a known source of prawn and milkfish fry, and fry collection is one alternative source of income among local coastal residents. The fry collectors of Tabina have even organized themselves into a cooperative.

Most operators explicitly preferred fry and fingerlings caught from the wild over hatchery-bred ones which they considered as weaker and slow-growing and vulnerable to prawn diseases. The fishpond operators and fry concessionaires, however, are of the opinion that the natural stock of both species is declining.

At the time of the survey, milkfish fry from the wild sell at P500 per thousand and milkfish fingerling sell at P1 to P2 per piece. Prawn fry sell for P300 to P700 per thousand depending on size and post larval stage. The cost of fry accounts for 40% to 45% of total production costs and is the major cost item in extensive operations.

Development Costs

Fishpond development was capital intensive. The major cost items were clearing, excavating, diking, and the construction of the supply canals, and the amount depended on the previous state of the developed area. Construction cost ranged from P25,000 to P130,000 and averaged between P50,000 and P70,000/hectare in late 1970s and early 1980s.

Most of the fishponds are located in what were once mangrove areas and rice farms. Because of the lack of development funds, some ponds have remained partially developed and inoperable.

Feeds

Commercial feeds accounts for more than half of the total operating costs when the culture method employed is extensive/semi-intensive. To cut on operating costs, operators oftentimes use a mix of commercial feeds and natural feeds cultured in ponds.

Extensive farming methods cost at least P10,000 per hectare per cropping exclusive of the cost of fry and commercial feeds. To include the latter, the total cost of production could run up to P50,000/hectare per crop. The amount spent for feeds is significantly lower when feed substitutes are used. There were operators who reported spending only P1,500 to P2,000 per hectare per crop.

Labor

The cost of labor is around 20% of the total operating costs. Fishpond owners generally hire a caretaker who is paid out of the income of the operation. As practiced in Labangan, caretakers are paid from 20% to 25% of the net income.

Marketing Costs

There is basically no marketing cost on the part of the fishpond operator. The costs are mostly borne by the buyers themselves.

Production

Production depends on the stocking density, production performance of the cultured organisms and the survival rate at harvest time. For prawns, the survival rate is as low as 20% to 50% in extensive culture and as high as 75% when properly managed. The variability is due to the different stocking densities and feeding schemes. On the other hand, the survival rate for milkfish is higher (from 90% to 100%). Given these figures, production is also variable and could range from 150 to 200 kg of prawns to a maximum of 1.8 tons per crop per hectare. Milkfish production is lower, at less than one ton, due to the lower stocking rate of milkfish in polyculture.

According to pond operators, hatchery-produced fry do not adapt to the traditional method of production as they are only left to grow on what are naturally available.

On top of prawns and milkfish, another 50 kg to 100 kg of crabs and other fish by-catch are also harvested. It was observed, however, that improper management of fishponds and the lack of proper supervision in its operations are also significant factors of production and profitability of pond operations. For some, the absence of sufficient brackish-water supply was cited as another limiting factor.

Marketing of Fishpond Products

The marketing of fishpond products is never considered a problem by the operators. Market channels for fishpond products have long been established and the market is always open to whatever is produced by the operators.

The marketing process starts with the growers informing the buyers of their harvest schedule. The buyers are either based in the locality, in Pagadian, Cagayan de Oro, or in Ozamiz City (figures 5 and 6). Pagadian City, for example, has some 27 buying stations specializing in aquamarine products. Local or Pagadian-based buyers simply go to the fishpond on the harvest date. There are operators who harvest in bulk and bring their produce to the processors and exporters based in Ozamiz City or in Cagayan de Oro City.

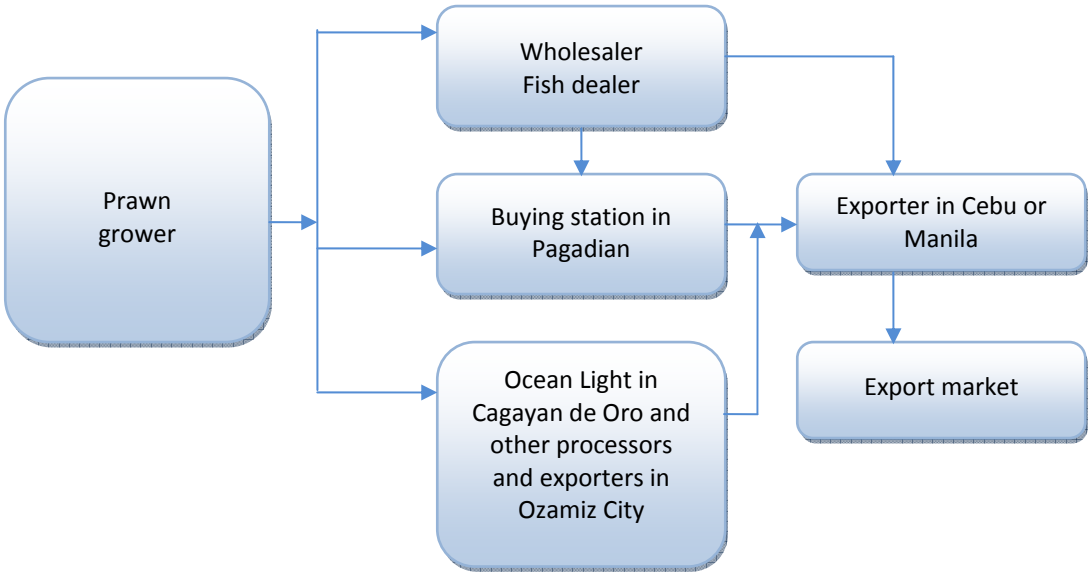


Figure 5. The marketing chain for prawns from the Zamboanga del Sur side of Illana Bay

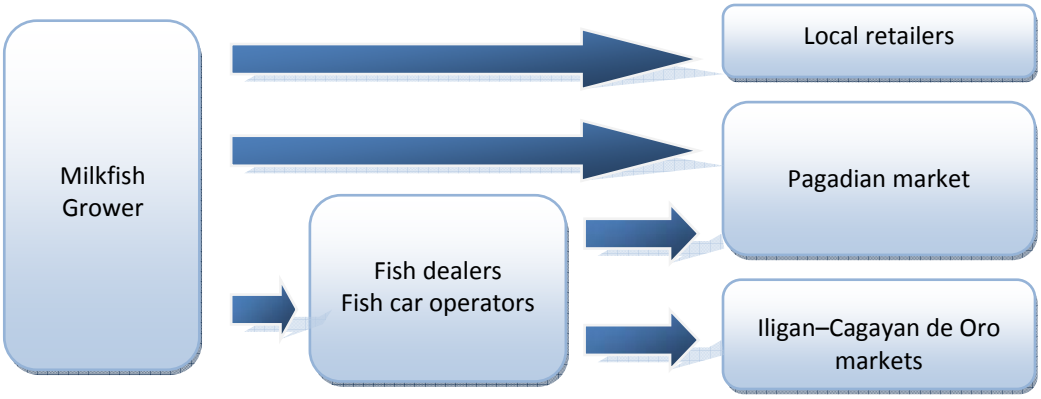


Figure 6. Forward linkages in the milkfish value chain

The really big-time exporters have set up buying stations in strategic locations that are very accessible to local growers around Illana Bay—Dinas, Dimataling and San Pablo.

The price of fishpond products, however, is dictated by the exporters and processors. The maximum price of shrimps at the time of the survey was P650/kg for super jumbo or XL-sized prawns and P300/kg for tempura-sized.

Fishpond operations also generated employment to a number of people—fish dealers and retailers, traders, and fish car operators (figure 6).

Profitability

Despite the relatively low production of prawns in fishponds, operators still get to earn positive returns on investment. At 1 fry/sq m, 50% survival rate and a price of P300/kilo, an operator expects to earn between P60,000 and P100,000 hectare/crop. At 3 fry/sq m, a fishpond operator expects to earn P180,000 hectare/crop.

Payback period is from 1 to 2 years—fishpond development costs were generally recovered in the first or second year of operation when pond fertility was still high. In good times, the investments could be recovered in just one operation or, at most, in one year's operation. The profitability of succeeding operations depend only on operating costs which most operators try to minimize by using substitutes and supplements.

The return on operating costs remains positive after initial investments are recovered. At present, operators estimate their ROI at 46 %. In the absence of bacterial infestation, ROI could be as high as 150%.

2.3 Fish Cage Culture of Fishes

The culture of commercially important fish species in cages is still in its infant stage in Illana Bay. Fish cage operations in the bay were generally pilot operations and experimental runs to determine the adaptability and profitability of fish cage operations using endemic fish species. The first floating cages were only limited to a few modules just to show to local residents and prospective investors the

feasibility of cage operations. The modules were operated by beneficiaries of livelihood assistance coursed through the local government by BFAR, LGSP-IBRA 9, the provincial government through the ZPULCRMP, and by other concerned organizations. The management of the cages was given to the Municipal Agricultural Officer, on top of his many other responsibilities.

Demonstration cages of various sizes, dimensions, and make were constructed in all the municipalities covered by the study. These cages were initially stocked with *siganid* fingerlings from the MSU Naawan Hatchery or from the wild. Later on, the cages were stocked with other species such as groupers, sea hare, lobster, abalone, sea cucumber, squid, and sea urchin. The cage culture of sea hare (*Dolabella* sp. and locally known as *donsol nga balat*) was tried out in Tabina and was found to be viable. The gonads of this invertebrate are eaten raw or cooked and have a high local demand.

The culture of lobster in cages was also tried out in view of the presence of lobster fingerlings in the coastal waters of Illana Bay from Tabina to San Pablo Abalone, sea cucumber, squid and sea urchins thrived and grew in Dimataling coastal waters and are naturally present in the area.
Some operators from Tukuran and Labangan tried cage culture of groupers, both spotted and striped. Culturist favored, the striped grouper more, however, fingerlings of striped groupers are not always readily available. All caretakers agree that I and groupers are incompatible and should not be placed in the same cage since groupers proved to be predatory. *Siganids* and grouper fry and fingerlings are locally available, but grouper fingerlings are more readily available in Tungawan, Zamboanga Sibuguey.

Production Costs

The fish cages were generally simple and relatively inexpensive. The major investment costs include only those for bamboo poles and nylon nets and labor cost. According to estimates, a unit of fish cage costs between P40,000 and P75,000.

BFAR provided more sophisticated cages built of steel and PVC pipes costing between P1.2 M and P1.8 M per unit. These more expensive cages were built in selected municipalities and turned over to the local government units to operate. These came in different sizes and a number of compartments.

The only major expense item for the actual operations is the cost of fry or fingerlings. *Siganids* and grouper fingerlings are locally available and are sold at P2 to P5 per piece depending on the size of the fish. The fry and fingerlings of other species are less expensive. The cost of feeds is minimal since trash fishes are commonly used as feeds.

The fry and fingerlings were generally stocked whenever they are available, and stocking density was based more on the availability of seed stocks. *Siganid* fry are abundant during the months of October to December and in these times, the cages are generally overstocked. On the other hand, when fries are not enough, the cages are understocked. Understocking resulted to high survival rates while overstocking resulted to low survival rates because of predation among the stocked fishes. Based on the results of the operations, the return on investments fluctuates between 50% and 200%, and averages 70%. Overall, stocking rates and feeding regimes, as earlier stated, have not been standardized yet.

Marketing

The market of cage-cultured fishes is the same as that of other fishes caught from the wild. Except for lobsters and groupers, there is no problem as far as marketing of fishes from Illana Bay is concerned. The fishes are either sold in the local market or brought by the fish trader to nearby towns and cities. There is almost always a local *comprador* in every municipality.

The market for groupers and lobsters is also big—they are targeted by exporters. However, lobsters are priced beyond the buying ability of the local people and therefore cannot be absorbed by the local market. The nearest market where lobsters are a preferred product is Zamboanga City but there is no fast and safe means of bringing the product to the city. The culture of lobsters and groupers in the far-flung areas of Illana Bay was eventually discontinued when ships and airlines ceased servicing the Pagadian-Cebu-Manila routes.

ROI and Payback Period

Although cage operations were done by trial and error, those who were involved with the operations were optimistic that they could significantly increase their production when trained on appropriate aquaculture technologies. They also believed that fish cage operations could be a beneficial alternative livelihood activity in the bay. The performance of the initial runs of BFAR and IBRA-sponsored cages proved the adaptability of groupers, siganids, lobsters, crabs and many other marine finfishes to cage culture and the high profitability of said operations. Under proper management, a return on investment above 100% and a payback period of only one operation are possible. The ROI is expected to increase if the cages are placed in areas not affected by strong wave currents and if these were properly managed.

CHAPTER III

POLICY AND INSTITUTIONAL ARRANGEMENTS

The existing aquaculture industry in Zamboanga del Sur follows no development blueprint. In the early 1950s, migrants from Panay and Luzon introduced the culture of milkfish in earthen impoundment known as *punong*. During that time, the Zamboanga peninsula wetland was still a frontier area, open to any enterprising soul. A hardworking migrant could simply carve a fishpond from the mangrove wilderness in his backyard. Since fisheries and marine resources of Zamboanga del Sur were still very rich and widely abundant, the people relied on their catch from the wild for their sustenance. This is why the coastal areas of Zamboanga del Sur remained a vast mangrove wilderness until the 1970s.

In the ’70s, the declining trend in fish production from marine waters alarmed the national government. Over-fishing using destructive and illegal fishing methods affected the fishing industry. To compensate for the growing deficit in capture fisheries, the government prioritized aquaculture development and expansion. The acquisition of fishpond lease agreements (FLA) became more lenient and credit facilities and extension services were made available to fishpond entrepreneurs. This, and the development of the technology in the fry production and pond culture of jumbo tiger prawn or *sugpo* in the 70s, triggered the rapid conversion of mangrove areas in Mindanao into fishponds.

In the early part of the 1980s, the Southern Philippine Development Authority (SPDA) started bulldozing hectares of pristine mangrove forests in Zamboanga del Sur. These activities started the unprecedented destruction of the virgin mangrove forests of Ipil, Buug, Kumalarang, Siay, Dinas, Dimataling, Tukuran, Labangan and Pagadian in Zamboanga del Sur and gave way to various fishpond development.

This chapter identifies and evaluates existing policies, policy implementation and institutional mandates in support of mariculture in the region.

3.1 Policies

3.1.1 The Local Government Code

The Department of Environment and Natural Resources (DENR) and the Department of Agriculture (DA) through the Bureau of Fisheries and Aquatic Resources (BFAR) oversee the conversion and development of mangrove areas into fishponds. Until the implementation of the Local Government Code (RA 7160), the local government did not have any significant intervention in the fishpond industry and development of fishponds except to impose taxes on incomes of fishpond operations. With RA 7160, local government units can share some authority and responsibilities with the DENR on any decision affecting mangrove areas and in the regulation and control of pollution from fishponds and other point sources.

However, the regulatory arm of the national government (i.e., DENR and BFAR), have limited authority in areas where traditional and hereditary ancestral rights are still strongly invoked by the natives. Thus, the exploitation and development of the mangrove forests in certain barangays along Illana Bay were dependent on the natives, shunting the efforts and conservation policies of the government.

3.1.2 RA 8550 and Fisheries Administrative Orders

In 1998, Congress passed the Philippine Fisheries Code of 1998 (RA 8550), replacing the Fisheries Code of 1975 (PD 704). A shift in policy direction took place, balancing fisheries exploitation and production with an equal concern for resource and environmental protection and management. In 2001, the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) issued the Code of Practice for Aquaculture (Fisheries Administrative Order 214) in response to RA 8550 to sustain fisheries production and bio-environmental security. These national laws, however, have yet to be complemented with municipal laws to become more efficient. So far, the primary basis for LGU intervention in this sector is usually the Municipal Revenue Code or the Code of General Ordinances that spell out the schedule of license fees for farms and ponds and the schedule of taxes for their respective harvests.

Unfortunately, the annual renewal of permits and collection of fees are not strictly enforced. According to the results of the focus group discussions, fishpond operators and seaweed growers seldom pay any tax to the government; others do not pay at all. Respondents said that the local government is not collecting taxes and fees but they were willing to pay as long as the tax is reasonable, they know where their taxes go, and that they benefit from the payments made.

3.1.3 Municipal Revenue Codes

Almost all the LGUs included in the study do not have local legal instruments and policies to regulate the practice of aquaculture in their localities. Whenever some issues have to be resolved in the aquaculture sector, LGUs refer to the national laws on forestry, fisheries, environmental management, and local land use and zoning ordinances. Fishpond operators and seaweed farmers are left free to do their trades with hardly any restrictive intervention from the local government. In the absence of laws and regulations, anyone who wishes to plant seaweeds may do so as long as the chosen area is vacant or free from priority use right claim. Except for the Municipalities of Tabina, Dinas, and Tukuran, the other municipalities have yet to come up with their Coastal Resources Management (CRM) plans that will rationalize the allocation and use of their coastal resources.

The Municipal Revenue Code is used by some municipalities to address concerns on site allocation and corresponding taxation in aquaculture. It defines the requirements in the establishment and operation of aquaculture activities and has pertinent provisions regarding access and allocation of municipal waters either by grant or exclusive privilege that applies to the operation of fish corrals and the catching of *bangus* fry in defined areas; lease or concession concerning fishing in streams, lakes and rivers and coastal waters; license-permit for taking or catching fish in municipal waters with nets, traps, or other fishing gears with or without fishing boats or vessels 3 gross tons or less; and in the establishment and operation of fishpond/prawn pond and fish breeding facilities.

The city of Pagadian, for example, imposes an annual fee of P300 per hectare for the operation of a seaweed farm, as provided in the City Revenue Code. The local government of Dumalinao also collects P500 per seaweed grower but this went down to P150 when production declined because of the incidence of seaweed diseases. Payments and collections stopped when seaweeds production continued to decline.

A higher fee is imposed on fishpond operation. LGU require municipal permits from fish cage operators, but being relatively recent endeavors, the collection of fees are either not aggressively

pursued or these activities are not yet reflected in the revenue codes of some municipalities making some growers and operators continue to enjoy tax holidays.

3.1.4 CRM Plan

The CRM plans of the municipalities of Tabina, Dinas, and Tukuran were prepared and completed sometime in 2003 and 2004. The plans addressed important issues on resource allocation and use; preferential use rights; habitat protection; conservation and preservation; and conflict management and navigational routes in the coastal waters; identification of conservation areas and parks and wildlife sanctuaries; and proper waste disposal. The CRM plans reinforces existing policies on the registration of resource users, zoning of resource areas for specific uses, delineation and allocation of areas for aquaculture, establishment of marine protected areas, and preservation of critical marine habitats. It covers more areas for environmental protection and rehabilitation and designates specific zones in coastal waters for mariculture, marine protected areas, *bangus* fry reserve, navigation lanes and the like.

Some municipalities, however, failed to successfully adopt and implement their CRM plans such that the exploitation and use of coastal waters remained in open access regime. Many coastal zone users are not registered and their activities are not controlled or regulated. In the absence of a coastal resource management plan, the use of the coastal resources overlaps. Seaweed lines, for instance, encroach into critical habitats such as seagrass beds and coral reefs.

3.1.5 Priority Use Rights

In most cases, the local government units play only a minimal role in determining the size, site location, systems of production and impact, and management of aquaculture activities. The allocation and determination of size and site of seaweeds farms is left to prospective growers with the nominal approval or clearance from barangay officials or from the Municipal Agricultural Officer (MAO) through the Fisheries Division.

Permits and taxes were seldom imposed on growers because most municipal governments viewed seaweed farming as a basic livelihood of fisher folk and not as a source of revenue for the LGU. The registration of resource users such as fishers, seaweed farmers, fishpond and fish coral operators, and the collection of license fees have been implemented in some municipalities, but were not sustained. The municipal governments usually stopped the collection of fees during times of calamities (i.e., when fishponds were washed away by rampaging flood waters or when seaweeds were attacked by plant diseases) and during campaign periods. Oftentimes, the LGUs failed to resume the collection of fees after these events.

In open access areas, the coastal waters are not reserved solely for small fishers thus, fishpond operators, upland farmers, and even government employees double as seaweed farmers to augment their income. Anyone with the capital to establish a seaweed farm may do so in an unclaimed or underutilized area with the permit or consent of the barangay officials of the locality. The same holds true for individuals willing to invest in cage operations.

3.1.6 Access and Navigation Lanes

Although seaweed farming remains generally an open access regime, the coastal communities recognizes the property use right of seaweed planters once they have established their farms. It has become the responsibility of barangay officials to settle or resolve any issue on site allocation, determination of passageways among farms, and the determination of major navigational lanes in

municipal waters. The establishment of passageways and navigational routes in the coastal zone were usually identified through consultations between the users and the barangay officials.

3.1.7 Environmental Laws

Local governments rely on the provisions of the National Environment Code of 1977 as basis for prohibiting conversion of mangrove areas into fishponds. This is also their basis for requiring aquaculture establishments to comply with environmental requirements. RA 8550 also directs aquaculturists to comply with the environmental requirements required of sustainable aquaculture.

3.2. Institutions

3.2.1 LGU Offices

Generally, in consonance with RA 7160 (Local Government Code of 1991), the local government offices are, directly or indirectly, involved in the passage and implementation of local legislations that have varying impacts on aquaculture, fisheries and environment. Most LGUs, however, fail to recognize that it has, under the Local Government Code, as much authority as the national government agencies in the conservation, protection and management of its coastal resources and environment, a mandate that impinges on aquaculture. Instead, the LGUs look up to DA-BFAR and DENR to settle issues and concerns of the aquaculture industry and the environment.

Local government units leave the responsibility of allocating farm areas, resolving seaweed industry conflicts and maintaining over-all control in the operation of seaweeds farms, ponds and cages to barangay officials, officials of growers associations and other concerned citizens. In Dinas, for example, barangay officials promote and uphold social agreements among farmers, especially in determining farm access and passageways, farm expansion, accommodation of new comers, and accidental damage to properties. There are some agreements contained in barangay ordinances—the imposition of a P5,000-penalty on anybody who accidentally cuts or destroys a seaweed line. This ordinance makes seaweed farmers or fishers extra careful in navigating their boats in seaweed farms.

The LGU involvement in aquaculture is limited to the issuance of business permits and fees and limited technical assistance upon request through the offices of the mayor, treasurer and the municipal agriculture officer.

3.2.2 Municipal Agriculture Office (MAO)

The Municipal Agriculture Office is directly responsible in the implementation and monitoring of fisheries programs and the observance of policies along coastal resource management. Its authority covers overseeing mariculture activities and linking sea farmers to sources of technical, training and financial assistance through the office of the municipal agriculturist. Seaweed growers are also assisted in accessing capital from external founding sources, training and technical assistance, and in the acquisition of common facilities like solar driers.

The Municipal Agriculture Officer (MAO) is assisted by a Fishery Technician and a Coastal Resource Management Officer (CRMO) for any legwork needed in aquaculture and fisheries. For lack of staff and logistics the Municipal Agriculture Office operates in an infirmary type of service, that is, those who need its services must come to it. This method extremely limits contacts with clientele, and improvement and growth of aquaculture in the area.

Development funds and livelihood assistance in the form of grants and loan packages are usually coursed through the MAO. However, the MAOs usually work with fisherman associations, fishpond operators and seaweeds growers for them to develop self-reliance. In Tabina, the LGU through the Municipal Agriculture Office released a revolving fund of P50,000. This amount can be loaned by seaweeds growers and is payable at the end of every cropping period at 6% interest. In like manner, the Fishery Division of the Municipal Agriculture Office of Dumalinao also granted credit to the seaweed planters association of Barangay White Beach. Any payment made will serve as the revolving fund of the Division to be loaned to other associations. This system, however, is yet to be tried among cash-strapped seaweed farmers.

3.2.3 FLET Bantay Dagat

The primary law enforcement body in the coastal community is the deputized *Bantay Dagat* Association and the fishery wardens. In coordination with barangay officials, the members of these organizations are responsible in the enforcement of national and local laws on fisheries and the environment. Part of their responsibility is to ensure that zoning of the coastal waters is observed so that navigational routes are always clear of any impeding structure and protected areas are not usurped by fish coral or invaded by seaweed lines.

Lately however, the members of the *Bantay Dagat* are focusing more on the MPAs and nearby waters—making the owners responsible for the security and protection of their fishponds, seaweeds farms and other culture systems.

The *Bantay Dagat* and the FLET were created in response to RA 8550 and RA 7160. They are important in the enforcement of fisheries laws. However, their performance has been obstructed by violators and their effectiveness has been hampered by inadequate LGU support on the maintenance of seaworthy patrol boats, fuel, surveillance, and communication equipment and incentives for the members of the team.

3.2.4 BFAR

As the main implementer of RA 8550, BFAR is responsible for the development of the fisheries industry in the bay. The issues and concerns of fisher folks and seaweed growers are always brought to the attention of the fisheries bureau.

In Illana Bay, the presence of BFAR is felt through its contribution to the industry in the form of: (1) technical assistance such as seminars and trainings to seaweeds farmers, fishpond and fish cage operators, (2) grants-in-aid in the form of solar driers and seaweeds nurseries for members of seaweeds growers association, fish cages for fisherman associations, and (3) financial assistance in the form of credit and seed money for the establishment of seaweeds nurseries and fish cages in selected barangays. All forms of assistance given by BFAR are always in coordination with the Municipal Agricultural Officer.

3.2.5 Financial Institutions

Banks are normally not present in the municipalities bordering Illana Bay except for the city of Pagadian. As exemplified by one enterprising operator, agricultural loan funds could only be accessed from development banks in Pagadian City. There were also organized cooperatives that provide livelihood grants to cooperative members. Sometimes, credit was also available in limited amounts to members of the SEC-registered associations that doubled as marketing cooperatives and micro lending institutions. However, only a few individuals could avail of grants and credit;

ordinary fishermen who wanted to avail capital support had difficulty in complying with the documents required by the funding agencies. Some marginal growers were left out of government support programs because of political reasons. As a result, some fish and seaweeds farmers source out credits from the buyers of their products and the suppliers of their farm inputs.

Other than the cooperatives and the fisherman and seaweeds growers associations through which microcredit services and livelihood grants are coursed through, pawn shops, loan sharks and fish traders became important sources of capital and operational funds because of their easy access.

The Department of Trade and Industry (DTI) also entertains applications for soft loans and other forms of financial assistance, but these are only available to members of fishermen and seaweeds growers association. Quedancor also has funding options available to fishermen wanting to venture in fish production; most seaweeds growers and fish farmers however, are not aware of these services.

3.2.6 Department of Science and Technology (DOST)

The Department of Science and Technology (DOST) takes charge of the research and technology transfer aspects of aquaculture. In Illana Bay, DOST have conducted seminars on seaweed growing and fish culture. In 2005, it granted financial support to the Basufica Fisher Folk Association for the construction of stilt driers. It also provided seed money for the demo-culture of finfishes in fish cages in selected municipalities.

3.2.7 USAID-DENR

The DENR is responsible on matters regarding fishpond development and operation, seaweeds production, and on coastal zone management, especially on the establishment and management of MPAs. With funds provided by the USAID through its EcoGov and GEM programs, DENR conducted the assessment of existing aquaculture and marine-based livelihood activities in the province and assisted the Illana Bay municipalities in capacity building for MPA management. USAID, through DENR, also funded the Livelihood Enhancement and Peace Program (LEAP) activities. Through LEAP, some seaweed growers in selected municipalities of Zamboanga del Sur received solar driers and other forms of assistance.

3.2.8 LGSP and IBRA 9

The Local Government Support Program (LGSP) through the Illana Bay Regional Alliance 9 (IBRA 9) was instrumental in the promotion and adoption of seaweed farming and fish cage operation in Illana Bay. It extended technical and financial assistance to participants of its seaweeds production program and facilitated the construction and operation of fish cages in selected municipalities in the bay. The other assistance extended by IBRA 9 include grants-in-aid and seed money for the acquisition of seedlings, construction of solar driers, and the establishment of seaweeds nursery, and microcredit to members of fisher folk and seaweeds growers associations. The gains made by the Alliance have been sustained by the LGU through the Fisheries Division of the Municipal Agriculture Office. Accordingly, trainings and seminars on seaweed production and fish cage operation had also been availed of from the Provincial Fishery Office through the facilitation of the Alliance and the different LGUs along the bay.

3.2.9 Other Institutions

There are a number of organizations that helped develop the aquaculture industry in the area. Foremost of these is the Philippine-Australian Development Assistance Program (PADAP) which granted selected multipurpose cooperatives substantial amounts to expand their loan services. This infusion of capital to the cooperatives, primarily the seaweeds growers, helped leapfrogged the seaweed industry in the area.

The Zone for Peace and Development (ZOPAD) of the Autonomous Region for Muslim Mindanao (ARMM) in collaboration with IBRA 9 also granted working capital to members of seaweeds growers associations, specifically for the construction of solar driers.

The provincial government, through the Zamboanga Peninsula Upper Lower Coastal Resource Management Program (ZPULCRMP) and the Provincial Agriculture Office-Fishery Division, also gave financial assistance to members of fishermen association in the form of livelihood grants, soft loans, and short-term microcredit.

To further boost fisheries and seaweeds production in Illana Bay, other forms of assistance were extended by TESDA, DOST, and other cause-oriented organizations.

Cooperatives

A number of cooperatives have thrived in Illana Bay. Foremost among these, and the most decorated, is the Zamboanga Sur Government Federation of Employees Cooperative (ZAMSURGOFEMCO) which originated in the municipality of Dinas.

Cooperatives stand as steadfast symbol of economic and social cooperation among small fishers and farmers—they offer various services to its members, including: credits, consumer goods, catering, and printing, among others. The cooperatives also serve as local mini-banks where prospective growers could borrow capital, or small loans for emergencies, at reasonable interest rates. They also serve as avenues through which grants-in-aid are facilitated.

Most cooperatives, however, suffer from low loan repayment rates. A few manage to survive through the unswerving loyalty and protectionism of its members.

Fishermen and Seaweed Associations

A number of seaweed growers and fisherfolk have organized themselves with the assistance of BFAR and the MAOs and Fishery Technicians in their respective municipalities. Some have been registered with the Securities and Exchange Commission (e.g., Buburay Seaweed Farmers Association), and with the Department of Labor and Employment (e.g., Bulanit Seaweed Growers Association and Combo Seaweed Growers Association), and recognized and accredited by the local government units. These associations are expected to grow into full-blown cooperatives. At the moment, most have been federated into what is now known as the Zamboanga del Sur Seaweed Farmers Association which links up the associations at the barangay level to sources of credits and technical assistance and services.

The associations were organized to serve as channels of grants-in-aid, capital, and other forms of financial assistance. As channels of funds, these associations were able to source out funds for livelihood projects, extend credit services to members, and purchase farm inputs coordination with barangay and municipal officials

The associations also became channels of technical assistance and services. They host trainings and seminars or provide facilitators and resource persons. The members were recipients of training grants for seminars and workshops on industry developments; in turn, they conduct echo seminars upon their return to the community

Sometimes, associations also served as the marketing arm of the members. They also often acted as self-regulating and policing bodies that help resolve conflicts among members to protect their farms.

Most associations have been running quite well and were able to deliver the expected services to their members. However, a number of associations have also failed because of financial mismanagement. The Department of Trade and Industry (DTI) grant to the Federation of Seaweed Growers Associations, for instance, have not yet been paid as the primaries have failed to remit their payments to the federation.

Loan repayment rates of beneficiaries remain low due to a number of factors: adverse weather conditions, flooding and dirty waters, short cropping seasons, and incidence of diseases. Due to mismanagement and the inability of many members to pay their loans, financing institutions have deprived opportunities and blacklisted some associations. This made some associations fold up.

Fishpond Associations

The fishpond owners operating along Illana Bay operate independently of each other. They do not have any organization that can articulate the needs and interests of the sector and link to sources of new production technologies and innovations. Their inability to organize hinders them to avail services from government agencies and external institutions. This may partly explain the fishpond owners' low farming technology and consequent below par production.

Fishpond operators from Pagadian City were the only group that attempted to organize themselves. These fishpond operators bonded together to protect, articulate, and enhance the interest and welfare of the sector. The members were especially visible in the advent of shrimp farming when their success or survival in the field was dependent on acquisition and use of innovative production technologies. However, as shrimp farming declined, the association became less and less active and is no longer visible at present.

CHAPTER IV

ISSUES AND CONCERNS OF THE AQUACULTURE INDUSTRY IN THE ZAMBOANGA DEL SUR SIDE OF ILLANA BAY

Seaweeds, prawns, and finfishes are some of the country's major export products and sources of revenue for the national government. The sustainability of the production of these products however, requires the need to address technological, environmental, economic, and socio-political issues and concerns of the producers themselves, namely: (1) the lack of finfish fry and fingerlings, crablets, and seaweeds seedlings, (2) lack of capital, (3) lack of technical know-how on intensive culture techniques, and (4) degraded water quality.

4.1 Technological Issues and Concerns

4.1.1 Lack of finfish fry fingerlings, crablets, and seaweed stock

Most fish growers preferred the use of fry from the wild as this guaranteed high survival rates until harvest. It was a general observation, however, that while commercially important fish and prawn species are endemic in the coastal waters of Illana Bay, the volume of catch and the natural stock of these species have declined over the years. The decline was attributed to the continued use of illegal and destructive fishing methods and the cutting of mangrove trees despite the existence of national laws on fisheries management and environmental conservation. The fry population was also observed to significantly decline when seaweed farms began to proliferate.

Fish producers were concerned that they could not optimize their operations for lack of fingerling inputs. Although fries and fingerlings are locally available, fish producers lack the required number of fries and fingerlings for a normal operation. In most operations, the lack of fry stock is supplemented with fry in succeeding days or weeks whenever the fry becomes available.

The problem of insufficient supply of fry is compounded by the absence of hatcheries for finfishes and crabs in the area. The existing *siganid* hatchery operated by MSU Naawan has limited capacity and could not produce enough fry if cage operations become full blast. Also, the supply of seaweed stocks could not accommodate the local demand; additional supplies are only available from nurseries that are located far from the area. Fishpond operators who ventured into crab fattening have not sustained operations due to the unpredictability of crablet supply from the wild.

4.1.2 Lack of skills and technical know-how by operators and caretakers

Some attempts to produce fishes in ponds, pens and cages failed, not so much because of the infeasibility of the species cultured but because most operators and their caretakers do not have the necessary skills and expertise to manage the production process. Private individuals who cultured endemic fish species in cages and fishpond operators who have been operating their fishponds for decades, admitted to their lack of skills and knowledge on basic technical and environmental requirements of different fish species targeted for culture.

Some practices of fishpond operators and seaweed growers that can illustrate their lack of skills and knowledge are discussed below:

- Ponds were overstocked beyond its carrying capacity to compensate for mortality during the culture period. In the absence of a life support system in the pond like paddlewheels, the

overstock becomes stunted or they slowly disappear. Mass mortality of prawns is virtually becoming a natural phenomenon in the area and as a result, a number of fishpond operators shifted to milkfish production.

- Some seaweed growers also apply fertilizers to enhance the growth of seaweed plants. This practice however also enhances the growth of filamentous algae around the seaweed thallii which ultimately choke the seaweeds plants to death.

- Seaweed growers use cellophanes and plastic bottles that settle and litter the sea bottom. These can accumulate and adversely affect the health of seaweeds and benthic organisms.

- To increase their production over their limited areas, seaweed growers shorten the distances between their lines resulting to reduce water movement, stagnation, water fouling and spread of bacterial infestation of seaweed stock.

At the moment, there are no regular extension service activities such as farm visitation and technology dissemination from concerned local units. However, the technicians from the Municipal Agriculture Office are willing respond to any request for technical assistance as long as it is endorsed by the Mayor's Office.

4.1.3 Fish and Seaweed Diseases

The outbreak of seaweed diseases nearly wiped out the seaweed stock in Panguil Bay in 2004 and 2005. The possibility of a similar outbreak in Illana Bay is imminent unless control measures are put in place. Even the prawn industry is at risk given its vulnerability to bacterial diseases.

Among the seaweed and prawn diseases identified were: luminous bacteria, the "red disease", the 30-days syndrome", white spot syndrome in prawns, *ice-ice* disease, *sirin-sirin* which are silt and epiphytes that stick to the plants, *lumot* or green algae that compete for dissolved oxygen and suffocate the seaweeds stock, *lambog* and other epiphytic infestations that afflict the seaweeds plants.

When the incidence of luminous bacteria virus peaked in the early 1990s, most prawn-pond operators experienced losses in semi-intensive operations. This led many of them revert back to extensive traditional farming methods. Today, extensive culture best characterizes most fishpond operations in the area and until now there has been no major breakthrough on the prevention of bacterial infestation or on the cure of prawns once they are attacked by the bacteria.

Seaweed farmers, on the other hand, have acknowledged the occurrence of the *ice-ice* disease as part of seaweed farming. So far, the only known solution to the problem is to physically remove these plant pests. To cut on losses, farmers simply cut off, and burn and bury the diseased part of the plant or immediately harvest what can still be salvaged. During the incidence of seaweed diseases, seaweed price remain low despite limited supply because of the low quality of the produce.

4.2 Environmental Concerns

4.2.1 Degraded Water Quality

The decline in fish stock from the wild was mainly attributed to the cumulative effects of water quality degradation and the unregulated exploitation of natural fish stock. Water quality is directly

affected by chemical effluents discharged from ponds, use of coastal waters as waste sink for chemicals and other effluents from water transport facilities, and the use of poison in catching fish. Flotsams from farm wastes, uprooted trees or broken branches, bamboo and shrubs not only damage seaweed lines during heavy rains but these also contribute to organic matter upon decomposition. Transboundary urban wastes such as plastic or polyethylene materials are carried by tidal currents into seaweed farms during the southwest monsoon and adversely affect maintenance and farm production

4.2.2 Flooding and Siltation

The coastal waters continue to decline because of soil erosion from the hinterlands, the deposition of solid wastes and other run-offs during heavy rains. The deposition of eroded soil from land-based activities leads to siltation and shallow ponds. Silt makes the waters turbid, suffocates seaweeds and inhibits their growth and production. River run-offs also cause salinity depression of the municipal coastal waters. The sudden drop in salinity during heavy rains and the drop in dissolved oxygen in shallow ponds during hot weathers were identified as causes of mass mortalities in ponds.

To fishpond operators, continuous rains not only cause flooding near river banks and the overflowing of rivers, it also damages fishpond dikes and cage structures.

4.3 Economic Concerns

4.3.1 Lack of Capital

Sufficient capital is needed for the construction of stronger cage structures; development, rehabilitation, improvement, and operation of fishponds; the construction of stilt driers; and the expansion of seaweeds farms. Operators, however, oftentimes don't have sufficient capital for these improvements.

In Labangan and Tukuran, for instance, wooden cages were easily destroyed by strong waves and by flood waters from the rivers. The bamboo cages were either destroyed by driftwoods and large debris or they eventually rotted and gave way to strong waves. Seaweed growers need sturdier culture systems that could withstand floods and debris. However, they are can not build and expand their areas of operation for lack of funds to finance the establishment and expansion of their farms.

Marginal seaweed growers also need capital to construct stilt driers. In the absence of driers, the products are sometimes sold raw and without added value. Other growers, on the other hand, need capital to buy seedlings for the next planting season.

Despite the profitability of pond operations, there were operators who abandoned their ponds because of their inability to maintain operations. Some fishponds remain underdeveloped or unrepaired to this day as pond development and improvement is capital intensive that.

During the survey, there were development banks and funding windows that lend capital to farmers and producers. However, based on the responses of FGD participants, only a few individuals could avail of their services. Ordinary fishermen who wanted to avail capital support complained of the tedious processing of loans and the difficulty in completing required documents. In most cases, individuals who were not able to access funds became victims of unscrupulous money lenders and *compradors* who pay for their produce in advance. Borrowed money was considered as advance payment for the produced seaweeds.

Other growers who were otherwise qualified to receive livelihood grants from the government did not receive government support programs because of politics.

4.4 Social and Political Concerns

4.4.1 Resource Use Conflict

A number of activities compete for the use of the area along the coastal zone. Since there is limited area left for the expansion of seaweed farms, some growers put up their culture lines on top of sea grass beds. Unfortunately, these sometimes encroach coral reefs.

Some lines were established in *bangus* and *sugpo* fry collecting grounds to the disadvantage of fry collectors and fishpond operators who are dependent on wild fry for their pond stock. Sometimes, seaweed farms are also recipients of fertile or toxic effluents from fishponds that contribute to algal blooms.

The coastal area in Tukuran, for instance, is suitable for seaweed culture at certain months and is also ideal for tourism and as fry grounds of culturable fish species.

Seaweed growers are concerned with the uncontrolled proliferation of seaweed farms and the increasing number of growers throughout the municipal waters. They are also wary about the possible impact of uncontrolled expansion in their own operations. Local growers sometimes complain that the remaining area for seaweed farming is becoming limited. Moreover, some entrants are financiers and *compradors* who are not residents of their barangays.

4.4.2 Peace and Order

Another concern of local governments is the volatile peace and order condition in the area. Since the coastal area is open to different armed groups, pirates and extortionists, some fishpond operators and seaweed growers have relocated elsewhere. Seaweed farmers, especially those with lines that are located a kilometer or two from the shorelines, were also wary of the constant threat of pirates or extortionists.

The development of coastal barangays is further hampered by clashes between the military and rebel groups and between certain clans and political groups. Fishponds in Pisaan in Dinas, for instance, are known as home to armed groups. These were abandoned because of armed encounters between lawless elements and the military in the area. In like manner, Sungayan in the same municipality had become almost a no man's land because of conflicts between certain clans. The fishponds in these barangays could have been rehabilitated and operated if they were peaceful. All these prevent outside investors from investing in the area.

Poaching is another social problem that fishpond operators and seaweed farmers have to face. Extra vigilance is required especially during harvest time. The security of fish and seaweed farms from poaching remains the exclusive concern of private owners and operators. Every now and then, organized *Bantay Dagat* teams from seaweed growers patrol and guard the coastal area to discourage illegal acts.

Unresolved boundary conflicts or land ownership claims have rendered some fishponds unproductive. Some fishponds have even regressed into mangrove forests.

4.4.3 Illegal Fishing

Seaweed farms attract grazing fish species and their predators, which in turn attract illegal fishermen to the area. Blast fishing usually occurs in deeper areas of the farms where schools of fish take shelter beneath the seaweed stocks. The blast severs lines, disconnects and turns seaweed stocks into fragments.

Illegal fishing activities are still being reported in the bay. Fine meshed nets and other destructive fishing gears that had been previously banned are still being used by some fishermen. Law enforcement is inadequate and illegal fishing methods like dynamiting remains.

4.5 Risks and Uncertainties

Some concerns can not be solved by growers. These problems include: monsoon winds and strong wave actions during certain months of the year; the direction of flow of current that contributes to transboundary pollution; rains and floods; siltation; and the over-all decline in the quality of coastal waters brought about by increasing populations in coastal areas.

Wastes, debris, cellophanes, dead animals, driftwoods, and water lilies from Pagadian City and as far away as Cotabato are moved by strong waves, wind, and current especially during the months of October to December between Illana Bay and the Moro Gulf and are observed all the way from Labangan to Dinas. Monsoon winds bring solid wastes to the coasts of Tukuran, Pagadian and Dinas where they are trapped forever. Solid wastes sometimes get entangled in culture lines and destroy the lines.

CHAPTER V

AQUACULTURE PROFILES BY MUNICIPALITY

5.1 Tabina

Tabina is the southernmost coastal municipality of Zamboanga del Sur. It is primarily an agricultural and fishing community. It is blessed with rich fishing ground that continues to provide fish despite their unflagging degradation.

Tabina has the distinction of being the first to come up with a CRM plan among the other municipalities of the province. It is currently managing three marine sanctuaries. Mangrove trees remain luxuriant and sea grass beds and coral communities are still found in some coastal barangays (figure 8).

Figure 7. Satellite map of Tabina, Zamboanga del Sur

5.1.1 Seaweed Farming

Status

Seaweed farming is a very recent development in Tabina (ca. 1996-1997). It is practiced in sheltered areas of the municipality's coastal waters such as San Vicente, San Andres, San Sebastian, and Abong-abong. A total of 65 hectares is being farmed by 66 sustenance fishing families who were allocated at least one hectare of seaweed farm area each. Interested families select an area where they can put up their culture lines and claim the area (*angkon-angkon lang*) for seaweed farming. Some families, who depend only on family labor, sometimes share their area with other families because of the lack of manpower to fully manage the allocated one hectare area.

Species

Like its neighboring municipalities, Dimataling and Dinas, the seaweed growers of Tabina plant the *E. cottonii* species, the so-called *burikat* variety, *giant* variety, *green* variety, and the *adic-adic* variety which have adapted to Tabina water conditions. The *lato* variety which is popularly served as salad in seafood restaurants was found to be not suited for culture in the area.

The farmers get their seedlings from BFAR nurseries, the nearest of which is in Barangay Buburay in Dimataling and in Margosatubig Igat Island. It was impossible for the farmers to produce their own seedstock as they completely harvest their crop before the rainy season with the next cropping still months away from their last harvest. This poses supply and cost risks to marginal growers. With income/proceeds from their previous operation almost exhausted/depleted for basic needs, most of them lack the necessary funds to purchase new sets of seedlings for the next planting season.

Season

Tabina has a distinct dry and wet season. The rainy season usually starts in May and runs up to October, with August having the highest rainfall (table 3).

Seaweed growing is generally seasonal, except in some sheltered coves. The coastal waters are rough and turbulent especially during the southwest monsoon. As much as possible, farmers do not plant during the rainy season as the occurrence of "ice-ice" disease is high during the season. It was also observed that seaweeds are luxuriant during *amihan* months, so farmers maximize the use of their lines during this season. Some lines are only one foot apart from each other. Seedlings weighing 250 gm to 500 gm are planted along the line at a distance of only 15 cm to 20 cm between each other. The plants are harvested after 45 to 60 days from planting during which the plants grow to twice or thrice its original weight. The average survival rate is around 80% of the total seedlings that were planted.

Seaweeds are generally harvested all at the same time, although sometimes, small growers harvest seaweeds partially whenever there is an urgent need for money.

Table 3. Weather conditions by month and cropping seasons, Tabina, Zamboanga del Sur

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Strong wave action caused by strong monsoon winds.				Rainy season. Planting season starts in May. The wind direction during the wet season is from southwest to west. Temperature is generally warm.								Dry season		
									Only a few grow seaweeds at this time of the year-between October to March. Northeast monsoon.					
									Rainy season. "Ice-ice" disease is prevalent.					

Technology

Farmers use the floating long line method. In this method, lines are attached to bamboo posts, called *pundo*, at each end. They measure the length of their culture lines (locally called *kutay*) in terms of *dupa* which is the distance between the two middle fingers when the arms are stretched wide open. On the average, one long line measures between 50 and 60 *dupa* which is equivalent to the whole length of one roll of polyethelene rope. There were growers, however, who operate lines twice these lengths. The distance between lines is approximately 1 to 1½ *dupa* for nearshore farms and 2 to 3 *dupa* for lines farther into the sea; the total number of lines possible per hectare, with 100 m by 100 m dimension, is 25 to 50.

Seedlings are tied to the line every 1½ to 3 *dangaw* (approximately 15 to 20 cm), or 3 to 5 seedlings per meter. One *kutay* measuring between 50 and 60 *dupa* produces at least one sack of dried seaweeds ready for marketing. One sack accommodates an average of 80 kg dry weight of seaweeds. At this rate, assuming that there are 50 100m culture lines per hectare, there would be 50 sacks (4,000 kg) of dried seaweeds per hectare per crop. At four croppings per year, a total of 16,000 kg (16 mt) per hectare per year is expected. While this is below the national average of 20 tons per hectare per year, this average is already acceptable considering that the culture period is only during the *amihan*.

There were growers, however, who reported bountiful harvests. One operator can produce a maximum of 4,000 kg of fresh seaweeds or an equivalent of 571.43 kg of dry seaweeds per cropping. As estimated from available data, the municipality has the capacity to produce from 1,040 mt/y to 7,429 mt/y of dried seaweeds from its 65 hectares of seaweed farms.

Production Costs

To establish a seaweed farm, farmers need to invest on wooden stakes and culture lines. Since the farmer also needs a wooden boat (with no outriggers), he must have around P20,555 to operate one hectare of seaweed farm. Since marginal fisherfolk do not have this amount, instead of using the recommended mono line, they make use of ropes that are readily available. For instance, some growers use packing tapes and smaller ropes as culture lines since bigger ropes are more expensive. Growers make use of old styrofoam boxes as floats and big stones as sinker. Investing on a weighing scale is optional since buyers always have their own. A wooden boat however is a necessity especially when the area is deep. The pump boat, on the other hand, is only needed during harvesting and those who do not own pump boats simply rent from others.

The growers generally dry their produce before they are sold. There are three available driers in the municipality—two were donated by BFAR and one is privately owned—but these are considered insufficient for the needs of all the farmers. The ratio of wet weight to dry weight is 7:1 for *burikat* variety and 5:1 for the *kapalaran* variety.

Labor Costs

Small-scale growers use mostly family labor. Family members help in tying cuttings while hired labor is used in setting out culture lines and during harvest. Because of this limitation, a family only operates 25 lines out of 50 which could be accommodated in a one-hectare farm. Caretakers are paid up to 1/3 of the net income while others reported paying as much as P6,000 to hired farm hands per hectare per cropping.

Cost of Seedlings

Most seaweed growers in Tabina need fresh seedlings because of the time gap between harvests and the start of another cropping. Seedlings are either bought by

bunch, kilo, or by *dupa*. In Tabina, every *dupa* of seedling stock costs P80[2]. Seedlings from one culture line measuring 60 to 80 *dupa* cost between P4,800 to P6,400; this price is relatively higher than the price in Pagadian. The high cost of seedlings limits the total area operated by every household. Due to lack of funds, farmers operate only a portion of the area allocated to them.

All in all, a farmer should initially have P14,250 to P40,600 to fully operate a one-hectare seaweed farm.

Financing

Growers usually turn to fish dealers and seaweed *compradors,* which double as financiers, for their working capital. Loaned money is considered as advance payments for future produce.

Only a few could avail the livelihood grants from the local government. Government agencies and foreign-funded projects have also provided some support: BFAR provided seaweed driers; DOST conducted a seminar on seaweed growing; and EcoGov conducted capacity building trainings on coastal resource management.

Marketing

Farmers in Tabina do not have any problem marketing their product. However, they do have a problem controlling the farm prices which are mostly dictated by the *compradors* who are pressured by processors and exporters.

Dried seaweeds are priced between P26 and P38 per kilo, while fresh ones are priced P4 to P5 per kilo. *Compradors* from Pagadian offer more or less uniform prices for seaweeds regardless of source.

Tabina growers sell their dried seaweeds to a *comprador* in Dimataling. Sometimes, they also deliver their products to their *suki* buying station in Pagadian. From Pagadian, the collected seaweeds are shipped to Zamboanga or Cebu, depending on the mother company to which the *comprador* is affiliated with. Although dried seaweeds are more often shipped to Cebu where the biggest processing company, the Shemberg Marketing Corporation, is found.

The longer the marketing chain, however, the lesser the amount received by the growers. The price difference between ex-farm price and the *compradors*' price to the wholesaler ranges from P1 to P5/kg; from the wholesaler to the processor the mark-up is higher.

Return on Investment (ROI)

A number of fishermen in Tabina turned to seaweed farming as their major economic activity and to augment their incomes. Seaweeds proved to have higher ROI than all the other production activities. Initial investments could be recovered in only 1 to 3 croppings, or in less than a year of operation depending on the materials used in the making of the culture lines as well as on the growth performance of the planted stock.

[2] Price of one dupa of seedling stock in Pagadian is only P35.

More sturdy and durable ropes are more expensive but could last for several years. In its duration, the farmers spend very minimal amount to operate, and the only remaining significant source of variable cost is the cost of the seedlings. After the recovery of capital investment cost, and after deducting the operating costs, everything else during the project life becomes profit**.**

At present, many growers try to put more lines in their self-designated areas to increase their incomes. Potential areas for expansion are located at the embayments at Barangay Abong-abong and San Andres. The embayments are sheltered and are considered suitable for seaweeds and cage culture.

Issues and Concerns

Limited area. The municipality has 25 km of coastline and 105 sq km reserved for fisheries development, since a large part of this area is exposed to monsoon winds, only certain areas are considered fit for seaweed culture. A number of fishing activities compete for the use of the coastal zone such as fish corrals, *tapay-tapays*, and fish cages, operating contrary to the prepared zonation of municipal waters. At present, there is still some room for expansion especially in Barangay Baganian which was excluded from previous development projects because of political frictions.

Financial constraints. Marginal growers often experience financial difficulties. Seaweed culture in Tabina is seasonal and the growers can only effectively produce seaweeds for eight months. The incomes from previous harvests are usually spent in the four-month gap between harvesting and planting. Since marginal growers need money to buy seedlings and lines have to be reinstalled for the next planting season, the future products of seaweed farmers are compromised anew to buyers who loan them the capital for their seaweed farm.

No nearby gasoline station. Seaweed growers and fishermen also need a gasoline station in the town especially during the harvest season when farmers use motorized boats. At present, gasoline is only available in retail amounts and is comparatively expensive.

5.1.2 Milkfish and Prawn Production in Fishponds

Aquaculture in Tabina takes two forms: the culture of milkfish and prawns in fishponds and the culture of *siganids* and other finfishes in fish cages. A 70-hectare privately-owned farm (partially stocked with milkfish and prawns) in Sto. Domingo is the only fishpond operating in the area. Ten hectares of this area remain undeveloped. There are only 2 croppings per year, each cropping is from 4 to 5 months using semi-intensive and extensive culture methods.

The operator gets his prawn fry from hatcheries in Iloilo and Tukuran and milkfish fingerlings from fry collectors. The operator also cultures crabs and sources his crablets from Barangay Taguitic in Kapatagan, Lanao del Norte.

The coastal waters of Tabina have long been a source of fries. Milkfish and prawn fry collection is one of the major sources of income among some households in Barangays

Abong-abong, Malim, San Sebastian, and Concepcion. In Sto. Domingo, the fry gatherers have organized themselves into a cooperative.

The fishpond operator harvests within 5 months, otherwise he would incur additional costs if he extends the culture period. At harvest time, the producer disposes the harvest at the price offered by the wholesaler. To make the prices higher, operations are scheduled so that harvest time would fall during the Christmas season. However, the selling price of fishpond products is ultimately determined by the wholesaler who has more knowledge of the prevailing market prices.

Prices

Prawns are priced according to quality and sizes. Super jumbo prawns, which accounts for approximately 10% of the total harvest, are sold at P650/kg while extra-large (XL) shrimps are sold between P450 to P550 per kilo; tempura-sized prawns sell for P300 and above per kilo. These are prices set by agents of exporters with buying stations in Pagadian, Ozamiz and Cagayan de Oro.

Milkfish are sold for P50 to P60 per kilo.

Profitability

The construction of the fishpond in the early '80s was capital intensive. The total area was gradually developed and until recently, portions of the area are only partially developed and operated. At present, ten hectares remain undeveloped. The total construction cost per hectare was estimated at P130,000 which when prorated over 20 years is equivalent to P3,250 per cropping. The operating expenses, depreciation costs and wages cost P23,430 per hectare per year vis-à-vis an estimated sales total of P83,250 per hectare per year. At present rates, this results to an ROI of 46% per annum.

Fishpond operation, especially when using semi-intensive culture, is considered very profitable. Investment costs are generally recovered in the first or second year of operation when pond fertility is still high. The return on operating costs remains positive for subsequent operations. In the absence of bacterial infestation, ROI can be as high as 150%. The only significant factor of production in terms of costs is commercial feeds which accounts for more than half of the total operating costs.

Marketing of Fishpond Products

Tabino has no problem marketing its fishpond products. The market channels had long been established. Prawns are delivered to a buying station in Pagadian, or brought to Cagayan de Oro for export processing. Milkfish and other by-catch are sold locally or brought to Pagadian or Cagayan de Oro for distribution in the domestic market.

Issues and Concerns

Prawns are one of the country's major export products and source of revenue for the national government. The industry, however, was beset with the incidence of the

luminous bacteria virus in the early ’90s, leading the big producers to practice extensive production methods to cut losses.

The pond operation in Tabina is technologically superior to others due to its stocking density, use of commercial feeds and hatchery-produced prawn fry. Its operation, however, has long been the object of complaint of fishermen from the area. Chemical effluents from the ponds were identified as one of the reasons for the decline in fish production in nearby fishing grounds.

Tabina is 63 km away from Pagadian City. To reach the municipality from the capital, one has to pass through 6 municipalities. The relative isolation of the town from the mainstream of communication and commerce and the lack of up-to-date information on market prices, make the growers rely on the information provided to them by fish traders and compradors.

The producers depend on fish dealers to determine the price of their catch. While it is true that price is dictated by quality and species, the actual price is ultimately determined by the wholesaler or financier who has more knowledge of the prevailing prices in the market. The producer has no option but to sell his produce, otherwise he will incur additional costs if he postpones the harvesting of his stock.

The municipality has an estimated 105 hectare of swamplands of which 3 hectares were identified as suitable for fishpond development. The present operator also has some area left for further development.

5.1.3 Fish Cages and Fish Pens

Grouper cage culture in Tabina.

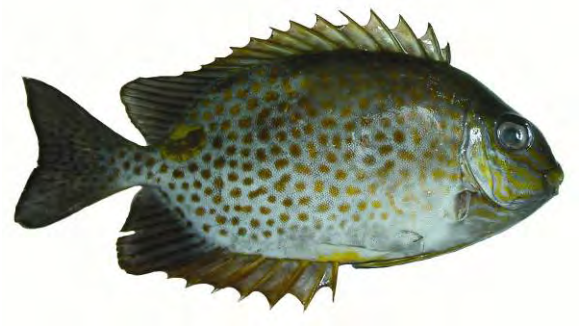
The culture of fishes in cages is a relatively new venture in Tabina. At present, there are 5 households in San Sebastian and some households in Barangays Malim and Abong-abong that is starting to culture fishes in cages. Fish cages with sizes ranging from 25 sq m to 100 sq m were constructed some 100 to 200 m from the shoreline and stocked with *siganids* and groupers fingerlings and sea hare (*Dolabella* species locally known as *donsol nga balat*) breeders at various times. Sea hare was cultured for its eggs which are considered a delicacy in the area. Berried sea hares were collected from the wild during low tide, stocked into the pens and fed with algae. *Siganids* and groupers were stocked separately as they were found to be incompatible; the groupers were predatory.

One entrepreneur also tried the production of lobster but stopped as it was difficult to market the product. Lobsters are priced beyond the buying ability of the local people and therefore

cannot be absorbed by the local market. This entrepreneur ships his harvest to the nearest market for lobsters, Zamboanga City. When the shipping line servicing the Pagadian-Zamboanga City route ceased operation, the operator also stopped his operations.

Technology

The operation of fish cages is still in its experimental stage. Stocking densities and feeding regimes have not been standardized and are still being observed by operators. Stocking is gradual and dependent on the number of fingerlings available. The stocked *kitong* are fed with algae while groupers are fed with trash fishes (*lapoy*) to cut on costs. Harvesting is done by selecting fishes that have reached marketable sizes.



Kitong

Production and Profitability

The fish cages constructed in Tabina were simple and relatively inexpensive. The major investment costs include bamboo poles, nylon nets, and labor cost.

The major expense item for the actual operations is the cost of fry or fingerlings. *Siganids* and grouper fingerlings are locally available and are sold at P2 to P5 per piece, respectively. The most number of fingerlings stocked was 1,000. The maximum cost of fingerling was P5,000.

Given proper management and funding support, fish cage operation could be a very profitable venture. *Siganids* and groupers are sold at P150/kg and the results of the initial operations showed their survival rates to be more than 90% after 3½ months of culture. Under proper management, it is possible to have more than 100% return on investment and a payback period of only one operation.

On the other hand, the 200 pieces of donsol produce gonads are sold between P50 to P200 per day

Marketing

The market of cage-cultured fishes is the same as other fishes caught in the wild. Since there is a local *comprador* in the municipality, there is no problem as far as fishes are concerned. The fishes are either sold in the local market or brought by the fish trader to nearby towns and cities.

There is a big market for groupers and lobsters. Some of the species grown in Tabina are exported. However, since groupers and lobsters are expensive, they can only be marketed outside the locality. When the shipping company, Wessam, stopped operations in Pagadian and airline services were no longer available, the culture of

groupers and lobsters was eventually discontinued as there were no longer any means of speedy transport that will bring the produce to Cebu or Manila.

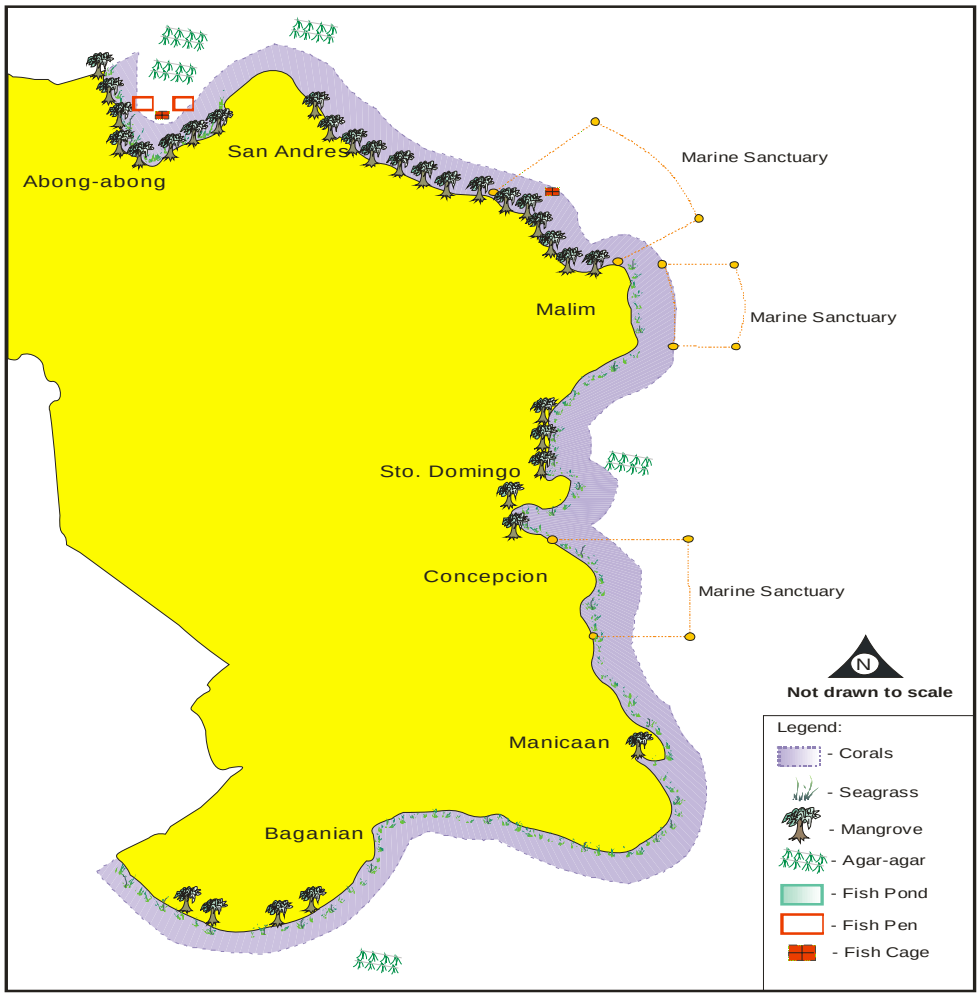


Figure 8. Resource map of Tabina, Zamboanga del Sur

Funding Support

Fish cage operation was introduced by BFAR in the coastal waters of Malim in Tabina. Subsequent operations were funded by grants provided by the Illana Bay Regional Alliance (IBRA) and BFAR through the local government. Operators can also access other funding options such as agricultural funds from development banks in Pagadian City. It is also possible to add to existing cages from the incomes of previous operations.

There are also organized cooperatives where livelihood grants are coursed through. Members can avail credit through these cooperatives.

Issues and Concerns

Diminishing supply of fry. Fish cage operators can not optimize their operations for lack of *siganids* and grouper fingerlings. Though these fingerlings are locally

available, there is a lack of supply necessary for a normal operation. Grouper fingerlings are scarcer than other fingerlings. In most operations, fry stocked are simply supplemented with fry in succeeding days or weeks whenever the fry become available. The existing *siganid* hatchery has limited capacity and could not produce enough fry for expanded operations. However, it could supply enough fingerlings for a pilot cage operation to showcase the feasibility of *siganid* production.

Crablets for crab fattening in ponds and pens are also hard to acquire in sufficient number. The decline in the natural stock of high valued species is attributed to the unregulated exploitation of their natural habitats and to the degradation of the natural habitat of fishes.

Implementation of the zonation plan. There is an apparent lack of order in the placement of fish cages, fish corrals and seaweed farms in Tabina causing their operations to impinge on each other. One particular cage was destroyed because it was hit by a pump boat that tried to navigate between structures.

Aquaculture Prospects

Based on the number of species cultured in pilot fish cages in the municipality, Tabina is a potential aquaculture area. The culture of *siganids*, groupers, and lobsters is possible and although cage operations were done by trial and error, those who were involved in cage production believe that they can significantly increase their production if they are properly trained on appropriate aquaculture technology.

Cage operators prefer crab fattening and the culturing of lobster, *siganids* and groupers because of the attractive prices these command in the market (table 4). The initial runs of BFAR and IBRA-sponsored cages proved the adaptability of groupers, *siganids*, lobsters, crabs and other marine finfishes to cage culture and the high profitability of these kinds of operations. Previous trials may have failed because of insufficient budget of the management and the lack of technical skills among caretakers.

Fish cage operations can still expand. The coastal areas of Abong-abong and San Sebastian (figure 8) are potential areas for fish production in cages since they are sheltered from southwest monsoon winds. The coastal waters off Barangay Baganian are another potential area that can be tapped for mariculture purposes however, commercial fishing boats dock in the area. The absence of a zonation plan in the barangay may pose a conflict among the many users of municipal coastal waters in the future.

Crab fattening in ponds and pens is also considered another potential aquaculture activity in the municipality. The looming problem, however, is the insufficient and declining supply of crablets from the wild.

Table 4: Recommended aquaculture activity to be developed in Tabina (Ranked as follows:1- first choice, 2- second choice, 3- third choice..)*

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	2 to 4
Seaweed farming	2 to 3
Lobster in cages	1 to 2
Crab fattening	1 to 3
Sugpo or lukon growing in fishponds	5
Squid culture in cages	4 to 5

* Generated from focus group discussion

5.1.4 Local Policies

The municipality does not have any ordinance that focuses solely on aquaculture. Policies affecting aquaculture practices may be gleaned from the municipal ordinances that embody the Fishery Code of Tabina (2001) and the Coastal Resource Management Plan (2003) of the town. The Municipal Revenue Code of 2000 defines the requirements in the establishment and operation of aquaculture activities, such as permits, taxes, etc.

The Fishery Code and the CRM plan prohibit the further conversion of mangrove areas into fishpond and enjoin any aquaculture establishment to comply with environmental requirements as prescribed by the National Environmental Code of 1977.

The CRM plan adopted in the middle of 2003 is very specific on the following policy concerns: registrations of resource users, zoning of resource areas for specific uses, delineation and allocation of areas for aquaculture, establishment of marine protected areas, and preservation of critical marine habitats.

5.1.5 Institutions Involved

LGU Unit

The Municipal Agriculture Office handles all agriculture and fisheries concerns of the LGU. The Fishery Technician and the CRM Officer of the municipality are directly responsible in the implementation of programs and policies related to coastal resource management. Their responsibility includes overseeing mariculture activities and linking sea farmers to sources of technical training and financial assistance.

The deputized fishery wardens and Bantay Dagat organizations take primary responsibility in the enforcement of national and local laws on fisheries and the environment. Implementation however, has been hampered by inadequate LGU support on the maintenance of patrol boats, fuel, surveillance, communication equipment and incentives for the members of the team.

Livelihood Organizations

There are two functional livelihood organizations in Tabina: the Malim Livelihood Cooperative (MLC) in Barangay Malim and the Tabina Muslim Christian Association (TAMUCHRISA).

MLC is composed of fishers, seaweed growers, and fish cage operators. TAMUCHRISA, on the other hand, is made up of Christian and Muslim upland farmers, fishers, seaweed growers and other occupational groups. Both groups grant small productive or providential loans to their members. They also channel financial and technical assistance from outside sources. Both organizations suffered from low loan payment rate. The death of a chairperson and the disappearance of some officers resulted to the collapse of TAMUCHRISA in the recent past. Today, some loyal members are trying to revive the organization.

Due to the inability of the fishers and seaweed growers' organizations to meet their members' needs, most have to succumb to the services of buyers and loan sharks.

External Institutions

The LGU through the Municipal Agriculture Office (MAO) recently started to assist seaweed growers by financing their operation. A revolving fund of P50,000 has been set up and loaned to farmers at P1,500 per beneficiary, payable at the end of a cropping period at 6% interest. This system is yet to be assessed for its effectiveness among cash-strapped seaweed farmers.

The DA-BFAR has donated two stilt driers in 2003 and extended training and technical assistance to seaweed growers in coordination with the MAO. During the Araw ng Tabina in June, 2007, DA-BFAR donated one module of fish cage to the LGU of Tabina. The cage was to be stocked with *Kitong, Lapulapu* or squid, whichever seedlings are immediately available, to be managed by the Malim Livelihood Cooperative.

5.2 Dimataling

Dimataling is located at the southwestern part of Zamboanga del Sur (figure 9). The municipality has mangrove areas that were replanted and protected as well as a newly established marine sanctuary. Fishing and farming are the main sources of income of the town's inhabitants.

Figure 9. Satellite map of Dimataling, Zamboanga del Sur

5.2.1 Seaweed Production

Seaweed production in commercial scale started in Dimataling in the late '80s, with seaweed farmers adopting the culture techniques developed by more successful growers in neighboring municipalities. Seaweed farming has supplanted fishing as a primary livelihood of coastal folks. The coastal waters of Dimataling are naturally sheltered from the southwest monsoon enabling fish farmers to grow seaweed all year round.

The production got its boost when Dimataling along with other municipalities along Illana Bay became part and beneficiary of the Livelihood Enhancement and Peace Program (LEAP), a project supported by the United States Agency for International Development (USAID). LEAP provided financial assistance to construct a solar drier and other forms of assistance for seaweed growers.

Dimataling has seaweed farms in 8 out of its 11 barangays along the coast of Illana Bay. The whole length of the coastal waters of Barangays Mahayag, Sumpot, Saloagan, Bakayawan down to Buburay, covering an area of 700 hectares, are planted with seaweeds. These farms are operated by some 1,500 farmers with each household given at least a half-hectare farm area. As agreed among themselves, only Dimataling residents were allowed to grow seaweeds within the municipality's coastal waters.

K. cottonii, known locally as *pulotan*, is the most commonly cultured species since most growers consider it as the more hardy species. Farmers also grow other varieties such as *adik*, and the "giant". The seedstock are from the grower's previous operation or bought from Pagadian nurseries. Farmers usually maintain two culture areas: near shore areas are reserved for plants almost ready to be harvested, and offshore areas are reserved for the culture of seed stocks. The lines sometimes extend up to 600 m away from the shoreline.

Seaweeds are grown throughout the year but the peak season is between May and October when the sea is considered calm and ideal for planting (table 5). A number of small scale seaweed growers avoid the probability of incurring losses by not planting during the *habagat* season. However, growers may plant in areas with muddy substratum during the hot sunny days, but during rainy days they have to relocate their culture lines to areas that are not muddy.

The culture period is 45 days to 2 months and the number of croppings is from 3 to 6 per year. The peak season is between May and October. The survival rate is 90% to 100%.

From 2000 to 2005, seaweed areas have increased threefolds. Consequently, the total production has likewise increased. According to LGU estimates, some 2,000 hectares could still be planted and the room for expansion extends farther into the sea. However the exact locations could not be determined as the boundaries of the municipal waters have not been defined.

Table 5. Weather conditions by month and seaweeds cropping seasons, Dimataling, Zamboanga del Sur, 2007

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Strong waves from January to April				Seaweeds planting season. Dimataling has longer calm season. Accordingly, there are no strong waves during this period.							

Source: FGD participants

Production Estimates

An individual plantlet grows between 2 to 3 kg after 45 days to 2 months of culture and at the planting rate of 1 plantlet every 20 cm along the line, a one-hundred meter line is expected to yield between 750 kg to 1,440 kg per line per harvest. According to official records, seaweed production per hectare is at 800 kg dry weight per crop or an equivalent of 3,200 kg to 3,360 kg dry weight per hectare per year. At P32 per kilo dry weight, a grower earns P102,400 to P107,520. The more enterprising growers, however, reported greater incomes of up to P240,000 per year.

Growers generally harvest their plants completely. There were times, however, when growers resort to partial harvesting but this usually occurs when small time growers have an urgent need for money.

Production Economics

The initial capital is spent on bamboo or wooden posts (where culture lines are attached) and culture lines. In Dimataling, some seaweed growers are sustenance fishermen who cannot afford to put up longer-lasting structures so they just make do with strips of packing tapes as culture lines and plastic straw string for tying. Their floats are made of bagged styrofoam balls, while the sinkers are simply made of bagged sands or stones. A small wooden boat is used for near shore operations.

Seedlings

Seedlings are the most expensive input to seaweed production. BFAR reports that for a quarter hectare seaweed farm, 1,500 kg of seaweed stock is needed. To save on costs, Dimataling growers set aside a number of lines as their source of plantlets for the next cropping.

Labor

Seaweed farming is labor intensive during planting and harvesting. The plants also require regular monitoring and cleaning to prevent epiphytes infestation and choking by fine filamentous algae. Most growers therefore limit their area of operation to less than a hectare to avoid incurring additional costs from hired labor. Marginal seaweeds growers make do with their available family workforce, otherwise they would spend around P6,000 per hectare per cropping for hired labor or some P24,000 per hectare per year.

Other Costs

Since dried seaweeds sell for 25% to 50% more than the fresh ones, seaweeds growers dry their products before selling them. In the absence of individual driers, some growers rent space in existing stilt driers located in their respective barangay and pay P0.10 for every kilo of seaweeds.

Marketing and Pricing

In most cases, marketing costs are assumed by the wholesalers. Local *compradors* are informed of the harvests so they can collect the produce from the farm fro free. Growers who bring the harvest to the buying station consider the cost as minimal.

Seaweeds are either sold fresh or dried, depending on the availability of stilt driers or the growers' accessibility to one. Five to 7 kg of fresh seaweeds, depending on the species (7:1 for *burikat* and 5:1 for *kapalaran dagko*), produce a kilo of dried seaweeds. Majority of growers dry their produce for 2 to 3 days on stilt driers before selling. Drying significantly increases revenue by 25% to 53%.

The seaweed growers of Dimataling sell their dried product to a local seaweed comprador[3] or deliver to their *suki* buying stations in Pagadian City. The local *comprador* is mostly patronized by local growers (approximately 85% of all growers) who have limited means to deliver their products to Pagadian, while the wholesalers

[3] There were at least 15 such middlemen and buying stations in different major fish and seaweed producing barangays.

based in Pagadian are patronized by the large scale growers who have the means to transport their produce to the city.

Depending on the season and the quality of produce, a kilo of wet seaweed sells for P3 to P4 while a kilo of dried seaweeds sells for P32 to P38. The price is determined by the *comprador* or wholesaler, while the exporter processor dictates the price among *compradors.* The price difference between the ex-farm and the *comprador's* price to the wholesaler ranges from P2 to P5 per kilo.
The seaweeds that are bought by compradors are stored in warehouses in Pagadian City, accumulated and shipped to Zamboanga or Cebu for processing. The *compradors* are mainly agents of exporters, the biggest of which is the Shemberg Marketing Corporation that holds its headquarters and processing plant in Cebu.

Backward and Forward Linkages

The seaweed industry in Dimataling has a multiplier effect—it not only increases the income of the family but it also creates a number of livelihood opportunities to others. The need for a continuous supply of seed stock has engendered a new set of growers specializing in the culture of seaweed seedlings. The players all work together to satisfy the market demands for products needing seaweeds as component.

Source of Funds and Technical Assistance

Most growers started small and gradually increased the number of their culture lines and farm area by using their incomes from previous harvests. There are also *compradors* who help finance seaweeds growers by giving them loans payable from the proceeds of their next harvest.

A number of growers who belong to fishermen and seaweed growers associations have become beneficiaries of the Livelihood Enhancement and Peace Program (LEAP) of the government. The LEAP grant included the provision of solar driers and other forms of assistance to seaweed growers in selected municipalities.

Profitability of Seaweed Operations

A number of rice farmers and fishermen have turned to seaweed farming as their major source of income or to augment their present incomes. Seaweeds proved to have higher ROI than the other production activities. Initial investments of small scale operators could be immediately recovered. Those of large scale operations could be recovered in 2 to 3 croppings, or in less than a year of operation, depending on the length and number of lines. The stakes and lines used in the production process could last from 3 to 5 years during which time the farmers spend very minimal amount to operate.

Financing

The inclusion of Dimataling in the EcoGov program has opened opportunities for its fishermen to avail grants and trainings on seaweed production. The Sumpot fishermen have availed of P100,000 seed money for microcredit from EcoGov and a loan of P35,000 from IBRA 9. USAID through its Growth and Equity in Mindanao (GEM) program is also providing capacity building trainings on coastal environment conservation among fisherfolk. Residents are also educated on the need to sustain aquatic habitats by involving them in workshops and focus group discussions.

Issues and Concerns

Seaweed diseases. Among the major concerns of seaweed growers is the incidence of the so called "ice-ice" disease and epiphytes infestation that afflict seaweeds plants. These diseases cause the decline in the yield and the quality of the product which adversely affects the market price of seaweeds.

Need for capacity building. Growers need more trainings, seminars, and workshops especially on how production can be improved. Seaweed growers also mentioned the need for a seaweed nursery and more solar driers.

Unstable peace and order situation. The major concern of the LGU is the unstable peace and order situation in the area. Outside investors can not set up their business in the municipality for threats to safety. The absence of defined boundaries between adjacent municipalities also limits seaweed growers to expand.

5.2.2 Brackishwater Fishpond Operations

Dimataling has a total of 619.42 hectares of brackishwater fishponds operated by 47 fishpond operators[4]. The annual production is estimated at 600 mt.

All operators operate an average of 7 hectares, except for one. The fishponds are found in Barangays Bakayawan (23.35 has), Buburay, Mahayag (105 has), Poblacion (87.3 has), and Tiniguangan(150 has), all located along the coasts and have access to Buburay River for their freshwater supply. The ponds are quite shallow, perfect for the culture of milkfish, prawns and shrimps (figure 10).

[4] Department of Agriculture, Region IX

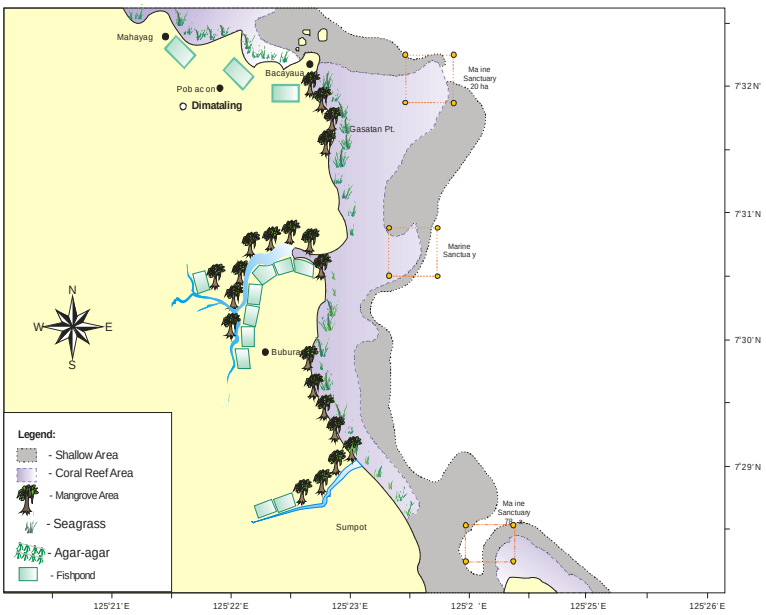


Figure 10. Resource map of Dimataling, Zamboanga del Sur

Most of the fishponds were developed in the late '70s and early '80s; production peaked in the '80s when some prawn growers employed semi-intensive production methods. Fishpond operations slowed down on the latter part of the decade when operators experienced reduced yields due to bacterial infestation of prawns. The subsequent losses experienced by most fishpond operators from their semi-intensive operations led many of them to revert back to using extensive farming methods which best characterizes most fishpond operations in the area at present.

In 1980, capital investments for the development of fishponds—clearing, excavating and diking—is about P50,000/hectare. Capital investments and the working capital for initial operations were recouped during the first 2 years of operation of ponds.

Fishpond operation is still profitable, but significantly lower compared to profits years ago. Operators now spend only on variable inputs such as procurement or production of fish food and for the maintenance of fishpond dikes. To cut on the use of commercial feeds for milkfish, operators simply grow filamentous algae; for prawns, they grow *lablab*. These are supplemented with squash (*calabasa)* and yellow corn grits (*binlod*) to enhance the color of prawns.

According to pond operators using traditional methods, hatchery-produced fry result to low survival rates because the fishes are only given minimum inputs and are left to grow naturally. The average survival rate (50%) and production of this method is low.

Small time operators depend on fries from the wild which they can buy in limited supply depending on their budget. Operators using semi-intensive culture methods buy fry in bulk from hatcheries. Milkfish fry from the wild sell at P500/thousand, or at P2/fingerling, while prawn fry sell for P700/thousand. Milkfish and prawn fries are available from known fry dealers and concessionaires from Cotabato and Pagadian cities and from Tukuran.

Production and Income

A fishpond operator in Dimataling reported that eight (8) styrofoam boxes (approximately 240 kilos) were produced from 30,000 sugpo fry and 5,000 bangus fingerlings stocked for 3 ½ months in a one-hectare fishpond. Prawns were sold at P15,000/box, thus his revenue was P120,000 for that particular harvest. Profit was between P75,000 to P100,000/hectare/crop.

On an annual basis, the above data translates to a gross income of between P240,000 to P360,000/year.

Generally, milkfish are cultured with prawns to serve as pond aerators because of their swimming motion. Milkfish, crabs and other by-catch which enter the culture ponds with tidal water add to the revenue of the fish farmer.

Marketing

Marketing fishpond products is not a problem in Dimataling, There are always agents of exporters in Pagadian ready to buy the prawns and fishes. Milkfish are either sold in the local market or are brought to Pagadian, Iligan, or Cagayan de Oro by fish dealers. Prawns, on the other hand, are brought to buying stations and sold to exporters' agents or are transported by to processors and exporters in Cagayan de Oro.

Prices are dictated indirectly by the exporters through their agents, or by fish traders operating in the domestic market. Prawns, which are classified by size, commands significantly higher prices while milkfish are priced similarly as other fishes caught from the wild. Milkfish are bought by fish dealers at P50 to P60/kg and sold at P80 to P100/kg in Iligan City.

Super jumbo prawns, which comprise some 10% of all produce, and extra-large (XL) sized prawns are sold from P500 to P650/kg. The market for these sizes is limited to exporters and processors who have agents and buyers in major aquaculture areas as well as in the cities of Pagadian, Ozamiz and Cagayan de Oro. Prawns with sizes lower than XL sell for P300 to P500/kg. All other products that are not bought by exporters are sold in local markets and in nearby cities in Cagayan de Oro City at P180 to P450/kg.

Issues and Concerns

<u>Prawn diseases.</u> The major concern of fishpond operators is the attack of prawns by luminous bacteria. There has been no major breakthrough on the prevention of bacterial infestation, or on the cure for bacterial infection of prawns. Operators simply under stock their ponds to reduce possible losses in case bacteria strikes or they immediately harvest their product to cut losses from their operations. Another concern is the rise of *bakwit*, a weed that hinders the movement of cultured organisms in ponds.

<u>Lack of capacity building trainings.</u> Operators see the need for more trainings, seminars, and workshops on aquaculture technologies that would help them improve their production levels. The improper management of fishponds and the lack of

proper supervision in its operations are significant factors of the profitability of pond operations. For some, the absence of sufficient brackishwater supply was cited as a limiting factor of fish production.

Unstable peace and order situation. Fishpond development in Dimataling is dependent on the rehabilitation of underdeveloped fishponds and in the intensification of operations. However, businessmen are wary to invest in Dimataling because of unstable peace and order condition.

Others concerns. The moratorium imposed by the government in the development of fishponds out of mangrove forests, the observed adverse impact of aquaculture on the aquatic habitats and the high investment cost of fishpond development have discouraged potential developers from entering the industry.

5.2.3 Fish Cage Operation

The culture of other commercially-important fish species in cages is still in its infant stage. So far, fish cage operations were merely pilot operations to determine the adaptability and profitability of fish cage operations using endemic species. Initially, there were fish cage operations constructed in Barangay Buburay and Sumpot (3 modules). Using funds from the Zamboanga Peninsula Upland Lowland and Coastal Resource Management Project (ZP ULCRMP) in 2005, the operations had some 20 beneficiaries and operated under the supervision of the local government unit. Unfortunately, the demonstration project failed to arouse the interest of the coastal dwellers, as initial inputs are considerable especially in the fabrication of cages.

Squid fry are abundant in the wild—the technology of growing them in captivity, however, has not yet been adequately tested.

There were private individuals who also experimented on culturing endemic fish species in cages but they lack the technical know-how necessary for successful operation. For instance, fry and fingerlings of *siganids* and groupers were generally stocked whenever they are available, and stocking density was based on the availability of seed stocks. When sufficient fries are not available, the operation is understocked, on the other hand, when fries are overly available, the fish cages are overstocked.

Due to the lack of recorded information of growers, the profitability of cage operations cannot be ascertained. There is optimism, however, on the part of the operators that indeed, fish cage culture of finfishes is highly profitable. Most operators use fry from the wild as they ensure high survival rates until harvest. So far, no hatcheries for groupers have been established and the only *siganids* hatchery cannot produce enough fry should cage operations goes full blast.

Fish culturists are also demonstrating some interest in culturing sea cucumber, lobster and squid in cages and to fatten crabs in fish pens (table 6). Crab fattening was not sustained for lack of crablets or fattening stock. Since abalone, sea cucumber, squid, and sea urchin are naturally present in the area, fishermen believe they would thrive and grow in Dimataling.

Fisherfolks expressed interest to attend seminars, workshops and trainings on aquaculture techniques on how to grow endemic species under different culture systems. They are, however, constrained from going into cage culture of finfishes by the lack of capital to

construct a unit. According to estimates, the construction cost of a unit of fish cage is at least P75,000.

Table 6: Recommended aquaculture activities to be developed in Dimataling
(Ranked as follows: 1- first choice, 2- second choice, 3- third choice,..)

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	1 to 2
Seaweed farming	1
Lobster in cages	5
Crab fattening	2 to 3
Sugpo or lukon growing in fishponds	2
Squid culture in cages	4

5.2.4 Local Policies

The municipality has no ordinance that regulates aquaculture activities. The LGU appears helpless or indifferent to fishpond operations. It generally views the fishpond industry as a concern of national agencies like the DENR and DA-BFAR. The Municipal Revenue Code imposes certain taxes on fishpond operations but collection is not aggressively pursued as some fishpond operators are reportedly not paying any taxes.

The exploitation and use of the municipality's coastal waters has remained open access due to the failure of the municipality to adopt and implement its coastal resource management plan. Anybody who wishes to establish his seaweed farm gets the approval or clearance of the top barangay officials in the area for any vacant space. There may be fees for transaction of this nature but none is declared official. It has become the responsibility of barangay officials tolerated or allowed by the municipal government to settle or resolve any issue on site allocation, determination of passageways among farms, and the determination of major navigational lanes in municipal waters.

The municipal government views seaweed farming as a basic livelihood of fisherfolk and not as a source of revenue. No permit or tax is imposed therefore on growers.

5.2.5 Institutions Involved

LGU Units

The Office of the Municipal Agriculturist assist seaweed growers gain access to trainings and technical assistance, capital from external funding sources, and in the acquisition of common facilities like solar driers.

Although without any legal basis, barangay officials are primarily responsible in maintaining order and harmony in the use of the coastal waters.

Livelihood Associations

The inability of fishpond operators to form an organization made it difficult for them to gain access to the services of government agencies and external institutions. This may partly explain their low farming technology and consequent below par production

Recently, seaweed growers in each barangay have been organized into associations through the initiative and assistance of the Fishery Technician in the Office of the Municipal Agriculture. As a result, opportunities for technical assistance and services were opened—members have availed training programs on the proper culture of seaweeds, the choice of species appropriate to site or farm conditions, and post harvest techniques.

The seaweed growers associations are expected to grow into full-blown cooperatives that will provide services, credit and marketing to members. At present, because of the lack of banking institutions in the community, members continue to avail of the services of buyers as source of production capital or from loan sharks for emergency needs.

External Institutions

In 2005, the Department of Science and Technology (DOST) granted the Basufica Fisherfolk Association some amount for the construction of a stilt drier. A grant is currently being negotiated with the Department of Trade and Industry (DTI) for the construction of a new seaweed drier. The grant requires the grantee association to provide counterpart labor and light materials in the construction of the drier (stilted cement platform). The DA-BFAR Region 9 has also been obliged to extend training and extension assistance when requested.

5.3 Dinas

Dinas is one of the coastal towns of southeastern Zamboanga del Sur. It is located in the Baganian Peninsula, bounded on the south by the municipality of Dimataling and on the north, by the municipality of San Pablo. The municipality is characterized by hilly, moderately hilly and slightly rolling land forms. Rain waters are drained from the rolling hills and empty into Dinas, Guinicolalay and Sibol Rivers down to the coastal waters. The coastal barangays stretch from Tarakan down to Locuban and are partly protected from monsoon winds by Pisaan and Ticala Islands.

Figure 11. Satellite map of Dinas, Zamboanga del Sur

Dinas is once known for its dense and extensive mangrove forests. It used to have the largest expanse of wetland and mangrove forest in the entire Zamboanga del Sur Peninsula. At present, the town has the largest seaweeds and fishpond areas in the Zamboanga del Sur side of Illana Bay. A number of coastal resource management activities have been introduced in the municipality to protect its already dwindling aquatic resources.

5.3.1 Seaweed Farming

The fishermen of Dinas started the culture of seaweed in the late ’80s. Since then, a vast expanse of coastal waters in Barangays Tarakan, Sambulawan, Sungayan and Pisaan had been developed into seaweed farms, making Dinas the municipality with the largest aggregate of seaweed farms in the province. Tarakan alone has more than 1,000 hectares of seaweed farms that extend beyond 6 km from the coastline.

An estimated ninety-five percent (95%) of households in these coastal barangays are currently involved in seaweeds production. Almost all near shore areas have been claimed[5] by residents.

Dinas seaweed growers plant variants of the *Kappaphycus* and *Eucheuma* spp. which are variously called *pollutant*, “giant”, or *cottonii* by the growers. Seed stocks are either cultured by growers or bought from various sources in Margosatubig, Tukuran and nearby nurseries.

[5] Ownership is claimed by simply staking a particular area

The more enterprising growers go as far as Bohol and Tawi-Tawi to look for disease-resistant, salinity-tolerant, and fast-growing stock. The method of farming is generally conservative.

Since production is continuous, other growers reserve from 10% to 20% of their harvest as starter stock for the next cropping.

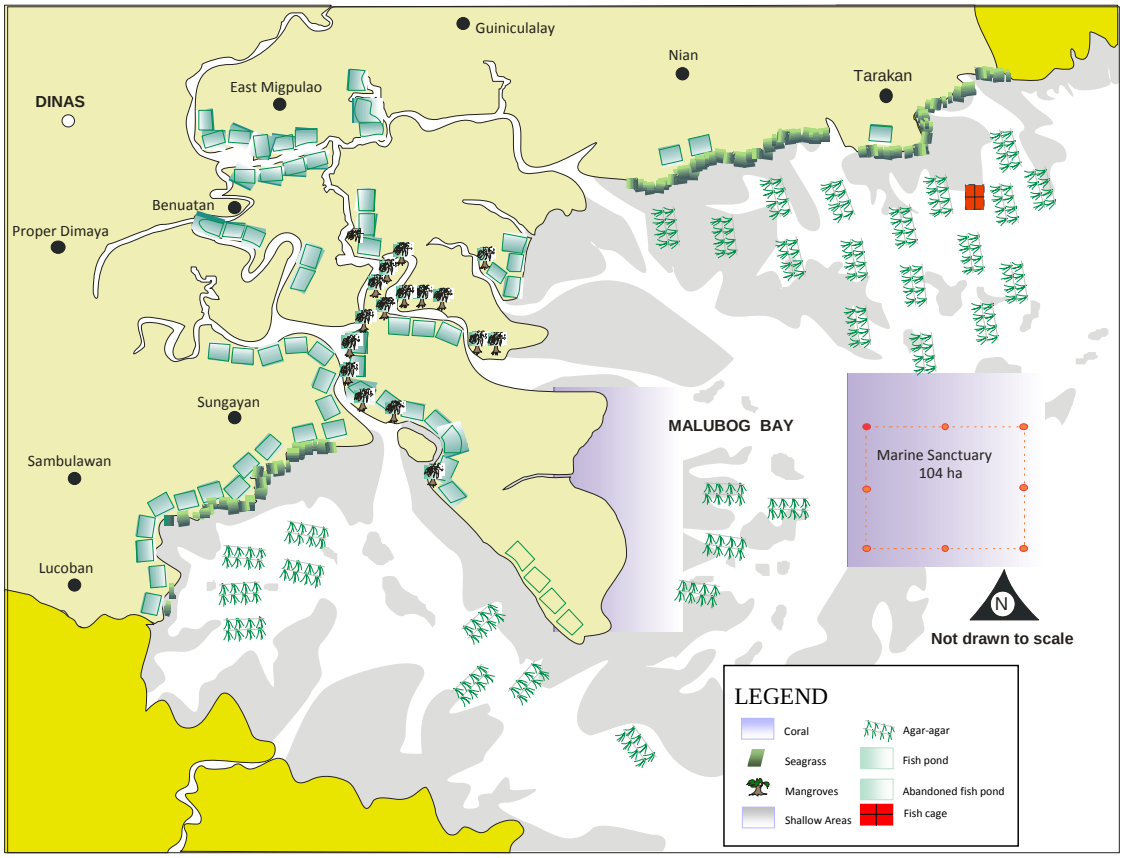


Figure 12. Resource and habitat map of Dinas, Zamboanga del Sur

The area devoted to the culture of seaweeds in Dinas is significantly wider than the farmed areas in the other municipalities. The growers use the long line method of culture— the lines measure between 100 m and 190 m long and are spaced 1 to 2 m apart from each other. In deeper areas, the lines are spaced far between, from 2 to 3 m apart to prevent the plants from touching each other.

The seedlings are planted at the rate of 3 to 5 seedlings per meter; and every cutting weighs 200 gm to 250 gm each. The plants are cultured for 45 to 60 days and then harvested completely. The survival rate is 85% to 100%. Every cutting yields 2½ kg to 3 kg at harvest time, or after 45 days of culture. Accordingly, a 150 m line yields from 1 to 3 sacks of fresh seaweeds, or 100 kg dry weight. Another 120m line yields from 80 to 90 kg dried seaweeds.

Seaweed farming in Dinas is done year-round. Some growers have, over the years, gradually invested in stronger lines that could withstand wave actions regardless of the season. Every cropping, a roll of mono line (approximately 200 m long) costing P1,500 is added to the

existing lines until the grower has enough lines in his one hectare allocation. The total construction cost averages P3,000 per 100 m/line.

After the culture lines had been established, the grower only needs to buy a soft tie or plastic straw to tie the cuttings to the line every operation. To keep the lines afloat, the growers use either cellophane filled with air, or empty plastic water bottles; lately, growers use styrofoam. Big stones and *ankla* are used to anchor the lines in the sea bottom. Anchors are especially used in farms located in deep waters.

Motorized boats with 6 to 7 hp are needed for deep sea water farming. Boats costing P18,000 to P25,000 are part of the fixed costs in seaweeds production. The boats are used in setting out the culture lines in deeper portions of the culture area and during harvesting. Some use motorized boats in transporting the harvest to buying stations. The products are usually sold fresh or dried, depending on the availability of stilt driers or on the grower's accessibility to one. Some growers dry their produce for 2 to 3 days in stilt driers from BFAR while others place the wet plants directly on the sand or ground, or on nylon nets that serve as drying mats. Five to 7 kg of wet seaweeds, depending on the species, produces a kilo of dried seaweeds. A kilo of wet seaweeds sells for P3 to P5 while a kilo of dried seaweeds sells for P31 to P38.

Labor is usually done by family members but big time operators hire laborers. The cost of labor is dependent on the kind of work that will be done: staking is P50 per *usok*; tying cuttings in the line is P2 per *dupa;* cleaning the plants is P100 to P150 per day; and the cost of transporting sacks of dried seaweeds is P40 to P50 per sack. Seedlings are bought at P5 to P10 per kilo. Everything considered, growers claim they spend between P4,000 and P5,000 as operating costs per hectare per year.

Net Income

Seaweeds farmers earn between P7,000 to P30,000 every four or five months, the amount depending on the area and number of lines a grower operates. On the average, a grower earns between P1,000 to P1,500 per line per crop. The more lines he operates, and the longer the lines, the greater would be income.

ROI

A number of fishermen and coastal residents have turned to seaweed farming not only to augment their incomes but also as their major economic activity. This is because seaweeds proved to have higher ROI, from 50% to 300%, than their other production activities. Initial investments could be recovered in only one to three croppings, or in less than a year of operation. A grower can recoup his expenses in only one operation if he starts with at least fifteen 100m culture lines. The lines used in the production process could be recycled thus the farmers need only to spend minimal amounts for the succeeding operations.

Marketing

Compradors determine the price of the produce. Marginal growers get operating capital and sustenance from *compradors* and financiers who are wholesalers or agents of seaweeds exporters and processors. The harvested seaweeds are brought to a local buying station, sold directly to a local comprador or delivered to a buying station or warehouse in Pagadian City then shipped to Zamboanga City or Cebu City. The greater share of

harvested seaweeds from Zamboanga del Sur is shipped to Cebu City, where the biggest processing plant is located.

Financing

To further develop the seaweed industry of the municipality, the local government of Dinas, with help from IBRA 9 and BFAR and other agencies, is providing microcredit and other forms of livelihood assistance to seaweed farmers in 10 coastal barangays[6] of the municipality. Seaweed growers were given stilt driers and seaweed nursery by BFAR and the Livelihood Enhancement and Peace Program (LEAP) of the government, and other forms of assistance by PADAP, TESDA, DOST, and other government and nongovernment agencies. For instance, EcoGov, through the DENR, assists the municipality in capacity building on MPA management.

There are other financing options available to the seaweeds growers of Dinas. Prospective growers can loan their starting capital at reasonable interest rates from the municipality's cooperative which also serves as a mini-bank. The municipality is also a beneficiary of livelihood grants and aid from national and international organizations.

Some growers still find it difficult to access loans and therefore lack the necessary capital to set up the optimum number of lines. Sustenance fishermen had to borrow money from *compradors* to set up their culture lines; some end up selling their produce to their financiers at reduced prices.

Issues and Concerns

Economic concerns. Growers are concerned with the uncontrolled proliferation of seaweed farms throughout the municipal waters and the possible impact of the uncontrolled expansion on their own operations. Moreso, some entrants are financiers and *compradors* who are not from their barangays.

The number of driers currently available is not enough for the needs of all the seaweed growers of Dinas. Constructing a drier requires capital that is beyond the capability of most growers to put up. Some growers find it hard to access credit sources and therefore fall prey to money lenders and *compradors* who pay for their produce in advance. At harvest time, these growers are tied to and saddled with debts and are left with no money to buy seedlings for the next cropping. Others are so hard up that they resort to partial harvesting of their crop in times of emergency.

Social concerns. The peace and order condition in the municipality is unstable. The development of coastal barangays is hampered by clashes between certain clans and political groups. Some growers have relocated elsewhere as coastal areas are open to different armed groups.

Seaweed farmers, especially those with lines that are located 1 or 2 km away from the shorelines were wary of the constant threat of pirates or extortionists. They also complained of blast fishing that cut their lines and damage their stock. Blast fishing usually occurs in deeper areas of the farms where school of fish take shelter beneath the

[6] Source: Dinas CRM Plan

seaweed stocks. *Bantay Dagat* patrols are not that effective in deterring the incursion of bad elements due to the wide expanse of the coastal waters.

Environmental concerns. The proliferation of seaweed farms have brought with it some risks that when left unchecked could lead to irreversible environmental degradation. The sea bottom have been littered with cellophanes, plastic bottles and other nonbiodegradable materials that could accumulate to critical levels and adversely affect the health of seaweeds and other benthic organisms.

Growers are also concerned of the flow of current from Cotabato City and the flooding of rivers. During the southwest monsoon, water lilies from Cotabato are deposited along the coasts. The current bring debris, cellophanes, dead animals, and driftwoods from Cotabato River that gets entangled in culture lines sometimes to the point of destroying the lines. The floods cause a drop in salinity of water that makes the seaweeds plant susceptible to diseases.

Technological concerns. Barangays where seaweeds are cultured (more specifically, Sambulawan, Pisaan, and Locuban) are concerned about the expanding seaweed farms, the growing number of families engaged in seaweeds culture, the construction of more stilt driers and the establishment of seed banks and nurseries and credit facilities. At times, the growers find it hard to secure quality seedlings.

Because of the absence of driers, the products were sometimes sold raw and without added value. The *ice-ice* disease has also been a perennial problem among seaweed farmers. Many farmers immediately harvest their stock when the disease is already affecting 40-50 percent of their plants. Seaweed growers demand for seminars and trainings on seaweeds culture, especially relating to the control of seaweeds diseases.

5.3.2 Brackishwater Aquaculture

Dinas has some 3,000 hectares of fully developed fishponds[7] carved out of its once dense mangrove forests. In the late '60s, mangroves were cut for charcoal and the swampland gave way to massive fishpond development in the '70s. Currently, these fishponds are extensively operated in the barangays of East Migpulao, Benuatan, Sungayan, Pisaan (where 33% of the population are involved in the industry), Guinicolalay (in Sitio Baka), Nian, Tarakan, and in Sambulawan, with the first 3 barangays accounting for majority of the total fishpond area in the municipality. The fishponds were carved out of mangrove forests

[7]Source: Dinas Municipal Economic Enterprise Development Plan

and from tracts of land under public domain; because of lack of funds, some ponds remain underdeveloped.

Shrimps and milkfish are the commonly cultured fish species in these ponds; prawn fries are sourced from the wild or from hatcheries; milkfish fingerlings are generally from the wild. The fry of shrimp, milkfish and mangrove crabs still abound in Dinas and continue to be the source of stocking seeds. At the peak of *sugpo* culture, however, some tried to source out their shrimp fry from the hatcheries of Kumalarang, Pagadian City and Tukuran. Some operators also allow wild fry of any kind into their ponds at the ingress of tidal current, culture them in such mixture or segregate them after a certain period for separate culture.

The culture method used is extensive or traditional, depending on the availability of fry. The average stocking rate is 3 post larvae per sq m but most times the ponds are under stocked. For instance, a 6-hectare prawn farm is stocked with only 30,000 prawn fry and 3,000 milkfish fingerlings.

Fishpond operation is done year round, every 4 to 5 months, or a total of 2 to 3 croppings per year. In the absence of diseases, survival rate is relatively high—75% for prawns and 90 to 100% for milkfish.

Production depends on the stocking density, production performance of the cultured organisms, and survival rate at harvest time. The 6-hectare fishpond stocked with 30,000 prawn fry and 3,000 milkfish fingerlings harvests only between 150 kg to 200 kg of prawns per hectare when survival rate is 75%. On top of this, on a per hectare basis, there are 200 kg of milkfish and around 50 kg of crabs and other fish species that enter the ponds with tidal water.

Investment and Operating Costs

Most of the fishponds in Dinas were developed in the late ‘70s and early ‘80s. At the time, development cost was around P25,000 to P50,000 per hectare depending on the previous state of the area. The major cost items in pond development were clearing, excavating, diking, and the construction of the supply canals. Most of the fishponds are located in what were once mangrove areas and rice farms.

Fishponds are more expensive to operate than other aquaculture business enterprises. Aquaculture inputs consist of fry, fingerlings, pesticides, fertilizers, feeds (beginner, grower and finisher), labor, and medicines. The cost of commercial feeds and fry eats up much of the operating costs. Feeds in pellet-form cost more than P600 per sack; to cut on costs, some operators use rice bran, camote, squash, or ground trash fishes either as supplements or as substitutes of commercial feeds.

The cost of labor is around 20% of the total operating costs. Transportation costs are usually shouldered by the buyers themselves.

Extensive farming methods of producing prawns and shrimps and milkfish in ponds cost at least P10,000 per hectare/per cropping exclusive of the cost of fry and commercial feeds. Fries are purchased from hatcheries or from fry collectors by the operators themselves. Prawn fry are bought at P300/thousand while milkfish fry are bought at P1/piece. At 3 fry/sq m, the cost of fry is approximately P9,000 so that extensive farming costs at least P19,000/hectare/cropping.

Financing

Dinas has a cooperative that serves as a mini-bank to the residents. Most fishpond operators, however, depend on the buyers of their products for their financing needs. The local government, on the other hand, gives grants-in-aid to selected farmers through the local fishermen-farmers associations or cooperatives.

Marketing

During the advent of *sugpo* culture in the '80s and mid '90s, Dinas almost took center-stage as the hub of shrimp trading in Zamboanga del Sur. Though most fishpond operators in the area settled with extensive culture and production per area—they were not comparable to that of intensive farms in the Visayas and other parts of Mindanao—the bulk of the produce of Dinas and neighboring towns made the difference. Buyers, exporters, and agents from Zamboanga City, Cebu and Manila put up their buying stations in strategic locations in the municipality. Producers need not go to Pagadian to deliver their products. AAA Exporters, for example, has a buying station adjacent to the fishponds in Barangay Benuatan which is also accessible to producers from the other barangays.

When the shrimp industry collapsed, the number of buyers declined. Nonetheless, shrimp buying stations have remained in the economic landscape of Dinas to this day.

There are also fishermen in Benuatan who engage in fish trading and act as *compradors* of locally produced aquatic products. Along with other compradors and financiers, they usually control the prices of the harvested products.

Prices

Fishpond operations in Dinas yield super jumbo and extra-large (XL) sized prawns which cost between P500 and P650 per kilo. Tempura-sized prawns cost between P300 to P400 per kg ex-farm. Super jumbo prawns comprise 10% of the total catch. Prawns that do not fall within the exportable sizes are sold locally at lower prices. These are priced from P250 to P350 per kilo ex-farm.

Milkfish are usually sold to local *compradors* and fish dealers who bring the fishes to Cagayan de Oro and the other nearby cities. Ex-farm prices range from P40 per kilo for small sized fishes, P45 for medium-sized ones and P55 for large fishes.

A fishpond operator expects to earn P180,000 per cropping[8]. At 1 fry per sq m, an operator expects to earn P60,000 per hectare per crop. When stocking density was only 1 fry per 2 sq m, the income was only P30,000 per hectare per year. Fishpond operators estimate their incomes from pond operation at P20,000 per hectare per crop. At its worst, an operator gets less than P10,000 per hectare. In harvests are good, the investments could be recovered in just 1 to 1 1/2 years or in just one operation. Payback period is from 1 to 3 years.

[8] At 50% survival rate of 3 fry per sq m and at a price of P300 per kilo of tempura-sized prawns.

Issues and Concerns

Economic concerns. Despite the profitability of pond operations, there were operators who have abandoned the development of their ponds because of financial constraints. Pond development and improvement is expensive and capital intensive. Abandoned fishponds are hoped to be rehabilitated and operated to become sources of additional income of operators.

Social concerns. The major problem faced by fishpond operators in Dinas is the unstable peace and order condition in many of its barangays. Fishponds in Pisaan for instance, were abandoned because of armed encounters between armed groups and the military in the area. Another barangay, Sungayan, had also become a no man's land due to conflicts between certain clans. These fishponds could have been rehabilitated and operated if the place was peaceful.

Fishpond operators also complained of poaching in ponds and the poisoning of rivers. Caretakers need to make extra precaution and should be properly and adequately armed especially near harvest time.

The other concerns identified by fishpond operators include the need for better roads to make ponds in remote barangays more accessible and security on the ownership of farms as most fishponds are not covered with fishpond lease agreements or titles.

Environmental concerns. Some residents in the municipality continue to practice illegal fishing methods, unregulated harvesting of fish, and the cutting of mangroves.

Continuous rains cause flooding in East Migpulao and Locuban. When rivers overflow, fishpond dikes are destroyed causing production losses among fishpond operators. Damaged fishponds take time and money to be repaired. Some Migpulao fishpond operators have planted bamboos along riverbanks as a flood control measure; they have also requested a flood control project to the LGU.

Another concern of seaweed growers is the use of pesticides in agriculture, particularly Thiodan. Growers also identified the practice of using poison to catch or harvest fish from rivers as an indirect cause of poisoning of the pond stock.

Stakeholders also need to be informed of the adverse impacts of mangrove cutting and culture methods that can harm the environment. There should be regular seminars on coastal resource management among these stakeholders.

Technological concerns. Prawn production in ponds could be maximized if fishpond operators apply intensive culture methods. However, intensive methods are very expensive and if uncontrolled, lead to environmental damages. The growers should be taught aquaculture concepts, principles and techniques to control the adverse environmental impacts of intensive culture methods. Fishpond operators strongly suggest for more trainings, seminars, and workshops on the different culture techniques.

Dinas has a lot of room for aquaculture ventures. Abandoned farms and undeveloped or underdeveloped farms can be rehabilitated and developed into friendly aquaculture farms .These are potential sources of millions of pesos worth of prawns and milkfish.

The fishponds can also be utilized for crab fattening. Fishpond operators who were into crab fattening said that it is feasible and profitable. Crablets, however, are not available in commercially viable number—the supply of crablets from the wild has declined to critical levels. There is a need for a crab hatchery to produce the crablets for commercial crab fattening operations.

Over-all production of crabs has been considerably low due to financial constraints, crab culturists simply feed the animals with trash fishes, crashed seashells and other refuse.

5.3.3 Fish Cages

Dinas was a beneficiary of fish cages from ZPULCRMP for the culture of *siganids* and groupers. According to the fishermen, fish cage operations in selected coastal barangays showed its viability and feasibility as a potential alternative livelihood activity in the municipality.

Dinas is also a natural breeding ground of commercially important fish species. These endemic species include: *kitong*, danggit, pugapo, lambay (blue crab), kinhason and talaba (seashells), lukon (prawns), *bangus* (milkfish), nooks (squid), talakitok, and olang (shrimps). Fry and fingerlings from these species are naturally available at certain months of the year (table 7).

Table 7: Seasonal abundance of *siganid* fries in Dinas, Zamboanga del Sur, 2007

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
									Kitong and danggit fry are reported as abundant.					

Issues and Concerns

The major limiting factors for the success of fish cage operations are: (1) the lack of capital of fishermen to put up the structure, (2) the declining supply of fry and fingerlings from the wild and, (3) the absence of know-how of potential operators on the basic technical and environmental requirements of different fish species for culture. All these contributed to the failure of most fish cage operations of BFAR and the local government unit in the municipality.

5.3.4 Local Policies

National laws regulate the conversion of mangrove areas or swampland into fishponds. The DENR and DA-BFAR are the primary agencies of the government to implement policies along this development. However, the regulatory arms of the national government have limited powers in areas like Dinas where traditional and hereditary ancestral rights are still strongly invoked by the natives. Until now, the exploitation or development of the mangrove forests of Dinas depends on the natives.

The local government of Dinas does not have any ordinance or standing policies on aquaculture. The LGU is not involved in concerns regarding fishponds except in the area of

permits and taxation. However, even this is not properly implemented as most fishpond operators do not pay operation's permit or taxes on production.

The adoption of the 10-year CRM plan in January 2004 somehow addressed certain issues affecting the practice of aquaculture in the municipality. This includes the zoning of resource use areas and navigational routes in the coastal waters; the preservation of critical habitats which led to the strengthening of MPAs and the creation of a wildlife park in Pisaan; and proper waste disposal. The registration of resource users, such as fishers, seaweed farmers, fishpond and fish coral operators has not however been implemented.

Although the area for seaweed farming has already been identified and fixed by local law, the access to the resource remains open. Anybody who has the capital to establish a seaweed farm may do so in an unclaimed or underutilized area through a permit or consent of the claimant and the barangay officials of the locality. In other words, the coastal water is not reserved for certain stakeholders, such as small fishers. Thus, fishpond operators, upland farmers, and even government employees double also as seaweed farmers to augment income.

5.3.5 Institutions Involved

LGU Units

The barangay governments assume responsibility in maintaining social control in the seaweed farming areas of Dinas. Barangay officials promote and uphold social agreements among farmers, especially in determining farm access and passageways, farm expansion, accommodation of new comers, and accidental damage to properties. Some agreements common in barangay ordinances are the imposition of P5,000 penalty on anybody who accidentally cuts or destroys a seaweed line. This ordinance makes seaweed farmers or fishers extra careful in navigating their boats in seaweed farms.

The offices of the municipal agriculturist and coastal resource management monitor the development, needs, and concerns of sea farmers. They facilitate the conduct of seminars and trainings to update farmers' knowledge and skills in growing seaweeds. They coordinate with barangay officials, the FLET, and Bantay Dagat teams in ensuring that navigational routes are always clear of any impeding structure and protected areas are not usurped by fish coral or invaded by seaweed lines. The protection of marine protected areas and the sea farms are also the primary responsibility of above law enforcement teams. Their performance has been stymied by the hit and run maneuvers of violators.

Livelihood Associations

The Tarakan Fisherfolk Multi-purpose Cooperative (TFMPC) stands as a symbol of economic and social cooperation among small fishers and farmers in Dinas. The coop offers small loans to members for operational capital and family emergencies. The TFMPC suffers from low loan repayment rate but manages to survive through the loyalty of members.

The Zamboanga Sur Government Federation of Employees Cooperative (ZAMSURGOFEMCO) is another source of credit in the area. Originated in Dinas

some 30 years ago, it is the most decorated provincial cooperative that offers varied services such as credits, consumer goods, catering, printing, etc. to its members.

There are no banks operating in Dinas. Other than the coops, pawnshops and loan sharks figured out as the other important sources of operational funds among seaweed farmers.

External Institutions

DA-BFAR provided a grant, through the local cooperative, for the construction of two silt driers in Tarakan. Beneficiaries provide labor and light materials such as bamboo slats as counterparts. The DA- BFAR also offers seminars and trainings to seaweed farmers upon request through the municipal agriculture office.

During the early years of seaweed farming, the Philippine-Australian Development Assistance Program (PADAP) granted TFMPC P300,000 to expand its loan services. This infusion of capital to the cooperative helped leapfrogged the seaweed industry in the area.

5.4 San Pablo

The municipality of San Pablo used to be a part of Dinas until Christian pioneers organized it into a separate municipality. Situated in the Baganian Peninsula area, it is bounded on the North by the municipality of Dumalinao; on the South by the municipality of Dinas; on the West by the municipality of Guipos; and on the East by Illana Bay. The original Subanen settlers used to call the place "Malbog" while Muslims who came later called it "Malubog" which means turbid water.

San Pablo is accessible by land through rough roads, and by water through rough turvy waters of Illana Bay. The land area is characterized as gently undulating and moderately rolling, sloping in many directions. From the west, the land slopes towards the eastern portions, linking the coastal area with mangroves. Farming and fishing are the principal economic activities. Its major crops are corn, coconut, rice, and marine products.

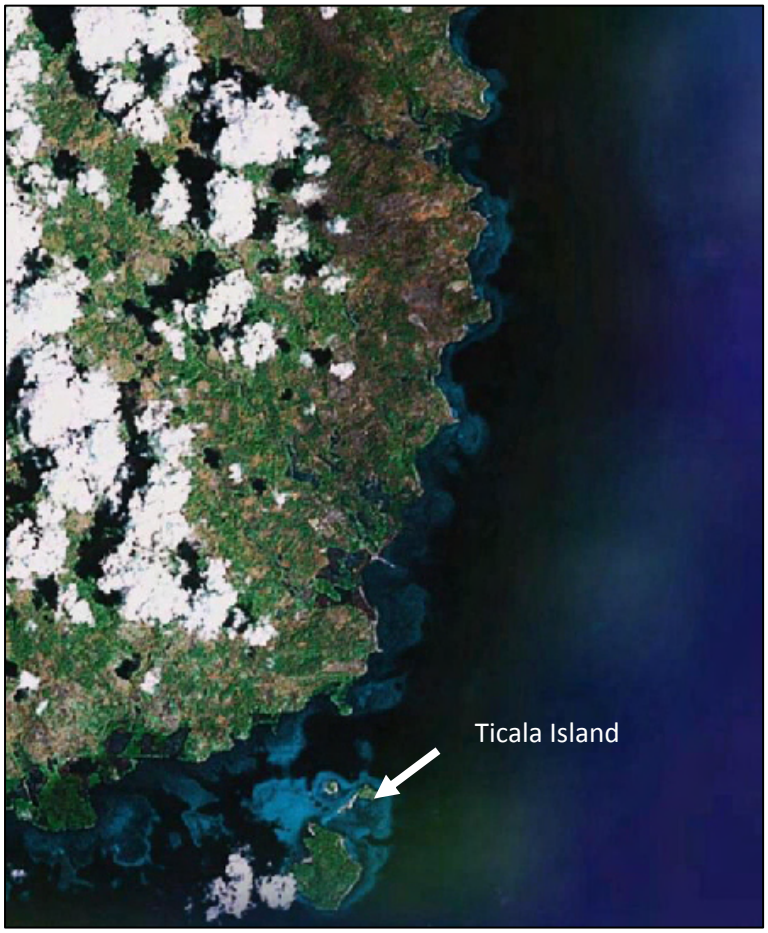


Figure 13. Satellite map of San Pablo, Zamboanga del Sur

The municipality has three fish sanctuaries. The fishing ground and coastal areas between the Poblacion and the Ticala Island are considered as highly productive and an ideal site for aquaculture development.

5.4.1 Seaweeds

Seaweed farming is a relatively new livelihood activity for some 150 small fishers of San Pablo. However, year-round farming is only limited to the coastal waters protected by the island of Ticala, the rest of the coastal areas of the municipality are exposed to the turbulence of southwest monsoon weather that makes seaweed growing unprofitable.

Seaweeds are farmed in barangays facing Ticala Island: Ticala (22 has), Buburay, Tandubuay (2 has), Buton (6 has), Marcos Village, Sagasan, and Bubual (10 has). The Tibutabo area (composed of Barangays Ticala, Buburay, Tandubuay, and Buton) was identified by the growers as the best seaweed producing area because of the favorable water conditions, Ticala Island acts as buffer against the monsoon winds (figure 13).

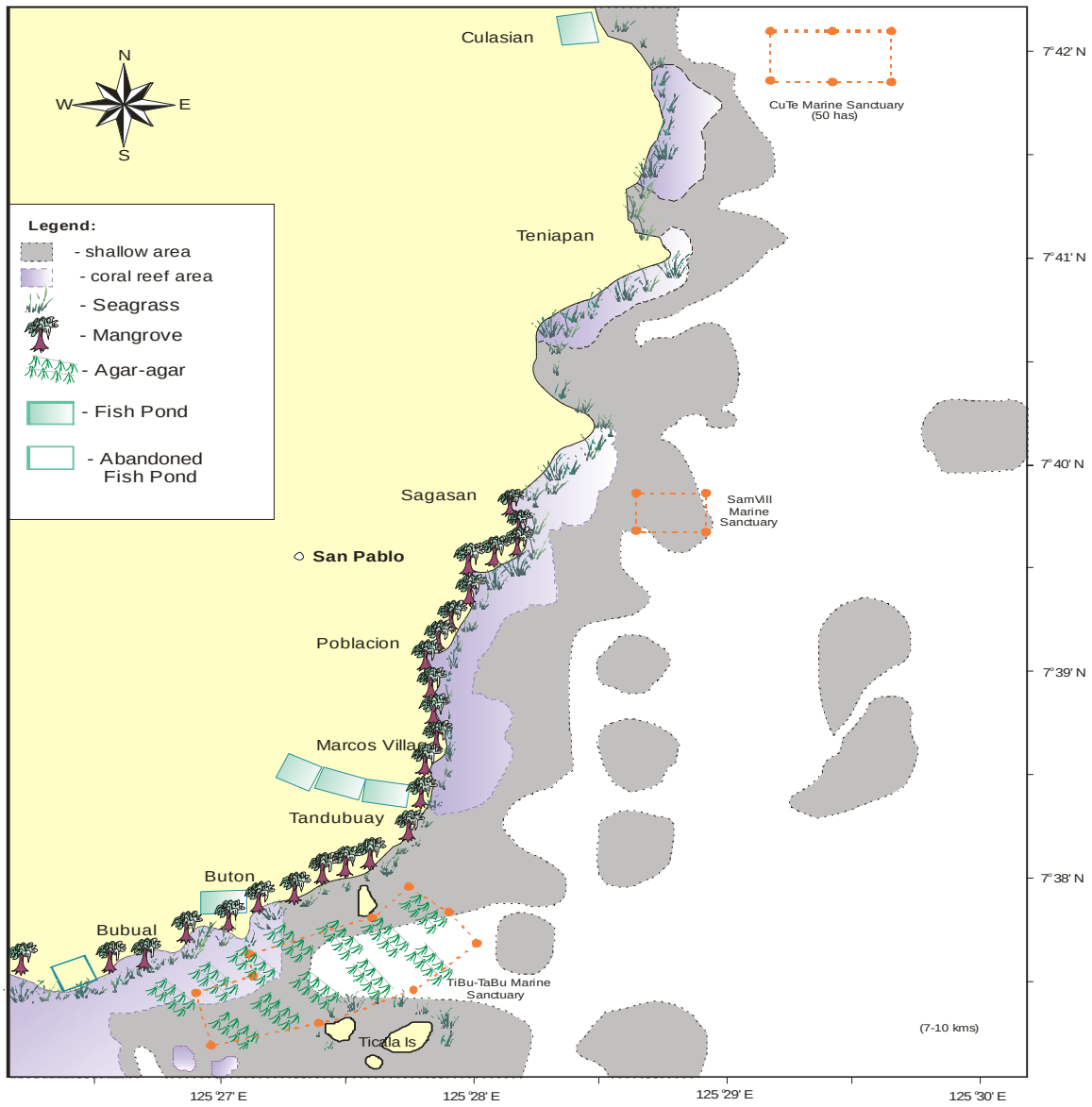


Figure 14. Resource and habitat map of San Pablo, Zamboanga del Sur

About 80% of the fishing households in these barangays are seaweed farmers. Similar to other municipalities, farmers can establish their farm in any area as long as it does not overlap with existing farms. The usual farm size is one hectare (100 m by 100 m).

Growers culture different varieties such as *tambalang*, *polutan*, *pulahan*, "Giant", *Tagbilaran and* "Vanguard". The stocks come from the nurseries in Pagadian and Sindangan in Zamboanga del Sur, or are grown by the growers themselves. A grower sometimes leaves 4 lines out of his 100 lines as starter stock for the next cropping. Some local growers also operate seaweeds nurseries.

Technology

Some 40 to 100 lines are placed over the width of the area, and spaced from 1 m to 3 m from each other; the number of lines could be increased to more than 100 when they are spaced less than 1 m from each other. As in other farms, 200 to 250 gram cuttings are planted one *dangaw* (approximately 5 to 7 inches) distance apart. These grow up to more than 1 kg after 1 month of culture to more than 2 kg upon harvesting. Complete harvesting is done every 45 to 60 days. Small growers who have urgent need for money, sometimes partially harvest their seaweeds. The products are usually sold fresh or dried, depending on the availability of driers or on the growers' accessibility to one. In the absence of stilt driers, growers make do with plastic mats and other matting materials. Drying is done for 2 to 3 days.

Production

Seaweeds growers reported a survival rate of 80% to 100%. The harvest rate is approximately 1 sack of seaweeds for every 5 *dupa* of mono line. The number of croppings is 2 to 3 times per year. Seaweed culture remains to be a year-round preoccupation but most growers avoid losses by not planting during the rainy season.

Investment Costs

Seaweed production begins with the establishment of long lines to culture seaweeds plantlets. To set up a one-hectare farm, the grower needs at the minimum, stones as *pundo* or sinkers, mono lines, straw ropes, soft tie, and cellophane bags filled with air as floaters. The total estimated value needed to prepare the farm for planting is P10,000 per hectare.

Production Costs

The cost of seedlings remains to be the major operating expense in seaweeds production. Seedlings are bought at P50 per *dupa*, or P100 per 3 *dupa* of mature plants. Though seaweed stocks are available, the local supply can not accommodate the local demand, additional supplies from far places are available but are more expensive.

The cost of labor is generally implicit and is usually not considered in determining the profitability of the endeavor. Women are usually involved in tying the seed stock in the culture lines while the men set out the lines, clean the plants, guard, harvest and pack the plants for marketing. When the stock is beyond the capability of the grower to handle, he hires laborers to assist in harvesting and transporting products. The average cost of labor and transport is estimated at P50 per sack of dried seaweeds.

Income and Profitability

Most growers started their farms using limited capital and gradually increased the number of culture lines after every harvest. The growers reported earning at least P10,000 every cropping and more during favorable weather conditions. The continued operation and the increasing number of seaweed growers attest to the profitability of seaweeds culture in the municipality.

Financing

Since San Pablo is a remote town, residents have limited access to funding opportunities. Because of this, seaweed growers organized themselves and formed cooperatives through which grants-in-aid were facilitated. There are also SEC-registered seaweeds growers' associations which, in coordination with the barangay councils, were able to source funds for their members.

The agencies that have assisted the different growers associations include: LGSP through IBRA 9, TIFA, ZSOPAD through LEAP which provided capital for *pisi*, seedlings, and other materials necessary to start seaweed farming. The DA-BFAR and lately the USAID through EcoGov which helped established MPAs and assessed existing marine-based livelihood activities.

Marketing and Prices

Five to 7 kg of wet seaweeds, depending on the species (7:1 for *burikat* and 5:1 for *kapalaran dagko*) produce a kilo of dried seaweeds. A kilo of wet seaweed sells for P3 to P4 while a kilo of dried seaweeds sells for P31 to P38. Because of the price difference, majority of growers sell their produce in dried form. Drying is done for 2 to 3 days prior to selling.

The seaweed growers of San Pablo sell their produce to *compradors* who are either independent traders or middlemen of processors or exporters. Generally, the seaweeds are brought to Pagadian where seaweed buying stations and warehouses are located. From Pagadian, the seaweeds are shipped either to Zamboanga City or to Cebu City, depending on the export affiliation of the Pagadian compradors.

Around 9 middlemen or *comprador* operate and maintain buying stations in 6 major seaweed producing barangays of San Pablo.

Issues and Concerns

The coastal waters of San Pablo are productive—as evidenced by the flock of seabirds feeding on its pelagic fishes. This productivity could be maintained if conservation measures are put in place and the issues and concerns of the fisherfolk are addressed. However, some of the concerns are beyond the ability of the growers to solve, such as the transboundary pollution involving drift woods, water lilies and solid wastes from as far away as Cotabato and Pagadian. These wastes are carried by tidal currents and get entangled with culture lines causing lines to break.

Seaweed farming is also threatened by the continuing transport of silt from land-based water runoffs to the coastal waters. Silt makes the waters turbid, suffocates seaweeds, and inhibits their growth and production. Removing the silt from plants requires regular manual labor that is physically demanding and time consuming.

Illegal fishing activities in the municipal waters are also becoming a problem. Fine meshed nets and other banned destructive fishing gears are still being used by some fishermen.

Some of the identified needs of the growers include the following: capital to expand their farm area, disease-resistant varieties, cure for the 'ice-ice' disease, and a technology that would solve the problem of siganids and sea turtle grazing on seaweed plants. Most growers have considered the occurrence of the "ice-ice" disease as part of farming, they simply cut off the diseased part of the plant and bury or burn the cutting.

For turtle and fish grazing, the growers have improvised clanging bottles to drive away the underwater grazers.

Seaweed poaching has also become a social phenomenon. Bantay Dagat patrol now includes seaweed farms in their surveillance of marine sanctuaries. Neighboring groups have also organized their own roving teams to secure their farms especially when the plants are about to be harvested.

Potentials

The Tibutabu area is considered a good area to culture seaweeds. The place is sheltered from wave actions by Ticala Island. Some 163 hectares are available for marine aquaculture activities in Tibutabu.

5.4.2 Fishpond Operations

San Pablo has an estimated 95.30 hectares of fishponds located in Barangays Bubual, Marcos Village, Poblacion, Sagasan, and Tandubuay (figure 10). The pond operations in these barangays employ around 93 families. Cage operations and seaweed farming can be a significant source of revenue of the local government.

The commonly cultured species in San Pablo are milkfish, prawns, shrimps, crabs and tilapia. Fish culture is extensively done–the use of commercial feeds (fish pellets) is minimal, filamentous algae are grown and used as feeds for milkfish. Indigenous materials such as ground *camote*, squash, yellow corn and trash fishes are also used as feed substitutes or

supplements. Most operators prefer fry and fingerlings caught from the wild over hatchery-bred which they consider weaker and slow-growing. Only the more enterprising fishpond operators use hatchery-produced prawn fry which can be acquired in bulk and in uniform sizes.

Marketing

San Pablo is one of the more productive municipalities in Illana Bay as far as fish production is concerned. Buying stations and middlemen is present in most of its coastal barangays. Prawns, milkfish, and other commercially important fish products are easily sold through these middlemen who, in turn, bring the products to wholesalers and agents of exporters and processors in Pagadian City.

Problems and Needs

The operators of San Pablo identified the following concerns and problems: (1) the lack of fry and fingerlings; (2) lack of funds to finance excavation of shallow ponds; (3) lack of know-how on intensive culture techniques; and, (4) degraded water quality in and out of the fishpond.

The municipal waters of San Pablo are heavily exploited. Illegal fishing activities still exist even in designated fish sanctuaries. Fishpond operators have also reported mass fish-kill in their ponds usually during heavy rains or during extremely hot weathers. Fish mortalities are generally attributed to the sudden drop in salinity during heavy rains and the drop in dissolved oxygen in shallow ponds during hot weather.

5.4.3 Fish Pens and Fish Cages

The San Pablo coastal waters have shown a high potential for mariculture activities. A number of commercially-important fish species are endemic in the area and have attract potential operators (table 8). These include *siganids*, groupers, lobsters, crabs, squids, and giant clams. Some fishermen have indicated interest in culturing lobster in cages using lobster juveniles which are locally caught.

To jumpstart cage and fish pen operations as alternative sources of income, the Zamboanga Peninsula Upland Lowland Coastal Resource Management Project put up a one-module fish cage in Barangay Culasian for 8 beneficiaries. LGSP also put up a one-half hectare fish pen with six 3 m x 6 m compartments in Barangay Teniapan. These were initially stocked with *siganids* and later with various fish species. Survival rate was high–between 90% and 95% after 3 months of culture. The structures, however, were destroyed by driftwoods and large debris brought by tidal currents. Among the coastal barangays, Buton had been specified as a good area for fish production in cages.

Table 8: Recommended aquaculture activity to be developed in San Pablo
(Ranked as follows: 1- first choice, 2- second choice, 3- third choice,…)

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	1 to 3
Seaweed farming	1 to 2
Lobster in cages	4 to 5
Crab fattening	2 to 3
Sugpo or lukon growing in fishponds	2 to 3
Squid culture in cages	5

5.4.4 Local Policies

The municipality of San Pablo does not have any local legal instrument to regulate the practice of aquaculture. Fishpond operators and seaweed farmers are free to do their trade with hardly any restrictive intervention from the local government. The LGU considers fishpond development and operation as a concern of DENR and DA-BFAR. Its only entry point in the enterprise is in the area of taxation; but the municipality does not exercise this authority. During the FGD, the fishpond operators admitted that they had not paid any tax to the local government. They said that they do not have any taxes to pay for fishpond operations since it is no longer profitable.

In the absence of laws or regulations, anybody in San Pablo who wishes to plant seaweed may do so as long as the chosen area is vacant or free from priority use right claim. In crowded areas like Ticala, one must have to get a clearance from the barangay chairperson to avoid any potential dispute. Barangay officials assume the role of resolving boundary conflicts, overlapping priority use rights and similar disputes among seaweed growers.

5.4.5 Institutions

Livelihood Associations

The fishpond operators of San Pablo do not have any associations. They operate on their own with no intervention from the local government. The outreach or extension program of the Municipal Agriculture Office concentrates on improving the productivity of small fishers.

As early as 1993, seaweed growers were already organized to become channels of farming technology, capital and other forms of assistance. Buburay Seaweed Farmers Association (BUSFA) was the first organization formed; it was even registered with the Securities and Exchange Commission (SEC). BUSFA was doing well until it was experienced financial mismanagement and closed business. The women counterpart of BUSFA, Muslim Christian Women Association (MCWA), was also doing well for sometime in providing small credits to its members. Later on, it also folded up due to inability of members to pay their loans.

External Institutions

When seaweed farming was just starting in San Pablo, the Local Government Support Programme (LGSP) through IBRA 9 extended financial assistance to participants of its seaweed production program. The assistance financed the acquisition of seedlings and met the training needs of participants. The ARMM-ZOPAD also granted the growers associations stilt seaweed drier with cement posts before their fold up. At present, DA-BFAR continues to extend technical assistance to seaweed farmers upon request through the MAO of the LGU.

5.5 Dumalinao

Dumalinao is a third class municipality of Zamboanga del Sur. It is located in the northeastern part of Illana Bay immediately next to the City of Pagadian. The main livelihood activities in the municipality are farming and fishing.

The inclusion of Dumalinao in EcoGov has led to the establishment of a fish sanctuary in Bibilik and the implementation of coastal-based livelihood projects in the coastal *barangay*s of the municipality. The coastal water of Dumalinao is partly sheltered from the adverse effects of the southwest monsoon thus favoring seaweed production year-round.

5.5.1 Seaweed Farming

Seaweed farming started in Dumalinao with only a few households in the late ‘80s. The success of the early growers triggered an increase in the number of seaweed growers. In the late 90’s, seaweed production peaked and became one of the leading sources of livelihood of coastal folk second to fishing and agriculture. The coastal waters of Dumalinao are partly sheltered from the effects of the southwest monsoon thus favoring seaweed production all year round. Households staked claims over certain areas where they put up their culture lines. When seaweed culture boomed in the 90s, the local government collected taxes from the growers. However, when the incidence of the “ice-ice” disease increased, the amount of paid taxes dwindled from P500 per grower to P200 then to P150 until finally, with the decline in production, the payments and collections stopped.

Dumalinao has a total of 85 hectares of seaweed farms with some 31 operators[9] in at least 6 coastal barangays[10]: Baroy (30 HH or 90% of households are seaweeds growers) Pantad (30 operators), Rebokon (20 operators), San Agustin (7 operators), Sunflower, Bibilik, and Metokong. Around 100 families in all of Dumalinao are engaged in seaweeds growing.

[9] ZPULCRMP, Municipality of Dumalinao
[10] Key informant interviews and FGD

Similar to adjacent municipalities, the species cultured include: *polutan*, "giant", *burikat*, *pino*, *cotonii*, and the "vanguard" which are planted in the deeper portions of the coastal waters. The growers source their seed stock locally (from Rebokon) or they get additional stocks from Tabina in Zamboanga del Sur, Baroy in Lanao del Norte and even as far away as Jolo.

The growers usually maintain 2 farm areas—one that is nearshore where lines are spaced near each other (2 ft to 1 *dupa*), and the other in the deeper areas where lines are spaced far from each other (2 to 4 m) to prevent from touching due to wave actions.

Growers usually use the long line method. Lines could be as short as 55 m or as long as 140 m. Each grower operates a minimum of 6 lines, but more enterprising growers operate more than 30 lines or from ¼ hectare to 1 hectare. The culture period is from 45 days to 2 months and although seaweeds could be grown year round, the growers plant between 2 to 3 croppings per year on the average.

At a survival rate of from 70% to 80%, a producer harvests between 1 to 2 tons of dried seaweeds per hectare per crop.

Production Costs

The major expenses in the establishment of culture lines are mono lines, sinkers and floats. However, small scale growers start with minimum amounts and simply make do with shorter lines to cut costs. For sinkers, they use big stones or bagged sands and for floaters, they use empty water plastic bottles.

Women are usually involved in tying the plantlets in the culture lines while the men set out the lines, clean the plants and guard and harvest and pack the plants for marketing. When the stock is beyond the capability of the grower to handle, he hires laborers to harvest and transport the product.

The cost of seedstock remains the biggest cost item during operations. Seedlings are procured at P2,000 per 3 lines of mature plants or at P100 for every 3 *dupa* of the same or at P50/*dupa*. To augment their incomes, some growers specialize in the production of seaweed seedlings for sale to farmers outside the municipality.

Growers with no driers rent at the rate of P0.50/kg or per *kutay* of seaweed harvested. Others just sell their fresh seaweed at a lower price to be spared of the tedious task of drying the produce. Some growers also rent out culture lines at the rate of P0.50 per *kutay*.

Financing

BFAR financed the construction of two 800-sq-m stilt drier for Rebokon and Pantad and another in Metokong through the assistance of MEDCO. However, the number of driers is deemed insufficient to meet the needs for all the growers.

A five-hectare seaweed nursery is established to supply seaweed stocks for local growers. The Rebokon Fisherman Association also maintains a one-hectare nursery. The members of the Baroy Fisherfolk Association received financial assistance from the LGU in the form of microcredit payable in 7 months. IBRA and BFAR also

provided grants-in-aid and seed money to establish a seaweed nursery for the members of the association. Others who were not able to avail of the services and grants had to generate seed money from seaweed buyers and financiers to be paid from the proceeds of their sales.

Table 9. Weather conditions by months and seaweed cropping seasons, Dumalinao, Zamboanga del Sur, 2007

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Planting season.		Sunny weather triggers the growth of filamentous algae.				Planting season.	Rainy season. Growers avoid planting during these months.					Planting season.	
			Abundance of siganid fry is observed.										

Marketing

The marketing of seaweeds was never a problem because of the presence of buyers in Pagadian. However, despite the high demand for the product, the price remains to be dictated by the buyer. Fresh seaweeds sell at P3.50/kg while dried seaweeds are sold at P33 per kilo. When the supply is low, the price of seaweeds is generally low due to the quality of plants harvested.

Profitability

A grower from Dumalinao who invested P6,000 for seaweed production received a gross profit of P40,000. Payback period is usually 1 to 3 harvests or less than a year of operations. During good harvests, all investments could be recovered after only 1 cropping.

Issues and Concerns

Lack of driers. Most growers complain of the lack of driers which eventually affects the quality of their dried seaweeds. To solve this inadequacy, the members of seaweed growers associations take turns in drying their produce on available driers.

Seaweed diseases. Another major complain of growers is the incidence of "sirin-sirin" that attaches itself to seaweeds and suffocate the seed stock. Filamentous algae grow abundantly during the rainy season, the growth enriched in part by the rain-water run-offs from higher grounds.

Wastes. Flotsams of upland origin like farm wastes, uprooted trees or broken branches, bamboo and shrubs damage seaweed lines during heavy rains. Transboundary urban wastes of plastic or polyethylene materials are carried by tidal currents into seaweed farms during the southwest monsoon and adversely affect maintenance and farm production.

Poaching. Seaweed farms are often left unguarded. Though poaching is not prevalent, it still affects some planters. Organized Bantay Dagat teams from seaweed growers occasionally guard the coastal area. At present, seaweed growers do not see any

adverse impact of seaweed farms. Some growers have expanded their operations to Salampaki and Lawis to take advantage of the favorable water conditions in these areas.

Lack of organization. Most growers are not members of associations, and many associations are not registered with CIDA or SEC and therefore have limited access to grants-in-aid and microcredit for livelihood activities. A seaweed grower's multipurpose cooperative that was earlier established failed. The LGU has a partial list of growers from whom the MPDC used to collect fees. The MPDC stopped the collection when the growers encountered losses.

5.5.2 Fishpond Operations

The coastal landscape of Dumalinao features some fishponds of various sizes at different levels of development or ruin. Fishpond operations in the municipality have been practiced as early as the 1950s but it was only in the 1980s when fishpond production peaked. At the moment, a total of 76 hectares of fishponds located in Barangays Rebokon, Upper Dumalinao, San Agustin and Pantad are reportedly operating in the municipality. The ownership of these fishponds has changed hands over the years. Of the total area at present, 45 hectares is reportedly owned by only one operator.

Pond operations are traditionally done. The *lukon* and *bangus* stock are generally fed with naturally growing filamentous algae and cultured diatoms. The use of commercial fertilizer in the culture of filamentous algae is minimal and the use of organic fertilizer is also limited owing to the unsustained supply of chicken dung. To cut on the use of commercial feeds, some growers fed their stock with finely ground seashells and yellow corn that are readily available. Feeding is irregular and insufficient hence to produce the required fish sizes, operators have to extend operating time.

The stocking rate varies from one operator to another and is dependent on the amount of algae available for food, on the availability of fry, and capital to purchase the fry. The lack of same-sized fry at the time of stocking was one of the reasons cited for understocking. It was observed that stocking rate was as low as 1,500 milkfish fingerlings and 2,500 prawn fry per hectare per crop when prawn is the major crop; and only 16,000 milkfish fry when milklfish is the major crop.

The municipality was endowed with fry grounds. However, many observed that the number of fry and the volume of fish catch have declined over the years. The fry population significantly decline when seaweeds farms proliferated. Because of the low stocking density and because of the lack of proper fish culture techniques on the part of the operators, fish production is correspondingly low. Records show that milkfish production was less than 1 ton per hectare per year and prawn production was less than 500 kg per hectare per year. There was an observed significant shift in the species cultured from prawns as the major species in the 1970s and 1980s to milkfish in the 1990s. The shift followed the massive losses experienced by the operators due to bacterial infestation of the cultured prawns.

Most ponds were not properly managed and became shallow over the years, thus pond waters are easily affected by changes in water temperature.

Economics and Marketing

The market for prawns is still big but only risk-taking operators produce prawns and shrimps. Inputs to fish production are still expensive; and given the risk of bacterial infestation and low survival rates, operators mostly stock prawns in limited number. Overall, pond operators gain profit which when estimated on a per hectare per crop basis, is very low.

The market is always open to the supply provided by the pond operators. Tempura and XL-sized prawns are sold in the export market while those falling outside export quality standards are sold locally.

The cost of pond development had long been recovered but there is need for more capital input to rehabilitate existing fishponds and to further develop underdeveloped fishponds that they may be intensively operated. Rehabilitation and pond improvement should consider the adverse impacts of pond effluents on the overall environment especially when the operator shifts to intensive culture techniques.

Issues and Concerns

The issues and concerns confronting fishpond operators are: the declining natural stock of commercially important fish species, the continuing overexploitation of the natural stock through the use of destructive fishing methods, and the expensive inputs of pond operations.

Fishponds that were earlier constructed have become shallow. Where before the original depth was 6 feet, lately the depth is reduced to only three to four feet and ponds have become more prone to flooding. Fishpond operators complained of lack of capital to improve the ponds or to develop these for more intensive culture.

Furthermore, the operators and their caretakers all need to review the basic techniques of fish production for them to improve their production skills. Most of the operators are still using traditional methods which do not maximize the utilization of ponds for fish production.

5.5.3 Fish Cage Operations

Fish cage operations in Dumalinao were pilot operations initially funded by BFAR. Fish cages costing between P1.2 M and P1.8 M were constructed using BFAR funds and were turned over to the local government unit for them to operate. These came in different sizes and compartments and were established in the waters of Barangays Rebokon, Pantad and Baroy. The cages were stocked primarily with *siganids* from Naawan, and groupers from Pagadian City and Tungawan, Zamboanga del Sur. In the initial runs, the cages were overstocked–the stocking rate ranged from 56 to 83 fingerlings per sq m. Despite this, the survival rate of the stocked fishes at harvest was 50%.

Based on the results of the operations, the return on investments fluctuates between 50% and 200%, and averages 70%. The ROI is expected to increase if they were properly managed and if the cages were placed in areas not affected by strong wave currents. The cages in Barangays Baroy, Rebokon and Pantad no longer exist as these had been swept away by strong water currents.

Table 10: Recommended aquaculture activity to be developed in Dumalinao
(Ranked as follows: 1- first choice, 2- second choice, 3- third choice,…)

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	1 to
Seaweed farming	1 to 2
Lobster in cages	5
Crab fattening	2 to
Sugpo or lukon growing in fishponds	2 to 3
Squid culture in cages	5

*Requires capital

5.5.4 Local Policies

The municipality of Dumalinao has no policies to regulate aquaculture. It has yet to pass its coastal resource management plan to address important issues on resource allocation and use, preferential use right, habitat protection and conservation, and conflict management. The Municipal Revenue Code, used by some municipalities to address concerns on site allocation and corresponding taxation in aquaculture, is not in use. Fishpond operators and seaweed farmers do not pay taxes to the local government. The allocation and determination of size and site is left to seaweed farmers with nominal approval or clearance from barangay officials. Farm access and the establishment of passageways and navigational routes are determined through consultations. Though seaweed farming in the community remains generally an open access regime, the community, nonetheless, recognizes the property use right of seaweed planters once they have established their farms.

5.5.5 Institutions Involved

LGU Offices

The development and operation of fishponds is seemingly considered purely a private enterprise and does not register in the socio-economic development framework of the municipal government unit. The LGU is not involved on matters concerning fishponds. Such issues are mostly left in the hands of the DENR and DA-BFAR—two national agencies whose organizational mandates and actions oftentimes collide resulting to the confusion and apathy of clients. The LGU fails to recognize that it has, under the Local Government Code, as much authority as the national government agencies in the conservation, protection and management of its coastal resources and environment, a mandate that impinges on aquaculture.

The LGU considers seaweed farming as an individual or family livelihood. Most of its intervention to seaweed farming is focused on assisting growers, through the fisheries division of the Municipal Agriculture Office, in accessing financial assistance, drying facilities, training and extension services. The social and political dynamics in allocating farm areas and in resolving and harmonizing conflicting interests are left to the barangay officials and leaders of growers associations. The protection of critical marine habitats from the encroachment of seaweed farms is

considered a non-issue. Apparently, seaweed farming is an economic activity that is not yet reflected in the Municipal Revenue Code, such that the farmers continue to enjoy tax holiday.

Livelihood Associations

The fishpond operators of the municipality are not organized and linked to sources of innovative culture and production technologies. Many fishponds are underutilized and unproductive for lack of capital and technology.

Generally, the seaweed growers also operate independently from each other, deadened by failures and frustrating experiences with cooperatives. Nonetheless, the Baroy Fisherfolk Association in one barangay of the municipality, comprising of small fishers and seaweed growers, has continued to operate with the help of the LGU as a channel of outside funding and technical assistance. The Baroy Fisherfolk Association was organized by the MAO in the late ‘90s as seaweed farming made inroads in Illana Bay. The association was the recipient of IBRA 9 grant for the establishment of seaweed nursery and the construction of stilt drier in the area to jumpstart seaweed growing. It was also the beneficiary of a small credit facility fund from the LGU of Dumalinao managed by the Municipal Agriculture Office to assist member-growers in acquiring farm inputs.

No banks operate in the municipality. The fishpond operators and seaweed growers have to rely on their own financial reserves or borrow from the association and buyers or even from loan sharks to keep their business going.

External Institutions

The Illana Bay Regional Alliance 9 (IBRA 9), with its support of seedlings and solar drier to the first farmers in the area, was instrumental in the promotion and adoption of seaweed farming in the municipality. The gains made by the Alliance have been sustained by the LGU through the Fisheries Division of the Municipal Agriculture Office. The provincial fishery office through the facilitation of the Association and the LGU of Dumalinao has also provided trainings and seminars on seaweed production.

5.6 City of Pagadian

Pagadian City is located at the northeastern side of Zamboanga del Sur. It is bounded by the municipality of Labangan from the south and by the municipality of Dumalinao from the north (figure 15).

Despite its being the commercial and political center of Zamboanga del Sur, the economy of Pagadian is still dependent on its agricultural and fisheries resources. The main products are rice, corn, coconut, fruits, root crops and fishery products.

The city is located along the coasts of Illana Bay from which it derives its fish products. The bay also provides a vast area for the culture of seaweeds, making seaweeds one of the city's major economic products.

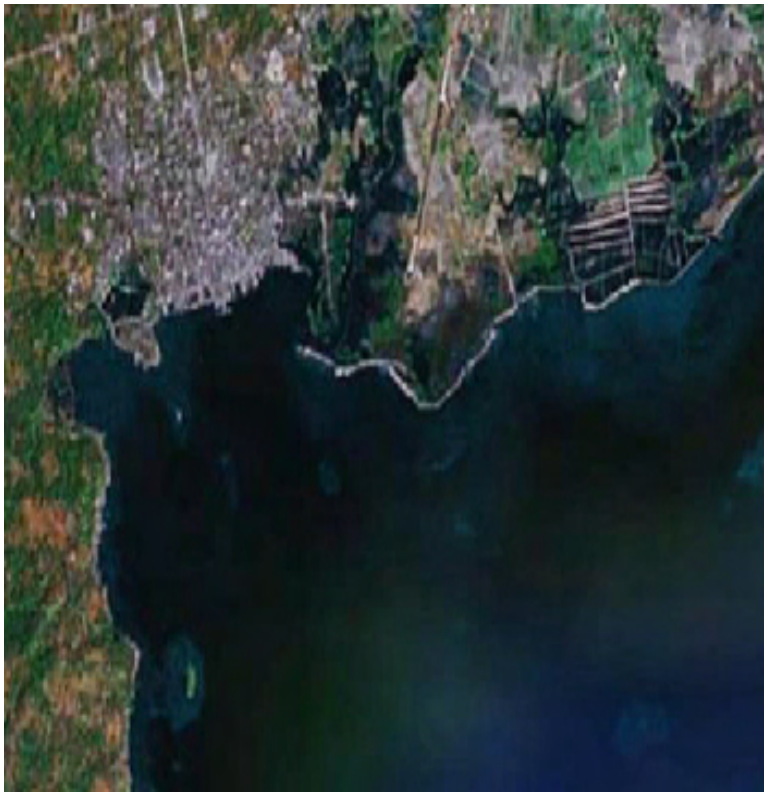


Figure 15. Satellite map of Pagadian.

The coastal zone of Pagadian City is favored by nature over its neighbors. Pagadian City does not experience typhoons due to its geographic location. The landmass of Dimataling and San Pablo shelter it from turbulent weather that the southwest monsoon brings to the area. Thus, the fishponds and seaweed farms are rarely affected by rampaging floods, raging winds and vicious waves. Unlike their counterparts in neighboring areas, the seaweed growers of the city can farm year-round.

In support of the fishing industry, the city has ice plant and cold storage facilities.

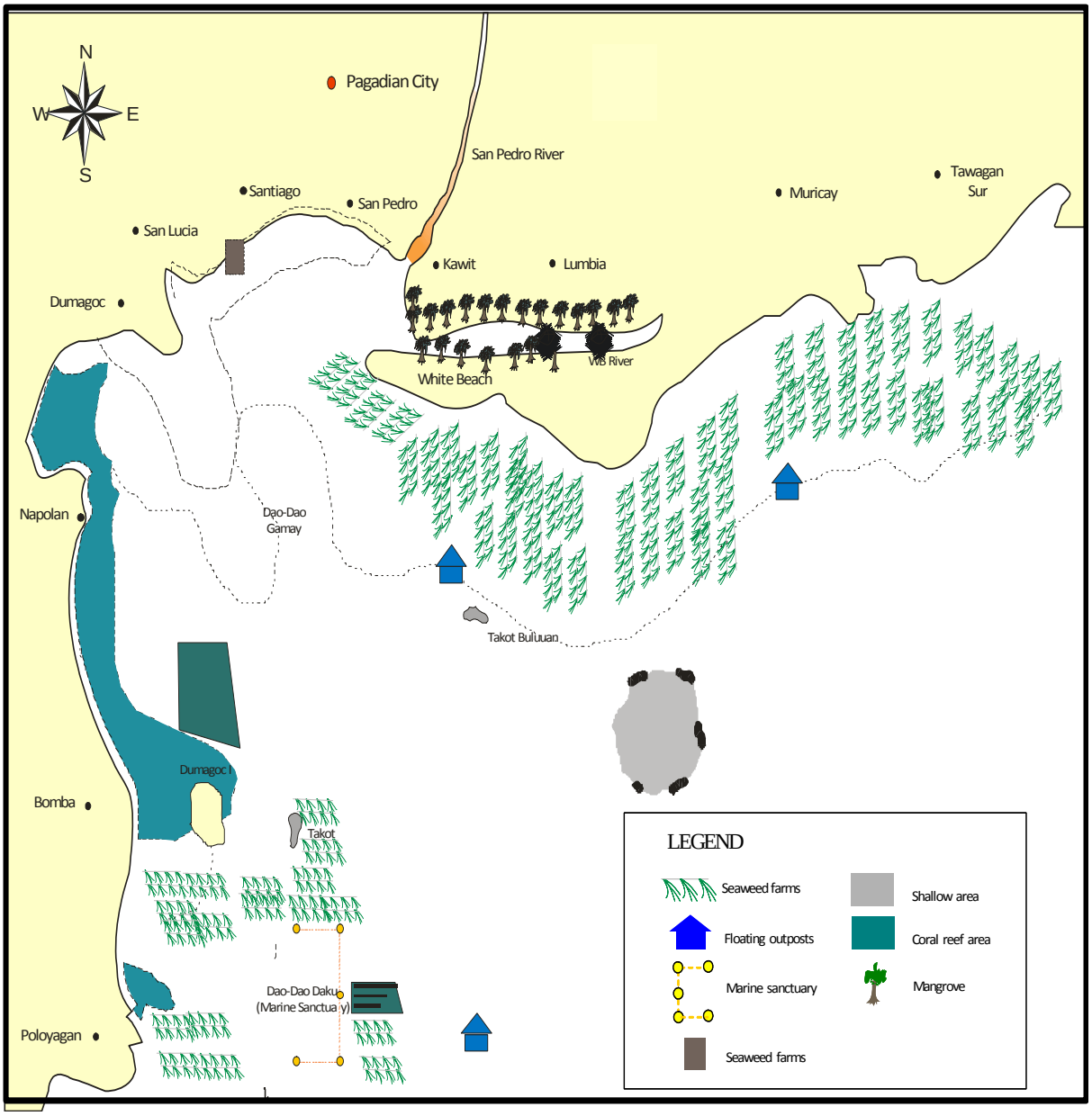


Figure 16. Resource and habitat map of Pagadian City showing the location of aquaculture activities.

5.6.1 Seaweed Farming

Seaweed farms began in Pagadian City in the later part of the ‘80s. Seaweed production boomed in late ‘90s. Official records show that seaweed farms are about 299 hectares but the actual area could be much more, given that 180 hectares are operated in Barangay Bomba alone and 100 hectares more are operated in Barangay Poloyagan. In fact, seaweeds are

grown in almost all of the city's coastal barangays (Tawagan Sur, Santiago, Kawit, Napolan and White Beach) where more than a thousand households are actively engaged in its culture. Growing seaweeds is a family affair that involves even young members in the maintenance (e.g., removing green algae that engulf lines and stocks, silts, plastic wastes, and barnacles from plants) of the farm, in harvesting and in drying the product.

Most growers operate 1 one-hectare farms using "polutan", "burikat", and the "pulahan" varieties. With the increasing number of growers, however, new entrants have to share a 1 hectare area with up to 5 other families. Growers are forced to maximize the use of their limited areas by having more lines.

To increase seaweeds production, Pagadian growers used fertilizers. The practice, however, was discouraged because, on top of being an additional cost item, it was also identified as growth enhancer of algae that attaches and chokes seaweeds plants until the seaweeds thalli rot.

Some seaweed growers are also engaged in seaweed nursery operations–the nursery operators supply the stock requirements of growers throughout Zamboanga del Sur. Despite the presence of local nurseries, a number of local growers still source out their seed stock from Dumalinao and from Barangay Tarakan, Dinas, Zamboanga del Sur.

The city government had initiated the registration of seaweed growers. Growers are given permits over a certain area upon payment of P80 per hectare of seaweeds farm. This, plus the license fees of growers and the taxes levied on their boats and other paraphernalia, amounts to P300 to P400 per grower per annum. Records show that in 2003 the LGU was able to collect P109,686 from licenses alone.

Production

Since the coastal waters of Pagadian City are exposed to strong waves, growers spaced their culture lines from 5 to 7 meters apart. Other growers, with limited areas, used spider web-like culture lines to optimize the use of their areas of operation. Growers using the mono line method operated longer lines, from 90 m to 170 m, which over time have become closer together to maximize area utilization. Nearshore lines which are not heavily affected by wave actions are spaced less than a meter apart while those located in the deeper portions that are exposed to strong waves are established far between.

The plants are grown for 3 months so there are at most 4 operations per year. Seaweed culture in Pagadian, despite the seasons, is year-round and the survival rate is generally high–above 95%. A one-hectare of farm produces from 800 kg to 1,000

kg per crop or from 2.4 to 6 tons per hectare per year. At P34/kg, gross revenue could reach P51,000/crop or P204,000/hectare annually.

Profitability

The profitability of seaweed farming is a come-on to many fishermen of Pagadian City. One grower reported a gross of P20,000 from a mere P1,000 initial capital, while another grower reported a gross of P70,000 from a P4,000 initial capital. The cost was minimized by producing their own seed stock and by using family labor in all aspects of production–the hiring of laborers is considered as additional expense item and responsibility as far as growers are concerned. Culture lines were improvised using recyclable ropes and packing tapes.

Table 11: Weather conditions by month and seaweeds cropping seasons, Pagadian City, Zamboanga del Sur, 2007

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Seaweed farming is done but production is observed low in March and April.					Hot weather observed.						
				Seaweed farming is okay during this period except for observed low production in July.							

Seaweed *compradors*, financiers, wholesalers and warehouses are based in Pagadian City. Local growers always have the advantage over other growers from far flung areas—they receive the same prices (P3 to P4.50 per kilo, wet weight; P31 to P33/kg, dry weight) for their products at no added cost. Seaweed *compradors* report that 30 tons to 100 tons of seaweeds are shipped to Cebu weekly. Even at a mark-up price or a P1 commission per kilo of seaweeds, an agent or comprador could easily earn P100,000 a week.

Financing

Pagadian has financial institutions that can provide initial capital to prospective seaweed growers. The more enterprising growers avail loans from the DTI or Quedancor and from development banks in the city. The city-based *compradors* also lend cash to finance seaweed production in other municipalities. Most seaweed growers started small and eventually became big-time operators by using their incomes from previous harvests to finance succeeding operations. Furthermore, USAID through its Growth in Equity in Mindanao (GEM) project have provided stilt driers to a number of seaweeds growers associations in the city.

Issues and Concerns

The issues and concerns that affect the success and sustainability of seaweed production in Pagadian City are the following:

Increasing number of growers. The increasing number of growers and the limited area remaining for seaweed farming is one of the foremost problems in Pagadian City. To expand their area of operation, growers have to extend their lines to deeper portions of the bay where they need to invest in culture lines that could withstand stronger waves. In the absence of funds, the growers have to contend with their present areas.

Water stagnation. As the number of farmers increase, the distance between seaweed lines shortens. Narrow lines reduce water movement and exchange, resulting to stagnation. Stagnation invites disastrous disease-causing bacteria and other organisms that may lead to the collapse of seaweed production

Algae growth. The use of fertilizers by some seaweed growers to enhance the growth of their plants also enhanced the growth of filamentous algae around the seaweed thallii which choke the seaweeds plants to death. Aside from competing for dissolved oxygen, the spreading algal mass engulfs lines and stocks therefore inhibiting seaweed growth. At present, physical removal of the plant pest is the only known solution to the problem.

Grazing. Seaweed farms attract grazing fish species (*siganids*, turtles, and other seaweeds associates) as well as their predators which thrive on the soft tissues of seaweeds. So far, growers do not have the technology to control grazing.

Blast fishing is reported to occur occasionally near farms and in deeper waters. The blast severs lines, disconnects and turns seaweed stocks into fragments.

Poaching is reported as a common but minor social problem. Members of various seaweed growers associations in the area regularly guard their seaweed farms. To deter poaching, seaweed farmers allow interested friends or neighbors to farm in their unused allocated area, if only for the latter to also watch over the farm of the former.

Insufficient stilt-driers. Growers prefer to dry their harvest to gain added value but 80% of them do not have stilt driers.The driers provided by BFAR, USAID-GEM, LGSP and other NGOs were considered insufficient for their needs.

Declining quality of coastal waters. Siltation continues because of eroded soil that are carried downstream as run-offs during heavy rains. Water temperature is unstable and readily fluctuates in shallow waters. Monsoon winds also bring solid wastes to Pagadian coastal waters and the current direction trap these solid wastes.

The use of the coastal waters of Pagadian as waste sink for chemicals (muriatic acid) used in cleaning barges and other effluents (used oil, grease, gasoline) from water transport facilities, have contributed to the degradation of coastal waters and have affected the growth and quality of seaweeds. One grower complained about the discharge of water used in washing junks to which he attributes a reduction in his produce.

Peace and order. Similar to other municipalities, peace and order is also a concern. There is fear of hijacking of trucks carrying seaweeds and fish products. Land travel is considered risky especially among fish traders because of extortionists. Illegal fishing methods like dynamite use remains.

5.6.2 Fishponds

Pagadian City has a total of 299.69 hectares of brackish water fishponds. These are currently utilized in the culture of prawns and milkfish, and occasionally, of crabs, for export and the local markets. Aquaculture in the city dates back to 25 years ago. With the onslaught of shrimp diseases, many fishpond operators shifted to the culture milkfish. Those who continue to raise shrimps do it in extensive manner with very limited stock. The poly-culture of shrimp and milkfish is likewise adopted by some but with milkfish as the primary stock.

Fishpond operators rely on the supply of fry from the wild. There are fry collectors in the area that sells fry inputs. The number of operators using hatchery-bred fry declined when operators observed that they were vulnerable to prawn diseases,

Production

Fishpond production depends on the number of fry stocked. Fishponds were often understocked and underutilized as fry were not readily available in sufficient number and feeds were expensive. To cut on costs, fishpond operators supplement commercial feeds with squash, camote, seashells, and ground trash fishes. The use of fertilizer to grow filamentous algae as milkfish food is minimal. Since it is cheaper and easier to produce milkfish, a number of fishpond operators are now culturing milkfish as their major crop instead of prawns. Before, milkfish was simply stocked in lesser number to serve as aerators.

Production per hectare per crop ranges from 300 kg to 600 kg of prawns plus an extra harvest of finfishes that include the intentionally stocked milkfish and others that enter the ponds at high tide. This translates to 600 kg to 1.2 tons of prawns per hectare per year. Compared to earlier production data, fishponds are no longer as productive as before. The shrimp stock easily succumbs to the diseases, or are stunted or just disappeared without any trace. The many years of use have accumulated so much indissoluble toxic wastes in the ponds that render them unproductive.

Economics

Almost all fishpond operators who had developed their ponds earlier had already recovered the cost of pond development. The payback period is estimated at 2 years—after one to two successful operations, an operator could already recoup his investments. The profitability of succeeding operations depend on operating costs which most operators try to minimize by using substitutes and supplements.

The culture of prawns and milkfish in fishponds is still profitable except that when expressed in terms of volume of harvest per hectare, profit is small relative to profits from pond operations using intensive culture techniques.

Marketing

There is basically no problem in marketing fishpond products in Pagadian City owing to the presence of 27 buying stations and of fish dealers and traders who procure prawns for the export market. The prawns are either transported to Ozamiz City or to Cagayan de Oro City where these are processed for exporting, or flown to Manila from these cities, also to be processed for the export market.

5.6.3 Fish Cages and Pens

Operators have tried the culture of grouper in cages in White Beach, Barangay Bomba using various sizes of fingerlings from Dimataling and from San Pedro, Pagadian City. Stocking rate was dependent on the availability of fingerlings. The cage measured 18 ft by 18 ft and set at a depth of 3 to 5 meters. The stock was fed with trash fishes (*galunggong* and *lupoy*) and culture for 6 to 7 months, after which they weighed 900 gm to one kg each.

The culture of *kikiro*, *kitong* and groupers in fish pens was also tested. The *kitong* and *kikiro* were fed with lumot while the groupers were allowed to subsist on naturally occurring organisms at the bottom of the pen. Only a third of the 3,500 fingerlings initial stock survived after 9 months of operation. The operators encountered difficulty in getting fingerlings for subsequent operations

Despite the failure of the trial operations, the potential for cage culture is still considered as relatively high. The area behind Dao-dao Island is considered appropriate for cage culture. However, there is still a need for training on the proper operation and management of fish cages among prospective operators.

The usual problems of flooding, pollution from boat washings, the use of poison in catching fish remain.

Because of the relatively high price of cultured species, marketing in the local market was a challenge.

Table 12: Recommended aquaculture activity to be developed in Pagadian
(Ranked as follows: 1- first choice, 2- second choice, 3- third choice,…)

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	1 to 3
Seaweed farming	1 to 2
Lobster in cages	5
Crab fattening	2
Sugpo or lukon growing in fishponds	4
Squid culture in cages	3

5.6.4 Local Policies on Aquaculture

The city has no legislations and policies specific to aquaculture. The LGU referred to the national laws on forestry, fisheries, environmental management and the local land use and zoning ordinance Whenever some issues have to be resolved in the aquaculture sector,. The city has yet to come up with its coastal resource management plan that may rationalize the allocation and use of its coastal resources.

The city's Revenue Code imposes a fee of P300/ha per year for the operation of seaweed farm. The City Agriculture's Office through its Fisheries Division is responsible for the allocation of farm sites to applicants. The Office in coordination with the fish growers associations in its barangay also establishes passageways in farm sites to avoid resource use conflict. A higher fee is imposed on fishpond operation, but the city has very little role to play, if at all, in determining size, site location, systems of production and impact, and management.

Issues have surfaced on resource use. Many seaweed farms encroach in sea grass beds and, in some instances, in coral reefs. Some also cover *bangus* and *sugpo* fry collecting grounds to the disadvantage of fry collectors and fishpond operators who are dependent on wild fry for their pond stock. During water management, fishponds inevitably release fertile or toxic effluents that may have contributed to the bloom of green algae in seaweed farms.

5.6.5 Institutions Involved

LGU offices

The LGU involvement in aquaculture is confined to the issuance of business permits and fees. They also provide limited technical assistance upon request through the offices of the mayor, treasurer and municipal agriculture officer. The Fishery Division of the Municipal Agriculture Office granted a loan of P140,000 to the seaweed planters association of Barangay White Beach. The payment of the loan would serve as the revolving fund of the Division to be loaned to other associations.

Aquaculture systems especially seaweed farms, are generally covered by the Fishery Law Enforcement Team (FLET) of the City and the Bantay Dagat associations at the barangay level.

Livelihood Associations

The fishpond operators of the city once bonded together into an association to protect, articulate and enhance the interest and welfare of the sector. The association was especially visible in the advent of shrimp farming when their success or survival in the field was dependent on acquisition and use of innovative production technologies. As shrimp farming declined the association became less and less active and visible.

On the other hand, 9 out of the 12 barangays of the city have seaweed growers associations, the most active of which includes the following: White Beach Seaweed Planters Association, San Pedro Seaweed Planters Association, and Bomba Seaweed Planters Association.

The different associations offer small credit services to their members. They also serve as channels or conduits of grants or financial assistance and new farming technology from external institutions. Trainings and seminar on seaweed production are facilitated or hosted by local associations. Association leaders also conduct echo seminars to their members upon their return from attendance of similar activities outside the city. The associations also serve as self-regulating and policing bodies to resolve conflicts among members and to protect their farms.

The different associations from Pagadian City and other municipalities of Zamboanga del Sur are federated into what is known as the Zamboanga del Sur Seaweed Farmers Association. The federation is responsible in linking up the associations at barangay level to external credits and technical assistance and services.

The credibility of seaweed growers associations blemished by their failure in financial management. Three years ago, the Department of Trade and Industry (DTI) granted the Zamboanga del Sur Seaweed Farmers Association a soft loan for seaweed production in the amount of P500,000. The money was re-loaned to primary associations as designed in the credit scheme. To date, the loan from DTI has not been paid as the primaries have failed to remit their regular payments to the federation. One association president, disappeared with the payment and other funds of said association.

Seaweed farmers also source out credits from buyers of farm products and suppliers of farm inputs. Many succumb to short-termed loans from loan sharks because of its accessability.

External Institutions

The following institutions have rendered financial and technical assistance to the seaweed growers of Pagadian City: USAID-Growth and Equity in Mindanao (GEM), stilt driers; DA-Bureau of Fisheries and Aquatic Resources, stilt driers and farming assistance; Department of Trade and Industry, soft loan; QUEDANCOR, individual loans; Provincial Agriculture Office- Fishery Division, farming assistance; and the City Agriculture Office- Fisheries Division, soft loan to association and farming assistance. National agencies and local government units have not, however, organized regular extension services to the industry. Extension assistance is provided upon the request of interested parties, often through the intercession of local government units.

5.7 Labangan

Labangan is an agricultural municipality located on the eastern part of the Province of Zamboanga del Sur. It shares a common boundary with the City of Pagadian at its western side and with the municipality of Tukuran and Illana Bay at its southern eastern side. The municipality is characterized as a vast fertile valley traversed and irrigated by Labangan River. It is primarily a rice producing town and is considered as the rice granary of the province.

Labangan is a melting pot of settlers from different parts of the country. More than 90% of the residents are migrants dominated by Cebuanos, Maguindanaos, Ilocanos, Subanens and Maranaos.

The coastal barangays of Labangan, Barangays Bulanit, Lower Sang-an, Old Labangan, Tapodoc, Dimasangca and Combo, are generally flatlands and swampy. Fishponds dot the landscape of these barangays while seaweeds farms occupy much of their coastal waters. However, seaweed farms and fishponds, are prone to flooding and siltation because of the Labangan river. The municipal waters are turbulent during monsoon winds making it impossible to farm seaweeds.

Figure 17. A satellite map of the municipality of Labangan.

5.7.1 Seaweed Farming

Seaweed farms began in Labangan in 2001 and currently cover some 965 hectares. These farms are mostly located in the offshore areas of Barangays Combo (approximately 400 has with 300 stakeholders) and Bulanit (approximately 100 has). It is estimated that 80% of the total households in these barangays are involved in seaweed production. Similar to other municipalities, growers can establish culture lines just by simply staking a claim over any available area; some more enterprising growers operate seaweeds farms way beyond the Labangan municipal waters.

The farms are located some 400 meters away from the shoreline and into the open sea to avoid the muddy substratum and wide shallow tidal flats near the mouths of Labangan and Tukuran rivers.

The culture lines are longer than in other areas, sometimes measuring more than 200 meters in length. Like Pagadian City, culture lines are spaced only 2 feet apart and the plants are spaced from 6 to 7 inches away from each other along the line.

The seaweed species cultured Labangan include: “giant”, ‘duralex”, *burikat* and “vanguard” varieties, and *cottonii*—a hardy variety preferred by most growers. Seedstocks generally

come from Dinas, Pagadian and Dumalinao, where they are cultured for 20 days in the nurseries and then transferred to the culture area for production.

Production per crop per hectare is between 500 kg and 800 kg (wet weight) for a 140 m line. This translates to an income of between P40,000 to P60,000. The products are usually sold fresh or dried, depending on the availability of stilt driers, or the growers' accessibility to one. From 5 to 7 kilos of wet seaweeds, depending on the species (7:1 burikat and 5:1 for kapalaran dagko), a kilo of dried seaweeds is produced. A kilo of wet seaweed sells for P3 to P4, while a kilo of dried seaweeds sells for P31 to P38. Drying is done for 2 to 3 days on solar stilt driers.

Economics and Profitability

The major expenses in seaweed farming cited by the growers were the establishment of the culture lines and the procurement of seed stocks. Labor is usually provided by family members but the more enterprising growers hire caretakers who get 1/3 of the net income. Start up capital varies from P20,000 to P200,000 per operator depending on the number of lines and on the area being operated. Despite the limited culture period, the investment could be recovered in only 1 to 2 operations or in less than a year of operation.

Marketing

The growers have not experienced any problems in marketing their products. Since Labanagan is near Pagadian City, growers could easily contact seaweed *compradors* from the city. Like other municipalities, the prices are dependent on direct buyers who in turn are dictated by the terms of the Cebu-based processors and exporters.

Issues and Concerns

Lack of support services. Seaweed growers of Labangan are concerned by the lack of support services in the form of nurseries, stilt driers and capital needed to expand their operation. At present, limited loan or credits are available to members of the SEC-registered Bulanit Seaweeds Growers Association—which doubles as a marketing cooperative and microlending institution.

Solid wastes. Labangan farmers worry about the transfer and deposition of solid wastes along its shores and into their farms. Wastes are moved by wind action between Illana Bay and the Moro Gulf and are observed all the way from Labangan to Dinas especially during the months of October to December. These months are characterized by strong winds, turbulent sea and turbid waters.

To avoid losses, the growers plant during the habagat when the prevailing wind is weaker. However, the lines are farther offshore to avoid the murky run-offs and the strong water currents brought about by floodwaters. So far, expansion is only possible further offshore away from river mouths. Since the water current is always strong even in these areas, culture lines have to be sturdy and securely anchored in the sea bottom. Like Tukuran, the coastal waters of Labangan become very rough and turbid during monsoon months, thus limiting the production of seaweeds to only certain period of the year.

Seaweed diseases. As in other parts of Illana Bay, seaweed growers of Labangan also experienced "ice-ice" disease and the phenomenon called *"lambog"*.

Table 13. Seasonal calendar for seaweeds farming in Labangan, Zamboanga del Sur

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
				First cropping. Sea is calm up to June.					Seaweeds culture subject to strong wave action and the onslaught of floodwaters. Ice-ice disease is observed. Solid wastes from Cotabato observed along the coasts.					

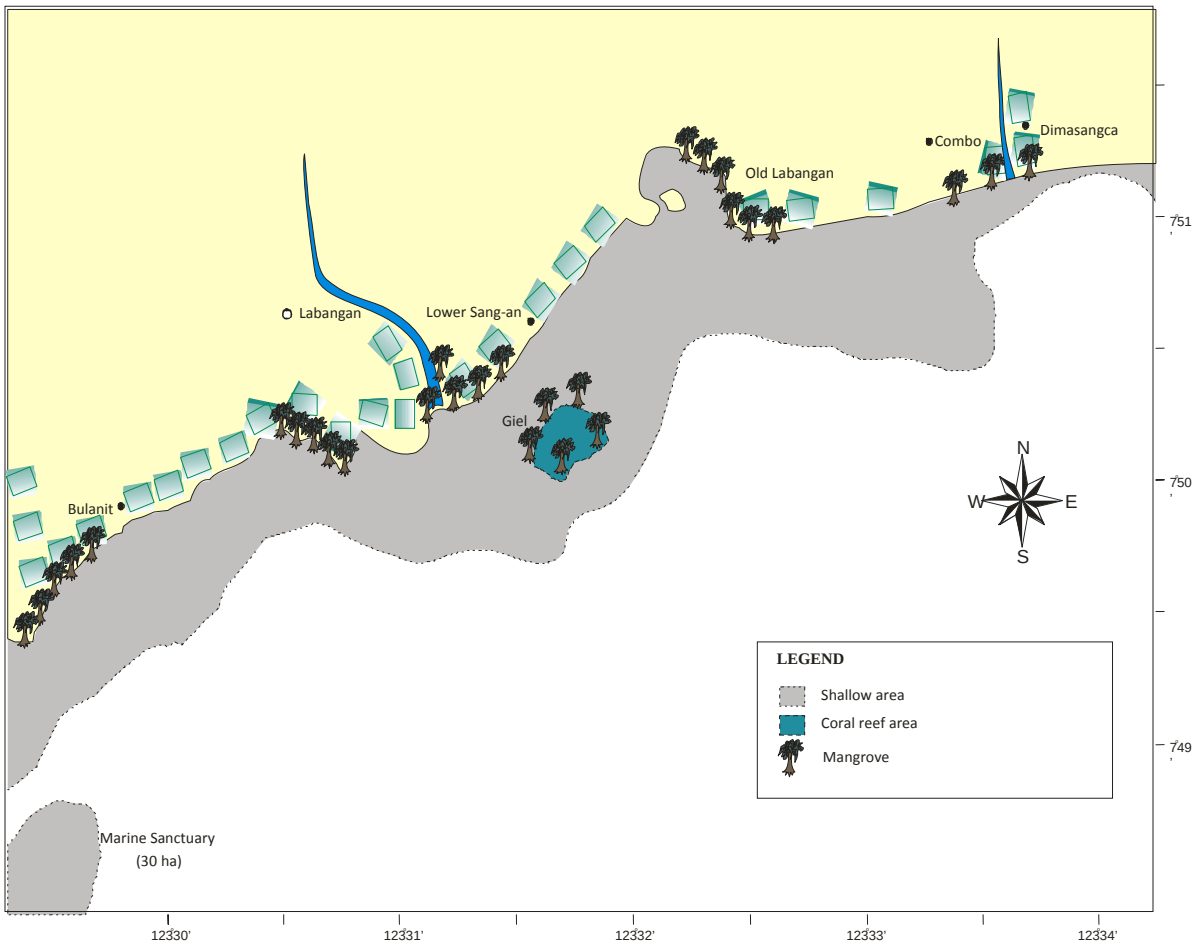


Figure 18. Habitat and resource map of Labangan
(Note the presence of Labangan River and the extent of soil erosion along the coasts of the municipality.)

5.7.2 Fishpond Operations

Fishpond operations in Labangan started as early as the ‘50s and ‘60s when it was first introduced by the Ilocano immigrants who first settled in Barangay Bulanit. The operations, however, peaked in the ‘70s when its mangrove areas gave way to massive fishpond development for the culture of prawns. Before this, prawns used to be a by-catch of milkfish in ponds.

The municipality has a total of 957.53 hectares of fishponds and 76 fishpond operators. Of the total area, 385 hectares are located in Barangay Lower Campo Islam, 231.5 hectares in Dimasangca, 200 hectares in Barangay Bulanit, and 200 hectares in Lower Sang-an. The other fishponds are located in Barangays Combo (30.48 has), Balimbingan (162 has), and in Old Labangan (34 has).

Despite its size, fish farming in the area is generally traditional and extensive. Most of the fishponds are not well developed but are mere enclosures of low lying farms that could hold water. In most cases, these are shallow or have become shallow over time and are therefore sensitive to changes in temperature and dissolved oxygen content of pond waters.

The fishponds used to be stocked with prawns but with the incidence of prawn bacterial diseases in the 1980s, the operators began to shift to milkfish as the major species of culture. Prawns were simply stocked extensively (less than 1 fry/sq m) and allowed to grow without or with minimal use of commercial feeds. Since the fry are left on their own, the culture period is generally longer—from 5 to 6 months per operation—allowing only a maximum of 2 operations per year. Those using commercial feeds harvest their crops earlier or after 4 months to reduce the costs of operations.

Production per hectare per crop varies from 350 kg to 1.4 tons of prawns and from 1 ton to 2 tons of milkfish. The variability is due to different stocking densities and feeding schemes.

Bangus fry collector

Economics and Profitability

The major inputs to pond operations are: (1) fry and fingerlings, (2) feeds, either grown naturally or introduced in pellet-forms, and (3) labor. Prawn fry and milkfish fingerlings are acquired locally, generally, from Tukuran and the nearby municipalities, and while these are locally available, their unavailability or insufficiency when needed is sometimes the main reason for the understocking of ponds.

Fishpond operators use commercial feeds only when their stocking density exceeds 6,000 fry per hectare, otherwise they feed their culture with camote, shellfishes and trash fishes that are readily available in the area.

Fishpond owners generally hire a caretaker. As practiced in Labangan, caretakers are paid from 20% to 25% of the net income.

According to pond operators, profits were low when expressed on a per hectare basis because of the relatively low stocking rates being practiced by most operators.

Marketing of Fishpond Products

The Labangan fishpond operators enjoy a comparative advantage over other operators because of their proximity to Pagadian City where fish dealers and wholesalers are based. The prices of prawns are dictated by the export market; the local market for milkfish. The buying prices of fish products are similar to other towns since all other towns along Illana Bay have the same fish dealers. For example, milkfish sell for P35 to P50/kg ex-farm while tempura-sized prawns sell for P400 to P450/kg. In times of glut, these sell for only P350/kg.

The fishpond operators believe that their fishponds are appropriately located and that they could improve their production levels by improving their fishponds. Since most fishponds were not properly designed (fishponds were only dug-outs that could hold water), most have become shallow over the years, and water quality has degraded and has become less productive. These fishponds could be improved by excavating the pond top soil or by removing the muck that accumulated from years of operations.

Issues and Concerns

Flooding. The ponds have become shallow and have not undergone major repairs since they were developed decades ago due to the high cost of repair.

Poaching. Similar to other municipalities, some operators experienced poaching. On a larger scale, however, fishponds became unproductive due to unresolved boundary conflicts or land ownership claims. Some have even regressed into mangrove forests to the joy of local environmentalists.

5.7.3 Fish Cage Operations

Labangan was one of the beneficiaries of the fish cage livelihood project of BFAR along Illana Bay. The cages were stocked with *siganids* and groupers. The operators of groupers favored striped lapulapu fingerlings over the more readily available spotted fingerlings. Fisherfolks blame the decline of the number of fry and fingerlings of commercially important fish species to the overexploitation and to the destruction of habitats due to dynamite fishing. According to Bulanit fisherfolk, illegal fishing activities are usually done by the fishermen of Pagadian City in their municipal waters.

Fish production in cages was proven feasible in Labangan, however, cages should be built to withstand strong wave actions. Like other municipalities, fish cage operation in Labangan stopped because the cages were destroyed by strong waves and flood waters from the rivers.

The establishment of fish sanctuary in Barangay Combo and the need to conserve the aquatic habitats off Labangan municipal waters limit the area available for cage operation in the municipality.

The table on the next page shows the mariculture preferences of the fisherfolk of Labangan.

Table 14: Recommended aquaculture activity to be developed in Labangan
(Ranked as follows: 1- first choice, 2- second choice, 3- third choice,…)

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	5
Seaweed farming	2 to 3
Lobster in cages	3
Crab fattening	2 to 3
Sugpo or lukon growing in fishponds	1 to 3
Squid culture in cages	5

5.7.4 Local Policies on Aquaculture

The municipality of Labangan does not have any specific ordinance regulating the culture and production of fish and crustaceans in impoundment or enclosure, whether inland or in marine waters. The same holds true in the growing of seaweed that has remained open access.

Fishpond operators and seaweed growers do not pay any tax, permits or any fees to operate. In the absence of a coastal resource management plan, the use of resources overlaps. Seaweed lines, for instance, encroach into critical habitats–sea grass beds and coral reefs.

Existing municipal resolutions or ordinances that may have indirect impact on aquaculture may include: (a) Resolution No. 101, Series of 1994, which is the *Sangguniang Bayan* Resolution approving the Town Plan of the Municipality of Labangan approved on October 7, 1994; and (b) Municipal Ordinance No. 22, Series of 1994, entitled, "An Ordinance adopting a Comprehensive Zoning Regulations for Labangan, Zamboanga del Sur. These ordinances regulate the cultivation or utilization of rivers and sandbars, buffer strips or easements, and the control and proper disposal of sewerage, industrial wastes.

For lack of local legislations, the LGU invokes national laws in the resolution of issues affecting the resources and the environment, such as the Environment Code of 1977, the Revised Forestry Code of 1975, and the Fishery Code of 1998.

5.7.5 Institutions Involved

LGU Offices

The administrative enforcement of the zoning ordinance is under the responsibility of the Zoning Administrator, Zoning Board of Appeals and Local Zoning and Review Board. It is not clear if these administrative bodies are functional.

The LGU relies on the Municipal Agriculture Office (MAO) for aquaculture concerns. The Municipal Agriculture Officer is assisted by a Fishery Technician. For lack of staff and logistics, the Municipal Agriculture Office only attends to concerns directly communicated to them. This method extremely limits contacts with its clientele which also hinders the improvement and growth of aquaculture.

The primary law enforcement body in the coastal community is the deputized Bantay Dagat Association. However, members of the Bantay Dagat are only focused on the MPAs and nearby waters. The security and protection of fishponds, seaweed farms and other culture systems still remain under the responsibility of their owners.

Livelihood Associations

With the assistance of the Municipal Agriculture Office, the small fishers in Barangay Bulanit and Combo have organized their own associations—the Bulanit Seaweed Growers Association and Combo Seaweed Growers Association. However, only the Bulanit Association is registered with the Department of Labor and Employment (DOLE) and accredited by the local government. The association in Combo has long been dormant.

The Bulanit Seaweed Growers Association serves as a channel for external assistance. It has received grants from IBRA-ZOPAD to start seaweed production in the 90s and the more recent grant for a solar drier from DA-BFAR. The association has extended small credits to its members and also served as their marketing arm. The association has been running quite well but loan repayment rate is very low. The income of farmers has been greatly affected by the adverse weather that brings flood and dirty waters and shortens the cropping season.

Loans for seaweed farm operations may be availed also by growers who are members of Labangan Cooperative (LABANGCO).

External Institutions

The Department of Agriculture‘s Bureau of Fisheries and Aquatic Resources (DA-BFAR) in coordination with the Municipal Agriculture Office (MAO) has extended technical assistance to the farmers in seaweed growing, as well a grant to construct a solar drier for the Bulanit Growers Association. In the early years of seaweed operation, the Illana Bay Regional Alliance (IBRA 9) in cooperation with the Zone for Peace and Development (ZOPAD) of the Autonomous Region for Muslim Mindanao (ARMM) granted a working capital for the members of the Bulanit Growers Association. EcoGov has also extended capacity building assistance to LGU-Labangan along coastal resource management, especially in the establishment of marine protected areas.

5.8 Tukuran

Tukuran is the first municipality of Zamboanga del Sur and shares a common boundary with the municipality of Karomatan (Sultan Naga Dimaporo) of the province of Lanao del Norte. It is situated in the isthmus of Zamboanga Peninsula and is bounded by Illana Bay in the south and by the municipality of Labangan in the east (figure 13). Like Labangan, the municipality is home to to the descendants of settlers and the original habitants, the Subanens.

Figure 19. Satellite Map of Tukuran, Zamboanga del Sur

The municipality is famous in the region for its fine beaches. The local government encourages the construction of resorts along its coasts to encourage tourism,

Tukuran is also equally famous for the fishes unloaded in its fish port. Commercial fishing vessels unload their catch in the port and distributed to strategic markets in Zamboanga del Sur and in the provinces of Lanao and Misamis.

Farming and fishing are the main livelihood activities of the residents of Tukuran. Fry collection is another economic activity especially in the barangays of Sugod and Tagulo. In view of the dependence of the population on the resources of the seas, the government of Tukuran was one of the first LGUs to sign up for the coastal resource management project of USAID-EcoGov. It boasts of its marine sanctuary and of the LGU's commitment to the conservation of marine resources.

5.8.1 Seaweed Culture

Tukuran has 9 to 10 km of shoreline along its 8 coastal barangays. Its coastal area is characterized by a wide tidal flat covering an area of around 90 sq m of coastal waters. These are located in barangays Lower Bayao, Sugod and Tagulo. The beaches near the Poblacion are used as picnic grounds and swimming area. A number of beach resorts are found along these shores.

Before, the whole coastal waters of Tukuran were filled with agar-agar; even the area where the fish sanctuary is now located was planted with seaweeds. In 2003, 120 residents of Alindahaw, Lower Bayao, and Panduma became beneficiaries of livelihood grants to operate 43 hectares of seaweed farms. The provincial government, through ZPULCRMP, also gave grants to 10 families to operate 2.5 hectares of seaweed farm. The municipality started

registering the growers and gave out licenses later in the year but was halted when farmers observed that seaweeds could only be grown from October onwards, or during *amihan* and when seaweed production dropped because of "ice-ice" diseases during the rainy season.

The area is exposed to strong wave action and strong floodwaters from Tukuran and Labangan Rivers that destroy the seaweeds culture lines. Growers also avoid Sugod because of the strong tidal flushing.

Issues, Concerns and Needs

Lack of capital. Seaweed growers need the capital to construct stilt driers where they could dry their harvested seaweeds. They also need additional capital to construct sturdier culture lines to withstand strong currents.

Resource use conflict. There is a need to delineate the boundaries of the municipal waters of Tukuran with Labangan and Sultan Naga (Karomatan). Seaweed growers of Labangan sometimes encroached the Tukuran municipal waters; the reverse is also true.

The beach areas are used for tourism and a number of resorts line the beaches of Lower Bayao, Sto. Nino and Alindahaw. The coastal waters are also suitable for seaweed culture at certain months of the year. However, these areas are also fry grounds of culturable fish species.

5.8.2 Fishpond Operations

A total of 167 hectares of swamplands and coastal mangrove areas along the coasts of Tukuran were developed into fishponds. Of these, 141 hectares in Lower and Upper Bayao and in Tagulo are fully developed and utilized by 18 fishpond operators. Fishponds are generally owned. The usual stock includes *lukon*, milkfish, tilapia and mud crabs.

Since Tukuran has fry concessionaires and dealers throughout the Illana Bay area, there was no problem with the supply of fry. Prawn and milkfish fry were either sourced from local hatcheries and fry gatherers from the villages of Sto. Nino, Lower Bayao, Sugod and Tagulo and the nearby coastal villages of Karomatan in Lanao del Norte. The fishpond operators and fry concessionaires, however, observed that the natural stock of both species is declining.

Technology

Fishponds developed in the late '70s and early '80s have been operating below full capacity because of the high cost of inputs, especially of commercial feeds and fry. The stocking rates of prawns and milkfish vary widely (from 1 fry per 2 sq m to 30 fry per sq m) depending on the number of delivered fry at one time as well as on the

operator's ability to pay at the time of fry availability. Since prawns are carnivorous, operators avoid stocking fry of different sizes. In polyculture, milkfish were usually stocked to aerate the ponds and are therefore stocked at lower rates.

Production

The survival rate for prawns is 20% to 50%, while the survival rate for milkfish is 90% to 100%. To avoid losses during bacterial infestations, the operators shifted to culturing milkfish as the major culture species instead of prawns.

Though production is year round, there are operators who chose to stock prawns towards the end of February, June and November. Grow-out period is from 4 to 6 months or until the prawns became 15 pieces to a kilo and milkfish number 3 to 4 pieces to a kilo. Thus, the total number of croppings is only 2 per year.

Prawn production is relatively low and ranges from 200 kg to 1.8 tons per hectare per cropping. But given the prices of prawns in the export market, this level of production still earns positive returns on investment.

Production Costs

Most operators used locally available shellfishes, trash fishes, yellow corn and squash as feeds for prawns. Commercial feeds were not popularly used because they add up to the production costs. For milkfish, growers used filamentous algae as feeds and they grew the algae using either chicken and hog manure (P50 to P60 per sack) or commercial inorganic fertilizer (1 to 2 sacks of 16-20-0 per hectare).

On the average some P1,500 to P2,000 is spent per hectare per cropping for feeds. The cost of fry accounts for 40% to 45% of total production costs. The total production costs inclusive of fry runs to P50,000 per hectare per crop. The development costs run up to P70,000 to P90,000 per hectare of fishponds.

Prices

Fishpond operators were mainly attracted to the high price of prawns. Tempura sized prawns sell for P290 to P335 per kilo as against the other shrimp species that sell for less these amounts.

The fishpond operators agreed that there is room for improvement of existing pond operations. Despite the reported losses, the continuing operation of prawn ponds is evidence of the profitability of prawn culture. The income from ponds could be increased if ponds were managed well.

Issues and Concerns

Prawn diseases. Fishpond operators were concerned on the incidence of luminous bacteria, the "red disease", the "30 days syndrome", and the so called white spot syndrome in prawns.

Degradation of natural habitat. There was also a growing concern on the degradation of the natural habitat of prawns and the continuing decline of its natural stock. Fishpond operators were aware of the adverse impacts of their operations on the environment. To prevent further degradation of the natural waters and to control bacterial infestation in fishes, some prawn growers have tried using probiotics in pond fish culture.

Potential

There is a high level of interest in crab fattening among the fishpond operators. Fishpond operators who cultured crabs attested to the profitability of the venture except that the sustainability of crablets for commercial production is not assured.

As far as prawn and milkfish culture is concerned, aquaculture could only be expanded in terms of increasing stocking rates. Most farms are operated extensively and could still accommodate additional stocks. Most fishpond operators who incurred losses from bacterial infestations of prawns tend to avoid the risks associated with prawn culture and intentionally stock their farms below the optimum, sometimes growing mostly milkfish in their ponds.

As for fishpond development, the coastlines of Tukuran, except for some 65 hectares in Sugod and Tagulo, are already settled. The rich mangrove forests that used to line the coastal zone of Sto. Nino and the adjacent barangays gave way to rice farms and human settlements.

Another option to increase production was to renovate existing ponds and to utilize unproductive ponds located in Lower Bayao (26 hectares), Sugod and Tagulo. These ponds have been abandoned by operators after they have incurred losses in their operations. Other operators relocated elsewhere as was the case in Tagulo because of the unstable peace and order situation.

The older ponds have become shallow over the years and the pond bottoms have accumulated the unconsumed feeds, creating muck, and polluting the pond waters. Shallow ponds have also become sensitive to changes in temperature and adversely affect the survival and growth of the stocked organisms. To retain the ponds' productivity, operators need capital for excavation and renovation of ponds.

The remaining 65 hectares of mangrove (*miyapi* spp) forests should be conserved to maintain ecological balance.

5.8.3 Fish Cage Operations

The municipality of Tukuran has had several attempts to culture finfishes in cages. From 2000 to 2003, the municipality was a beneficiary of fish cages from BFAR, LGSP, and the municipal and provincial government units. A submerged 12 x 12 x 12 cu ft fish cage was

installed in 2000 and this was stocked with spotted grouper fingerlings from the wild. The operation was considered successful because poaching was avoided and fish cages were not destroyed by big waves. The culture of finfishes in a floating cage was piloted in 2003 by some 25 residents of *barangay* Alindahaw who were beneficiaries of the ZPULCRMP through IBRA–LGSP. Siganid fingerlings from Naawan Hatchery were cultured in a fish cage located near the sanctuary. The operation failed because proper stocking rates were not observed-the stock were overcrowded in the cage resulting to a very low survival rate–from the initial stock only 250 pieces of 200 gm fishes were harvested.

The failure of other fish cage operations in Tukuran was mainly attributed to strong wave action, the lack of technical know-how among technicians, and the lack of logistics by the management to sustain the stock. Stock poaching was also reported to be one of the causes of the low yield. Other attempts to operate fish cages were also considered failures, not so much because of the infeasibility of the species but because of the lack of technical know-how and improper management.

The operation of submerged fish cages was requested by fishermen who have tried the technique. Submerged fish cages are not prone to poaching. The only problem experienced by operators was cannibalism among fishes of different sizes. A pilot run of submerged cage operation wherein the cage was stocked with groupers and *siganids* showed that it was economically viable and highly profitable since the cultured species are commercially important. The expenses incurred were minimal since only trash fishes were used as feeds. The operators could also earn regularly by partially harvesting the big fishes monthly.

The prospective operators do not see any problem in marketing the product. When the harvest is in big, growers could dispose the produce to Cebu or Manila where they could be sold in the export market.

The impact of the operation of submerged fish cages to the environment is yet to be seen. The accumulation of feeds on sea bottom, for instance should be considered. Though this is not yet an immediate concern, it is possible that in the future, an array of fish cages would fill the tidal zone and with it the accumulated left-over fish foods and fish fecal matters. At the outset, there is a need to control their possible accumulation.

A study of water currents is needed to determine the flushing rate and direction of flow of matter at all water levels.

Potential Mariculture Activities

There is a growing interest in the culture of crabs in cages. Fishpond operators who cultured crabs in cages attested to the profitability of the venture except that the sustainability of supply of crablets for commercial production is not assured.

The table on the next page shows the mariculture preferences of the fisherfolk of Tukuran.

Table 15: Recommended aquaculture activities for Tukuran
(Ranked as follows: 1–first choice, 2-second choice, 3–third choice, …)

AQUACULTURE ACTIVITY	Rank
Kitong, danggit, lapulapu in fish cages	1 to 2
Seaweed farming	3 to 4
Lobster in cages	3
Crab fattening	1 to 2
Sugpo or lukon growing in fishponds	3
Squid culture in cages	3

5.8.4 Local Policies on Aquaculture

The municipality has no specific ordinance regulating aquaculture. The primary basis for LGU intervention is the Revised Municipal Revenue Code of 1992 and the Code of General Ordinances of 1998. The adoption of the CRM Plan of 2004 compliments existing policies on resource use.

The Municipal Revenue Code has pertinent provisions regarding access and allocation of municipal waters either by grant or exclusive privilege that applies to the operation of fish corrals and the catching of *bangus* fry in defined areas; lease or concession concerning fishing in streams, lakes and rivers and coastal waters; license-permit for taking or catching fish in municipal waters with nets, traps, or other fishing gears with or without fishing boats or vessels three (3) gross tons or less; and in the establishment and operation of fishpond/prawn pond and fish breeding facilities. Accordingly, municipal permit is also required currently in the operation of seaweed farms.

The zoning of land and resource areas for development, proper waste storage and disposal, even the regulations of certain fishing activities that are re-iteration of those provided for in the National Fishery Code, are mandated by the Code of General Ordinances of 1998. The CRM plan of 2004, on the other hand, reinforces existing policies on zoning. It covers more areas for environmental protection and rehabilitation and designates specific zones in coastal waters for mariculture, marine protected areas, *bangus* fry reserve, navigation lanes and the like.

5.8.5 Institutions Involved

LGU Offices

Generally, in consonance with the Local Government Code of 1991 (RA 7160), the following local government offices or agencies in Tukuran (as well as in some other LGUs in Zamboanga del Sur) are involved–directly or indirectly–in the passage and implementation of local legislations that have varying impact on aquaculture, fisheries and environment:

1. Regulations on Business and Trade
    a. Mayor's Office
    b. Municipal Treasurer's Office
    c. Sangguniang Bayan
2. Health and Sanitation
    a. Municipal Health Office
    b. Environmental Sanitation Office
    c. Municipal Agriculture Office
3. Zoning Regulations
    a. Zoning Administrator's Office
    b. Municipal Planning and Development Office
    c. Coastal Resource Management Office
4. Extension Services
    a. Municipal Agriculture Office-Fishery Division
    b. Coastal Resource Management Office – IEC Committee
5. Fishery Law Enforcement
    a. Municipal Mayor
    b. Municipal Fishery and Aquatic Resource Management Council
    c. Coastal Fishery Law Enforcement Team
    d. Punong Barangay
    e. Deputized Bantay Dagat Association

The primary activity of these local government offices is limited to the initial issuance of permits for operation. However, even the annual renewal of permits and collection of fees are not strictly enforced. The focus group discussions revealed that fishpond operators and seaweed growers do not pay any taxes to the government. They said that the local government is not collecting taxes but they are willing to pay if required or demanded to pay as long as the tax is reasonable, that they know where their taxes go, and that they also benefit from the payment.

Regular extension service activities like farm visitation and technology dissemination from concerned local units are non-existent. The technicians from the Municipal Agriculture Office, nonetheless, respond to any request for technical assistance if this passes through and is endorsed by the Mayor's Office.

The security of fish and seaweed farm from poaching or any destructive activity remains the exclusive concern of private owners or operators.

Livelihood Associations

The fishpond owners of Tukuran operate independently. They do not have any organization that will articulate the needs and interest of the sector and link up to sources of new production technologies and innovations.

On the other hand, the seaweed growers in the municipality have 2 associations: the Muslim-Christian Fisherfolk Association (MCFA) and the Alindahaw Fisherfolk Association (AFA). These small fishers associations generally serve as conduit of funds from external sources especially for common livelihood projects. Past livelihood projects, such as the fish cages project of MSFA, failed due to the lack of technological know-how, non-participation of members, and mismanagement. In the

recent past, AFA also received a grant from BFAR-LGU to serve as revolving fund on small credits for members wanting to purchase seaweed seedlings.

External Assistance

The Local Government Support Program (LGSP) in coordination with the LGU of Tukuran and MSU Naawan once facilitated putting a *Kitong* fish cage demonstration farm in the municipal coastal water. No official report came out on the performance of the project, but closed-in observers said that the fish died of starvation because of the lack of logistical planning and supply.

CHAPTER VI

POTENTIAL AND RECOMMENDED SITES FOR AQUACULTURE DEVELOPMENT

6.1 Fish Cage

The coastal water of Illana Bay is a natural breeding ground of commercially important fish species whose fry and fingerlings are naturally available at certain months of the year. The culture of *siganids*, groupers and lobsters have been found possible in areas sheltered from monsoon winds and located away from strong wave actions.

Based on the number of species cultured in pilot fish cages in the municipality, Tabina has shown greatest potential for marine aquaculture among the places surveyed. It is possible to have cage operations as the coastal area of Abong-abong is sheltered from southwest monsoon winds and the water current is moderate during the *amihan* months.

The performance and high profitability of the initial runs of BFAR and IBRA-sponsored cages in Tabina proved the adaptability of groupers, *siganids*, lobsters, crabs and many other marine finfishes to cage culture. There was also a relatively high level of interest among the local fisherfolk to engage in cage operations.

Tibutabu, the area between Ticala Island and San Pablo, is another potential site for cage culture. Barangay Buton, which is part of Tibutabu, was specifically recommended for mariculture. The water current in the area at the time of the survey was moderate.

The Tibutabu area has 163 hectares for mariculture activities that are sheltered from wave actions by Ticala Island. The coastal waters around Tibutabu are productive—as evidenced by the flock of seabirds feeding on its pelagic fishes. A number of commercially important fish species (*siganids*, groupers, lobsters, crabs, squids, and giant clams) are endemic in the area and have shown feasibility for commercial production thereby attracting potential operators.

Seaweed growers and fishermen of Dimataling prefer fish cage operation. The places recommended for fish cage operation include Barangays Buburay, Sumpot and Bacayauan. Bacayauan registered moderate wave action and could therefore be considered. A number of residents also indicated interest in the culture of lobster in cages using locally caught juveniles. Fish cages should be sturdy to guard against occasional driftwoods that sometimes find their way into the area because of tidal current.

6.2 Seaweed Farming

Most of the seaweed farms around Illana bay (Pagadian City, Labangan and in Tarakan, Dinas) are already crowded and most coastal areas are fully occupied with culture lines.. Furthermore, the coastal areas of Labangan, Tukuran, and some parts of Dumalinao were vulnerable to the effects of monsoon winds and strong wave actions that made seaweeds farming impossible during certain months of the year.

There are areas, however, that could still be used for seaweed farming. These include Barangay Baganian at the tip of the Baganian Peninsula, parts of the coastal waters of

Dimataling, the coastal waters of Salampaki and Lawis in Dumalinao, and the Tibutabu area in San Pablo.

Barangay Baganian in Tabina has not been included in previous development projects for quite a time and its coastal area has not been fully tapped as seaweed farms. Wave action in the area was observed to be moderate. However, since commercial and municipal fishing boats dock in the area, there is a need to identify aquaculture and docking sites to prevent future conflicts among its resource users.

The coastal waters of Salampaki and Lawis in Dumalinao have water conditions favorable to the growth of seaweeds. Seaweeds farmers have expanded their operations in these barangays because of the limited area for seaweeds farms in the other parts of the municipality. The level of interest in seaweed farming among the fisherfolk is relatively high.

On the other hand, the Dimataling LGU estimates that some 2000 hectares of its municipal waters could still be utilized as seaweeds farms. The room for expansion extends farther into the sea. However the exact locations and extent of these areas could not be determined as the boundaries of Dimataling municipal waters have not been defined yet.

6.3 Fishpond Operations

The provincial coastline have been developed into fishponds. The rich mangrove forests that used to line the province's coastal zone had given way to rice farms, fishponds and human settlements leaving only patches of sparse mangrove forests. The moratorium on fishpond development somehow halted the continued destruction of the remaining mangroves needed to maintain ecological balance.

As far as prawn and milkfish culture is concerned, no area is recommended for further development. Pond operations could only be expanded in terms of increasing stocking rates, by employing higher stocking densities. Giving supplemental feeds and using life support facilities can make the survival and production rates higher. This implies the need to modify pond design to incorporate settling ponds and buffer zones.

Another option for increased fish production is the renovation and utilization of existing ponds which were earlier abandoned because of the volatile peace and order situation. A number of these ponds are found in Lower Bayao and Tagulo in Tukuran and in Pisaan and Locuban in Dinas.

6.4 Crab Fattening

Crab fattening is preferred by most pond operators because of the attractive prices crabs command in the market. Operators who have tried crab fattening in ponds attested to its profitability and have since expressed a high level of interest in crab production.

The mangrove areas of Dinas, Tabina, Labangan, Tukuran and Dimataling are available for crab production in pens. The major constraint, however, is that the sustainability of crablets for commercial production is not assured. Operators complained about the insufficient and declining supply of crablets from the wild.

CHAPTER VII

SUMMARY AND RECOMMENDATIONS

The development and growth of aquaculture is a response to the emerging economic opportunities at a given time. The investment in aquaculture did not operate in a development framework that aimed for the sustainable development of the industry or secure the integrity of the environment. The advent of shrimp farming and the lucrative economic benefits it promised to farmers, for instance, led to the massive destruction of mangroves forest in Zamboanga del Sur and to the intensive production of the shrimp in newly-opened fishponds. All this resulted to the massive and accelerated degradation of the coastal environment and the eventual intoxication and deterioration of shrimp ponds— making them unproductive in just a matter of 4 to 6 years. Today, many fishponds operate below their potentials, or are underutilized, or have not been used at all for quite sometime.

There is an apparent reluctance among LGUs to get involve in the operation of fishponds in their jurisdiction. Most adopted a hands-off policy and preferred to leave the matter to the DENR and DA-BFAR. LGUs do not exercise their mandate, duties and responsibilities to protect their coastal resources, prevent deforestation of mangrove forests and secure their coastal waters from any form of pollution especially from point sources.

The 2001 Code of Practice for Aquaculture is not observed in the area. Fishpond designs and structures remain in their old setup and no changes has been made concerning the requirements on buffer zones, water treatment and settling ponds, use and disposal of chemicals and effluents, and distances of and the encroachment of mariculture systems in critical marine habitats.

The prospect for fishpond development in Illana Bay lies in rehabilitating the underdeveloped and abandoned fishponds and in the intensification of fishpond operations. Ponds are potential sources of millions of pesos worth of prawns and milkfish if properly developed, production is intensified, and pond operations are properly managed. The rehabilitation and improvement of ponds should be financed to make these ponds more productive.

Seaweed farming swept the Zamboanga peninsula almost overnight in the late ‘80s. Many local government units were unprepared for the sudden and fast development. Most LGUs consider the seaweed industry as a private individual or family livelihood in open municipal waters. Policies have not been developed to secure its sustainability and earn appropriate revenues from its operation. The municipal governments made the barangay and livelihood association officials responsible for the social and political dynamics in allocating farm areas and in resolving and harmonizing conflicting interests. However, since the arrangement is person-oriented and time-bound, it may not be sustainable.

Many consider the protection of critical marine habitats, such as seaweed meadows and coral reefs, from the encroachment of seaweed farms a non-issue. The common intervention of LGUs in the local seaweed industry is limited to providing assistance to seaweed growers in accessing technical services and in sourcing external capital and production facilities.

7.1 Some Policy and Administrative Considerations

Local legislations should be enacted to address important policy concerns in aquaculture sustainability, biodiversity, ecological balance, and environmental integrity. Such legislations

may reinforce, complement or strengthen existing national laws and legal issuances like the Code of Conduct for Aquaculture. Consequently, administrative actions are required to put the law in place and secure and sustain the industry along the following:

Fishponds. Fishpond operations, along with cage operations and seaweed farming, can be a significant source of revenue of the local government. The issues identified above, however, should be addressed to sustain the industry.

1. Regulate the cutting of mangrove trees for household use and stop the conversion of mangrove areas into fishponds and human settlements.

2. Focus on increasing yields of existing fishponds, rather than increasing fishpond areas. Most fishponds in the area need to be rehabilitated through pond deepening, removal of muck and wastes or fallowing and dry cleaning using solar energy to restore pond productivity.

3. Implement regulations requiring fishpond owners to maintain or plant bamboos and mangroves as buffer zones along fishponds, rivers and shorelines. The remaining mangrove forests should be preserved and conserved to maintain ecological balance

4. Protect and conserve the natural growth of mangroves in unused or abandoned fishponds after a period of five years.

5. Implement regulations on the treatment of fishpond waste water before it is released to waterways.

6. Continue to involve nongovernment organizations in initiating mangrove restoration projects.

7. Form an institutional arrangement among the DA-BFAR, MSU Naawan, and the provincial and municipal fishery offices so they can coordinate resources and talents in providing regular training, farm visitations and fish health laboratory services to improve the productivity of fishpond operators. The group can also screen and promote new commercially viable species to replace disease-ridden and unproductive fishpond commodities.

8. Organize or revive the organization of fishpond operators associations to leverage access to new and more productive fishpond species, technology, and technical and financial assistance.

9. Promote the establishment of hatcheries by the private sector for the commercial production of fry and fingerlings of commercially important fish species

Seaweed Farming

1. Implement the registration of seaweed growers to monitor the use and the production capacity of the municipal water.

2. Regulate the size allocation per individual or family seaweed farm for equitable distribution of resources.

3. Regulate the distance of at least one meter between seaweed lines to maintain water movement and water quality.

4. Establish a seaweed seed bank and nursery in Illlana Bay that may be jointly run by local governments and tertiary seaweed growers cooperative in the province under the Illana Bay Regional Alliance (IBRA) 9 to always assure the growers of quality seedlings year round.

5. Establish a seaweed research and health laboratory under the auspices of DA-BFAR, MSU Naawan, and the provincial and municipal fishery units in the province of Zamboanga del Sur to help secure the health and quality of seaweed products in the area. Develop, through research, disease-resistant seaweed varieties and to conduct research on the control of seaweed diseases.

6. Study the feasibility of constructing mechanical seaweed driers in strategic farming areas to improve the current method of solar-dependent driers.

7. Tap the assistance of DOST, DTI, biotechnology research institutions and the national government for the establishment of a seaweed processing plant in Zamboanga del Sur. This will promote the development of cottage industries in seaweed processing and will generate employment opportunities among the people of Zamboanga del Sur.

8. Strengthen local seaweed growers associations and cooperatives as a vehicle for mutual benefits and assistance to leverage for external technical and funding assistance, and as a mechanism to resolve conflicts among growers.

Finfish Cages and Crab Culture

1. The production of finfish or squids in cages should only be encouraged in selected protected coves.

2. The availability of sufficient fry from the wild or from reliable hatcheries should first be considered before any investments are made. Though MSU Naawan is also producing commercial quantity of *siganids*, the volume of production may not yet be sufficient to meet the need of the industry.

3. The culture and fattening of mangrove crabs in fishponds is dependent on the availability of crablets and fattening stock. Fish farmers throughout Zamboanga del Sur have recently observed the scarcity of crablets and “thin” crabs or *bayot* in their natural source. This may be caused by over-harvesting and the destruction of the crab’s natural habitat. Thus, the culture of mangrove crabs should only be considered as a “backyard” industry and not as a major aquaculture activity until hatchery-produced crab fries are easily made available.

4. Aquaculture should be included in the integrated development and management of watershed, catchment and the coastal areas through the establishment of a cross-sectoral planning mechanism in local government units.

7.2 Implementing a Zonation Plan

There is lack of order in the placement of fish cages, fish corrals and seaweed farms that their operations sometimes impinge on each other. One particular cage was destroyed because it was hit by a pump boat which tried to navigate between structures. Unless the municipalities zonify their coastal zones, the competition for space between cage operators and MPA advocates would remain unresolved inasmuch as important habitats such as seagrass beds, mangrove forests and coral reefs are all suitable for mariculture activities.

The municipal CRM plans should consider aquaculture development and the carrying capacities of coastal waters to be more meaningful and sustaining. This is to avoid the detrimental impact of aquaculture to the environment.

There is a need to delineate the boundaries of the municipal waters. Seaweed growers of Labangan sometimes encroached the Tukuran municipal waters and the reverse is also true. There is a need to formulate and implement water use zonation plans to protect the different habitats.

7.3 Provision of Infrastructures and Social Services

The relative isolation of some fishpond areas from the mainstream of communication and commerce and the lack of up-to-date information on market prices make growers rely on the information provided by fish traders and *compradors***.** Local governments should provide better communication facilities and construct better roads to make access to coastal areas and market easier.

Finally, local governments should always maintain peace and order in their respective jurisdictions. The risks from the unstable peace and order conditions in the area have discouraged entrepreneurs and investors from putting up business and staying in the region.

7.4 Probable Environmental Impacts

This early, growers should be made aware of the consequences of improper disposal of nonbiodegradable materials. The probable environmental impact of cage operations is not yet an immediate concern for most of them. It is possible that in the future, an array of fish cages would fill the tidal zone. At the outset, it is necessary to communicate among potential investors the need to control the possible adverse impacts of the accumulated unconsumed feeds and fish fecal matter on sea bottom. Given the necessary funding support, many fishermen expressed their interest to invest in fish cage operations. A study of water currents may also be needed in the future to determine the flushing rate and direction of flow of matter at all water levels.

The common practice of using cellophane as floats in seaweed farms in Zamboanga del Sur can become a problem if not properly disposed after use.

The Philippine Environmental Governance 2 Project (EcoGov 2)
Unit 2401, Prestige Tower
F. Ortigas Jr. Road (formerly Emerald Avenue)
Ortigas Center, Pasig City 1605
Philippines
Tel. (632) 635-0747 ❑ Fax: (632) 637-8779
http://ecogovproject.denr.gov.ph