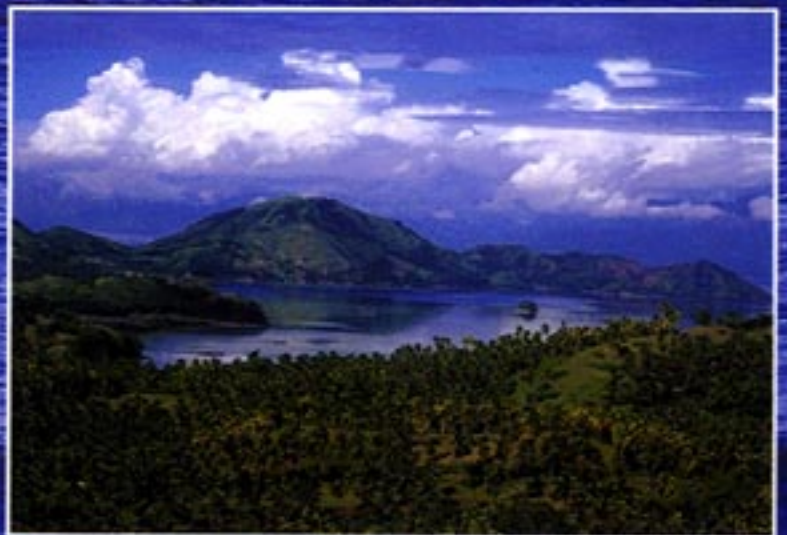


**COASTAL
ENVIRONMENTAL
PROFILE**
of the
MALALAG BAY AREA
Davao del Sur, Philippines

**Imelda S. Valle
Ma. Chona B. Cristobal
Alan T. White
Evelyn T. Deguit**



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Coastal Resource Management Project

of the

Department of Environment and Natural Resources

supported by the

United States Agency for International Development

2000

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FOREWORD

The Philippines is endowed with a rich abundance of coastal natural resources along its 18,000 km of shoreline. Davao del Sur, with the longest shoreline in Region 11 stretching along 11 municipalities, is no exception. Davao del Sur has long depended on its fisheries, coral reefs, mangroves, beaches, coastal bays, and estuaries for aquaculture and other uses. From the upland to the seas of Davao del Sur, occupations in food security employ a large portion of the coastal population. But, unfortunately, trends in production are not good.

As in other coastal areas, the coastal resource base is being degraded through a variety of impacts from human folly. Fisheries are being depleted through excessive effort and use of destructive methods. Shoreline habitats are either being damaged or converted to alternative uses that no longer support viable fisheries as in the past. Equally, agriculture practices in coastal and upland areas are having many negative impacts on coastal resources and particularly water quality because of poor soil management practices, use of pesticides and other chemicals, and increasing deforestation. All these problems emphasize the need for integrated coastal management in Davao del Sur.

The first step towards a more integrated and comprehensive planning and management regime for coastal resources is to develop an information base that guides planning. The *Coastal Environmental Profile of the Malalag Bay Area* represents an important first step in the coastal management process. It can help guide long-term solutions to some of the coastal problems of the area and provide a set of baseline data upon which to measure changes in the environment in the present and the future. It can also be used to monitor the effectiveness of coastal projects.

This profile will assist in informing all the decision-makers and stakeholders in the areas about the need to protect and manage their coastal areas and resources. It contains much useful information and provides guidance on management policies. Let us use it wisely and develop much-needed coastal management plans for our province.

ROGELIO E. LLANOS
Governor
Davao del Sur

PREFACE

The *Coastal Environmental Profile of the Malalag Bay Area, Davao del Sur, Philippines* provides baseline information on the coastal environment of the Malalag Bay Area. It will assist with management planning at the municipal and *barangay* levels within the Malalag Bay Area for years to come. It is also useful as a guide for other coastal municipalities in Davao del Sur and Davao Gulf.

This profile is produced as part of the activities of the Coastal Resource Management Project (CRMP) in collaboration with the municipalities and province of Davao del Sur. The CRMP has worked in the area since 1996 to develop and encourage leaders among local communities, nongovernment organizations, and local government units to work for coastal resource management (CRM). CRM is the process of planning, implementing, and monitoring beneficial and sustainable uses of coastal resources through participation, collaboration, and sound decision-making. This is achieved by involving the affected community, resource users, local and regional government, nongovernment organizations, and the private sector. It aims to promote an integrated coastal management approach that focuses on sustainable coastal resource use and minimizes direct negative impacts on coastal resources from fishing, aquaculture, and other forms of development.

Malalag Bay typifies a once-rich ecosystem now ravaged by the misuse and abuse of the people who have lived from the bounty of the sea. The coastal habitats of Malalag Bay are characterized by a few patches of secondary growth of mangrove forest, some seagrass areas, and about 100 ha of coral reefs. This represents a significant decline over 50 years ago and hopefully sets the baseline on improvement for the area through improved protection and management.

The bay is considered a favorable site for port and industrial facilities as well as aquaculture development. This presents another challenge in that such development normally depletes the natural resource base through reclamation and pollution. CRM planning for Malalag Bay must consider the trade-offs between maintenance and improvement of its natural resource base of habitats and fisheries and shoreline development of aquaculture and industries. The bottom-line is that all development must be done in a manner that minimizes waste and pollution.

The integrated and participatory approach to coastal management for the profile area of Malalag Bay has proven successful in other areas of the Philippines. This approach depends on the dynamic action of community groups with local and national government agencies responsible for resource management. This participatory approach does not dictate to the people, but rather, equips them, who rely the most upon the coastal environment, with the necessary tools to make rational and sustainable decisions. The first step in this process is the development of baseline information for planning. This profile completes this step for the Malalag Bay Area.

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The preparation of this coastal environmental profile was made possible by the assistance and cooperation of many institutions and individuals inside and outside of the Malalag Bay Area. The following government organizations are thanked for contributing important data:

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Environment and Natural Resources Office, Davao del Sur
Bureau of Fisheries and Aquatic Resources, Region XI
Department of Environment and Natural Resources, Region XI

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Finally, this profile could not have been completed without the commitment of Honorable Rogelio E. Llanos, Governor of Davao del Sur and all the municipal and *barangay* officials and employees within the Malalag Bay Area.

The Coastal Resource Management Project, implemented by the Department of Environment and Natural Resources and funded by the United States Agency for International Development, has published this document.

ACRONYMS and ABBREVIATIONS

BFAR	Bureau of Fisheries and Aquatic Resources
BFARMC	<i>Barangay</i> Fisheries and Aquatic Resources Management Council
CPUE	catch per unit effort
CRM	coastal resource management
CRMP	Coastal Resource Management Project
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DOST	Department of Science and Technology
DOT	Department of Tourism
EIA	Environmental Impact Assessment
ENRO	Environment and Natural Resources Office(r)
EO	Executive Order
FARMC	Fisheries and Aquatic Resources Management Council
GT	gross ton
ha	hectare
HALT	Hillside Agricultural Land Technology
kg	kilogram
km	kilometer
km ²	square kilometer
L	liter
LGU	local government unit
LOI	Letter of Instruction
mg	milligram
MGB	Mines and Geosciences Bureau
ml	milliliter
mm	millimeter
MSU	Mindanao State University
mt	metric ton
NEDA	National Economic and Development Authority
NGO	nongovernment organization
OPAG	Office of the Provincial Agriculturist
PCAMRD	Philippine Council for Aquatic and Marine Research and Development
PCRA	participatory coastal resource assessment
PD	Presidential Decree
PNP	Philippine National Police
PO	people's organization
PPDO	Provincial Planning and Development Office
ppt	parts per thousand
RA	Republic Act
SUML	Silliman University Marine Laboratory

COMMONLY USED LOCAL TERMS

Local Terms	English Translation	Local Terms	English Translation
FISHING GEAR			
<i>Baling</i>	Lift net	<i>Bolinao</i>	Anchovy
<i>Basnig</i>	Bag net	<i>Borot</i>	Scad
<i>Bubo (pangnokos)</i>	Squid trap	<i>Bugaong</i>	Therapon, tigerfish
<i>Bunsod</i>	Fish corral	<i>Bulan-bulan</i>	Flagtail
<i>Katay, palangre,</i> <i>pasol pambariles</i>	Long line	<i>Bulgan</i>	Big-eye
<i>Manubid, pamariles,</i> <i>pambaca, pamirit, subid,</i> <i>pangaraw, undak</i>	Single hook and line	<i>Butete</i>	Pufferfish
<i>Palangre/pamarilis, subid,</i> <i>panubid, pasol, undak</i>	Multiple hook and line	<i>Kabalyas</i>	Tuna and mackerel
<i>Palaran, panglambay,</i> <i>panglampornas, pamalo,</i> <i>pangtamban, pukot,</i> <i>pukot-doble, pukot-triple,</i> <i>pukot-paapong</i>	Gill net	<i>Kapal</i>	Damselfish
<i>Pamana, pana, pana-suga</i>	Spear gun	<i>Karaw</i>	Tuna and mackerel
<i>Pamante, pamo, pukot,</i> <i>pangnadhaw, patuloy,</i> <i>panggal</i>	Drift gill net	<i>Katambak</i>	Emperor bream
<i>Pamante triple, pamante-abay</i>	Bottom set gill net	<i>Kitong</i>	Rabbitfish
<i>Panggal</i>	Fish trap	<i>Dali-dali</i>	Flatfish
<i>Sudsud</i>	Scoop net	<i>Danggit</i>	Rabbitfish
		<i>Galunggong</i>	Scad
		<i>Ganting</i>	Squirelfish
		<i>Gapas</i>	Threadfin bream
		<i>Gisaw</i>	Mullet
		<i>Gonggong</i>	Therapon, tigerfish
		<i>Guno</i>	Silverside
		<i>Hinok</i>	Goatfish
		<i>Hilo</i>	Eel
		<i>Ibis</i>	Cardinalfish
		<i>Iho</i>	Shark
		<i>Ito</i>	Catfish
		<i>Labayan</i>	Wrasse
		<i>Lagaw</i>	Threadfin bream
		<i>Lalagan</i>	Snapper
		<i>Lapu-lapu</i>	Grouper
		<i>Latab</i>	Mojarra
		<i>Liplipan</i>	Billfish
		<i>Lipti</i>	Sweetlip and grunt
		<i>Mamsa</i>	Jack
		<i>Marang</i>	Billfish
		<i>Matambaka</i>	Scad
		<i>Maya-maya</i>	Snapper, seaperch
		<i>Mol-mol</i>	Parrotfish
		<i>Mongit</i>	Surgeonfish
		<i>Pagi</i>	Stingray
		<i>Palad-palad</i>	Flathead
		<i>Pandawan</i>	Dolphinfish
		<i>Pirit</i>	Tuna
		<i>Pugapo</i>	Grouper
		<i>Rompe-kandado</i>	Barracuda
		<i>Sagisi</i>	Threadfin bream
		<i>Salay-salay</i>	Crevalle, trevally
		<i>Salmon-salmon</i>	Scad and jack
		<i>Sapsap</i>	Slipmouth
FISHES			
<i>Alibangbang</i>	Butterflyfish		
<i>Aluman</i>	Snapper		
<i>Anduhaw</i>	Tuna		
<i>Aso-os</i>	Whiting		
<i>Badlon</i>	Jack, cavalla, crevalle		
<i>Bagis</i>	Surgeonfish		
<i>Balo</i>	Needlefish		
<i>Banak</i>	Mullet		
<i>Banghutin</i>	False whiting, blanquillo		
<i>Bangsi</i>	Flying fish		
<i>Bangus (semilya)</i>	Milkfish fry		
<i>Bantol</i>	Scorpionfish, turkeyfish, lionfish, stonefish		
<i>Barilason</i>	Jack, cavalla, crevalle, trevally, dart		
<i>Bariles</i>	Tuna and mackerel		
<i>Bilason</i>	Fusilier, bananafish		
<i>Bilong-bilong</i>	Moonfish		

Local Terms**English Translation**

<i>Solid</i>	Fusilier
<i>Sunogan</i>	Flathead
<i>Talakitok</i>	Scad and jack
<i>Tamban</i>	Herring
<i>Tangigue</i>	Spanish mackerel
<i>Tanglaron</i>	Wrasse
<i>Timbungan</i>	Goatfish
<i>Tulingan</i>	Frigate tuna
<i>Ubod</i>	Moray eel

MOLLUSKS

<i>Aninikad</i>	Miter shell
<i>Bulatok</i>	
<i>Imbaw</i>	Venus shell
<i>Litob</i>	Bubble shell

OTHER INVERTEBRATES

<i>Alamang</i>	Small shrimp
<i>Alimango</i>	Mud/mangrove crab and blue crab
<i>Balat</i>	Sea cucumber
<i>Banagan</i>	Shovel-nosed, slipper lobster
<i>Kasag</i>	Mud/mangrove crab and blue crab
<i>Kubutan</i>	Cuttlefish
<i>Kugita</i>	Octopus
<i>Lambay</i>	Blue crab
<i>Lokon</i>	Penaeid shrimp
<i>Nokos</i>	Squid
<i>Pasayan</i>	Penaeid shrimp
<i>Tostos</i>	Squid
<i>Uyap</i>	Small shrimp

GLOSSARY OF TERMS

Bag net. A mobile impounding drag net; locally called *basnig*. This is a conical or cubical net operated with the aid of light on dark nights. A lifting motion effects the capture. Requires about 7 to 10 people.

Bottom set gill net. An entangling net which is locally called *pamante-triple* or *pamante-abay* or by the generic name for gill net (*pukot*). This net is anchored, weighed down, or attached to the bottom so that it is not free to move with the water current.

Commercial fishing. Fishing for commercial purposes in waters more than 15 km from the shoreline with the use of fishing boats of more than 3 GT.

Drift gill net. An entangling net commonly called *pamo*. It is also locally referred to as *pamante*, *patuloy*, *pangtamban*, or by the generic gill net name, *pukot*. When used at night, with light, it is also referred to as *panganduhaw*. This type of gill net is usually fixed to boats and is free to move with the wind or tide, and is used throughout the year.

Fish cage. Any method of culture of fish and aquatic resources in a fish enclosure which is either stationary or floating, made up of nettings or screens sewn or fastened together and installed in the water with opening or cover at the surface and held in place by wooden/bamboo post or various types of anchors and floats.

Fish corral. Locally known as *bunsod*, this is a guiding barrier constructed of bamboo and/or nets which are set by means of regularly-spaced stakes or posts in tidal waters or along the natural paths of fish into a desired area. Trapped fish may be collected daily during the morning, especially during the months of May to December.

Fish pen. An artificial enclosure constructed within a body of water for the culture of fish and aquatic resources made up of bamboo and other poles arranged in an enclosure with either fine bamboo materials, screen, or nylon netting to prevent escape of fish.

Fish sanctuary. A place set aside or an established fishery reserve or fish refuge and sanctuary where it shall be unlawful for any person, corporation, and cooperative to conduct any fishing operation or disturb, take, catch, destroy, or kill any marine organism within the designated body of water.

Fish trap. Locally called *panggal*, is a set trap or enticing device made of bamboo or rattan which is a regular, usually rectangular, receptacle preventing escape of fish by means of trap doors or tricky passageways. Trapped fish may be collected at regular intervals, in terms of days or weeks.

Fishery. The business of catching, taking, raising, culturing, handling, marketing, and processing of fish and other aquatic products. The fishing grounds, the right to fish, or take such products therefrom.

Fishery reserve. A designated area or areas in municipal waters or Philippine waters either by ordinance or proclamation as fishery reservation for the exclusive use of the government or of the inhabitants thereof or for the culture of fish and other aquatic animals for educational, scientific, and conservation purposes or fishing rights reserved for exclusive use of the government.

Gill net. Various sized entangling net in which capture of fish is by gilling effected by the actual meshes of the net. This is commonly referred to by locals as *pukot*, *palaran*, *pamalo*, *panglambay*, *panglampornas*, *pangtamban*, *pukot-doble*, *pukot-triple*, *pukot paapong* (with light).

Lift net. A mobile impounding net in which capture is effected by a vertical lifting motion of the gear. It is locally called *baling* usually used with petromax.

Long line. An extremely long line with a large series of baited hooks, either set or drifting, and requiring only periodic attention at more or less fixed time intervals. Generic local name is *pasol* (for line) with hook numbers ranging from 2 to 1,000 and hook sizes ranging from #12 to #17, #100 to #120, #565 to #579. Filament size varies from nylon #8 to #150. Other local names are *palangre*, *katay*, *pasol-pambariles*, *panubid*, *undak*.

Multiple hook and line. A collective name applied to all handlines with multiple hooks including set or drift long lines. Multiple handlines are composed of a single vertical line with a small series of barbed hooks attached to it by spreaders at regular intervals.

Municipal waters. Waters included between two lines drawn perpendicular to the general coastline from points where the boundary lines of the municipality or city touch the sea at low tide and a third line parallel with the general coastline and 15 km from it. It also includes streams, lakes, and tidal waters within the municipality, not being the subject of private ownership and not comprised within the national parks, public forests, timberlands, and forest reserves. However, where two municipalities are so situated on the opposite shores that there is less than 15 km of waters between them, the third line shall be equally distant from the opposite shores of the respective municipalities.

Scoop net. Also referred to as scoop seine which is basically a small purse seine employed as an accessory gear in hauling the catch direct from the large semicircular enclosure of deepwater fish corrals which may be devoid of a collecting pond or crib. It also refers to a fishing method wherein schools of fishes lured towards surface waters by light are scooped out of the water with a circular net. Locally called *sudsud* (with petromax).

Single hook and line. Also called simple handline or drop line. A single vertical line carrying one or two barbed, baited hooks and worked simply by dropping into the water and waiting for a fish to bite. Generic local name is *pasol* or *subid*. Also called by various names, most often after the most dominant species in the catch, such as *manubid-pamarilis*; *pambaca*; *pamirit*; *pangaraw*; *palutao (ulang)*; *pamalo*; *pamariles* (deep-sea fishing); *pamirit*; *pangtangigue*; *pawin*; *subid*; *undak* (with light). Hook sizes range from #06-#20 to #566-#571 while filament size varies from nylon #8 to #190.

Spear gun. Locally called *pana* or *pamana*, sometimes *pana-suga*. It constitutes a hand instrument provided with pointed, barbed, or barbless blades at the straight tip which are not detachable from the handle or shaft. It can be thrown by hand although sometimes shot from a gun or bowlike device. It is used at night or dawn, with a light source. Fishers may come in groups of two or three with one spear gun each.

Squid trap. Similar to fish traps with screen as siding and specifically targets squids by using squid-attracting baits.

Chapter 1

INTRODUCTION



Malalag Bay is a 65 km² semi-oval embayment located on the southwestern coast of Davao Gulf with 58 km of coastline from Barangay Balutakay, Hagonoy to Colapsin Point in Sta. Maria (Figure 1.1). It is located within the grid coordinates between 6° 21' 57" to 6° 42' 50" north latitude and 125° 05' 29" to 125° 34' 48" east longitude within the province of Davao del Sur which lies at the southeastern portion of Mindanao.

Malalag Bay is under the jurisdiction of five municipalities: Hagonoy, Malalag, Padada, Sta. Maria, and Sulop, collectively called as the Malalag Bay Area (MBA). The MBA is bounded on the north by Digos and Matanao, on the east by Davao Gulf, on the south by Malita and Malungon, Sarangani Province, and on the west by Sultan Kudarat and North Cotabato.

Malalag Bay was once called Kasilaran Bay, named after a palm found abundant in the area. In the 1970s, when the municipality of Malalag was gaining popularity as a developing town within the bay area, Kasilaran Bay was then renamed. The bay was called Malalag Bay due to its proximity to Malalag and its wharf located in the innermost portion of the bay.

Most of the inhabitants of the MBA are of Visayan origin. They came from the islands of Bohol, Leyte, Negros, Panay, and Samar with the majority coming from Cebu. A few Muslims also inhabit the area primarily from the provinces of Basilan, Sulu, Tawi-Tawi, and other Muslim-dominated provinces of mainland Mindanao.

Two aboriginal tribes, Kalagans and the Tagacaolos, inhabit the MBA. The Kalagans

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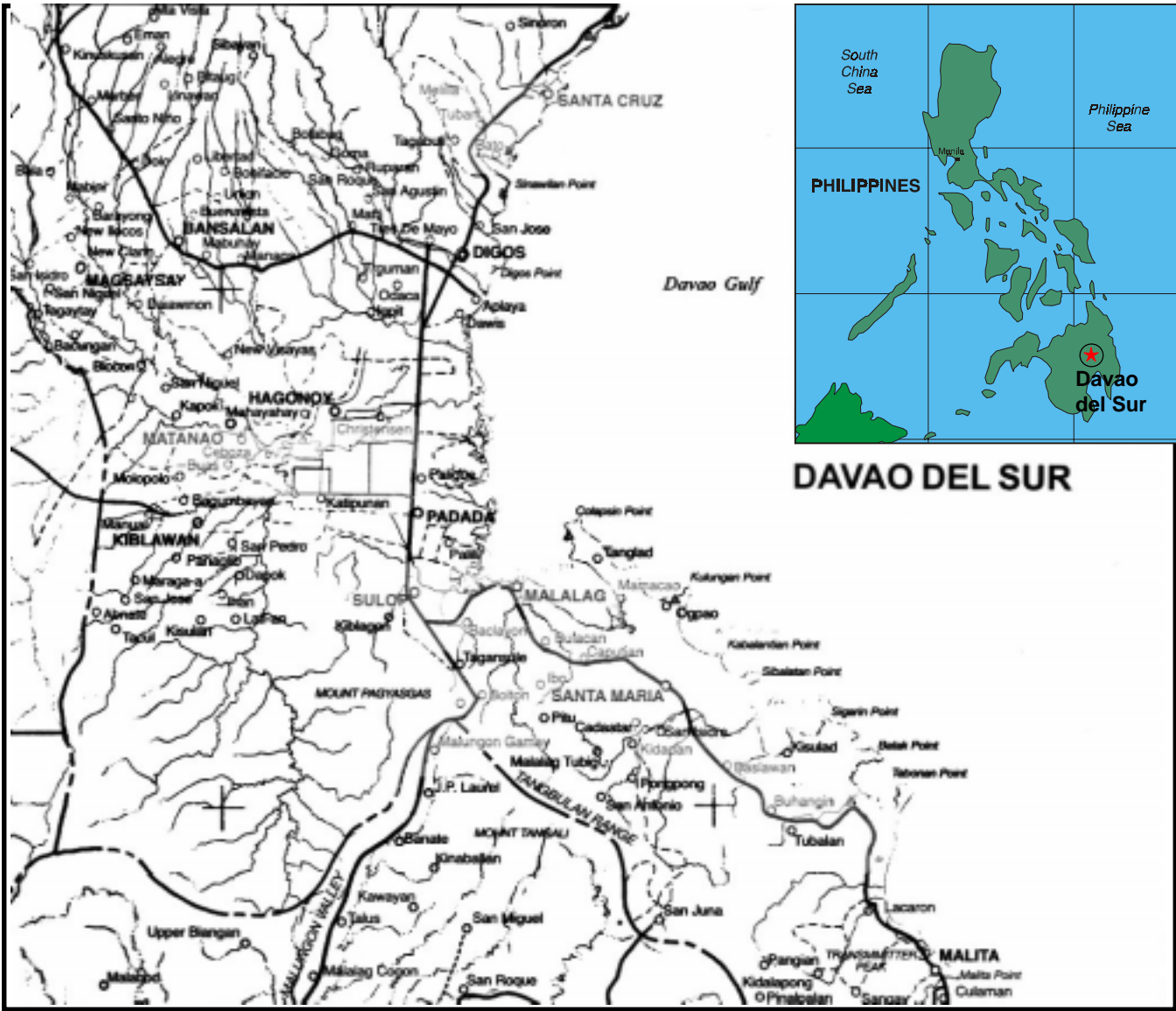


Figure 1.1. Malalag Bay with outlying municipalities.

reside in Barangay Aplaya of Hagonoy while the Tagacaolos are natives of Sta. Maria. However, few are located in the coastal area with the majority located in the upland communities of the municipalities of Malita, Don Marcelino, and Jose Abad Santos.

The bountiful coastal resources of Kasilaran Bay persuaded the Muslims, Cebuanos, and other Visayans to settle along the area between 1920 and 1940. Old settlers felt the coastal and marine resources of the bay could support any human utilization and exploitation.

In the 1950s, dynamite fishing caused much destruction to the coral reefs, but people

did not notice its effects on the ecosystems nor on their livelihood. They, however, pursued different fishing methods to maintain or even increase their volume of catch unaware of the depletion of the fish stocks.

Devastation of the forest cover was also brought about by logging activities from the 1940s until the 1960s when timber was hauled to Malalag Bay and transported by ships outside the municipality. Succeeding destruction was hastened by the continuing influx of migrants to the logged areas, triggered primarily by a lack of economic opportunities in the lowlands. Slash-and-burn farming still persists and has caused much destruction, not only to the forest cover but also to the biodiversity of the place. Denudation continues to pose a grave threat to the community with the lands exposed and vulnerable to soil erosion and degradation. MBA now experiences long dry spells that result in the drying of water sources in general.

Davao Gulf and the MBA in particular share the following environmental problems and concerns as the rest of Mindanao:

- Forest destruction - Forest denudation has accelerated the loss of top soil, increased the severity and frequency of floods, increased siltation to downstream farms, settlements, and various coastal habitats, and decreased the supply of water for domestic and agricultural use. The rapid increase in the population of farmers aggravates issues of land tenure, sustainability of traditional sloping agricultural practices, and access to basic services.
- Water pollution - Pollution of the rivers and seas is mainly being caused by unregulated disposal of industrial, agricultural, and household wastes as well as oil spills. Pollution caused by fertilizers, chemicals, and pesticides from banana plantations and other agricultural development; effluents from sugar milling plants and other industrial establishments; oil spills dumped by docking vessels and motorized fishing boats that produce oil wastes during cleaning and changing oil; waste discharges such as uneaten fish feeds, fecal and excretory wastes from mariculture activities; and the solid waste pollution brought about by the negligence of households in the proper disposal of trash and the cellophane from the banana plantations resulted in the gradual depletion of the marine ecosystem. The narrow shelf makes the mangrove, seagrass, and coral reef communities vulnerable to these land- and sea-based sources of pollution.
- Persistent illegal and destructive fishing activities - The use of dynamite, poisonous plant extracts, and obnoxious commercial substances during fishing; the illegal entry of commercial fishing boats within the bay; the use of fine mesh nets including *baling* and *lampornas* resulted in the depletion of fishery resources.

Forest denudation continues to pose a grave threat to the community with the lands exposed and vulnerable to soil erosion and degradation.

It is further compounded by the increasing population of fishermen along the coastline and the open-access nature of the fishery especially for the small pelagic fishery.

Beset with various environmental problems, the MBA was selected as one of the six learning areas of the Coastal Resource Management Project (CRMP). The MBA serves as one of the models for CRMP which spearheads coastal resource management (CRM) through community leadership and initiatives.

This coastal environmental profile provides baseline information on the coastal habitats, resources, and socioeconomic condition of the MBA to the local government units (LGUs), nongovernment organizations (NGOs), people's organizations (POs), and the coastal communities and will serve as a guide in the development and formulation of CRM plans in the MBA.

The specific objectives of this profile are to:

- Determine the status of the shallow nearshore habitats, resources, and socioeconomic condition of the inhabitants for monitoring purposes;
- Identify issues and constraints besetting the MBA to be used in assessing the progress of the CRM;
- Synthesize mapped information which will constitute a visual database for spatial analysis;
- Summarize and assess information and ecosystem and resources, social and economic conditions, and legal and institutional regimes for management; and
- Provide a source of information for communities, government, planners, researchers, and others in the planning and education process.

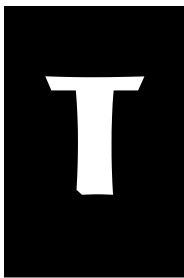
This coastal environmental profile covers the MBA from the boundary of Hagonoy to the boundary of Sta. Maria. It is a compilation of existing baseline information available from the five municipalities, Provincial Planning Development Office (PPDO) of Davao del Sur, Mindanao State University (MSU), Silliman University (SU), Department of Agriculture (DA), Department of Environment and Natural Resources (DENR), and from actual biophysical and socioeconomic surveys of the coastal zone.

Information for this profile was collected from primary sources including a participatory coastal resource assessment (PCRA), short-term site surveys, interviews with local resource users, LGUs, and community discussions. Secondary sources such as reports, maps, government files, and photographs were also utilized.



Chapter 2

PHYSICAL FEATURES



The Malalag Bay Area (MBA) is characterized by distinct physical features which make it unique within the province of Davao del Sur. This chapter presents information on the land area, topography, hydrology, soil, land uses, and climate in the MBA.

LAND AREA

The MBA has a total land area of 70,783 ha and a coastline of 71 km. Of the five municipalities, Sta. Maria is the largest with a total land area of 20,478 ha while Padada is the smallest municipality with 4,503 ha. However, more than 80 percent of the area is agricultural with less than 20 percent considered as coastal area. In terms of length of coastline, Sta. Maria has the longest coastline with 46 km, followed by Malalag (8 km), Hagonoy (8 km), Padada (6 km), and Sulop (3 km).

Table 2.1 shows the land area distribution and the coastline length of each municipality within the MBA while Figure 2.1 shows the proportion of non-coastal and coastal *barangay* land area per municipality.

TOPOGRAPHY

The general topography of the MBA is flat with scattered hills and mountains. The level portions of the MBA are in the municipalities of Hagonoy, Padada, and Sulop which partly comprise the Padada River Basin where irrigated land areas are found. The stretch of flat land is estimated to be 55 percent of the total land area.

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and a
coastline of
71 km.***

Table 2.1. Land area distribution and coastline length of each municipality in the MBA.

Municipality	Land area (ha)	Coastal area (ha)	Total no. of <i>barangays</i>	No. of coastal <i>barangays</i>	Length of coastline (km)
Hagonoy	11,664	2,472	21	5	8
Malalag	18,612	2,040	15	3	8
Padada	4,503	1,133	17	4	6
Sta. Maria	20,478	6,487	22	8	46
Sulop	15,526	288	25	1	3
Total	70,783	12,420	100	21	71

Source: PPDO (1996).

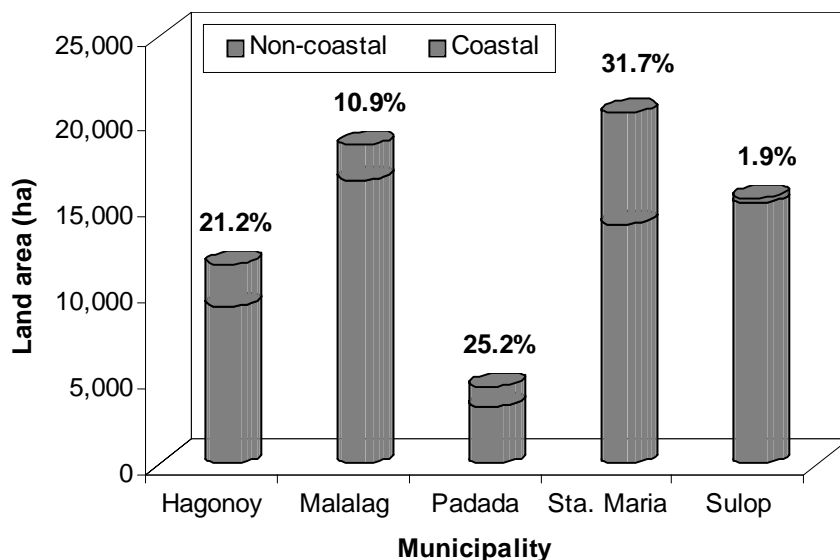


Figure 2.1. Proportion of non-coastal and coastal *barangay* land area per municipality.

On the southern frontiers and most of its borders are hilly lands and mountains. In Malalag Bay, the mountain range serves as a natural barrier from storms or strong winds making it a safe anchorage for inter-island vessels. Along the eastern side of the Sta. Maria coast are narrow white beaches and seagrass beds and coral reefs. On the northern and southeastern parts of Malalag, Sulop, Padada, and Hagonoy are flatlands, volcanic sand, fishponds, and seagrass beds.

HYDROLOGY

The waters of Davao Gulf and Malalag Bay are strongly oceanic as a result of its size and the interaction of the Pacific equatorial current as it encounters eastern mixing during strong monsoons. The inner part of the bay is an estuary.

The total water area of Malalag Bay is 65 km² while the municipal waters extend to cover an area of approximately 135 km². There are nine rivers in the MBA; however, only three major rivers drain into Malalag Bay. These are the Mal River and the Balatukan River, both draining in the Hagonoy coast and the Balasinon River that drains in the area bordering Malalag and Sulop. The Balasinon River, though large and of economic importance due to oyster culture, is not really a river but a long estuary that is used as a major canal of adjacent fishponds. Circulation of bay water, however, does not seem to favor the outflow of water from the bay (Figure 2.2).

In 1998, the CRMP conducted an environmental study to determine the health status of Malalag Bay for mariculture (pens and cages) activities. The decision to declare a given portion of Malalag Bay as suitable or unsuitable for mariculture was based on a direct parameter comparison with the DENR and derived standards. The findings based on the amount of wasted feed solids settled at the bottom, indicated that the intensity of fish culture in the bay exceeded its limits by about 2.5 times (Baleña 1998).

The suitability map (Figure 2.3) shows that the whole bay is only conditionally suitable (medium) for culture while nearly two-thirds of the bay is classified as unsuitable (low). Further complications are the mariculture usage of the entrance to the bay, the sanctuary, and the marginal areas shallower than 2 m (tidal range). This result is corroborated by the suitability rating of about 40 percent, averaged spatially from the suitability plot. The findings of the study, however, are valid for the northeast monsoon period of observation, simplified by the virtual absence of tributaries to the bay, due to the prolonged spell of the El Niño.

In 1999, the MSU conducted physical, chemical, and biological studies of the coastal waters of Davao del Sur which covered ten coastal municipalities including four MBA municipalities: Hagonoy, Padada, Malalag, and Sta. Maria. Table 2.2 shows the DENR water quality criteria for coastal and marine waters while Tables 2.3, 2.4, and 2.5 show the physical, chemical, and biological properties of the coastal waters of Davao del Sur, respectively.

As seen in Table 2.3, the nearshore area is flat (depth = 1.2 - 5.0 m) and gradually slopes down in an irregular manner (depth = 25.0 m). Transparency in nearshore waters was low (4.0 m) while highest light penetration was 14.25 m at a depth of 25 m. Temperature readings ranged from 28 to 31°C. Highest total suspended solids were obtained in Don Marcelino at 5.88 mg/L which was due to the sediment discharge of the river nearby. pH values in all

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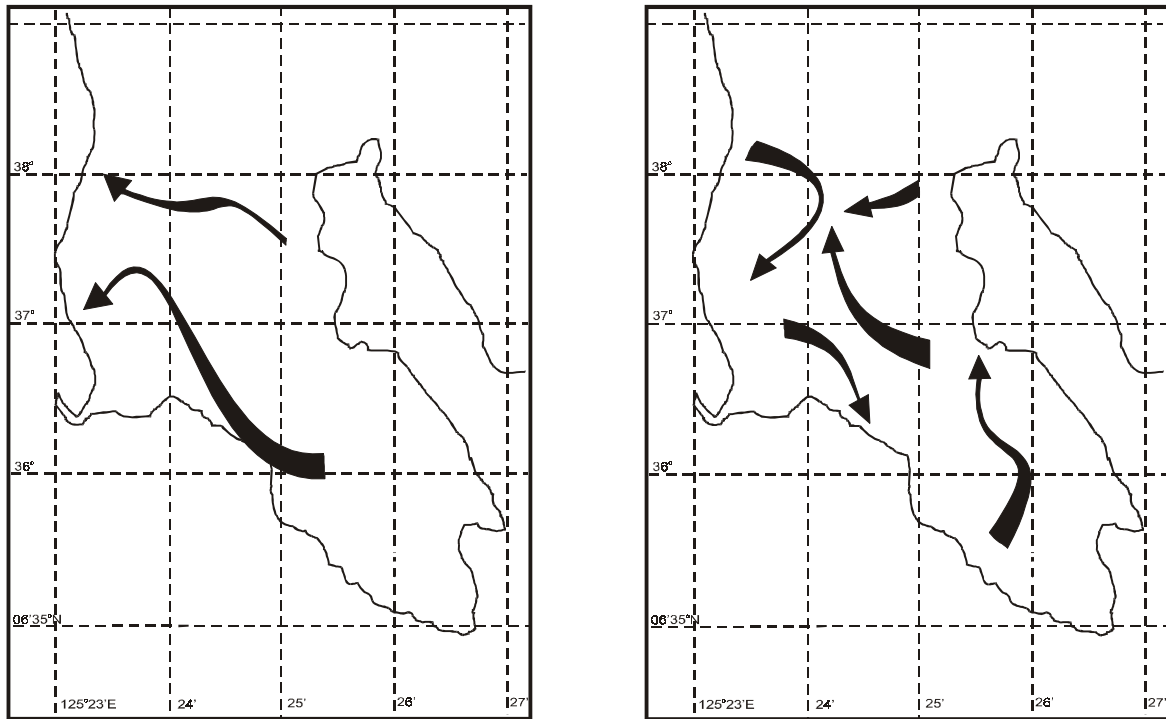


Figure 2.2. The circulation of Malalag Bay.

Notes: Left: during the rising tide; Right: during the falling tide.

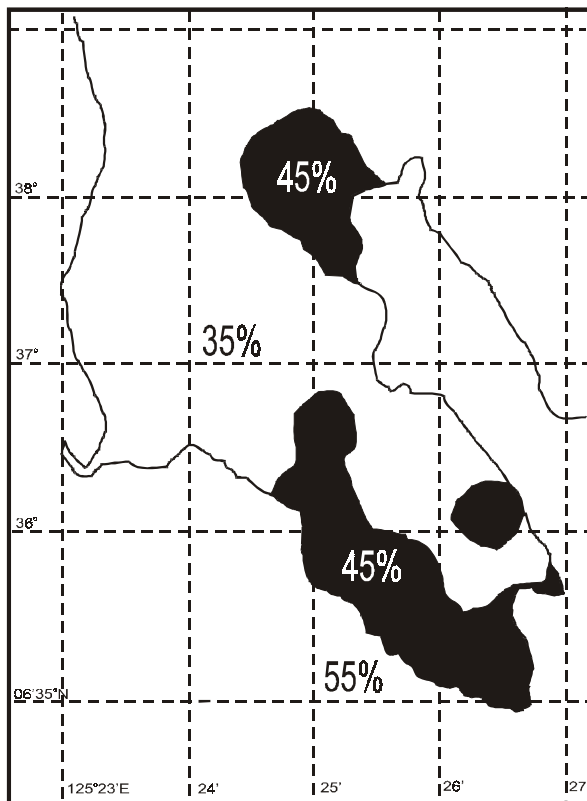


Figure 2.3. Suitability of Malalag Bay for mariculture.

*Notes: LOW (0-33%) - unsuitable; MEDIUM (34-67%) - conditionally suitable (supervised or regulated mariculture); HIGH (68-100%) - suitable
The whole bay area is classified under MEDIUM suitability and, hence, allows only supervised mariculture activities. Nearly 2/3 of the bay is almost suitable for these activities.*

Source: Baleña (1998).

Table 2.2. Water quality criteria for coastal and marine waters. 7

Parameters	Units	SA	SB	SC	SD
Physical					
Temperature	°C	3	3	3	3
pH (range)	-	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.0-9.0
Dissolved oxygen	mg/L	5.0	5.0	5.0	2.0
Total suspended solids	mg/L	<30/L inc.	<30/L inc.	<30/L inc.	<30/L inc.
Chemical					
Cadmium	mg/L	0.05	0.01	0.01	-
Chromium	mg/L	-	0.02	0.05	-
Copper	mg/L	0.05	0.05	0.05	-
Mercury	mg/L	0.002	0.002	0.002	-
Biological					
Total coliform	MPN/100ml	70	1,000	5,000	-
Fecal coliform	MPN/100ml	Nil	200	-	-

Note:

Class SA: Suitable for propagation, survival and harvesting shellfish for commercial purposes. Suitable as tourist zone, establishment of natural marine parks and coral reef parks

Class SB: Recreational Water Class I. Areas regularly used for public bathing, swimming, skin diving, etc. Fishery Water Class I. Spawning areas for Chanos chanos (bangus or milkfish) and similar species.

Class SC: Recreational Water Class II. Boating, etc. Water Class II. Commercial and sustenance fishing. Marshy and for mangrove areas declared as fish and wildlife sanctuaries.

Class SD: Industrial Water Supply Class II. Cooling, etc. other coastal and marine waters, by their quality, belong to this qualification.

Source: DENR Administrative Order No. 34, Series of 1990.

Table 2.3. Physical properties of the coastal waters of Davao del Sur.

Study site	Station	Depth (m)		Transparency		Temperature (°C)		pH		DO (mg/L)		Salinity (ppt)		Total suspended solids (mg/L)	
		Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore
Sta. Cruz	Coronan	2.20	14.00	1.20	7.50	29.00	31.00	8.50	8.50	4.65	4.50	29.00	31.00	2.86	3.20
	Bato	1.50	24.00	0.00	9.50	31.00	31.00	8.10	8.50	4.20	4.80	30.00	30.00	8.22	1.20
	Tagabuli	2.70	21.00	1.80	8.00	30.60	31.00	8.50	8.40	4.80	4.90	30.00	30.00	2.24	2.16
Malalag	Centro	1.20	14.00	1.20	7.50	29.00	30.00	8.40	8.40	4.60	5.10	30.00	30.00	1.90	2.98
	Baybay	1.50	13.00	0.80	5.50	30.00	30.00	8.40	8.50	4.20	4.50	25.00	28.00	1.86	2.85
Digos	Aplaya	1.77	22.67	1.01	12.25	29.30	30.00	8.40	8.60	5.00	5.20	16.66	28.66	2.50	1.80
	Davis	1.80	25.00	1.80	14.25	30.00	31.00	8.40	8.60	5.10	5.00	30.00	31.00	1.66	1.98
Sta. Maria	Kulungan	20.00	7.50	1.67	3.60	28.56	28.50	8.46	8.60	5.20	5.80	29.00	29.00	1.90	2.98
	Basiawan	4.50	8.70	1.50	3.33	29.00	29.00	8.40	8.50	5.50	3.10	25.00	27.50	1.86	3.58
Malita	Tubalan	5.00	19.00	4.00	9.33	30.00	29.00	8.60	8.50	5.20	5.70	28.00	30.00	2.85	3.08
	Poblacion	3.10	10.00	1.25	4.65	29.00	28.00	8.46	8.60	5.50	5.80	30.00	31.00	2.42	3.47
Don Marcelino	Kinama	2.83	15.00	0.00	7.00	28.00	29.00	8.50	8.60	3.60	4.50	25.00	28.00	8.88	5.28
	Lawa	4.33	18.66	0.00	6.66	28.00	29.00	8.50	8.70	2.50	3.10	22.00	26.00	8.06	5.88

Source: MSU (1999).

Table 2.4. Chemical properties of the coastal waters of Davao del Sur.

Municipality	Sampling station	Nitrate (mg/L)		Phosphate (mg/L)		Orthophosphate (mg/L)		Ammonia (mg/L)	
		Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore	Near-shore	Off-shore
Sta. Cruz	Coronan	0.059	0.068	0.241	0.258	0.363	0.315	-	0.019
	Bato	0.049	0.090	0.630	0.284	0.474	0.306	0.006	0.019
	Tagabuli	0.049	0.043	0.276	0.302	0.297	0.250	0	0.006
Malalag	Centro	0.034	0.610	0.280	0.267	0.261	0.239	0	0.013
	Baybay	0.031	0.078	0.319	0.319	0.341	0.201	-	-
Digos	Aplaya	0.650	0.800	0.238	0.302	0.411	0.450	0	0.043
	Dawis	0.480	0.719	0.051	0.306	0.459	0.540	0	0.023
Sta. Maria	Kisulad	0.859	0.837	0.070	0.358	0.275	0.110	0	0.012
	Basiawan	0.831	0.816	0.044	0.162	0.245	0.123	0.006	0.006
Malita	Tubalan	0.670	0.769	0.039	0.123	0.192	0.070	0	0.006
	Poblacion	0.834	0.766	0.154	0.603	0.083	0.040	0	0.012
Don Marcelino	Kinama	0.834	0.803	0.039	0.092	0.127	0.062	0.006	0.006
	Lawa	0.619	0.734	0.171	0.354	0.210	0.083	0	0.012

Source: MSU (1999).

Table 2.5. Biological properties of the coastal waters of Davao del Sur.

Municipality	Sampling station	Total coliform (MPN/100 ml)		Fecal coliform (MPN/100 ml)	
		Nearshore	Offshore	Nearshore	Offshore
Sta. Cruz	Bato	140	80	110	80
Digos	Dawis	110	80	80	80
Padada	Punta Piape	240	180	210	110
Hagonoy	Aplaya	180	140	180	180
Malalag	Baybay	80	40	80	80
Malita	Poblacion	140	80	110	80
	Sabang	110	80	80	80
Sta. Maria	Basiawan	110	80	80	80
Don Marcelino	Poblacion	240	180	210	180

Source: MSU (1999).

stations ranged from 8.1 to 8.7 which were slightly alkaline while dissolved oxygen (DO) concentration was 2.5 to 5 mg/L. Low DO was obtained in Don Marcelino. The turbidity of the water and the high total suspended solids affected the photosynthetic activity of the phytoplankton resulting in low DO. Decomposition of organic matter was also contributory since wastes from fish landing areas were drained into the sea.

Based on Table 2.4, Sta. Maria, Malita, and Don Marcelino showed a higher nitrate concentration from 0.67 to 0.859 mg/L than the other sampling stations. Ammonia levels were not detected while others had very low concentration. The actual amount depends on the balance between animal excretory rates and plant uptake and bacterial oxidation. Phosphorus that exists as phosphate was highest (0.2 to 0.319 mg/L) in Malalag while other stations had 0.05 to 0.27 mg/L. Orthophosphate in all stations ranged from 0.04 to 0.363 mg/L. The concentration of phosphorus in waters depends on the available sources of phosphorus in the area.

Guihing in Hagonoy was the only sampling area for heavy metals. Cadmium was not detected while chromium was less than 0.009 mg/L and copper, 0.1 mg/L. Lead (0.3 mg/L) and total mercury (0.003 mg/L), however, were detected. Based on the DENR standards for heavy metals, concentration in the area is negligible but slow accumulation can occur in the substratum of the area.

As seen in Table 2.5, all sites sampled yielded positive results for coliform contamination. Highest coliform counts were obtained in Punta Piape (Padada). Results of fecal coliform counts showed that the primary source of concentration is of fecal origin. Animal wastes and garbage were left unattended and fecal matter were seen littered in the coastline. If compared with Table 2.2, the coastal waters of the 10 sampling stations could qualify for Class SB which are generally safe for public bathing, swimming, and skin diving and can be used as spawning grounds for milkfish and other commercially important species. However, these areas are unsafe for consumption of raw seafood especially bivalves and other filter feeders. Intestinal bacteria polluting the water could concentrate in the gills of filter feeding organisms, which when eaten raw, can cause intestinal disorders.

SOIL

A significant land resource advantage of the MBA is the presence of vast fertile agricultural lowland plains with rivers running through them. Principal soil types in the MBA by municipality are shown in Table 2.6.

LAND USES

The MBA has a total land area of 70,783 ha of which more than 70 percent is classified as alienable and disposable land while about 27 percent is timberland (Figure 2.4). The land-use

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plan for the entire MBA is not yet complete. Of the five municipalities, only Hagonoy and Malalag are currently undertaking revision of their land uses.

The MBA is predominantly agricultural. The allocation of agricultural area ensures the

Table 2.6. Soil classification of the MBA by municipality.

Municipality	Soil type	Parent material	Distinct characteristics
Hagonoy	San Miguel silty clay loam	Alluvium mainly washed from uplands, underland with igneous rocks	Fertile and productive soil and adaptable to most agricultural crops
Malalag	Madunga clay loam	Mixture of shale, sandstone, and gravel deposits	Moderately fertile; good for pasture
	Malalag clay loam	Mixture of igneous metamorphic and shale	Limited agricultural use due to thin soil profile suited to forestry
Padada	San Manuel silty clay loam San Manuel clay loam Cabangan clay loam	Alluvium mainly washed from uplands, underland with igneous rocks	Fertile, productive, adaptable to most agri-crops
Sta. Maria	San Manuel silty clay loam San Manuel clay loam Malalag clay loam	Alluvium mainly washed from uplands, underland with igneous rocks	Fertile, productive, and adaptable to agri-crops suited to forestry
Sulop	San Manuel silty clay loam	Alluvium mainly washed from uplands, underland with igneous rocks	Fertile, productive, and adaptable to most agri-crops
	Cabangan clay loam	Alluvium washed from uplands, underland with sedimentaries	Excellent for rice when irrigated Needs drainage for upland crops

Source: PSPT (1994).

highest possible productivity in the agricultural sector for food security and inputs in the industrial sector. The big allocations of the agricultural area support the livelihood and employment of the majority of the people who are not yet prepared for skilled employment in the industrial sector.

Forestlands also comprise these municipalities. A great portion of their areas are timberlands where integrated social forestry (ISF) and appropriate upland farming system are being undertaken to regenerate depleted forest covers and likewise protect the critical watershed areas.

The built-up areas are subdivided into urban and rural. Most of the built-up areas are found in the urban areas which are experiencing an influx of migrating local population.

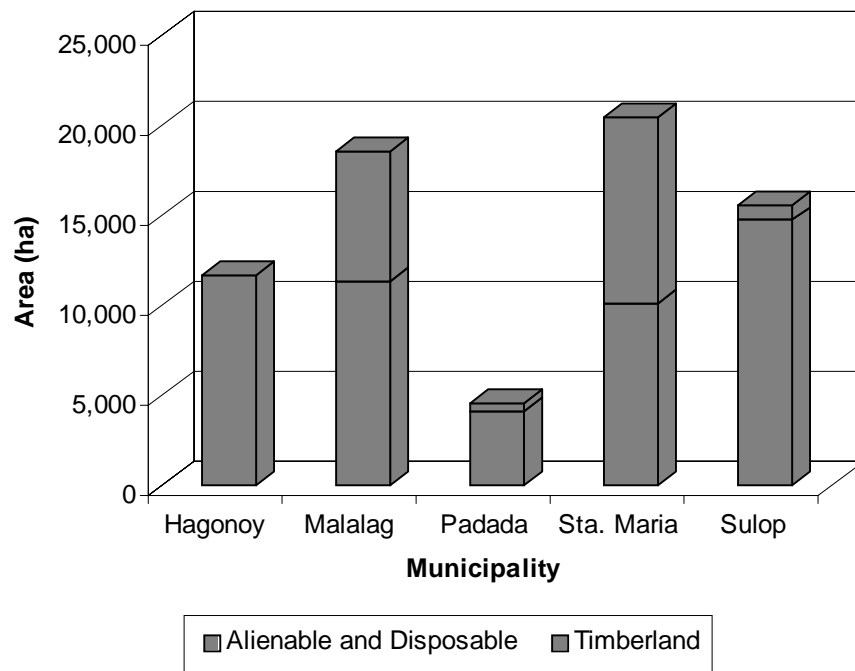


Figure 2.4. Land classification of the MBA by municipality.

Source: PPDO (1993).

A great portion of the coastal areas is allocated to fishponds. Some of these areas are under Fishpond Lease Agreements (FLAs) under the jurisdiction of the Department of Agriculture (DA). There are also some mangroves; however, conversion into fishpond areas has decreased mangrove area, thus depleting the natural productivity of the ecosystem in the bay area.

CLIMATE

The province of Davao del Sur is blessed with a favorable climate characterized by a wet dry season. The coldest time of the year is usually in December and January and the hottest in April and May.

The rainfall pattern generally conforms with type IV, characterized by a more or less evenly distributed rainfall with no marked seasonality. The province falls south of the typhoon belt and is therefore not normally affected by the main thrust of tropical depressions. The MBA has a climate which is favorable for agricultural production since most areas receive rainfall throughout the year and are not directly affected by typhoon and low pressure systems. Its

intermediate climate category is further characterized as receiving an annual rainfall of 1,500 to 2,500 mm, moderate dry season moisture deficit, and average of 210 to 270 days growing period. This type of climate supports cultivation of tree crops, fruits, and aquaculture.

SUMMARY

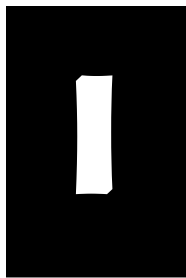
The MBA with a total land area of 70,783 ha is predominantly utilized for agriculture with less than 20 percent considered as coastal areas. Although the areas within Hagonoy, Padada, and Sulop are generally flat, Malalag and Sta. Maria are along a mountain range which buffers Malalag Bay from storms and strong winds. The MBA, likewise, has a climate which generally favors agricultural production since rainfall is evenly distributed throughout the year and the area is not directly affected by typhoons.

Of the nine rivers in the MBA, only three major rivers drain into Malalag Bay. The circulation pattern does not favor the outflow of water from the bay. The low circulation of water out into Davao Gulf combined with the intensive fish culture have resulted in the low suitability of the bay for further mariculture activities. The results of the CRMP study on the health status of Malalag Bay revealed that the intensity of fish culture in the bay exceeded its limit by about 2.5 times and that the whole bay is only conditionally suitable (medium) for culture while nearly two-thirds of the bay is unsuitable (low).

The physical, chemical, and biological studies conducted by MSU on the coastal waters of Davao del Sur indicated slightly alkaline waters, low DO concentrations, and the presence of coliform. These findings can be attributed to the sediment discharges of the rivers draining to the sea and the decomposition of organic matter from fish landing activities, animal wastes, and garbage littering the coastline.

Chapter 3

NATURAL RESOURCES



nherent in the growth of the Malalag Bay Area (MBA) is the availability of its natural resources. This chapter presents the extent and status of mineral, forests, and coastal resources found in the MBA.

MINERAL RESOURCES

Based on the Mines and Geosciences Bureau (MGB) records, eleven mineral resources occur in Davao del Sur including gold, silver, lead, copper, chromium, limestone, white clay, molybdenum, sulphur, phosphate, and guano. However, the size of deposits on these resources is not known.

Although gold has been discovered in Malalag and the people have been extracting it through the panning method, these mineral deposits remain to be explored. Malalag also has copper, manganese, limestone, and phosphate rocks. Hagonoy and Padada are rich in sand and gravel which remain as the main source for infrastructure development in the bay and neighboring areas. Table 3.1 lists the mineral resources found in the MBA.

FOREST RESOURCES

The MBA has a protected forest of 2,367 ha and a production forest of 1,947 ha. The MBA no longer has old growth or secondary growth forests; what remain are areas classified into timberlands. However, these areas only have patches of big trees with most of the area already denuded and deforested. Among the five municipalities, Sta. Maria has the largest timberland with an area of 10,396 ha, followed by Malalag with 7,281 ha.

The MBA has a protected forest of 2,367 ha and a production forest of 1,947 ha.

Table 3.1. Mineral resources of the MBA.

Mineral	Hagonoy	Padada	Sulop	Malalag	Sta. Maria
Copper					
Manganese					
Limestone					
Phosphate					
Sand and gravel					

Source: PSPT (1994).

***Rehabilitation of
the denuded
forestlands is one
of the priority
programs of the
DENR.***

According to the Local Government Support Office in 1994, forest denudation has accelerated the loss of top soil, increased the severity and frequency of floods, increased siltation to downstream farms, settlements and various coastal habitats, and decreased the supply of water for domestic and agricultural use.

With the alarming condition of the forestry resources, the DENR implemented the Integrated Social Forestry Project (ISFP) within Davao del Sur. In 1993, a total of 1,022 ha of denuded forest were reforested. Rehabilitation of the denuded forestlands is one of the priority programs of the DENR.

The DENR is also implementing Integrated Social Forestry (ISF) where deserving forest occupants are given security of tenure through the issuance of Certificate of Stewardship Contracts (CSCs) with a duration of 25 years and renewable for another 25 years. From 1993 to 1996, the DENR has issued a total of 586 CSCs to farmer beneficiaries in the MBA. The municipality of Sta. Maria had the highest number of CSCs issued (506) involving an area of 1,191.35 ha (Table 3.2).

The forest-environment sector has long been beset with issues concerning denudation of the upland areas to critical levels due to misuse and abuse of forest resources. The growing population is contributing to this trend.

COASTAL RESOURCES

During the participatory coastal resource assessment (PCRA) mapping in 1997, the coastal residents in the MBA identified the most abundant and most commercially valuable resources found near their coastal communities. Traditional fishing methods and other activities in the area as well as problems and issues were also identified.

Table 3.2. Certificate of Stewardship Contracts and corresponding area issued by the DENR under the Integrated Social Forestry Project in the MBA.

Municipality	Barangay	Year established	No. of projects	No. of CSCs issued	Area (ha)
Hagonoy	Balutakay	1993	1	1	0.36
Malalag	Pitu	1993	1	31	62.07
	Pitu	1996	2	43	103.27
Padada	Palili		1	5	18.65
Sta. Maria	Mamacao, San Agustin, Ogpao, Tanglad, Sto. Niño	1993	5	253	524.89
	Buca	1995	1	162	439.86
	Basiawan, Buca, Kidadan, Pongpong, Tanglad	1996	6	91	226.60
Total			17	586	1,375.70

Source: PPDO (1993, 1996).

Results of the mapping showed that a considerable area of coral reefs, mangroves, and seagrasses still exist in all municipalities (Table 3.3). The following section shows the coastal resource map of each municipality as well as the transect diagrams of the coastal *barangays* presenting the resources, uses, and issues in relation to the various habitats.

Table 3.3. Habitats in the MBA.

Habitats	Hagonoy (ha)	Padada (ha)	Sulop (ha)	Malalag (ha)	Sta. Maria (ha)	Total
Sandy beach	119	45	26	48	184	422
Rocky shoreline	-	-	-	23	99	122
Inshore flat	107	207	117	21	59	511
Seagrass beds	160	88	25	118	353	744
Coral reef	95	80		108	385	668
Estuary	12	-	0.24	1	118	131.24
Mangrove	47	18	9	42	137	253
Mudflat	175	119	30	53	94	471
Terrestrial zone	4,635	3,623	15,259	7,932	21,488.47	52,937.47
Marine zone	12,822	814	276	845	37,944	52,701

Hagonoy

Of the 21 *barangays* of Hagonoy, five are coastal, which occupy 2,472 ha, about 20 percent of the total land area of Hagonoy. Although only 18 percent of the population live near the coastal areas, the entire population is dependent on fisheries.

As seen in Figure 3.1, the areas of habitats mapped through the PCRA are as follows:

- Sandy beach 119 ha
- Inshore flat 107 ha
- Seagrass bed 160 ha
- Coral reef 95 ha
- Estuary 12 ha
- Mangrove 47 ha
- Mudflat 175 ha

The most abundant fishery resources are mackerel, sardines, mullet, hairtail, goatfish, grouper, moonfish, sailfish, scallops, and clams. Fishing methods used are beach seine, bottom set gill net, fish pot, hook and line, push net, and troll line.

The coastal resources of Hagonoy are beset by problems and issues such as beach/shoreline erosion, coral bleaching, declining fish catch, destructive fishing, fishing gear conflicts, lack of alternative livelihood activities, lack of law enforcement, mangrove conversion, pesticide pollution, siltation, waste dumping, water turbidity, and sand extraction.

Specific resources, uses, and issues in the five coastal *barangays* of Hagonoy are presented in Figure 3.2.

HAGONOY FACTS AND FIGURES

Barangays (21): Aplaya, Balutakay, Clib, Guihing, Hagonoy Crossing, Kibuaya, La Union, Lanuro, Lapulahao, Leling, Mahayahay, Malabang, Maliit Digos, New Quezon, Paligue, Poblacion, Sacub, San Guillermo, San Isidro, Sinayawan, Tologan

Coastal Barangays (5): Aplaya, Balutakay, Guihing, Leling, Paligue

Total Land Area: 11,664 ha

Coastal Land Area: 2,472 ha

Length of Coastline: 8 km

Population: 41,752

Population of Coastal Barangays: 7,346



Legend:

HABITATS

- Sandy beach
- Rocky shoreline
- Inshore flats
- Seagrass beds
- Coral reef
- Estuary
- Mangrove
- Terrestrial zone
- Marine zone
- Mudflats
- Municipal boundary
- Road

RESOURCES

- 200 Mackerels
- 207 Sardines
- 210 Mulletts
- 211 Hairtails
- 217 Goatfish
- 223 Groupers
- 224 Moonfish
- 231 Sailfish
- 301 Scallops
- 306 Clams

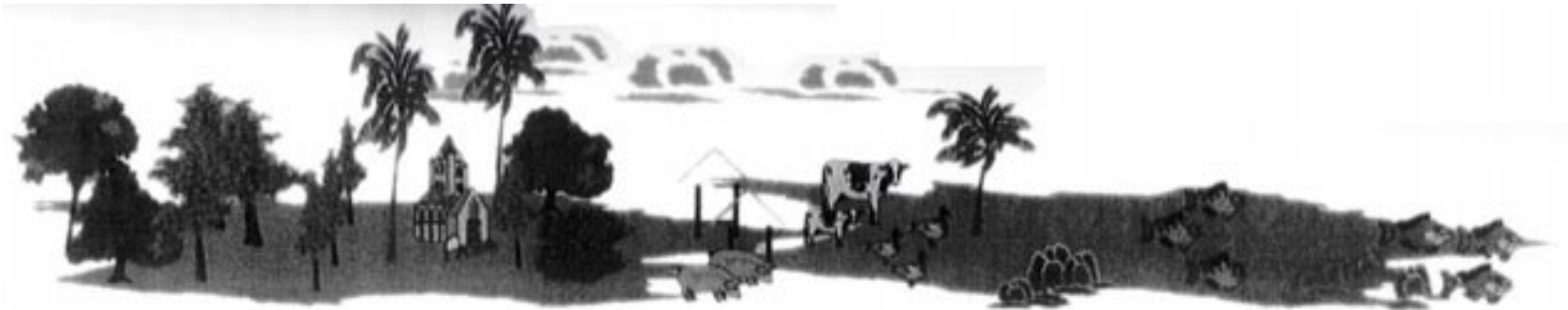
USES

- T3 Beach seine
- T5 Bottom set gill net
- T18 Fish pot
- T22 Hook and line
- T27 Multiple hook and line
- T31 Push net
- T45 Troll line

ISSUES

- I52 Beach/shoreline erosion
- I56 Coral bleaching
- I59 Declining fish catch
- I512 Destructive fishing
- I520 Fishing gear conflicts
- I528 Lack of alternative livelihood activities
- I521 Lack of law enforcement
- I538 Mangrove conversion
- I543 Pesticide pollution
- I549 Siltation
- I557 Waste dumping
- I564 Water turbidity
- I562 Sand extraction

Figure 3.1. Coastal resource map of the municipality of Hagonoy, Davao del Sur.



	HABITATS				
	Terrestrial zone	Mangrove	Sandy beach/mudflat	Seagrass bed/ coral reef	Marine zone
Resources	Crop, trees, animals, houses, garden	Fishpond, swamp, mangroves	Sandy beach, cottage, trees, beach resort, finfish, corals, seagrass, crustaceans, mollusks, muddy beach	Shellfish, finfish, seagrass, coral reef, mollusks, corals, crustaceans	Pump boat, fish, fish corals, reef, finfish, seaweeds
Uses	Food, shelter, livelihood, lumber, beautification	Habitat, fuel, lumber, house construction, shelter, livelihood	Shelter, livelihood, recreation, habitat, lumber, food, fish shelter, breeding	Food, livelihood, shelter, breeding, fish habitat, food for fish, human food	Livelihood, foodfish habitat
Issues	Sanitation problem, illegal cutting of trees, soil erosion, pollution, stray animals	Illegal cutting, soil erosion, siltation	Sanitation, flooding/drainage, prostitution, pollution, damaged fish shelter, illegal fishing, soil erosion, siltation	Illegal fishing, pollution, commercial fishing, overfishing, fishing by outsiders	Limited fish because of the damage of corals and stones, illegal fishing, pollution, commercial fishing

Figure 3.2. Hagonoy transect diagram (Barangays Aplaya, Balutakay, Guihing, Leling, and Paligue).

Malalag

Of the 15 *barangays* of Malalag, three are coastal. Although coastal areas occupy only 11 percent of the total land area of Malalag, almost 28 percent of the population are coastal dwellers and dependent on coastal resources.

As seen in Figure 3.3, the areas of habitats mapped through the PCRA are as follows:

• Sandy beach	48 ha
• Rocky shoreline	23 ha
• Inshore flat	21 ha
• Seagrass bed	118 ha
• Coral reef	108 ha
• Estuary	1 ha
• Mangrove	42 ha
• Mudflat	53 ha

The most abundant fishery resources are rabbitfish, mackerel, parrotfish, sardines, mullet, snapper, slipmouth, goatfish, oysters, and clams. Fishing methods used are bag net, fish corral, fish pot, hook and line, spear fishing, troll line, and gleaning.

The coastal resources of Malalag are beset by problems and issues such as coliform pollution, destructive fishing, encroachment on the fishing ground by outsiders, lack of alternative livelihood activities, siltation, and absence of revenue from docking vessels.

Specific resources, uses, and issues in the three coastal *barangays* of Malalag are presented in Figure 3.4.

MALALAG FACTS AND FIGURES

Barangays (15): Bagumbayan, Baybay, Bolton, Bulacan, Caputian, Ibo, Kiblagon, Lapulapu, Mabini, New Baclayan, Pitu, Poblacion, Rizal, San Isidro, Tagansule

Coastal Barangays (3): Bagumbayan, Baybay, Bulacan

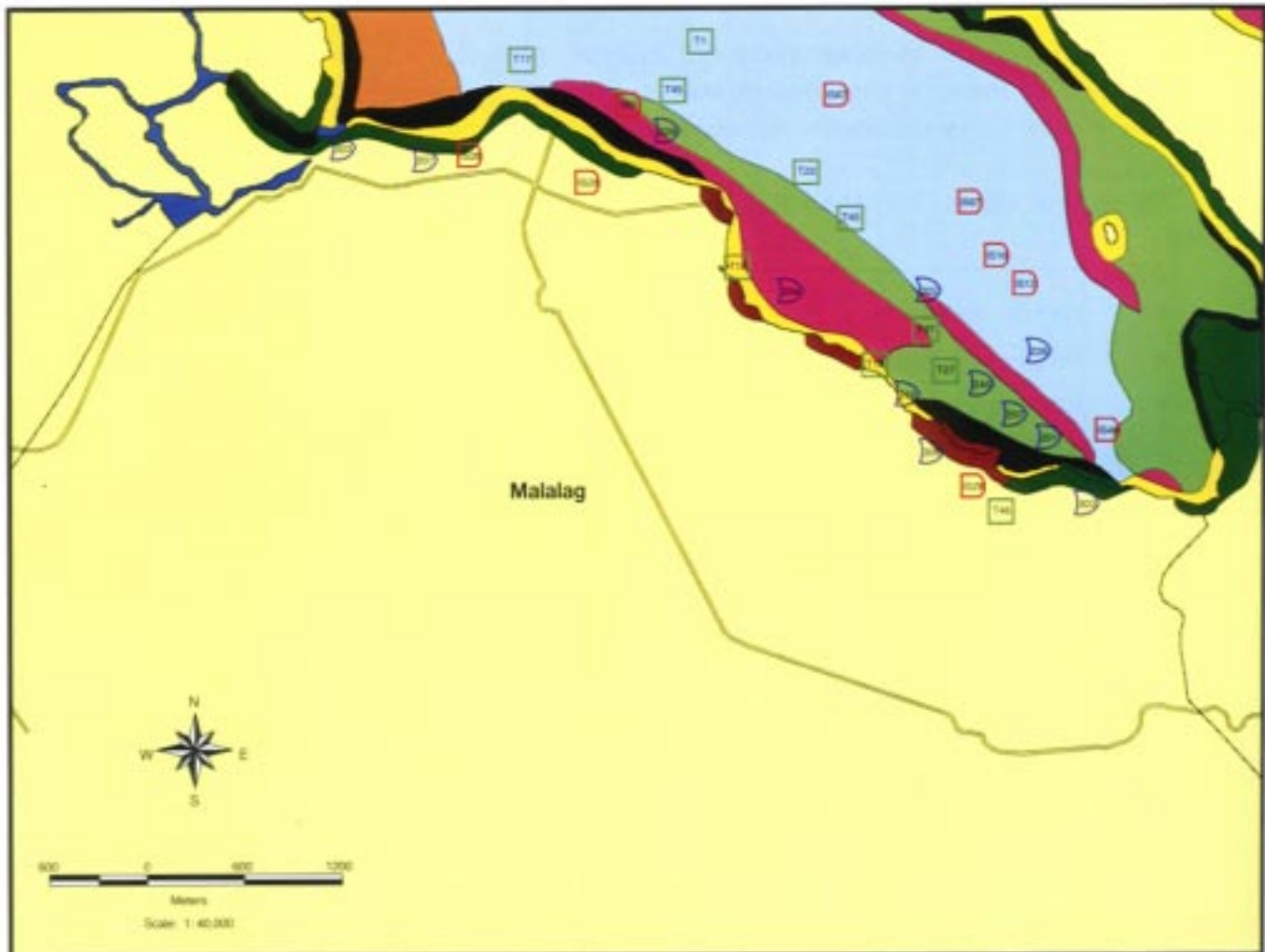
Total Land Area: 18,612 ha

Coastal Land Area: 2,040 ha

Length of Coastline: 8 km

Population: 30,733

Population of Coastal Barangays: 8,590



Legend:









HABITATS

-  Sandy beach
-  Rocky shoreline
-  Inshore flats
-  Seagrass beds
-  Coral reef
-  Estuary
-  Mangrove
-  Terrestrial zone
-  Marine zone
-  Mudflats
-  Municipal boundary
-  Road

RESOURCES

-  301 Rabbitfish, spinefeet
-  302 Mackerels
-  304 Parrotfish
-  307 Sardines
-  310 Mullet
-  326 Snappers
-  328 Slipmouths
-  340 Goatfish
-  303 Oysters
-  306 Clams

USES

-  T1 Bag nets
-  T17 Fish corral
-  T18 Fish pot
-  T22 Hook and line
-  T27 Multiple hook and line
-  T41 Spear fishing
-  T45 Troll line
-  T46 Gleaning

ISSUES







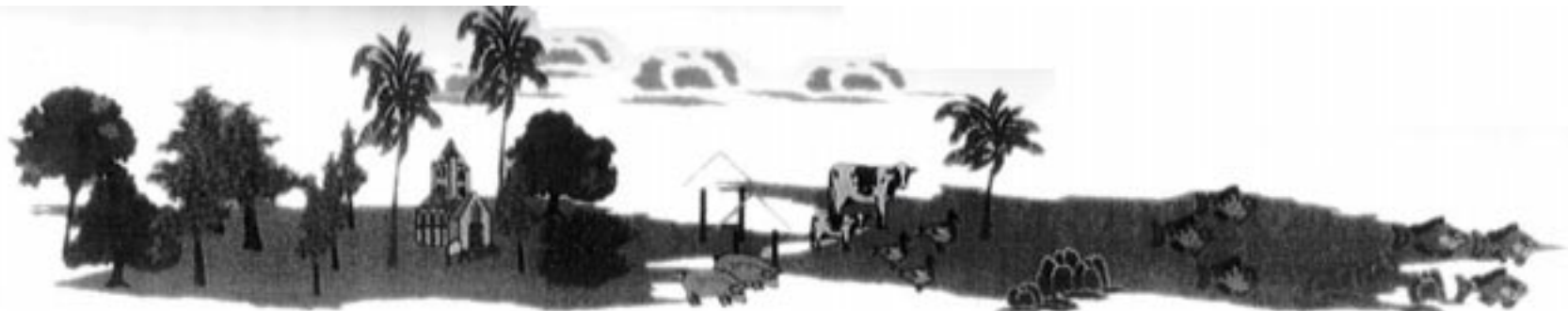
-  IS4 Coliform pollution
-  IS12 Destructive fishing
-  IS18 Encroachment on the fishing ground by outsiders
-  IS28 Lack of alternative livelihood activities
-  IS49 Sittation
-  IS67 Absence of revenue from docking vessels

Figure 3.3. Coastal resource map of the municipality of Malalag, Davao del Sur.



HABITATS					
	Terrestrial zone	Mangrove	Sandy beach/mud-flat/rocky shoreline	Seagrass bed/coral reef	Marine zone
Resources	<i>Gemilina</i> , <i>ipil-ipil</i> , <i>cogon</i> , <i>hagonoy</i> , banana, coconut tree, bamboo, mangoes, cacao, vegetable, houses, school, chapel, clinic, <i>barangay</i> hall, fish landing hall, basketball court, deep well, mosque, cemetery, cooperative, day care center, barracks, gasoline station, animal, seawall	Mangrove, fishpond, house, coconut, banana, cacao	Sand, stone boats, mud	Crabs, shellfish, seagrass, fish, corals, sea cucumber, stone	Fish, artificial reef
Uses	Lumber, firewood, copra, foods, resting place, livelihood, potable water, education, shelter, peace, health, business, prayer meeting, protection	Lumber, firewood, livelihood, shelter, copra, food, breeding ground	Serve as beach, docking area	Food, breeding ground, fish shelter, decoration, fish sanctuary	Breeding ground, shelter, food
Issues	Strong wind, overcutting, illegal cutting, stray animals, solid/chemical waste disposal, lack of potable water, unpassable road, flood site, denudation, overgrazing, lack of sanitation	Waste disposal, lack of sanitation, mangrove depletion	Very dirty, garbage, pollution, quarrying sand and gravel	Overfishing, illegal fishing, occasional fish killing, pollution	Overfishing, illegal fishing, <i>lampornas</i> , dynamite, oil spill

Figure 3.4. Malalag transect diagram (Barangays Bagumbayan, Baybay, and Bulacan).

Padada

Of the 17 *barangays* of Padada, four are coastal, occupying about 25 percent of the total land area of Padada. Almost 20 percent of the population are coastal dwellers.

As seen in Figure 3.5, the areas of habitats mapped through the PCRA are as follows:

• Sandy beach	45 ha
• Inshore flat	207 ha
• Seagrass bed	88 ha
• Coral reef	80 ha
• Passes/Channels	236 ha
• Mangrove	18 ha
• Mudflat	119 ha

PADADA FACTS AND FIGURES

Barangays (17): Almendras District, Don Sergio Osmeña, Harada Butai, Lower Katipunan, Lower Limonzo, Lower Malinao, NC Ordaneza District, Northern Paligue, Palili, Piape, Punta Piape, Quirino District, San Isidro, Southern Paligue, Tologan, Upper Limonzo, Upper Malinao

Coastal Barangays (4): Palili, Piape, Punta Piape, San Isidro

Total Land Area: 4,503 ha

Coastal Land Area: 1,133 ha

Length of Coastline: 6 km

Population: 22,384

Population of Coastal Barangays: 4,279

The most abundant fishery resources are sardines, big-eye scads, mullets, moonfish, therapons, whittings, goatfish, spotted mojarras, scallops, and clams. Fishing methods used are bottom set gill net, drive-in net, fish corral, crab and fish pot, hook and line, torch fishing, push net, spear fishing, and troll line.

The coastal resources of Padada are beset by problems and issues such as breakage of corals, coral bleaching, declining fish catch, destructive fishing, encroachment on the fishing ground by outsiders, fish kills, fishing gear conflicts, lack of alternative livelihood activities, lack of law enforcement, lack of

legislation, low awareness, mangrove conversion, overfishing, pesticide pollution, and siltation.

Specific resources, uses, and issues in the four coastal *barangays* of Padada are presented in Figure 3.6.

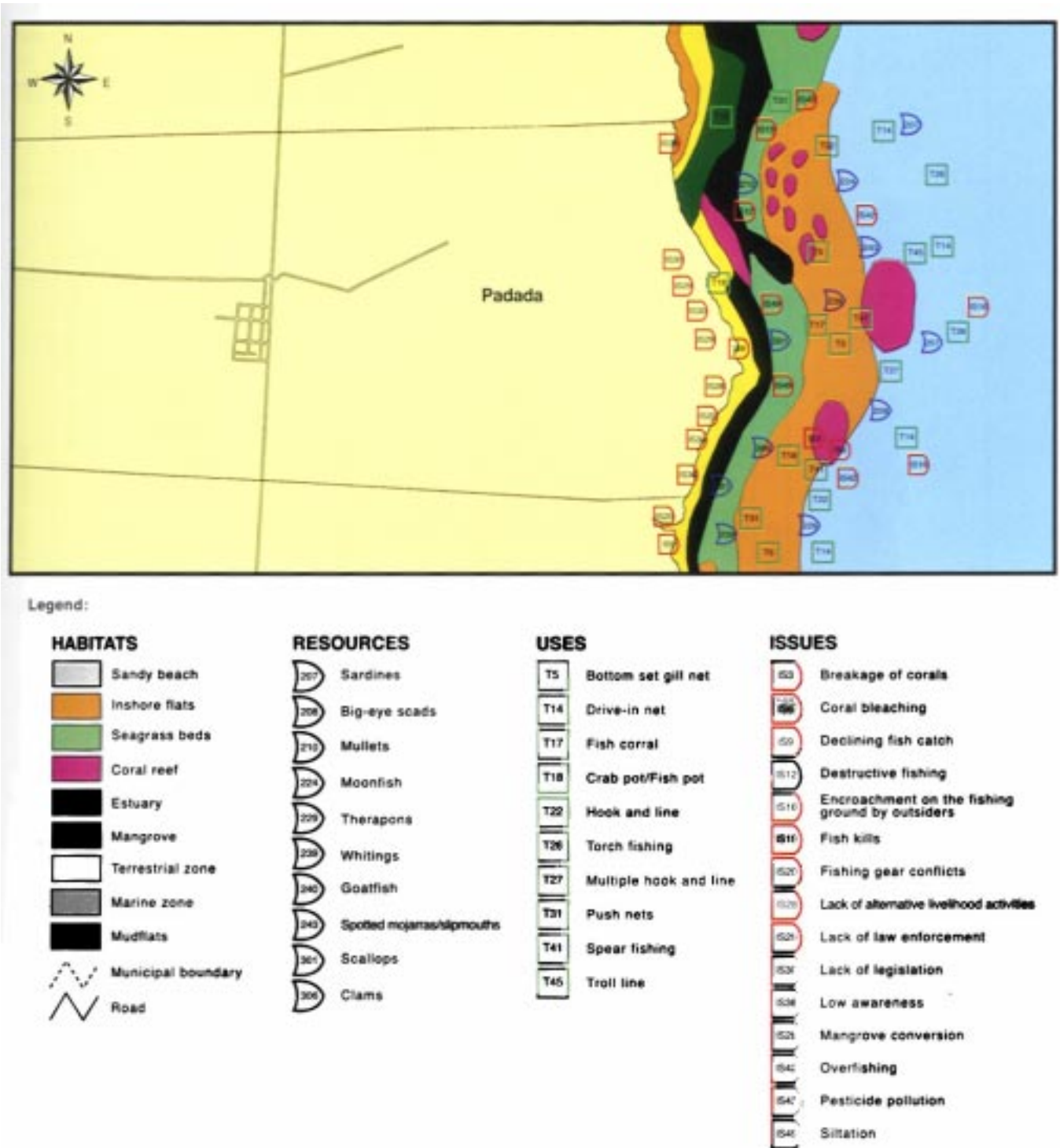
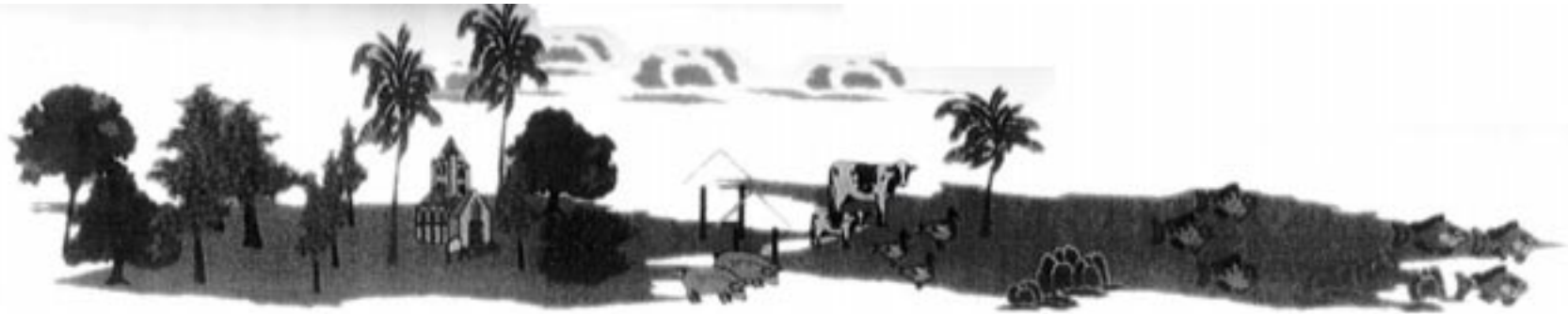


Figure 3.5. Coastal resource map of the municipality of Padada, Davao del Sur.



	HABITATS				
	Terrestrial zone	Mangrove	Sandy beach/mudflat	Seagrass bed/coral reef/inshore flat	Marine zone
Resources	Coconut, tree, banana, fruit trees, corn, house, multi-purpose hall, school, chapel	Fishponds, aroma shrubs, mangroves, sand, crabs, mudfish, shellfish, mud	Beach, sand, seawall, shellfish, fish	Seagrass, shellfish, corals, milkfish fry, crabs, shrimps, finfish, starfish, sea urchin, sea cucumber, sand, stone, guard house	Fish, shellfish, shrimps, squids, crabs, reptiles, artificial reef
Uses	Food, shelter, lumber, livelihood, protection, education, religious services, meeting place, residential	Aquaculture, food, source of livelihood, shellfish habitat, residential	Buffer zone, docking area, picnic area	Food, livelihood, nursery, breeding ground, shellfish habitat, fish habitat, protection against illegal fishing	Food, livelihood, fish habitat, rehabilitation
Issues	Illegal cutting, erosion, lack of security, sanitation, lack of potable water, chemical pollution, waste pollution, use of poisonous plant extract	Security on home lot ownership, pollution	Pollution, beach erosion	Exploitation of shellfish, destruction of habitats, illegal fishing, destructive fishing, dynamite fishing, use of poisonous plant extract, waste pollution, fishing by outsiders, beach seine, scissors net	Illegal fishing, destructive fishing, cyanide fishing by outsiders, compressor, using poisonous substances

Figure 3.6. Padada transect diagram (Barangays Palili, Piape, Punta Piape, and San Isidro).

Sta. Maria

Of the 22 *barangays* of Sta. Maria, eight are coastal, occupying almost 32 percent of the total land area. Thirty-seven percent of the population reside in these *barangays*.

As seen in Figure 3.7, the areas of habitats mapped through the PCRA are as follows:

• Sandy beach	184 ha
• Rocky shoreline	99 ha
• Inshore flat	59 ha
• Seagrass bed	353 ha
• Coral reef	385 ha
• Estuary	118 ha
• Mangrove	137 ha
• Mudflat	94 ha

The most abundant fishery resources are rabbitfish, sardines, big-eye scads, round scads, mullet, spotted snapper, skipjacks, tunas, scallops, and clams. Fishing methods used are bag net, beach seine, cover net, hook and line, squid jigger, and troll line.

The coastal resources of Sta. Maria are beset by problems and issues such as beach/shoreline erosion, declining fish catch, encroachment on the fishing ground by outsiders, illegal fishing, lack of alternative livelihood activities, lack of social services, low prices of fishery products, theft of fishing gear/accessories, and absence of revenue from docking vessels.

Specific resources, uses, and issues in the eight coastal *barangays* of Sta. Maria are presented in Figure 3.8.

STA. MARIA FACTS AND FIGURES

Barangays (22): Basiawan, Buca, Cadaatan, Datu Daligasao, Datu Intan, Kidadan, Kinilidan, Kisulad, Malalag Tubig, Mamacao, Ogpao, Poblacion, Pongpong, San Agustin, San Antonio, San Isidro, San Juan, San Pedro, San Roque, Sto. Niño, Sto. Rosario, Tanglad

Coastal Barangays (8): Basiawan, Kisulad, Mamacao, Ogpao, San Agustin, Sto. Niño, Sto. Rosario, Tanglad

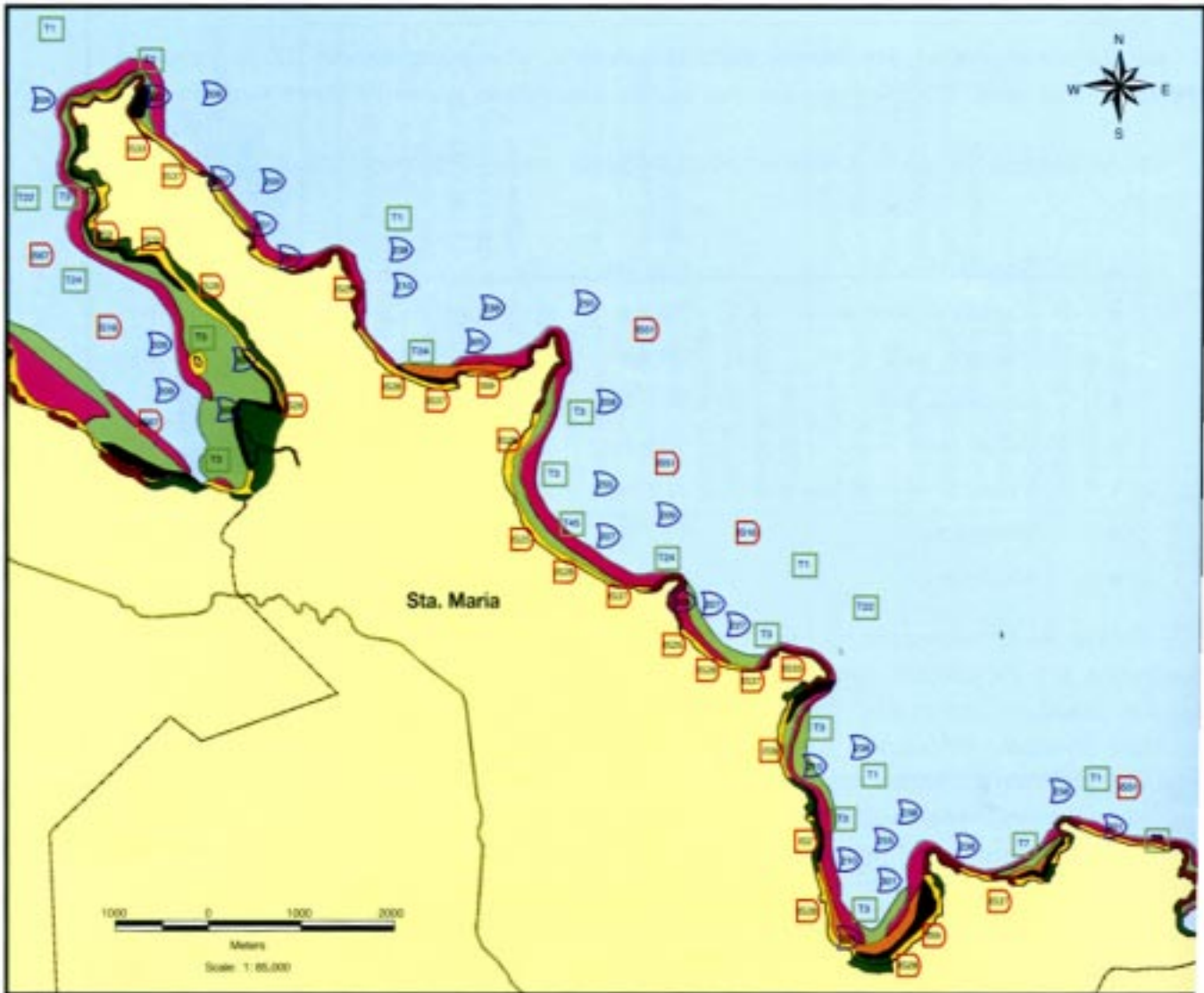
Total Land Area: 20,478 ha

Coastal Land Area: 6,487 ha

Length of Coastline: 46 km

Population: 41,919

Population of Coastal Barangays: 15,691



Legend:

HABITATS

- Sandy beach
- Rocky shoreline
- Inshore flats
- Seagrass beds
- Coral reef
- Estuary
- Mangrove
- Terrestrial zone
- Marine zone
- Mudflats
- Municipal boundary
- Road

RESOURCES

- 301 Rabbitfish, spinefoot
- 307 Sardines
- 308 Big-eye scads
- 309 Round scads
- 310 Mulllets
- 327 Spotted snappers
- 328 Skipjacks
- 329 Tunas
- 301 Scallops
- 305 Conches

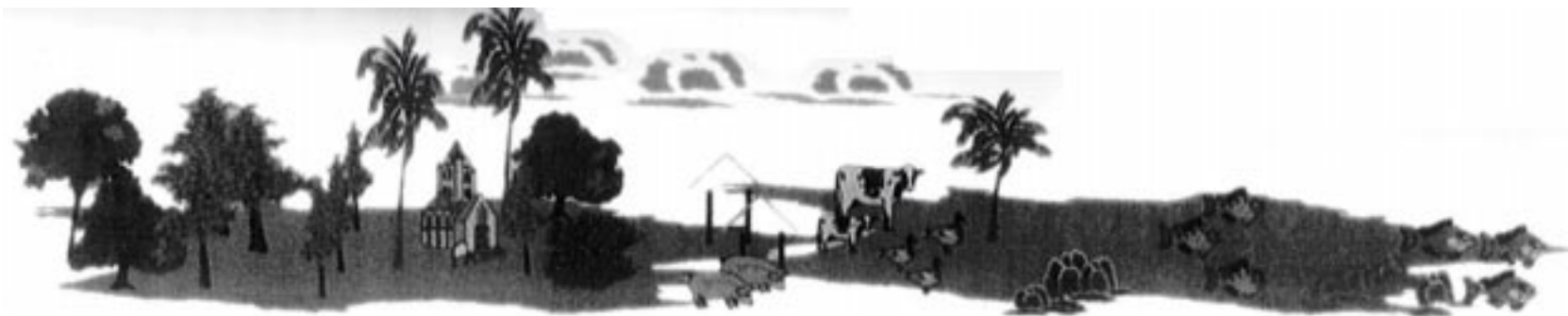
USES

- T1 Bag nets
- T3 Beach seine
- T17 Cover net
- T22 Hook and line
- T24 Squid jigger
- T27 Multiple hook and line
- T45 Troll line

ISSUES

- IS2 Beach/shoreline erosion
- IS9 Declining fish catch
- IS16 Encroachment on the fishing ground by outsiders
- IS25 Illegal fishing
- IS28 Lack of alternative livelihood activities
- IS33 Lack of social services
- IS37 Low prices of fishery products
- IS51 Theft of fishing gears and accessories
- IS47 Absence of revenue from docking vessels

Figure 3.7. Coastal resource map of the municipality of Sta. Maria, Davao del Sur.



HABITATS							
	Terrestrial zone	Mangrove	Estuary/ mudflat	Sandy beach/ rocky shoreline	Seagrass bed/ coral reef	Inshore flat	Marine zone
Resources	Houses, community, cooperative, chapel, day care center, deep well, garden, trees, <i>gemilina</i> , <i>ipil-ipil</i> , <i>cogon</i> , <i>hagonoy</i> , coconut, banana, fruit trees, crops, cacao, corn, animals, livestock, human	Mangrove, oyster, shellfish, finfish, fish, fry, crustaceans, crabs, fishpond, residential	Milkfish, mudfish, shrimps, crabs	Sandy beach, muddy beach, sand, stone, beach cottages, waiting shade, boats, finfish, shellfish, fish, crabs, seabirds, coconut, <i>lambayong</i>	Corals, reefs, fish, shellfish, finfish, seagrass, crustaceans, mollusks, sea cucumber, sand, stone	Finfish, shellfish, crustaceans, mollusks, reptile, sand, stone	Fish, artificial reef
Uses	Residential, education, business, potable water, beautification, agricultural, livelihood, lumber, copra, food, shelter, farming, firewood, roof material	Livelihood, food, habitat, timber, firewood, house construction, wind breaker, decoration, residential	Food, livelihood	Livelihood, food, habitat, recreation, docking, infrastructure purposes, educational, sanitation	Livelihood, fish and organism habitat, food, fish, decoration, breeding ground of fish, navigation	Livelihood, food, habitat, habitual fishing	Livelihood, food, habitat, navigation
Issues	Tidal/wave control, povesamanation area, home and lot, illegal cutting of trees, denudation, bald mountain, overgrazing, soil erosion, sanitation problem, no potable water, unpassable road, flood site, waste disposal, pollution, stray animals, slow development, low income, lack of security	Poisoning, mangrove cutting, improper zoning, soil erosion, siltation, pollution, sanitation	Poisoning/pesticide, illegal expansion, community passing and access	Illegal fishing, destructive fishing, soil erosion, siltation, flooding, drainage, insecurity of home lot tenure, illegal foreshore use, land occupation, labor and employment, no proper management	Illegal fishing, overfishing, fishing by outsiders, commercial fishing, superlight, fine mesh net, pollution, siltation	Depletion of fishery resources, navigational obstruction, zoning problem, commercial fishing, obnoxious substance, use of poisonous plant extract	Depletion of fishery resources, habitat destruction, zoning problem, delineation of boundary, dynamite fishing, anchorage

Figure 3.8. Sta. Maria transect diagram (Barangays Basiawan, Kisulad, Mamacao, Ogpao, San Agustin, Sto. Niño, Sto. Rosario, and Tanglad).

Sulop

Of the 25 *barangays* of Sulop, only one is coastal. It occupies about 2 percent of the total land area of Sulop. Two percent of the population are coastal dwellers.

As seen in Figure 3.9, the areas of habitats mapped through the PCRA are as follows:

• Sandy beach	26 ha
• Inshore flat	117 ha
• Seagrass bed	25 ha
• Estuary	0.24 ha
• Passes/Channels	250 ha
• Mangrove	9 ha
• Mudflat	30 ha

SULOP FACTS AND FIGURES

Barangays (25): Balasinon, Buguis, Carre, Clib, Harada Butai, Katipunan, Kiblagon, Labon, Laperas, Lapla, Litos, Luparan, Mckinley, New Cebu, Osmeña, Palili, Parami, Poblacion, Roxas, Solongvale, Tagolilong, Talao, Talas, Tanwalang, Waterfall

Coastal Barangay (1): Balasinon

Total Land Area: 15,526 ha

Coastal Land Area: 288 ha

Length of Coastline: 3 km

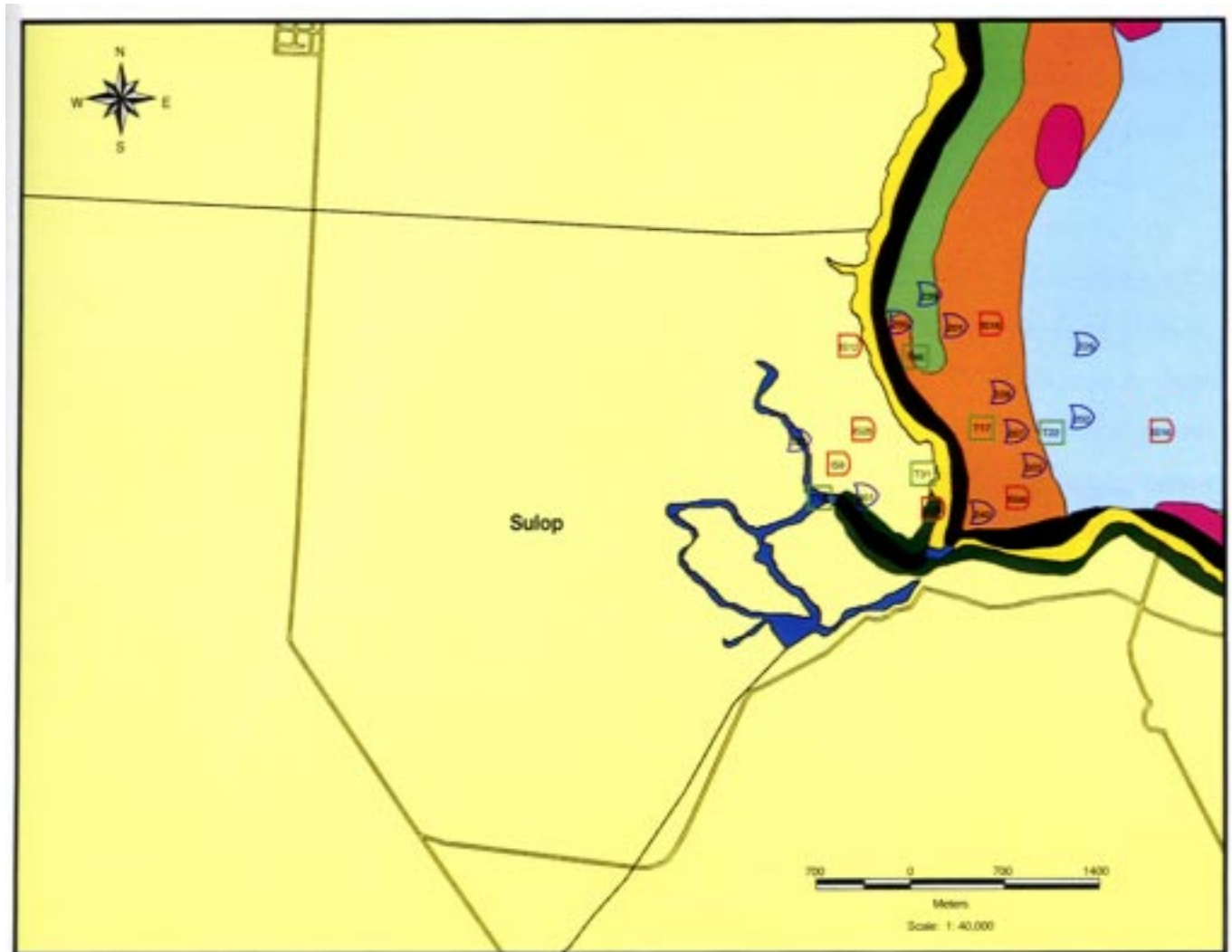
Population: 25,968

Population of Coastal Barangay: 494

The most abundant fishery resources are rabbitfish, mackerels, sardines, snappers, therapons, whittings, goatfish, silver side, scallops, and oysters. Fishing methods used are fish corral, blue crab pot, hook and line, push net, and gleaning.

The coastal resources of Sulop are beset by problems and issues such as declining fish catch, destructive fishing, encroachment on the fishing ground by outsiders, lack of alternative livelihood activities, siltation, and water turbidity.

Specific resources, uses, and issues in the lone coastal *barangay* of Sulop are presented in Figure 3.10.



Legend:

HABITATS

- Sandy beach
- Inshore flats
- Seagrass beds
- Coral reef
- Estuary
- Mangrove
- Terrestrial zone
- Marine zone
- Mudflats
- Municipal boundary
- Road

RESOURCES

- 0201 Sigands/Rabbitfish
- 0202 Mackerels
- 0203 Sardines
- 0204 Snappers
- 0205 Therapons
- 0206 Whittings
- 0207 Goatfish
- 0208 Silver side
- 0209 Scallops
- 0210 Oysters

USES

- T17 Fish corral
- T18 Blue crab pot
- T22 Hook and line
- T31 Puah net for fry
- T46 Gleaning

ISSUES

- 005 Declining fish catch
- 012 Destructive fishing
- 014 Encroachment on the fishing ground by outsiders
- 028 Lack of alternative livelihood activities
- 040 Siltation
- 056 Water turbidity

Figure 3.9. Coastal resource map of the Municipality of Sulop, Davao del Sur.



HABITATS						
	Terrestrial zone	Mangrove	Estuary/ mudflat	Sandy beach	Inshore flat	Marine zone
Resources	Residential, community	Oyster, mangrove, shellfish, fish, crabs	Milkfish, mudfish, shrimps, crabs	Sandy beach, shellfish, fish, crabs, seabirds	Crustaceans, mollusks, reptiles	Fish
Uses	Residential, agricultural, livelihood	Habitat, livelihood, timber, firewood	Food, livelihood	Livelihood, food, habitat	Livelihood, food, habitat	Livelihood, food, habitat
Issues	Tidal/wave control, povesamanation area, home and lot	Poisoning, mangrove cutting, improper zoning, siltation	Poisoning/ pesticide, community passing and access	Illegal fishing, siltation, navigation area, passage	Water turbidity, encroachment on the fishing ground by outsiders	Encroachment on the fishing ground by outsiders

Figure 3.10. Sulop transect diagram (Barangay Balasinon).

The MBA coastal resources are varied and diverse, providing food and employment for a majority of the populace primarily through fisheries. Their biological diversity has great ecological and economic significance and must, therefore, be conserved and sustainably developed. However, pollution and overexploitation, among others, increasingly threaten these important marine resources.

1. *Mangroves*

Mangroves are an important resource for coastal communities. Primary uses of mangroves include fuel wood, timber, medicinal products, and poles for building.

Similar to forestlands, intense exploitation has consequently resulted in the near extinction of the mangrove ecosystem within the coastal zone. From a considerable area of marshlands with thick mangroves of years past, only patches of mangroves are left today. An essential link to the food chain and a niche for breeding of various fishes, mangroves have not been given the importance they deserve. The poor state of the mangrove ecosystem was caused by its conversion into fishponds and the unregulated cutting for firewood.

In 1987, remote sensing images of Malalag Bay by the National Mapping and Resource Information Authority (NAMRIA) estimated the mangrove cover at 78.52 ha. From the survey conducted by the Silliman University Marine Laboratory (SUML) in February 1997, the total mangrove area was only 7 ha (Table 3.4). The areas surveyed were Sulop, Malalag, and Sta. Maria. Mangroves were in patches at Sitio Bolo, Bulacan, Baybay, and Taguicon, Malalag. Of 16 species noted in the survey, the most common were *Rhizophora mucronata* and *Sonneratia alba* (Table 3.5).

As seen in Table 3.6, the highest density of saplings and seedlings, all *Avicennia marina*,

An essential link to the food chain and a niche for breeding of various fishes, mangroves have not been given the importance they deserve.

Table 3.4. Mangrove area surveyed by SUML in the MBA.

Site	Area (ha)	Remarks
Malalag	5	Mangroves in patches, bordering fishpond dikes; a large area has been converted into fishpond
Sta. Maria	2	1.5 ha. Six species of mangroves were observed in patches at Kisulad, Sta. Maria Natural growth of 0.5 ha. Mangrove was seen in Basiawan, Sta. Maria.

Source: SUML (1997).

Table 3.5. Mangrove and associated species found in the MBA.

Species	Common name	Areas of incidence
RHIZOPHORACEAE		
<i>Rhizophora mucronata</i> Lamk.	<i>Bakhaw baye</i>	Malalag and Sta. Maria
<i>Ceriops decandra</i> Griff. Ding Hou	<i>Hangalay; lapis-lapis</i>	Malalag and Sta. Maria
<i>Bruguiera parviflora</i> W. and A. ex Griffith	<i>Pototan lalake</i>	Malalag
AVICENNIACEAE		
<i>Avicennia marina</i> (Forsk.) Vierh.	<i>Piape baye</i>	Sta. Maria
<i>A. alba</i> Blume	<i>Piape laki</i>	Malalag and Sta. Maria
<i>A. lanata</i> Ridley	<i>Piape laki</i>	Malalag and Sta. Maria
SONNERATIACEAE		
<i>Sonneratia alba</i> J. Sm.	<i>Pagatpat; Pedada</i>	Malalag and Sta. Maria
COMBRETACEAE		
<i>Termanalia catappa</i> L.	<i>Talisay</i>	Malalag
PALMAE		
<i>Nypa fruticans</i> (Thunberg) Wumb.	<i>Nipa</i>	Sta. Maria
EUPHORBIACEAE		
<i>Excoecaria agallocha</i> L.	<i>Alipata; Buta-buta</i>	Malalag
ACANTHACEAE		
<i>Acanthus ilicifolius</i> L.		Sta. Maria
BIGBONIACEAE		
<i>Dolichandrone spathacea</i> (L.F.) K. Schum.	<i>Bito-bitoon</i>	Sta. Maria
MELIACEAE		
<i>Xylocarpus granatum</i> Koenig	<i>Tabigui</i>	Malalag
<i>X. moluccensis</i> (Lamk.) Roem.	<i>Piagau</i>	Malalag
FABACEAE		
<i>Pongamia pinnata</i> (L.) Pierre		Sta. Maria
<i>Prosopis vidiana</i> Naves	<i>Aroma</i>	Sta. Maria

Source: SUML (1997).

was observed in Basiawan, Sta. Maria. *A. marina* saplings reached 90,000 stems per ha and seedlings reached 3,125 stems per ha. The natural mangrove forest in the area had a mature stand area of 65.04 m²/ha and stem density of 54 stems per ha. Diameter at breast height was in the range of >60 cm and *Rhizophora* and *Sonneratia* species attained a height of 30 cm.

In Kisulad, Sta. Maria, the most numerous saplings and seedlings were those of *R.*

Table 3.6. Mean density of mangrove seedlings and saplings in the MBA.

Place	Species	Seedlings (stems/ha)	Saplings (stems/ha)
Basiawan, Sta. Maria	<i>R. mucronata</i>	85,000	625
	<i>A. marina</i>	90,000	3,125
	<i>S. alba</i>	10,000	None
Kisulad, Sta. Maria	<i>S. alba</i>	10,000	2,500
	<i>R. mucronata</i>	30,000	None
	<i>A. marina</i>	10,000	None

Source: SUML (1997).

mucronata, attaining a density of 30,000 stems per ha for saplings and 2,550 stems per ha for seedlings. Saplings of *S. alba* and *A. marina* attained a density of 10,000 stems per ha.

Malalag had a mature basal stand area of 57.52 m²/ha and 21 stems per ha. There were no saplings and seedlings in the area and mangroves were all secondary growth.

Mangrove loss on Malalag Bay is almost 100 percent due to fishpond conversion. Fishpond conversion has adversely affected the species diversity of mangroves and has resulted in the loss of associated species, not to mention the loss of secondary productivity. Addressing this problem is vital and necessary for the long-term sustainability of Malalag Bay. This could be done by massive reforestation with suitable species such as *Sonneratia* and *Avicennia*.

However, in addressing this problem, consideration should be given to the value of fishpond production in this area. In the latest economic report of Malalag, 60 percent of the annual fishery production, which ranged from 68.4 to 113.41 mt was contributed by fishponds.

2. Seagrasses and Algae

Seagrasses are essential links between the coral reefs and mangrove areas. Some of their functions include reduction of water energy and motion, regulation of the chemical composition of coastal waters and sediments, regulation of runoff and stabilization of bottom sediments, maintenance of coastal fertility, regulation of biological control mechanisms, maintenance of migration and nursery habitats, and enhancement and maintenance of coastal ecosystem and genetic diversity.

From the 1997 SUML study, about 597.5 ha of seagrass and algal beds were present from Piape, Padada to Sta. Maria. A total of 76 algal species in 51 genera and 8 species of

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seagrass in 6 genera were collected from Malalag Bay. In all stations surveyed, except for Malalag, red algae dominated. In terms of seagrasses, *Enhalus acoroides*, *Thalassia hemprichii* and *Halophila ovalis* were common in all stations (Table 3.7).

Vegetation type is generally determined by substrate. Seagrasses favored sand and silt substrates as in Padada and Malalag while *Sargassum* were most abundant in areas with

Table 3.7. Seagrass species found in the MBA.

<i>Cymodocea rotundata</i>	<i>Syringodium isoetifolium</i>
<i>Cymodocea serrulata</i>	<i>Enhalus acoroides</i>
<i>Halodule pinifolia</i>	<i>Halophila ovalis</i>
<i>Halodule uninervis</i>	<i>Thalassia hemprichii</i>

Source: SUML (1997).

limestone or dead coral substrate which partly explains the differences in dominance patterns and species composition within an area.

3. Corals

Coral reefs serve as spawning and nursery grounds for fishes and support fisheries directly. They also contribute to sand formation and deposition and serve as natural breakwaters thereby preventing beach erosion.

Malalag Bay typifies a once-rich ecosystem now ravaged by the misuse and abuse of the people who depend on the bounty of the sea. In 1991, the Rapid Aquatic Resource Appraisal (RARA) conducted by the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) revealed that only 113 ha of corals remained alive. The PCRA results of 1998 indicate that 95 ha of coral reef exist in the area.

The 1997 SUML study noted that the coral reef area, specifically in Piape Reef, located in the municipality of Padada, was approximately 5 ha. The reef flat extent of the stations in Malalag Bay, including Piape Reef, ranged from 80 to 200 m and the reef slope ranged from 30° to 70° (Table 3.8). Branching and massive corals were the common hard growth forms. Substrate composition was generally sand, rubble and rock, except in the Malalag Marine Sanctuary where silt comprised most of the substratum.

With regard to species composition, 90 taxa of scleractinian corals in 14 families were recorded in the MBA. Among the stations, San Agustin Point had the highest number of taxa (62) followed by Dagandang (54), Piape Reef (49), and Kulagsing (46), while

Table 3.8. Reef extent and other description of the stations in the MBA.

Stations	Reef flat extent (width)	Slope	Substrate	Remarks
Malalag Marine Reserve, Malalag	80-90 m from the shoreline to the reef crest; coral community starts at 50 m after the seagrass bed	30°-40° at 10 m deep	Mostly silt and rubble; little sand	Branching <i>Porites</i> were abundant; high cover of rubble and rocks in the shallow area
Piape Reef, Padada	100-150 m	50°-70° at 10-12 m deep	Sand, rubble, rock	Good coral cover; branching <i>Porites nigrescens</i> were dominant
Kulagsing, Sta. Maria	80-90 m from the shoreline to the reef crest; coral reef width from the reef flat down to slope area is 120 m	50° at 13 m deep	Sand, rubble, rock	Sandy area beyond 17 m deep; branching <i>Acropora</i> were abundant in the deep area; shallow area is dominated by soft corals and massive <i>Porites</i> ; good coral cover; one crown-of-thorns starfish, <i>Acanthaster planci</i> , was found
Dagandang, Sta. Maria	100-200 m from the shoreline to the reef crest	30° at 8-10 m deep	Mostly sand and rubble; rock	Massive <i>Porites</i> were dominant
San Agustin Point, Sta. Maria	200 m from the shoreline to the reef crest	50°-60° at 7 m deep	Sand, rubble, rock	Good coral cover. Massive <i>Porites</i> were dominant

Source: SUML (1997).

the lowest number was noted in the Malalag Marine Reserve (26). Four non-scleractinian coral taxa and seven soft corals were also identified (Table 3.9).

Based on the results of random quadrat sampling, the five stations surveyed in the MBA had a mean live hard coral cover of 56 percent. The highest mean live hard coral cover was obtained in Padada (78.13 percent) and Sta. Maria (70.63 percent). However, the former station also showed the highest mean dead coral cover of 10.63 percent and the lowest percentage of abiotic components at 4.38 percent. San Agustin, Sta. Maria had 53.75 percent live hard coral cover and had the highest cover of soft coral of 17.50 percent. Lowest live hard coral cover was recorded in Malalag (42.19 percent) and Dagandang (35.65 percent). Also both stations showed the highest cover of abiotic components. Malalag had 54.69 percent cover of abiotic components, 27.34 percent of which was contributed by rubble, 25.94 percent by silt, and 1.41 percent by sand. Dagandang, Sta. Maria had 52.51 percent cover of abiotic components which were composed mostly of rubble (21.25 percent), sand (23.13 percent), and rock (8.13 percent). Table 3.10 shows the mean cover of benthic categories in five stations in the MBA. Figure 3.11 shows the MBA benthic cover.

4. Fisheries

Table 3.9. Corals found in the MBA.

HARD CORALS	
ORDER SCLERACTINIA	
FAMILY ACROPORIDAE	
<i>Acropora</i> (branching)	<i>Acropora subglabra</i>
<i>Acropora</i> (digitate)	<i>Astropora</i>
<i>Acropora</i> (encrusting)	<i>Montipora</i> (encrusting)
<i>Acropora</i> (tabulate)	<i>Montipora</i> (foliose)
<i>Acropora echinata</i>	<i>Montipora</i> (submassive)
<i>Acropora microphthalmia</i>	<i>Montipora aequituberculata</i>
<i>Acropora nobilis</i>	<i>Montipora digitata</i>
<i>Acropora palifera</i>	
FAMILY AGARICIDAE	
<i>Codoseis mayeri</i>	<i>Pavona cactus</i>
<i>Gardineroseris planulata</i>	<i>Pavona decussata</i>
<i>Leptoseris</i>	<i>Pavona varians</i>
<i>Leptoseris scabra</i>	<i>Pachyseris rugosa</i>
<i>Leptoseris yabei</i>	<i>Pachyseris speciosa</i>
FAMILY CARYOPHYLLIDAE	
<i>Euphyllia anora</i>	<i>Physogyra lichtensteini</i>
<i>Euphyllia diuisa</i>	<i>Physogyra sinuosa</i>
<i>Euphyllia glabrescens</i>	
FAMILY DENDROPHYLIDAE	
<i>Turbinaria</i>	<i>Turbinaria mesenterina</i>
<i>Turbinaria hondens</i>	
FAMILY FAVIIDAE	
<i>Caulastrea furcata</i>	<i>Favites halicora</i>
<i>Cyphastrea</i>	<i>Goniastrea</i>
<i>Diploastrea helicopora</i>	<i>Goniastrea retiformis</i>
<i>Echinopora hordia</i>	<i>Leptastrea</i>
<i>Echinopora lamellosa</i>	<i>Leptastrea pruinosa</i>
<i>Favia</i>	<i>Montastrea</i>
<i>Favia maxima</i>	<i>Oulophyllia</i>
<i>Favites</i>	<i>Platygira</i>
<i>Favites abdita</i>	<i>Plesiastrea</i>
FAMILY FUNGIIDA	
<i>Cydoseis</i>	<i>Hepolitha limax</i>
<i>Fungia</i>	<i>Hepolitha weberi</i>
<i>Fungia condinna</i>	<i>Podabada crustacea</i>
<i>Fungia sabra</i>	<i>Polyphyllia talpina</i>
<i>Heliolungia</i>	<i>Sandalolitha robusta</i>
FAMILY MERULINIDAE	
<i>Hydnophora exesa</i>	<i>Hydnophora rigida</i>
<i>Hydnophora microcoris</i>	<i>Merulina ampliata</i>
FAMILY MUSSIDAE	
<i>Labophyllia hempichii</i>	
FAMILY OCULINIDAE	
<i>Galaxea fascicularis</i>	
FAMILY PECTINIDAE	
<i>Echinophyllia aspera</i>	<i>Pectinia aldicornis</i>
<i>Mycedium elephantodus</i>	<i>Pectenia lactuca</i>
<i>Oxypora lacera</i>	<i>Pectenia paeonia</i>
FAMILY POCILLOPORIDAE	
<i>Podilopora verrucosa</i>	<i>Seriopora hystrix</i>
<i>Seriopora calendum</i>	<i>Stylophora pistillata</i>

HARD CORALS	
ORDER SCLERACTINIA	
FAMILY PORITIDAE	
<i>Goniopora</i>	<i>Poites anae</i>
<i>Poites</i> (encrusting)	<i>Poites cylindrica</i>
<i>Poites</i> (massive)	<i>Poites nigrescens</i>
<i>Poites</i> (submassive)	<i>Poites rus</i>
FAMILY SIDERASTREIDAE	
<i>Coscinaria exesa</i>	<i>Psammocora profunda</i>
<i>Psammocora contigua</i>	
ORDER COENOTHECALIA	
FAMILY HELIOPORIDAE	
<i>Heliopora coelestis</i>	
ORDER MILLEPORINA	
FAMILY MILLEPORIDAE	
<i>Millepora</i>	<i>Millepora exesa</i>
ORDER STOLONIFERA	
FAMILY TUBIOPORIDAE	
<i>Tubipora musica</i>	
SOFT CORAL	
ORDER ALCYONACEA	
<i>Anthelia</i>	<i>Sarcophyton crassicaule</i>
<i>Labophyton</i>	<i>Sinularia</i>
<i>Nephthes</i>	<i>Xenia</i>
<i>Sarcophyton</i>	

Source: SUML (1997).

Table 3.10. Mean cover of benthic categories using random quadrat method (n=10) in the MBA.

Stations	Corals			Fauna	Abiotic				Total
	Live hard coral	Soft coral	Dead coral		Rubble	Sand	Silt	Rock	
Malalag Marine Reserve, Malalag	42.2	1.89		1.2	27.3	1.4	26.0		100
Piape Reef, Padada	78.1	5.6	10.6	1.3				4.4	100
Kulagsing, Sta. Maria	70.6	9.4	3.8	3.1	1.9	10.0		1.2	100
Dagandang, Sta. Maria	35.6	5.0	2.5	4.4	21.3	23.1		8.1	100
San Agustin Point, Sta. Maria	53.7	17.5	1.9	2.5	6.9	10.6		6.9	100
Mean	56.0	7.9	3.8	2.5	11.5	9.0	5.2	4.1	

Source: *SUML (1997)*.

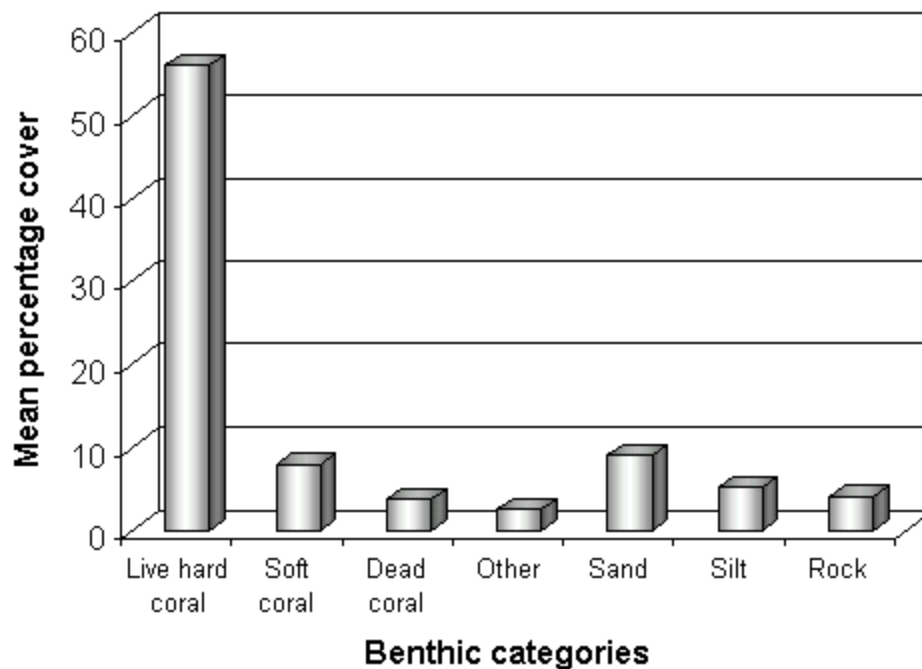


Figure 3.11. Mean benthic cover from coral reefs in five stations in the MBA.

Fishery resources in the Philippines are broadly classified into marine and inland resources. Marine resources include coastal areas and other traditional fishing grounds, while inland resources include lakes, reservoirs, rivers, brackishwater and freshwater fishponds.

For fish production purposes, fishery resources are categorized as either marine or aquaculture. Marine fishery resources consist of commercial and municipal fisheries while aquaculture comprises brackishwater fisheries, freshwater fisheries, and seafarming. Table 3.11 shows the fishery resources in the MBA.

Total marine resources production, both municipal and commercial, is 2,679.10 mt while aquaculture resources in the MBA have an aggregate fishpond area of 1,247.15 ha with a total

Table 3.11. Fishery resources in the MBA.

	Hagonoy	Padada	Sulop	Malalag	Sta. Maria	Total for MBA
Brackishwater pond						
<i>BANGUS (MILKFISH)</i>						
Area (ha)	384.67	167.62	352.69	189.00	153.17	1,247.15
Production (mt)	363.40	108.05	295.30	148.65	116.72	1,032.12
<i>PRAWN</i>						
Area (ha)	20.00	-	-	-	-	20.00
Production (mt)	89.60	-	-	-	-	89.60
Marine fish catch (Municipal)						
Production (mt)	275.00	486	15.0	198.50	1,549.40	2,523.9
Marine fish catch (Commercial)						
Production (mt)				35.30	120.00	155.20
<i>SEAWEEDS</i>						
Area (ha)	-	5.00	-	-	-	5.00
Production (mt)	-	3.25	-	-	-	3.25
<i>OYSTER</i>						
Area (ha)	-	-	-	1.50	1.50	3.00
Production (mt)	-	-	-	10.00	12.60	22.60

Source: PSPT (1994).

production of 1,032.12 mt. The principal aquaculture activity in the MBA was milkfish production. The largest milkfish farm (384.67 ha) is in Hagonoy, followed by Sulop (352.69 ha), Malalag (189 ha), and Padada (167.62 ha). Sta. Maria has the smallest farm with 153.17 ha. The prawn farm in Hagonoy is 20 ha with a yield of 89.60 mt. For seafarming, seaweed production has a total yield of 3.25 mt from an area of 5 ha while oyster culture with an area of 3.0 ha produces 22.60 mt.

A list of 133 finfish species belonging to 26 families were encountered in the MBA during the census conducted by SUML in 1997 (Table 3.12). The family Pomacentridae had the most

number of species, comprising 22.56 percent of the total number of species. The family Labridae was second with 19.55 percent and the family Chaetodontidae was third with 15.094 percent. Labrids and pomacentrids are two of the most abundant fishes in coral reefs (Randall et al. 1990). Pomacentrids are small fishes thus are not generally targeted for food by fishers. Labrids, on the other hand, vary in size (5-229 cm) and can grow to sizes large enough to be desirable to subsistence fishers. All of the species censused were either reef or reef-associated; no pelagic species were observed.

Sta. Maria has the most species (68) in 19 families. Malalag has the least number of species (40) in 14 families, as well as the lowest species richness and lowest average abundance.

5. Others

Endangered Species

There are no reports of sightings of endangered marine mammals such as whales, dolphins,

Table 3.12. Reef fish composition in the MBA.

Family	Common name	Species
ACANTHURIDAE	Surgeonfishes	<i>Acanthurus</i> sp. <i>Acanthurus bleekeri</i> <i>Acanthurus pyroferus</i> <i>Ctenochaetus binotatus</i> <i>Ctenochaetus striatus</i> <i>Naso hexacanthus</i> <i>Naso minor</i> <i>Zebrasoma scopas</i>
AULOSTOMIDAE	Trumpetfishes, flutemouths	<i>Aulostomus chinensis</i>
APOGONIDAE	Cardinalfishes	<i>Apogon bandanensis</i> <i>Apogon compressus</i> <i>Apogon</i> sp. <i>Archamia zosterophora</i> <i>Cheilodipterus macrodon</i> <i>Cheilodipterus quinquelineatus</i>
BALISTIDAE	Triggerfishes	<i>Balistapus undulatus</i> <i>Balistapus</i> sp. <i>Sufflamen bursa</i>
BLENIIDAE	Blennies	<i>Meiacanthus atrodorsalis</i> <i>Meiacanthus grammistes</i>
CAESIONIDAE	Fusiliers	<i>Caesio caeruleus</i> <i>Caesio cuning</i> <i>Pterocaesio pisang</i>
CENTRISCIDAE	Razorfishes	<i>Aeoliscus strigatus</i>
CHAETODONTIDAE	Butterflyfishes	<i>Chaetodon baronessa</i> <i>Chaetodon bennetti</i> <i>Chaetodon kleinii</i> <i>Chaetodon lunula</i> <i>Chaetodon mertensi</i>

Table 3.12. (continued)

Family	Common name	Species
		<i>Chaetodon octofasciatus</i> <i>Chaetodon punctatofasciatus</i> <i>Chaetodon trifasciatus</i> <i>Chaetodon ulietensis</i> <i>Chaetodon unimaculatus</i> <i>Chaetodon vagabundus</i> <i>Chaetodon</i> sp. <i>Coradion altivelis</i> <i>Coradion chrysozonus</i> <i>Forcipiger flavissimus</i> <i>Forcipiger longirostris</i> <i>Heniochus diphreutes</i> <i>Heniochus chrysostomus</i> <i>Heniochus varius</i>
CIRRHITIDAE	Hawkfishes	<i>Cirrihitichthys falco</i>
FISTULARIDAE	Cornetfishes	<i>Fistularia commersonii</i>
HAEMULIDAE	Sweetlips and grunts	<i>Plectorhinchus chaetodontoides</i>
LABRIDAE	Wrasses	<i>Bodianus diana</i> <i>Bodianus mesothoras</i> <i>Cheilinus celebicus</i> <i>Cheilinus diagrammus</i> <i>Cheilinus fasciatus</i> <i>Cheilodipterus macrodon</i> <i>Choerodon anchorago</i> <i>Chrysiptera cyanea</i> <i>Cirrihalabrus cyanopleura</i> <i>Cirrihalabrus</i> sp. <i>Coris schroederi</i> <i>Epibulus insidiator</i> <i>Halichoeres hortulanus</i> <i>Halichoeres melapterus</i> <i>Halichoeres prosopion</i> <i>Halichoeres scapularis</i> <i>Halichoeres</i> sp. <i>Latrichthys unilineatus</i> <i>Latroides dimidiatus</i> <i>Latropsis australis</i> <i>Pseudocheilinus octotaenia</i> <i>Stethojulis bandanensis</i> <i>Thalassoma hardwicke</i> <i>Thalassoma lunare</i> Unidentified labrid sp. 1 Unidentified labrid sp. 2
LUTJANIDAE	Snappers	<i>Macolor niger</i>
MONACANTHIDAE	Filefishes	Unidentified monacanthid
MULLIDAE	Goatfishes	<i>Parupeneus barberinus</i> <i>Parupeneus multifasciatus</i> <i>Upeneus tragulas</i>
NEMIPTERIDAE	Threadfin breams	<i>Scolopsis bilineatus</i> <i>Scolopsis ciliatus</i> <i>Pentapodus</i> sp.

continued

Table 3.12. (continued)

Family	Common name	Species
PINGUIPEDIDAE	Sandperches	<i>Parapercis cylindrica</i>
POMACANTHIDAE	Angelfishes	<i>Centropyge bicolor</i> <i>Centropyge bispinosus</i> <i>Centropyge tibicen</i> <i>Centropyge vroliki</i> <i>Chaetodontoplus mesoleucus</i> <i>Pygoplites diacanthus</i> Unidentified angelfish
POMACENTRIDAE	Damselfishes	<i>Abudefduf vaigiensis</i> <i>Amblyglyphidodon aureus</i> <i>Amblyglyphidodon curacao</i> <i>Amblyglyphidodon leucogaster</i> <i>Amphiprion clarkii</i> <i>Amphiprion percula</i> <i>Amphiprion perideraion</i> <i>Chromis analis</i> <i>Chromis atripes</i> <i>Chromis retrofasciatus</i> <i>Chromis ternatensis</i> <i>Chromis viridis</i> <i>Chrysiptera cyanea</i> <i>Chrysiptera leucopoma</i> <i>Chrysiptera rollandi</i> <i>Dascyllus aruanus</i> <i>Dascyllus reticulatus</i> <i>Dascyllus trimaculatus</i> <i>Lepidozygus</i> sp. <i>Neoglyphidodon melas</i> <i>Neopomacentrus azysron</i> <i>Pomacentrus amboinensis</i> <i>Pomacentrus brachialis</i> <i>Pomacentrus coelestis</i> <i>Pomacentrus moluccensis</i> <i>Pomacentrus nigromarginatus</i> <i>Pomacentrus reidi</i> <i>Pomacentrus</i> sp. <i>Stegastes</i> sp.
SCARIDAE	Parrotfishes	<i>Scarus dimidiatus</i> <i>Scarus lepidus</i> <i>Scarus scaber</i> <i>Scarus tricolor</i> <i>Scarus</i> sp.
SCORPAENIDAE	Scorpionfishes	<i>Pterois antennata</i>
SERRANIDAE	Groupers	<i>Cephalopholis boenak</i> <i>Cephalopholis</i> sp. <i>Plectropomus leopardus</i> <i>Pseudanthias huchtii</i> <i>Pseudanthias tuka</i>
SYNODONTIDAE	Lizardfishes	<i>Saurida gracilis</i>
TETRAODONTIDAE	Pufferfishes	<i>Canthigaster solandri</i>
ZANCLIDAE	Moorish idols	<i>Zanclus cornutus</i>

Source: SURL (1997).

dugongs, or marine turtles in the area. Moreover, there is no record showing the result of studies/research in the MBA for these marine fauna.

Beaches

The MBA is endowed with several beautiful beaches where resort facilities for swimming, meetings, and other gatherings are located. One is Eagle's Eye Beach Resort in Malalag. The other two beaches are Leling and Piape resorts in Hagonoy which are ideal for swimming and scuba diving. In the nearby town in Digos, the Dawis Beach Club also offers similar facilities.

SUMMARY

In summary, the MBA is endowed with forests and coastal resources. However, these resources have long been beset with issues such as denudation of the upland areas and destruction of the coastal habitats. The abuse of the forest resources has resulted in topsoil loss, increased severity and frequency of floods, and increased siltation to downstream farms, settlements, and coastal habitats. The pressure of pollution and overexploitation on the coastal areas has resulted in declining fish catch, the near extinction of the mangrove ecosystem, and water contamination.

The Malalag Bay Area



Fishpond and mangrove remnants at Sitio Taguian, Malalag, Davao del Sur.



Mangroves at Dalamuan, Mamacao, Sta. Maria, Davao del Sur.



Fish cage and mangroves at Sitio Sulok, Tanglad, Sta. Maria, Davao del Sur.



Fish corrals at Brgy. Balasinon, Sulop, Davao del Sur.



Portion of Malalag Bay fronting Culagsing Point.



Participatory Coastal Resource Assessment, 1997 (Tanglad).



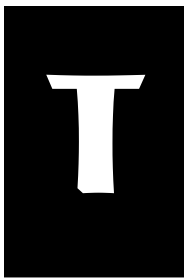
Participatory Coastal Resource Assessment, 1997 (Sta. Maria).



Participatory Coastal Resource Assessment, 1997 (Hagonoy).

Chapter 4

SOCIOPOLITICAL SETTING



The sociopolitical setting in the Malalag Bay Area (MBA) is presented in this section. The political and administrative boundaries and demography of each municipality comprising the MBA as well as the health and infrastructure or support systems available in the MBA are discussed.

POLITICAL AND ADMINISTRATIVE BOUNDARIES

The five municipalities of the MBA are composed of 100 *barangays* of which 21 are coastal. The municipality of Hagonoy is composed of 21 *barangays*; Malalag, 15; Padada, 17; Sta. Maria, 22; and Sulop, 25. Figure 4.1 shows the MBA municipalities.

Davao del Sur has two congressional districts with Padada and Hagonoy located in District I and Malalag, Sulop, and Sta. Maria in District II. Each district is represented by a Congressman.

The MBA is also under the political supervision of the provincial government headed by the governor. The seat of the provincial government, however, is located in Digos.

The municipality of Padada was created by virtue of Executive Order No. 236 issued by President Elpidio Quirino on 1 July 1949. It is bounded on the north by the municipality of Hagonoy, on the east by Davao Gulf, on the south by the municipality of Sulop, and on the west by the municipality of Kiblawan.



Figure 4.1. The MBA municipalities.

On 28 May 1953, the municipalities of Hagonoy and Malalag were created from a portion of the municipality of Padada by virtue of Executive Order No. 596 issued by President Elpidio Quirino. Hagonoy is bounded on the north by Digos, on the south by Padada, on the east by Davao Gulf, and on the west by Matanao. The municipality of Malalag comprises the southern part of Padada. It is bounded on the north by Padada, on the east by Davao Gulf, on the south by the municipality of Sta. Maria, and on the west by the province of South Cotabato.

The municipality of Sulop became an independent municipality from Padada by virtue of Executive Order No. 295 issued by President Carlos P. Garcia. It is bounded on the north by Padada, on the east by Davao Gulf, on the south by the municipality of Malalag, and on the west by the municipality of Kiblawan.

The municipality of Sta. Maria was separated from the municipality of Malalag through Republic Act No. 4743 as issued by the Philippine Congress. It is bounded on the north by the municipality of Malalag, on the east by Davao Gulf, on the south by Malita, and on the west by the province of South Cotabato.

Each municipality is under the political supervision of the municipal mayor assisted by the *barangay* captain of each *barangay*.

DEMOGRAPHY

Population Size, Density, Distribution, and Growth Rate

In 1995, the MBA had a total population of 162,756 and a one percent growth rate. Among the five municipalities, Malalag registered the highest growth rate (two percent) while Sta. Maria had the lowest growth rate (less than one percent).

In 1995, the MBA had a population density of 230 persons per km². The municipality of Padada was densely populated with a population density of 497. Next came the municipalities of Hagonoy, Sta. Maria, and Sulop with a density of 358, 205, and 167, respectively. The municipality of Malalag was the least densely populated area with a population density of 165 persons per km².

The total population in the 21 coastal *barangays* was 36,400 (PPDO 1996) with 7,346 located in Hagonoy; 8,590 in Malalag; 4,279 in Padada; 15,691 in Sta. Maria; and 494 in Sulop. Table 4.1 shows the population size, density, and growth rate per municipality in the MBA.

Table 4.1. Population size, density, and growth rate of the MBA.

Municipality	Population	% Growth rate	Population density (persons/km ²)
Hagonoy	41,752	1.37	358.00
Malalag	30,733	2.1	165.12
Padada	22,384	1.24	497.10
Sta. Maria	41,919	0.92	204.70
Sulop	25,968	1.16	167.25
MBA	162,756	1.36	230.00

Source: PPDO (1996).

Households

In 1995, the MBA had a total population of 162,756 comprised of 32,235 households with an average household size of five persons (PPDO 1996). Hagonoy had the highest number of households (8,359), followed by Sta. Maria (8,060), Malalag (6,059), and Sulop (5,251). Padada had the least number of households (4,506).

Age and Gender Composition

In 1995, the age group of 5 to 9 years had the highest population of 22,851 or 14 percent of the whole population of the MBA. Next was the age range of 10 to 14 years with 20,307 or 12.48 percent of the MBA total population. The smallest percentage of the population belonged to the age bracket of 85 years old and over with only 255 persons. The productive age (15-64 years old) was 91,862 or 56 percent of the whole population.

The MBA's male:female ratio is 104 with Malalag having the highest male:female ratio of 106 while Padada has the lowest male:female ratio of 101.

Urban and Rural Distribution

In 1990, the MBA had an urban population of 36,148 and a rural population of 116,166 (Table 4.2). Hagonoy had the largest urban population of 12,502 while Malalag had the lowest with 3,860. On the other hand, the municipality of Sta. Maria had the largest rural population with 34,090 while Padada had the lowest with 12,794.

Education

Based on the 1994 MBA-PAIC Profile, the MBA posted a literacy rate of 91 percent. The municipality of Padada had the highest literacy rate of 97 percent while Sta. Maria had the lowest literacy rate of 83 percent (Figure 4.2).

Table 4.2. Urban and rural population in the MBA.

Municipality	Total population	Urban	% Urban population	Rural	% Rural population
Hagonoy	39,001	12,502	32.00	26,499	68.00
Malalag	27,709	3,860	14.00	23,837	86.00
Padada	21,039	8,295	39.00	12,794	61.00
Sta. Maria	40,033	5,943	15.00	34,090	85.00
Sulop	24,494	5,548	22.00	18,946	78.00
Total	152,276	36,148	24.00	116,166	76.00

Source: PSPT (1994).

As of 1996, there were 91 elementary schools (89 public and 2 private), 16 high schools (8 public and 8 private), and 2 private tertiary schools. Figure 4.3 shows the school distribution in the MBA.

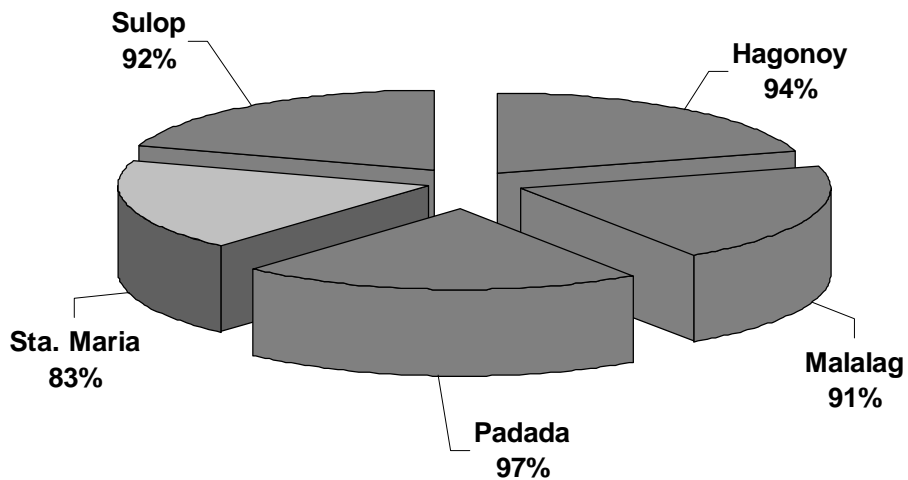


Figure 4.2. MBA literacy rate.

Source: PSPT (1994).

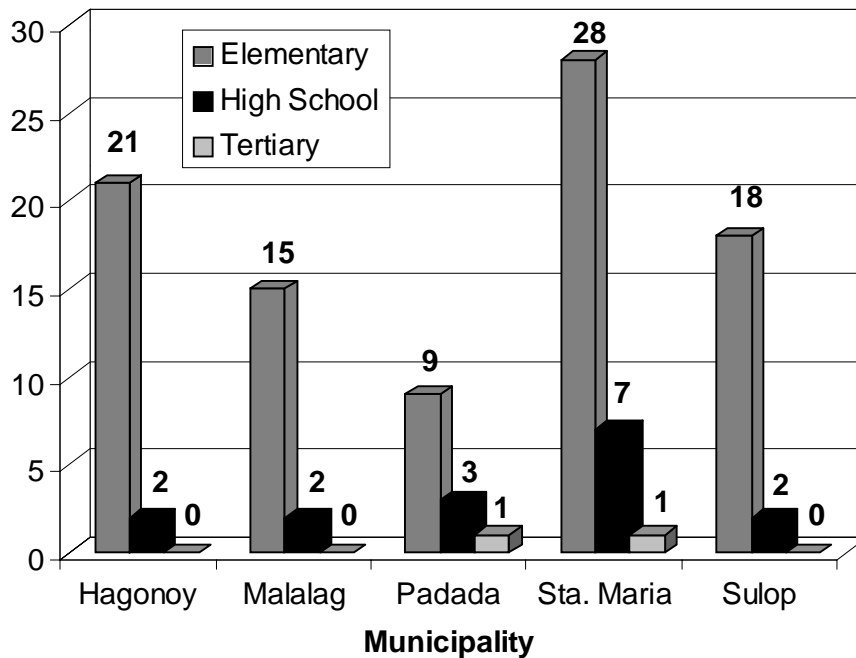


Figure 4.3. School distribution in the MBA.

Source: PPDO (1996).

Among the coastal inhabitants interviewed by SUML in 1997, 7 percent (15) of the respondents had no formal schooling, about 63 percent (139) finished elementary school, 27 percent (60) reached high school, 2 percent (5) reached college. Only one respondent had a college degree and another was able to obtain vocational education. The low record of collegiate level education and the higher level elementary education can be attributed to the presence of elementary schools and the absence of higher learning institutions within the learning area. There are, however, some schools that offer fisheries and fisheries-related courses in some municipalities such as Malalag. Another factor is the migration of graduates to other areas where there are opportunities for employment.

Labor, Employment, and Income

As of 1993, the total labor force in the MBA was 61,419. Of the total labor force, about 56,728 (92 percent) were employed and about 4,691 (8 percent) were unemployed (Figure 4.4).

Around 20 percent of the total labor force were located in the urban areas, predominantly engaged in service and trade sectors while 80 percent were from rural areas, predominantly engaged in agriculture (coconut and banana plantation workers) and coastal fisheries. The main employment of coastal households was fishing. Methods of fishing included gill net, hook and line, bag net, fish corral, purse seine, fish pot, scoop net, and pressure gear. The use of floating fish cages has been expanding in the bay. Income is primarily derived from seasonal harvesting of milkfish fry and grouper fry. Catch volumes have been declining in recent years.

The survey conducted by SUML in 1997 revealed that the main livelihood of the coastal communities within the MBA was fishing (41.9 percent), followed by business (14.2 percent), farming and unskilled labor (10 percent), and fisheries-related income (8.4 percent). Table 4.3 shows the ranges and averages of income obtained from the different categories of livelihood in the MBA.

Business provided the largest source of income (PhP3,042/month) while fishing and fishery-related activities which were the main sources of livelihood of the people, provided only an average monthly income of PhP2,157 and PhP2,241, respectively. Very few (9.7 percent) of the coastal residents in the MBA owned agricultural land. Most residents were fishermen. However, more than half (62 percent) of the residents owned livestock or poultry, mostly for their own consumption.

Religion

Based on National Statistics Office data of 1990, 90 percent of the population in the MBA are Roman Catholic. The remaining 10 percent are distributed among other

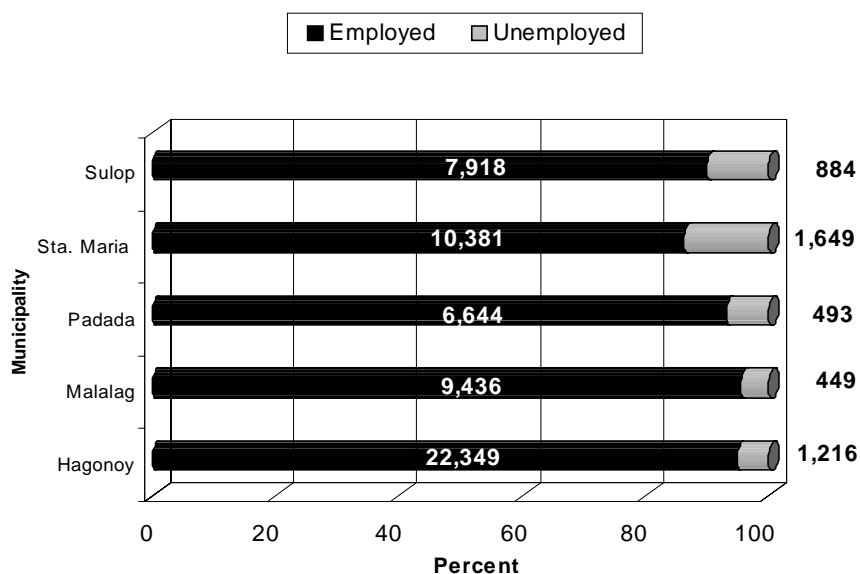


Figure 4.4. Total labor force and employment rate in the MBA.

Source: PSPT (1994).

Table 4.3. Summary of the ranges and averages of income obtained from different categories of livelihood in the MBA.

Livelihood	Monthly range, PhP (min-max)	Total monthly income, PhP (average)	Annual income, PhP (average)
Fishing	25 to 8,000	2,157	23,980
Fisheries-related income	60 to 13,000	2,241	26,517
Fishing and non-fisheries-related income	350 to 2,155	953	10,573
Farming	65 to 9,500	1,578	11,676
Business	100 to 24,000	3,042	35,556
Salary	150 to 6,000	1,878	22,532
Skilled labor	200 to 3,000	1,551	18,005
Unskilled labor	125 to 2,800	945	9,929
Non-fisheries-related income	1,325 to 5,300	2,708	28,617
Other sources of income	15 to 1,500	500	5,970

Source: SUML (1997).

Note: US\$1 = PhP 26 in 1997

religious sects such as Aglipay, United Church of Christ in the Philippines, Iglesia ni Kristo, Islam, Jehovah's Witness, Seventh Day Adventist and Protestant (NSO 1990).

Dialects

According to National Statistics Office data, the MBA's population, based at approximately 152,300 in 1990, is mostly Cebuano speaking (73 percent of the total population). Some 10 percent of the populace use the Tagacaolos dialect and around 17 percent use other minor dialects which include Hiligaynon, Ilocano, Waray, Bicol, Maguindanao, Aklan, Chavacano, Kinaray-a, Surigaonon, and Bilaan.

HEALTH, SANITATION, AND MEDICAL CARE

All municipalities in the MBA have a government main health center. These centers are supported by 38 *barangay* health stations where 10 are located in Hagonoy, 7 in Malalag, 4 in Padada, 10 in Sta. Maria, and 7 in Sulop (PPDO 1996). There are two public hospitals operating in Padada and 20 private clinics in the MBA.

There are 64 government health personnel working in the MBA which include 5 physicians, 11 nurses, 43 midwives, and 5 dentists.

Seventy-one percent of the total households in the MBA have sanitary toilets, 13 percent have unsanitary toilets, and 16 percent have no toilets (Table 4.4). Most of the houses without toilets are found along the seashore and hard-to-reach *barangays*. Of the 5 municipalities, Hagonoy has the most number of households with sanitary toilets totaling 11,801 followed by Sta. Maria with 7,887. On the other hand, about 4,154 households have unsanitary toilets (open pit privy and Antipolo type) while 5,267 houses are without toilets.

SETTLEMENTS

In 1990, the MBA had a total of 29,698 housing units of which 97 percent were occupied and the remaining 3 percent were vacant (Figure 4.5). This resulted in a ratio of 1 percent household per occupied housing unit.

Of the total occupied housing units, a large proportion was built of *cogon/nipa* for roofing (35 percent). Other roof construction materials were galvanized iron/aluminum (0.3 percent), and asbestos (0.01 percent).

Based on the construction materials of the outer walls, 35 percent of the total occupied housing units used light materials (bamboo, *sawali*, *cogon*, or *nipa*), 50 percent used wood, and 2 percent used salvage or other construction materials. There were also occupied housing units without walls.

Table 4.4. Excrete disposal facilities by municipality in the MBA.

Municipality	Household	Sanitary toilets			Unsanitary toilets	With out toilets
		Flush/septic tanks	Water sealed toilets	Sanitary pit privy	Open pit privy and Antipolo	
Hagonoy	8,541	19	4,958	6,824	387	915
Malalag	6,224	15	1,600	2,787	1,632	1,326
Padada	4,608	64	2,381	3,417	368	593
Sta. Maria	8,201	20	3,216	4,651	1,570	1,114
Sulop	5,364	58	2,337	3,628	197	1,319
MBA	32,938	176	14,492	21,307	4,154	5,267
Total (%)		5	44	65	13	16

Source: PPDO (1996).

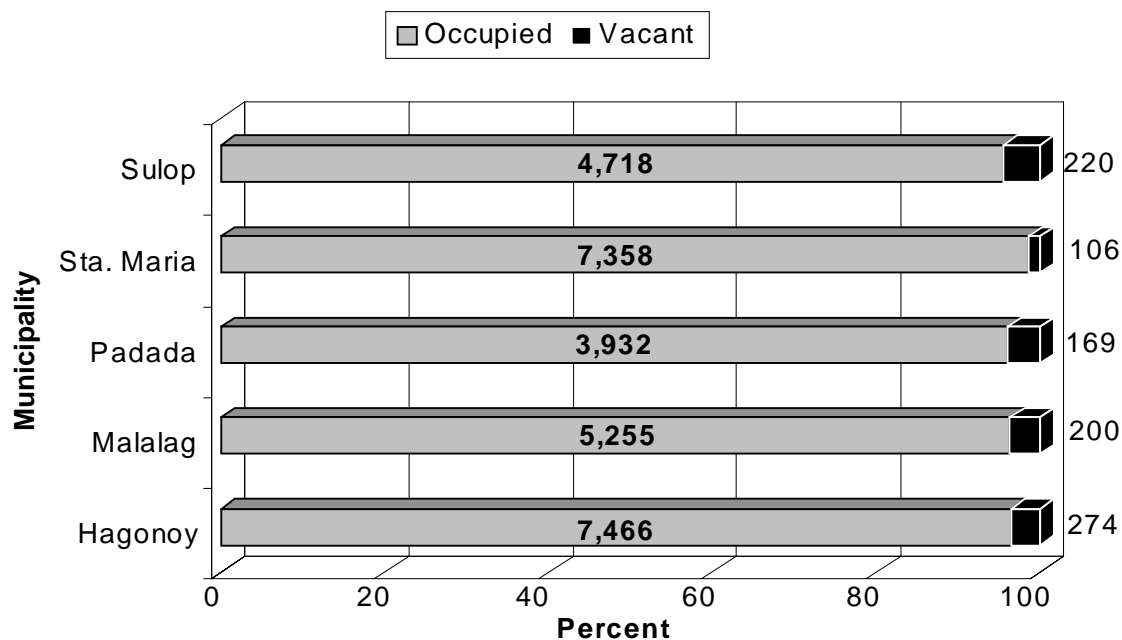


Figure 4.5. Housing units by municipality in the MBA.

Source: PPDO (1996).

With regard to the tenurial status of the housing unit, of the 26,903 households, 23,531 (87 percent) own their housing units, 877 (3 percent) rent their house, and the rest occupy the houses for free with or without the consent of owners.

Among those who own their housing units, 24,798 of the households purchased their houses from their own financial resources, 176 households were assisted through loans from Government Service Insurance System (GSIS), Home Development Mutual Fund (PAG-IBIG), Social Security System (SSS), Development Bank of the Philippines (DBP), and other government lending institutions, and 19 units were financed by private banks and private individuals (Table 4.5).

Table 4.5. Sources of household construction financing in the MBA.

Sources of financing	No. of households					
	Hagonoy	Malalag	Padada	Sta. Maria	Sulop	MBA
Purchased/constructed own house	6,178	4,608	3,105	6,797	4,110	24,798
Own resources/interest free loans from relatives/ friends	5,888	4,530	8,912	6,675	4,044	30,069
Government assistance (PAG-IBIG, GSIS, SSS, DBP, etc.)	105	9	47	7	8	176
Private banks/foundation/ cooperatives	12	-	-	7	-	19
Employer assistance	93	-	9	20	21	143
Private	19	60	115	61	21	276
Others	56	9	9	20	12	106

Source: PPDO (1996).

The provincial government has also been implementing the Barangay Site Development Project (BSDP) which was originally conceptualized to answer the need of the indigenous people to acquire their own house. Later, the project was expanded to include the improvement of the economic condition of the beneficiaries and was no longer limited to the indigenous people. The project now gives indigent *barangay* residents the opportunity to fulfill their long-time wish to acquire residential lots and *barangay* sites, administration for their health center, *barangay* hall, day care center, vegetable gardening area, tree park area, basketball court, and market place which they can call their own. The objective of the BSDP is to assist the *barangay* in the acquisition of land for *barangay* site at minimal cost. Under the project, the province will shoulder 50 percent of the total cost, 30 percent from the municipality, and 20 percent from the *barangay*.

Most of the houses (73 percent) in the coastal areas of the learning area are made of light materials. The rest of the houses are a combination of semi-permanent materials such as *nipa* huts (23 percent) and permanent materials like concrete (4 percent).

In terms of ownership, 86 percent of the coastal population own their houses while the rest either rent or share dwellings with relatives. However, only 41 percent own residential lots.

ROADS, TRANSPORTATION, COMMUNICATION, AND OTHER RELATED INFRASTRUCTURE OR SUPPORT SYSTEMS

Roads and Bridges

The MBA's municipal and *barangay* road networks measure some 80 km and 370 km, respectively. Majority of the roads in the MBA are gravel surfaced except for town centers which are mostly concrete. The longest national road in the province is the Malalag-Malita-Jose Abad Santos road (195 km). Of this, 132 km are gravel and the rest asphalt.

As of 1996, bridges along the MBA national road had a total length of 198 meters (m) stretched along Balutakay (16 m), Padada (82 m), Malalag (24 m), Culibao (27 m), Cumasi (22 m), and Basiawan (27 m).

Transportation

Land vehicles in the MBA include cars, jeepneys, buses, tricycles, PUBs, and trucks. In the coastal communities, the most common means of transportation are jeepneys and tricycles.

The MBA towns with transport terminals are Hagonoy, Padada, Sulop, Malalag, and Sta. Maria. Digos has one centralized bus terminal.

The MBA has a wharf located at Baybay, Malalag and is currently serving as a loading terminal for molasses. However, the wharf access is too shallow for commercial vessels and should be extended by 100 to 150 m into the bay with T-terminal to accommodate two ships in deeper water.

Communication

The MBA has two government postal offices located in the municipalities of Digos and Hagonoy. Private companies such as Aboitiz, LBC Express Inc., and JRS Express likewise offer mail services but only cater to large towns and cities.

Most of the houses (73 percent) in the coastal areas of the learning area are made of light materials.

Although all MBA municipalities have existing telegram stations, only Malalag and Sta. Maria have a telegraphic transfer office. Only one radio station operates in the MBA. It is located in Padada and operates at a very low frequency of 500 kHz.

There are two telephone companies operating in the MBA. PILTEL in Digos has a 2,500 capacity, 2,486 subscribers and 46,320 expansion programs while MABASCO in Malalag has 200 lines or capacity with 101 subscribers.

Irrigation

The Kibuaya mini dam (70 m long) in Hagonoy and the Padada mini dam (12 m long) in Padada are the only two existing mini dams in the MBA. Hagonoy has a national irrigation system covering 2,629 ha while the communal irrigation systems in Sta. Maria and Malalag cover only 60 ha and 50 ha, respectively.

Shore Protection Structure

Seawalls have been constructed along the municipal shorelines to prevent encroachment by the sea into lands that have become the foundation of residential houses and roads. Five shore protection structures with a total length of 479 m were constructed along the coastal municipalities in the MBA. These are Bagumbayan Seawall (130 m), Baybay Seawall (92 m), Piape Seawall (92 m), Padada Seawall (90 m), and Leling Seawall (75 m).

Power Supply

The power needs of the MBA are served by the Davao del Sur Electric Cooperative. However, approximately half of the *barangays* in the MBA are electrified except for Padada where all *barangays* are electrified.

Water Supply

There are three water supply systems in the MBA. These are Level I, which utilizes artesian wells, deepwells, and shallow wells; Level II, which includes developed springs with communal fauceting; and Level III, which includes developed springs with individual household connection (Table 4.6).

In 1996, 69 percent of the total households in the MBA had potable water supply facilities. Level I serves 86 percent, Level II serves 5 percent, and Level III serves 9 percent. Water sources of households without potable water supply facilities include deepwells, rain water, and rivers. In the MBA, Hagonoy has the highest portion of population with potable water supply facilities at 78 percent while Sulop has the lowest at 52 percent.

Table 4.6. Access to potable water facilities by municipality in the MBA.

Municipality	No. of households	No. of households with access to potable water facilities					No. of households without access to potable water facilities			
		Level 1	Level 2	Level 3	Total	Percent	Shallow-wells and springs	Open dug wells, rivers, etc.	Total	%
Hagonoy	7,974	5773	238	190	6201	78	1733	40	1773	22
Malalag	5,638	3086	165	290	3541	63	2,114	83	2097	37
Padada	4,296	2293	180	395	2868	67	928	500	1,428	33
Sta. Maria	7,228	4079	432	950	5,461	76	1738	29	1767	24
Sulop	5,048	2541	82	0	2623	52	1611	814	2,425	48
MBA	30,184	17,772	1,097	1,825	20,694	69	8,129	1,466	9,490	31

Source: PPDO (1996).

Waste Disposal

The MBA has 17 solid waste collection facilities consisting of 4 jeeps or dumptrucks and 13 wheel barrow/carts. Almost all households dispose of their solid waste through burying and compost pit (13,005), burning (8,024), and open dumping (9,731). On the other hand, about 15,353 households use blind drainages in disposing of their liquid wastes, 203 households use septic tanks, while the rest throw their liquid waste anywhere and in open canals. Table 4.7 shows the solid and liquid waste disposal facilities in the MBA.

Table 4.7. Solid and liquid waste disposal facilities by municipality and by number of households in the MBA.

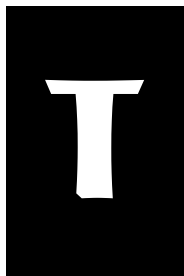
Municipality	No. of households	Solid waste collection		Solid waste disposal			Liquid waste disposal			
		No. of dump trucks/ jeep	No. of wheel barrow/ carts	Burying & composting	Burning	Open dumping	Can boxes	Blind drainages	Septic tanks	Anywhere open canals
Hagonoy	8,126	1	2	3,642	2,335	2,149	187	5,252	3	2,871
Malalag	5,745	1	2	1,593	2,396	1,756	138	1,534	24	4,187
Padada	4,378	1	4	2,074	1,557	747	378	3,153	162	1,063
Sta. Maria	7,365	1	3	3,708	310	3,349	746	3,252	14	4,099
Sulop	5,144	--	2	1,988	1,426	1,730	238	2,162	--	2,982
MBA	30,758	4	13	13,005	8,024	9,731	1,687	15,353	203	15,202
%		0.01	0.04	42.28	26.09	31.64	5.48	49.92	0.66	49.42

SUMMARY

In summary, of the 162,756 residents in the MBA, about 22 percent are considered coastal dwellers who generally rely on fishing and fishery-related activities for their livelihood. The majority of the fishermen own their houses (*nipa* and *sawali*) while the rest either rent or share dwellings with relatives. There is a low record of collegiate level education among the coastal inhabitants. Solid and liquid waste facilities and management are severely lacking in most of the MBA.

Chapter 5

ECONOMIC SECTORS



he economy of the municipalities in the MBA depends on fisheries, agriculture, industry, and to a small extent, tourism. The farming sector is the most important, with marine fishing ranking second with regard to source of livelihood and income.

FISHERIES

The fisheries sector includes marine and aquaculture fisheries. Marine fishing, both municipal and commercial, is done within the municipal waters of Malalag Bay which covers approximately 135 km² and serves as the fishing ground of the locality. Aside from marine fishing areas, the MBA is endowed with inland fishing grounds: brackishwater ponds and freshwater ponds.

MARINE FISHERIES

Capture Method

Based on the SUML survey in 1997, thirteen types of gear or methods of fishing were used in the MBA (Table 5.1). The most prevalent gear type in the bay was multiple hook and line (125 units), single hook and line (67 units), and gill net (37 units). Only three gear types, however, were monitored for actual catch landing enumeration: bottom set gill net, gill net, and lift net.

The farming sector is the most important source of livelihood and income. Marine fishing ranks second.

Table 5.1. Fishing gear used in the MBA.

Classification	Gear type	Number of units by municipality				Total
		Malalag	Padada	Sta. Maria	Sulop	
Impounding nets	<i>Basnig</i>			2		2
	<i>Baling</i>		2			2
	<i>Sudlud</i>				2	2
Entangling net	<i>Pamante (triple), pamante abay</i>		1	1		2
	<i>Pamante, pamo, pukot, panganduhaw (with light), patuloy (pangtamban)</i>	8	2			10
	<i>Palaran, panglambay, panglampornas, pamalo, pangtamban, pukot, pukot-double, pukot-triple, pukot-paapong with light</i>	17	3	13	4	37
Barriers and trap	<i>Bunsod</i>			3	14	17
	<i>Panggal</i>				1	1
	<i>Bubo (pangnokos)</i>				11	11
Lines	<i>Katay, palangre, pasol, pambariles</i>		7			7

Source: SUML (1997).

Among the 13 gear types reported in the SUML study, the top three most efficient gear in catching the most number of species were long line (31 species, dominated by the pelagic *Thunnus albacares*), fish corral (26 species, predominantly demersal such as the goatfish, *Upeneus* sp. and rabbitfish, *Siganus canaliculatus*), and multiple hook and line (18 species, predominantly pelagic such as *Thunnus albacares* and *Scomberomorus* sp.). Gill nets had a more varied catch of both demersal and pelagic species, with the belonid, *Strongylura* and an unidentified exocoetid predominating. Single hook and line only caught about 11 species, predominantly pelagics with the tuna, *Thunnus albacares* at the top of the list. The most species-specific gear, catching only one species (*Sepiotheutis* sp.) was the squid trap.

Malalag Bay is characterized by a fishery dominated by pelagic species which rake a higher income than demersals. The most important species in the fishery seems to be tuna, *Thunnus albacares*, caught by low-impact gear such as fish corral, multiple hook and line, single hook and line, and long line. Netting gear, which targets more demersals, showed less efficiency and profitability.

The results of the PCRA in 1998, however, showed that the most common fishing gear used in the MBA were multiple hook and line, single hook and line, and fish traps. Of the five municipalities, Sta. Maria has the most multiple hook and line locally called *undak* (2,688 units) and single hook and line locally called *pahawin* (1,596 units). Sulop has the most fish traps locally called *pasgong* (1,200 units). Table 5.2 shows the fishing gear used in the MBA.

Number of Fishers

Based on PCRA data in 1998, the MBA had a total of 1,611 municipal fishers of which 1,145 are full-time and 466 are part-time (Table 5.3 and Figure 5.1). The MBA also has 1,464 fishing *bancas* of which 425 are motorized and 1,039 are non-motorized. However, about 222 fishers are without *bancas*. As of 1996, the total annual production for municipal fisheries was estimated at 4,132 mt/year.

The commercial fishery is centered in Malalag. There are about 25 commercial fishers operating 3 units of fishery boats with a total tonnage of 14. Commercial fishing activities generate about 28 mt/year of fish.

Catch per Unit Effort

Table 5.4 shows the catch per unit effort (CPUE) and income per unit effort (IPUE) of the municipalities in Malalag Bay based on household interviews by SUML in 1997. CPUE refers to the volume of fish caught in kg per fisher per fishing hour while IPUE refers to the equivalent amount of fish caught in pesos received by each fisher per fishing hour. IPUE, however, does not reflect the cost of fishing, e.g., gasoline consumed during the fishing trip,

As seen in Table 5.4, the fish corral recorded the highest CPUE at 3.63 kg/man-hour, followed by the multiple hook and line (1.9 kg/man-hour), single hook and line (0.76 kg/man-hour), and gill net (0.64 kg/man-hour). The bag net and bottom set gill net had the lowest CPUE at 0.29 kg/man-hour.

In terms of IPUE, the fish corral reaped the highest income at PhP106.97/man-hour, followed by multiple hook and line (PhP75.84/man-hour), scoop net (PhP64.29/man-hour), and fish trap (PhP50.00/man-hour). The IPUE for single hook and line, gill net, and long line however generated lower incomes from PhP23 to PhP38/man-hour.

Table 5.2. Fishing gear used in the MBA based on PCRA data in 1998.

Type of gear	No. of units per municipality				
	Hagonoy	Malalag	Padada	Sta. Maria	Sulop
NETS					
<i>Baling, basnig, bintol, hantok, lampornas, laya, pahubas, palabo, palaran, pamalo, pamangse, pamante, panamban, panapao, panglambay, paninilya, patuloy, pokot, sadyap, sagiwsiw, sahid, sudsud, trawl, tumbok</i>	322	314	125	1,960	104
HOOK AND LINE					
<i>Pahawin, palangre, pamariles, pamasol, pangaraw, pangnukos, paniwit, panubid, subid, talunton, troll line, ulang-ulang, undak</i>	402	349	812	4,736	8
TRAPS					
<i>Bubo, bunsod, panglambay, paugmad, panggal, tangab fry, pasgong</i>	237	253	1,013	492	1,265
OTHERS					
<i>Pamana, pamuga, panginhas, panulo</i>	10	15	55	102	-

Table 5.3. Number of municipal fishers and corresponding fish production in the MBA.

Municipality	No. of municipal fishers					No. of fishing bancas					Total fish production (mt)			
	1993	1994	1995	1996	1998*	1993	1994	1995	1996	1998*	1993	1994	1995	1996
Hagonoy	521	525	446	253	205	172	176	184	178	139	285	290	155	330
Malalag	1,647	1,680	1,665	724	144	542	582	534	563	135	190	250	385	394
Padada	1,500	1,600	87	114	356	430	450	67	91	316	486	500	46	120
Sta. Maria	3,550	3,255	3,947	4,500	836	1,210	1,245	2,629	3,000	829	1,704	1,704	1,596	650
Sulop	62	62	1,083	1,083	70	62	62	1,248	1,248	45	20	21	2,636	2,638
Total	7,280	7,122	7,228	6,674	1,611	2,416	2,515	4,662	5,080	1,464	2,686	2,744	4,819	4,132

Source: PPDO (1993, 1996).

Note: *Based on PCRA conducted in 1998.

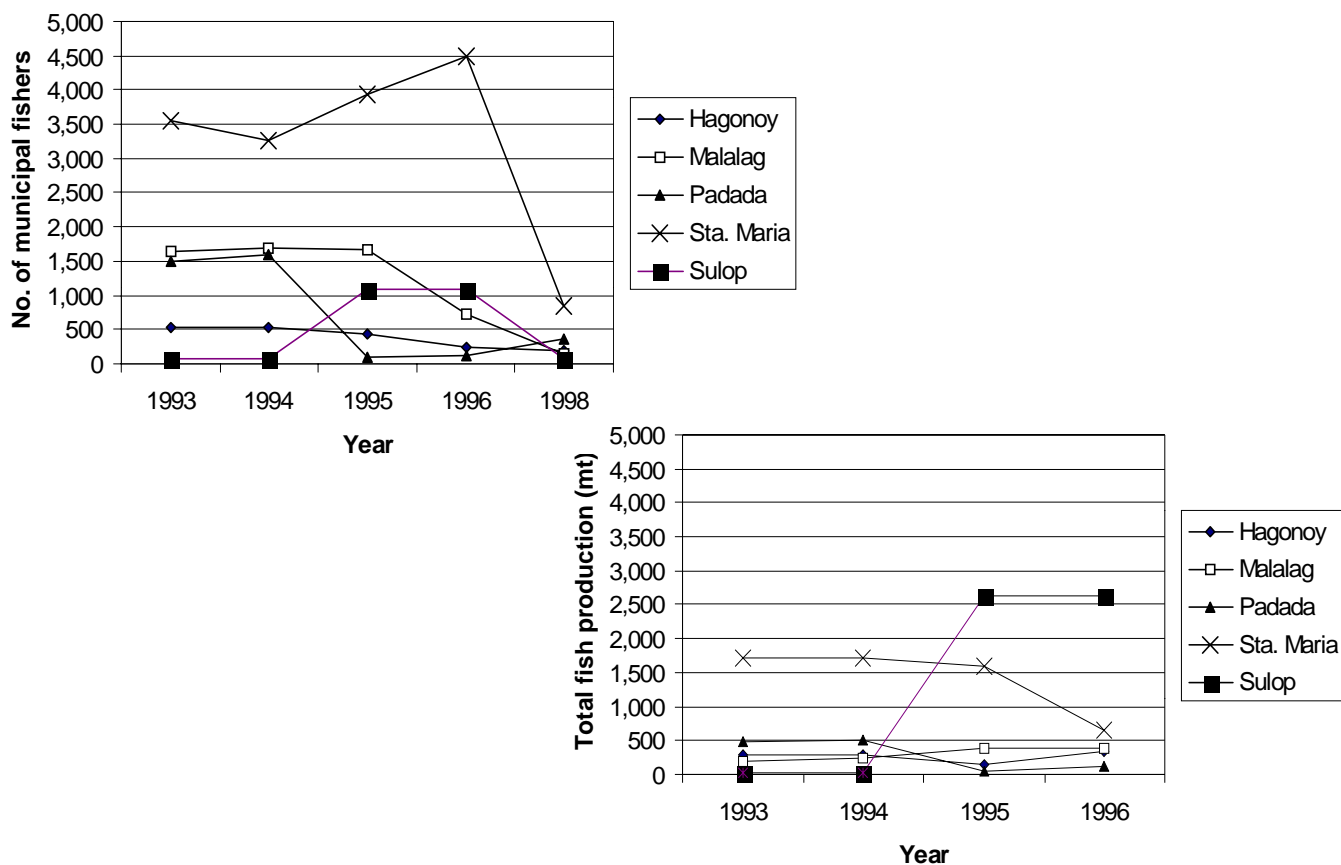


Figure 5.1. Number of municipal fishers and corresponding fish production in the MBA.

Table 5.4. Catch per unit effort (CPUE) and income per unit effort (IPUE) in the MBA, 1997.

Gear type	Average manpower utilized per trip	No. of hours per trip	Average effort (man-hour)	Average CPUE		Average IPUE	
				(kg/trip)	(kg/man-hour)	(PhP/trip)	(PhP/man-hour)
Bag net	8.50	12.50	7.11	31.50	0.29	773.75	7.11
Bottom set gill net	3.00	7.50	9.44	3.25	0.29	85.42	9.44
Drift gill net	1.15	12.40	12.02	4.05	0.32	154.30	12.02
Fish corral	1.18	2.70	106.97	4.66	3.63	149.21	106.97
Fish trap	1.00	10.00	50.00	5.00	0.50	500.00	50.00
Gill net	2.98	15.30	33.88	14.64	0.64	701.51	33.88
Long line	4.17	88.80	23.20	89.15	0.40	3,313.25	23.20
Lift net	2.50	4.00	6.59	6.75	0.51	116.30	6.59
Multiple hook and line	1.72	11.10	75.84	25.16	1.90	973.83	75.84
Scoop net	1.00	3.50	64.29	1.50	0.43	225.00	64.29
Spear gun	1.20	6.60	13.14	2.80	0.43	86.62	13.14
Single hook and line	2.97	59.70	38.08	62.92	0.76	2,301.39	38.08
Squid trap	1.50	3.00	21.39	1.63	0.42	82.92	21.39

Source: SUML (1997).

Catch per Species (Weight) per Gear

Based on the 1997 SUML study, 76 finfishes in 34 families (including eight unclassified species), five crustaceans in three families, and seven mollusks in three families (including three unclassified species) were recorded in four sites in the MBA from household interviews and actual catch data enumeration. Only 50 species were confirmed by actual catch data enumeration. About 14 species were identified during monitoring of landings, which were not reported by fishers: four species of wrasses (Family Labridae); five species of parrotfishes (Scaridae); the tuna, *Euthynnus affinis* (Scombridae); two rabbitfishes (Siganidae); one barracuda (Sphyraenidae); and the squid *Loligo* sp. (Loliginidae).

About 49 percent of the total species reported caught by fishers were reef species (30 percent) or reef-associated species (19 percent), i.e., species which inhabit nearby reef habitats such as mangrove and seagrass beds. The non-reef species comprised about 40 percent of the total number of the species reported caught, 13 percent of which were pelagic or migratory such as the clupeids, coryphaenids (dolphinfishes), and scombrids (tunas and mackerels).

In terms of reported landed volume, household interviews showed that the tuna, *Thunnus albacares*, locally called *bariles* or *carao*, was the major catch in the bay with a relative abundance of 54 percent. This species, however, was not seen during actual catch enumeration. What was caught most abundantly during fish landing monitoring was the pelagic/reef-associated species scads, *Selar crumenophthalmus*. Overall, this was reported as the second most abundant species landed by fishers in the bay. Table 5.5 shows the summary of catch composition, biomass, and relative abundance per gear type based on household interviews in 1977.

Based on PCRA data in 1998, multiple hook and line usually caught big-eye scads (*matambaka*), crevalle (*salay-salay*), and sardines (*tamban*). Single hook and line caught moonfish (*bilang-bilong*), groupers (*lapu-lapu*), jacks (*talakitok* and *mamsa*), Spanish mackerel (*tangigue*), snappers (*maya-maya*), and frigate tuna (*tulingan*). The third most abundant gear, fish trap, caught crabs, *lambay*, *kasag*, and *kagang*.

The intense exploitation of the marine resources, together with the increasing population of fishermen, has started to deplete fish harvest, which is already being felt in the MBA. Important management issues plaguing the fisheries sector include rapid population growth, poverty, and environmental degradation. An increase in coastal population implies an increase in the number of fishers. This number is

Table 5.5. Summary of catch composition, biomass, and relative abundance per gear type in the MBA.

Gear type	Species	TWT (kg)	(%) RA	
Bag net	<i>Sepioteuthis</i> sp.	4.0	29.6	
	<i>Siganus canaliculatus</i>	3.5	25.9	
	<i>Liza</i> sp.	2.5	18.5	
	<i>Stolephorus</i> sp.	2.5	18.5	
	<i>Punao</i>	0.5	3.7	
	<i>Litub</i>	0.5	3.7	
	Sub-total		13.5	
Bottom set gill net	<i>Siganus canaliculatus</i>	122.5		
Drift gill net	<i>Siganus canaliculatus</i>	9.8	61.0	
	<i>Upeneus</i> sp.	1.2	7.5	
	<i>Parupeneus</i> sp.	1.0	6.5	
	<i>Scarus</i> sp.	1.0	6.5	
	<i>Lethrinus</i> sp.	1.0	6.2	
	<i>Portunus pelagicus</i>	0.8	4.7	
	<i>Liza</i> sp.	0.4	2.5	
	Labrid sp.	0.3	1.9	
	<i>Terapon</i> sp.	0.3	1.9	
	<i>Abudefduf</i> sp.	0.1	0.6	
	<i>Acanthurus</i> sp.	0.1	0.6	
	Sub-total		16.0	
Fish trap	<i>Portunus pelagicus</i>	5.0	41.7	
	<i>Scylla</i> sp.	3.0	25.0	
	<i>Upeneus</i> sp.	2.5	20.8	
	<i>Nemipterus</i> sp.	0.5	4.2	
	<i>Sepioteuthis</i> sp.	0.5	4.2	
	<i>Epinephelus</i> sp.	0.5	4.2	
	Sub-total		12.0	
Lift net	<i>Auxis thazard</i>	20.0	30.3	
	Clupeid sp.	13.0	19.7	
	<i>Decapterus macrosoma</i>	10.0	15.1	
	<i>Selar crumenophthalmus</i>	15.0	22.7	
	<i>Siganus canaliculatus</i>	5.0	7.6	
	<i>Stolephorus</i> sp.	3.0	4.5	
	Sub-total		66.0	
Fish corral	<i>Upeneus</i> sp.	43.8	42.1	
	<i>Siganus canaliculatus</i>	23.5	22.6	
	<i>Portunus pelagicus</i>	7.1	6.8	
	Penaeid sp.	5.3	5.1	
	<i>Caranx</i> sp.	4.5	4.3	
	<i>Terapon</i> sp.	3.4	3.3	
	<i>Sepioteuthis</i> sp.	3.0	2.9	
	<i>Liza</i> sp.	2.8	2.6	
	<i>Parupeneus</i> sp.	1.4	1.4	
	<i>Penaeus</i> sp.	1.1	1.0	
	<i>Apogon</i> sp.	1.0	1.0	
	<i>Pelates</i> sp.	1.0	1.0	
	<i>Scylla serrata</i>	1.0	1.0	
	<i>Siganus guttatus</i>	1.0	1.0	
	<i>Gerres</i> sp.	0.9	0.8	
	<i>Dasyatis</i> sp.	0.5	0.5	
	Gill net	<i>Plotosus</i> sp.	0.5	0.5
		<i>Sillago</i> sp.	0.5	0.5
		<i>Octopus</i> sp.	0.3	0.3
<i>Cheilio inermis</i>		0.2	0.2	
Holocentrid sp.		0.2	0.2	
<i>Lethrinus</i> sp.		0.1	0.1	
Muraenid sp.		0.1	0.1	
Platycephalid sp.		0.1	0.1	
Tetraodontid sp.		0.1	0.1	
Shark		0.5	0.5	
Sub-total			104.2	
Gill net		<i>Strongylura</i> sp.	180.0	64.7
		Exocoetid sp.	48.0	17.2
		<i>Siganus canaliculatus</i>	10.0	3.6
		<i>Rastrelliger kanagurta</i>	8.0	2.9
		<i>Portunus pelagicus</i>	6.0	2.7
		<i>Siganus guttatus</i>	4.0	1.4
		<i>Caranx</i> sp.	3.0	1.1
		<i>Parupeneus</i> sp.	2.8	1.0
	<i>Selar crumenophthalmus</i>	2.5	0.9	
	Clupeid sp.	2.0	0.7	
	<i>Scarus</i> sp.	2.0	0.7	
	<i>Cheilio inermis</i>	1.5	0.5	
	<i>Liza</i> sp.	1.0	0.4	
	<i>Upeneus</i> sp.	1.0	0.4	
	<i>Terapon</i> sp.	0.5	0.2	
	<i>Salindangan</i>	0.5	0.2	
	<i>Caraballas</i>	5.5	2.0	
Sub-total		278.3		
Long line	<i>Upeneus</i> sp.	1.3	1.2	
	<i>Thunnus albacares</i>	25.0	23.1	
	<i>Terapon</i> sp.	3.2	3.0	
	<i>Selar crumenophthalmus</i>	14.5	13.4	
	<i>Scomberomorus</i> sp.	2.5	2.3	
	<i>Plotosus</i> sp.	0.3	0.3	
	<i>Parupeneus</i> sp.	3.2	3.0	
	<i>Nemipterus</i> sp. 1	2.5	2.3	
	<i>Nemipterus</i> sp. 2	0.1	0.1	
	Muraenid sp.	1.0	0.9	
	<i>Lutjanus</i> sp. 1	1.5	1.4	
	<i>Lutjanus</i> sp. 2	0.9	0.9	
	<i>Lutjanus</i> sp. 3	7.7	7.2	
	<i>Lethrinus</i> sp. 1	0.1	0.1	
	Labrid sp.	0.2	0.2	
	Holocentrid sp.	3.5	3.2	
	<i>Epinephelus</i> sp. 1	0.8	0.7	
	<i>Epinephelus</i> sp. 2	0.2	0.2	
	<i>Dasyatis</i> sp.	0.7	0.7	
<i>Caranx sexfasciatus</i>	1.5	1.4		
<i>Caesio</i> sp.	10.5	9.7		
<i>Auxis thazard</i>	0.45	0.4		
<i>Apogon</i> sp.	15.0	13.8		
<i>Tulingan</i>	5.0	4.6		

continued

Table 5.5. (continued)

Gear type	Species	TWT (kg)	(%) RA
	<i>Salmon-salmon</i>	0.1	0.1
	<i>Sunogan</i>	0.3	0.3
	<i>Bulgan</i>	0.8	0.7
	<i>Bagabaga/doding</i>	1.5	1.4
	<i>Bago</i>	2.1	2.0
	<i>Batwanon</i>	0.2	2.0
	<i>Gapas</i>	0.2	0.2
	Sub-total	108.4	
Multiple hook and line	<i>Thunnus albacares</i>	63.1	50.0
	<i>Scomberomorus</i> sp.	20.0	16.0
	<i>Selar crumenophthalmus</i>	14.6	11.6
	<i>Auxis thazard</i>	4.0	3.2
	Clupeid sp.	4.0	3.2
	<i>Tulingan</i>	3.5	2.8
	<i>Rastrelliger brachysoma</i>	3.0	2.4
	<i>Salmon-salmon</i>	3.0	2.4
	<i>Samin-samin</i>	2.5	2.0
	<i>Coryphaena</i> sp.	2.0	1.6
	Exocoetid sp.	2.0	1.6
	<i>Bulatok</i>	1.5	1.2
	<i>Decapterus macrosoma</i>	1.0	0.8
	<i>Sepioteuthis</i> sp.	0.5	0.4
	<i>Epinephelus</i> sp.	0.5	0.4
	<i>Nemipterus</i> sp.	0.5	0.4
	<i>Cephalopholis</i> sp.	0.5	0.4
<i>Chanos chanos</i>	0.5	0.4	
	Sub-total	126.8	
Scoop net	<i>Acetes</i> sp.	10.0	87.0
	Penaeid sp.	1.5	13.0
	Sub-total	11.5	

Gear type	Species	TWT (kg)	(%) RA
Spear gun	<i>Siganus canaliculatus</i>	7.0	50.0
	<i>Portunus pelagicus</i>	1.5	10.7
	<i>Siganus canaliculatus</i>	1.5	10.7
	<i>Apogon</i> sp.	1.0	7.1
	<i>Parupeneus</i> sp.	1.0	7.1
	<i>Epinephelus</i> sp.	0.5	3.6
	Muraenid sp.	0.5	3.6
	<i>Sepia</i> sp.	0.5	3.6
	<i>Octopus</i> sp.	0.3	2.1
	<i>Scarus</i> sp.	0.2	1.4
		Sub-total	14.0
Single hook and line	<i>Coryphaena hippurus</i>	125.0	3.6
	<i>Decapterus macrosoma</i>	62.0	1.8
	<i>Makaira</i> sp.	100.0	2.9
	<i>Scomberomorus</i> sp.	13.0	0.4
	<i>Selar crumenophthalmus</i>	273.5	7.9
	<i>Sepioteuthis</i> sp.	7.0	0.2
	<i>Thunnus albacares</i>	2,275.5	65.8
	<i>Pirit</i>	263.5	7.6
	<i>Salmon-salmon</i>	2.0	0.1
	<i>Tulingan</i>	287.0	8.3
<i>Liplipan</i>	50.0	1.4	
	Sub-total	3,458.5	
Squid trap	<i>Sepioteuthis</i> sp.	1.5	

Legend: TWT = Total weight in kg; RA = relative abundance in %
Source: SUML (1997).

enhanced by migration of landless and marginalized farmers and unemployed urban poor who seek refuge in the fishery sector. Clearly, fisheries has become an employer of the last resort (Pauly and Chua 1988) and poverty is its constant companion. Pauly and Chua (1988) reported that many of these migrants, lacking the skills in artisanal fishing, were oftentimes the first ones to employ destructive techniques.

Pollution, forest denudation, siltation, denudation of mangroves, and degradation of coral reefs, and disturbances in the estuarine and seagrass beds by using illegal fishing activities have all contributed to the depletion of fishery resources. The presence of illegal fishing activities like dynamite fishing, the use of fine mesh nets, and others suggests a poor implementation of fishery laws. Based on the survey conducted by the PCAMRD in 1990, coral reefs along the Malalag Bay Area were heavily damaged. Only about 5 to 15 percent remained in good condition.

Aquaculture

In 1995, the brackishwater aquaculture in the MBA was estimated at 1,271 ha producing about 2,089 mt of milkfish (*bangus*) and prawn (*sugpo*). Of the total hectareage, about 1,227 ha are allocated for milkfish production and only 35 ha for prawn culture (Table 5.6). In 1996, the hectareage allocated for prawn culture was converted to milkfish production.

Table 5.6. Brackishwater resources data by municipality in the MBA.

Municipality	No. of operators				Milkfish				Prawn			
	FLA		Private		Area (ha)		Production (mt)		Area (ha)		Production (mt)	
	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996	1995	1996
Hagonoy	6	12	18	18	385	363	375	436	20	-	87	-
Malalag	21	32	4	17	189	191	153	182	-	-	-	-
Padada	6	17	4	3	169	215	126	214	-	-	-	-
Sta. Maria	3	3	22	22	131	131	141	144	15	-	6,654	-
Sulop	15	9	19	31	353	373	259	336	-	-	-	-
Total	51	73	67	91	1,227	1,273	1,054	1,312	35	0	6,741	0

Source: PPDO (1996).

From freshwater aquaculture, production of tilapia, carp, and shrimps reached 3.21 mt from a production area of 3.16 ha. Of the four producing municipalities, Hagonoy contributed 2.25 mt or 70 percent of the total production while Sulop had the least with 0.06 mt (Table 5.7). A downward trend is evident for freshwater aquaculture (Table 5.7).

Moreover, the total production area for seafarming was also observed to be on a downtrend due to the unstable market of seaweed, and oyster and the occurrence of a red tide. Seaweed farming was confined only to Malalag while the culture of oysters was confined to the municipal waters of Malalag and Sulop. The total area occupied by seafarming increased from 2.47 ha in 1995 to 3.4 ha in 1996. The increase was due to new oyster culture in the municipality of Sulop in 1995. However, production decreased from 44.2 mt in 1995 to 12 mt in 1996.

Malalag has a fish sanctuary of 50 ha. At present, there are small scale mariculture projects. There are 29 families engaged in oyster culture. With the red tide phenomenon (when poisonous substances infiltrate shells, clams, oysters, etc.) occurring from time

Table 5.7. Freshwater resources data by municipality in the MBA.

Municipality	1994			1995			1996		
	No. of freshwater operators	Area (ha)	Total production (mt)	No. of freshwater operators	Area (ha)	Total production (mt)	No. of freshwater operators	Area (ha)	Total production (mt)
Hagonoy	38	2.5	8	38	2.5	2.25	38	2.5	2.25
Malalag	1	0.02	Unproductive	1	0.02	Unproductive	4	0.33	Areas still on excavation
Padada									
Sta. Maria	5	2.31	2.53	5	2.31	1.68	2	0.08	0.90
Sulop							1	0.25	0.06
Total	44	4.83	10.53	44	4.83	3.93	45	3.16	3.21

Source: PPDO (1996).

to time, the market is adversely affected. The method of culture relied heavily on hanging coconut shells. The culture of the seaweed *Eucheuma spinosum*, financed by the DA, failed due to the attack of the "ice-ice" disease. However, the LGU has introduced the *Eucheuma cottonii*. The project started in 1994, which was operated by the LGU and Malalag Christian Cooperative Inc. (MCCI). The initial observation is that the variety thrives well in the area and it readily reproduces. Edible sea cucumbers also abound in the area but there are no steady buyers.

Aside from milkfish culture and marine fishing, oyster culture is being undertaken by a substantial number of residents of Barangay Balasinon in Sulop. In 1995, twenty families engaged in oyster culture. The method of culture relied on oyster beds with hanging sliced rubber. Basically, the product is sold in the form of oyster meat and is marketed in Sulop, Padada, and Digos at Php20 per bottle.

The impact of aquaculture in the MBA may be viewed in terms of its positive and negative effects. Two of the most obvious benefits from the enterprise are its contribution to fish production and the generation of employment opportunities in rural areas. However, aside from the destruction of mangrove areas for fishpond development and the operation of fish farms, particularly intensive prawn farms, aquaculture contributes to coastal pollution and salt intrusion into domestic water sources. In addition, the proliferation of fish cages in the bay in recent years has contributed to the pollution loading of the bay. This pollution load contains uneaten fish feed and fecal and other excretory wastes. Intensive fish cages, floating pens and other systems that are relatively open to the natural waters have the greatest

potential to cause environmental degradation from totally untreated waste discharges. In areas where cages are crowded, the circulation of fresh seawater is impeded and the pollution caused by the decomposition of feeds affects broad areas and even natural stocks of fish.

INDUSTRY

In 1996, the MBA had ten major manufacturing firms (Table 5.8), all of which are agriculture dependent using the primary crops of the MBA such as sugarcane, cacao, banana, coconut, and other indigenous materials. However, a large percentage of their products are for the export market.

The DASUCECO at Barangay Guihing can mill 4,000 mt of sugarcane per day. The plant can accommodate the sugarcane produced from about 11,302 ha of sugarcane area from around the province and its neighbors. The FILINVEST and KLDI, two of the largest sugarcane plantations located in the MBA, both provide sugarcane to DASUCECO.

Table 5.8. Major industries in the MBA.

Name of establishment	Location	Product/service rendered
Cocoa Investors, Inc. (CII)	Hagonoy	Dried cocoa beans
Davao Sugar Central Company (DASUCECO)	Hagonoy	Raw and refined sugar
FILINVEST	Hagonoy	Sugarcane
Guihing Agricultural Development Corporation (GADECO)	Hagonoy	Cavendish banana
L and S Ventures Plantation, Inc.	Hagonoy	Cavendish banana
Kawayan Land Development, Inc. (KLDI)	Hagonoy	Sugarcane
Southern Davao Development Corporation (SODADECO)	Hagonoy	Prawns
United Sugarcane Planters of Davao del Sur (USPD)	Hagonoy	Sugarcane production and trading
Malalag Ventures Plantation, Inc. (MVPI)	Malalag	Cavendish banana
Phil. Cocoa Estate Corporation	Sta. Maria	Dried cocoa beans

Source: PPDO (1996).

The GADECO caters to the production of cavendish banana. As of 1996, the company had 1,920 ha planted to cavendish banana with an annual production of 1,871 mt. Also in Barangay Guihing is the CII, previously engaged in producing dried cocoa beans. In the later part of 1995, it shifted to mango production. Another company located in Hagonoy is the SODADECO which is engaged in prawn culture and hatchery.

The municipality of Malalag has a port which accommodates inter-island vessels and a docking area for some foreign vessels. The docking of foreign vessels in the bay, however, has generated some jurisdictional issues between the LGUs of Sta. Maria and Malalag and the Philippine Ports Authority and the Regional Maritime Command of the PNP. In May 2000, however, the full management and supervision of the port facility was turned over by the Philippine Ports Authority to the Malalag LGU. Malalag is also into banana plantation and export. It is lucky to have accommodated the MVPI, a joint venture project of the Lapanday Group of Companies and the Original Banana Exporters. Two existing storage facilities for molasses are also located in Malalag and owned by Total Bulk and CIFRA companies. Malalag is also known for its bamboo furniture, romblon mats and bags, and rope making.

Sta. Maria, Sulop, and Padada remain largely rural but rich in resources like coconut, corn, sugarcane, and cacao. Industrial activities in these municipalities are limited to either microscale or cottage.

Industrial effluents coming particularly from sugar milling and oil dumping from docking vessels have, however, contributed to the deterioration of the water quality of Malalag Bay.

AGRICULTURE

Food and Commercial Crops

The MBA is characterized by a predominantly production-based agriculture (Table 5.9). Food crops cover approximately 11,000 ha of the MBA's cultivable land area of which 6,500 ha are corn farms and 4,300 ha are rice farms (Figure 5.2). Commercial crops in the MBA utilize approximately 32,000 ha with coconut production covering about 23,000 ha.

Table 5.9. Food and commercial crops in the MBA in 1996.

Crops	Hagonoy	Padada	Sulop	Sta. Maria	Malalag	MBA
COMMERCIAL CROPS						
Coconut						
Area (ha)	2,262.79	3,679.00	5,173.00	7,400	4,460.66	22,975.45
Production (mt)	2124.00	3,222.00	4,867.00	8,233	5,789.00	24,235.00
Sugarcane						
Area (ha)	866.78	213.11	1,107.50	3.00	510.00	3,567.17
Production (mt)	52,387.04	12,052.85	44,548.64	206.23	21,810.40	131,005.16
Banana (Local)						
Area (ha)	321.20	180.00			78.00	579.20
Production (mt)	874.80	630.00			150.50	1,655.30
Banana (Export)						
Area (ha)	1,115.00		47.00	48.00	500.00	1,710.00
Production (mt)	82,405.00		235.00	546.60	19,000.00	101,186.60
Coffee						
Area (ha)			8.00	65.00	78.00	151.00
Production (mt)			6.40	169.00	26.87	202.27
Cacao						
Area (ha)	10.00		13.00	15.00	90.00	128.00
Production (mt)	10.00		13.00	30.00	21.50	74.50
Cotton						
Area (ha)	3.75		3.00			6.75
Production (mt)	3.00		3.00			6.00
Mango						
Area Planted (ha)	919.00	15.00	94.00	132.00	1,075.00	2,235.00
Area (Fruit bearing) (ha)	6.00	4.00	11.00	8.00	30.00	59.00
Area (Non-fruit bearing) (ha)	913.00	11.00	83.00	124.00	1,045	2,176.00
Production (mt)	360.00	225.00	75.00	525.00	1,800.00	3,485.00
Root crops (Cassava, camote, gabi, ubi, irish potato, carrots)						
Area (ha)		15.00	43.00	55.70	7.50	121.20
Production (mt)		35.00	43.00	400.50	7.50	486.00
Vegetables						
Area (ha)	30.00	6.50	14.50	39.30	23.00	113.30
Production (mt)	30.00	26.00	7.25	78.60	23.00	164.85
FOOD CROPS						
Palay						
Area (ha)	3,865.00	0	17.00	230.00	216.00	4,328.00
Production (mt)	23,190.00		51.00	920.00	788.00	24,949.00
White corn						
Area (ha)	900.00	1,048.75	1,700.00	2,520.00	82.00	6,250.75
Production (mt)	2,700.00	870.50	3,400.00	2,520.00	262.40	9,752.90
Yellow corn						
Area (ha)		24.00	80.00	134.00		238.00
Production (mt)		17.00	210.00	270.00		497.00

Source: PPDO (1996).

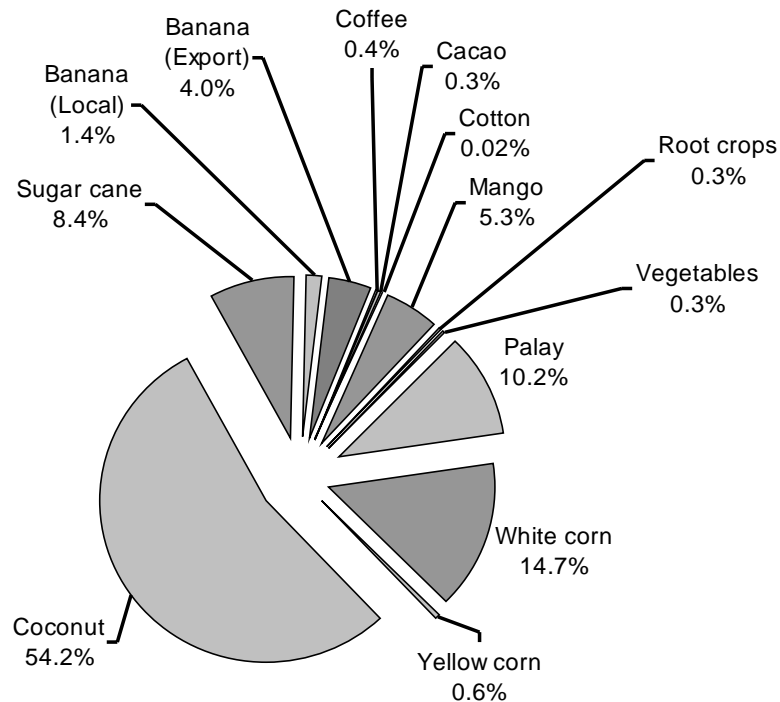


Figure 5.2. Land use for food and commercial crops in the MBA.

Other important crops in the MBA are sugarcane (3,567.17 ha), banana (2,289.2 ha), mango (2,235 ha), coffee (151 ha), cacao (128 ha), and cotton (6.75 ha). The top agricultural products of the MBA in terms of production value are sugarcane (131,005.16 mt), banana (102,842 mt), and palay (24,949 mt) (Figure 5.3).

The marketing of agriculture production derived from food and commercial crops in the MBA is hampered by infrastructural deficiencies, product seasonality, and price inelasticity. Improved infrastructure, a shift towards a high-value agriculture, and value added processing will significantly improve the learning area's competitive market position in the coming years.

The agricultural sector is one of the major contributors to water pollution. Agricultural production has increasingly relied on chemical fertilizers and pesticides to boost productivity. Lapanday, a big banana plantation, sprays chemicals by airplane and uses fertilizers for the production of its bananas for export. In general, waste associated with the agricultural sector includes runoff and leaching of fertilizers and pesticides and herbicides used. Agricultural runoff has been identified by the DENR as one of the reasons that led to the deterioration of the country's coastal waters. Agricultural activities are the source of excessive nutrients, oxygen-demanding wastes, and organic chemicals (pesticides).

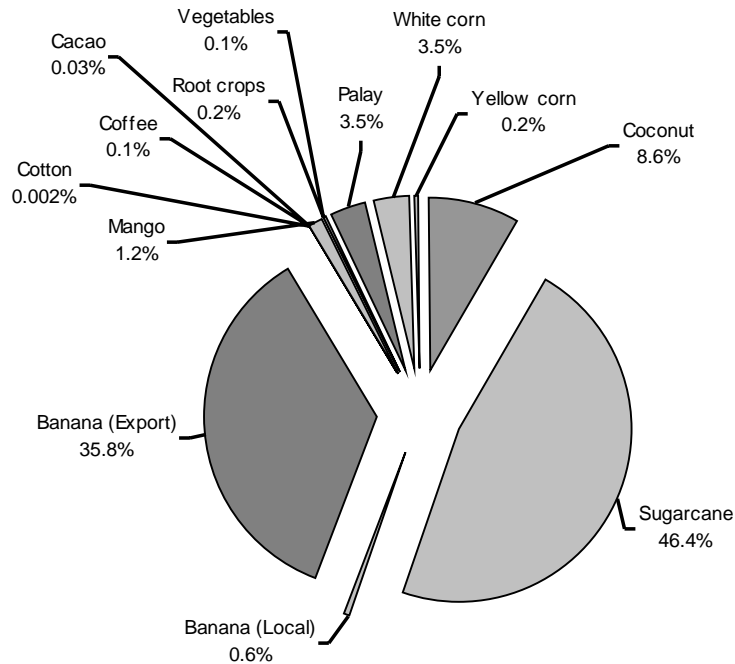


Figure 5.3. Food and commercial crops in the MBA.

Livestock and Poultry

The major livestock and poultry produced in the MBA are cattle, carabao, hogs, goats, chickens, and ducks (Table 5.10). Hogs registered the highest production at 39,872 heads in 1995 while goats exhibited the highest increase in the number of heads produced at 5,167 in 1994. Total chickens raised for 1995 reached 308,413.

Livestock farming, particularly pig farming, has significant pollution effects. Typical piggery wastes would have the following characteristics:

- BOD 9,000 to 12,000 mg/L
- COD 4,500 to 6,500 mg/L
- Nitrogen 120 to 180 mg/L
- Phosphorus 7 to 12 mg/L

The quantity of oxygen-demanding waste in water can be determined by measuring the biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Oxygen-demanding waste are organic waste that deplete the oxygen level in water-bodies when it decomposes. Oxygen depletion can cause fish and other forms of oxygen-consuming aquatic life to die. BOD measures the amount of dissolved oxygen (DO) needed by organisms during the decomposition of organic waste. This is the

Table 5.10. Livestock and poultry (number of heads) in the MBA.

Animal	Year	Hagonoy	Malalag	Padada	Sta. Maria	Sulop	Total
Carabao	1994	1,791	1,434	1,070	3,109	2,821	10,225
	1995	1,938	1,505	1,338	2,953	2,679	1,0413
Cattle	1994	2,534	1,025	2,450	1,706	71	7,786
	1995	2,745	1,076	2,293	1,791	1715	9,620
Goats	1994	6,558	1,402	2,270	5,182	9211	24,623
	1995	6,990	1,076	2,436	9,395	9,893	29,790
Hogs	1994	6,181	5,622	8,393	9,537	9,966	39,699
	1995	6,974	5,903	8,270	10,013	8,712	39,872
Chicken	1994	31,589	45,885	58,122	75,017	78,589	289,202
	1995	33,684	49,679	63,765	78,767	82,518	308,413
Ducks	1994	9586	1,011	2,272	2,190	2,310	17,369
	1995	10,331	1,061	2,270	2,299	2,356	18,317

Source: PPDO (1996).

primary indicator of the magnitude of organic waste from land-based sources such as industrial, municipal, and agricultural activities. The higher the level of the BOD, the more polluted is the waterbody. Municipal sewage, distillery waste, and piggery waste are some examples of organic waste that can increase the BOD level of water. COD also measures the amount of DO needed by organisms during decomposition of waste. However, unlike BOD, COD can account for the portion of inorganic waste that undergo degradation. The DENR has set BOD and COD standards from 50 to 120 mg/L and 100 to 200 mg/L, respectively, on the receiving waterbody classification.

Livestock waste can also cause excessive nutrient loading of nitrogen and phosphorus to marine ecosystems leading to algal blooms. When livestock waste decay, they can deplete the oxygen in the water resulting in fish kills, widespread destruction of benthic habitats, surface algal scum, water discoloration, and release of toxins from sediment, and alter species composition and size structure for primary producers.

TOURISM

Davao del Sur is enriched by various scenic spots that are mostly natural attractions such as hot springs, caves, waterfalls, beaches, hills, and mountain parks. Also, historical attractions such as fortress remnants, Japanese tunnels, and foxholes are found in the province. In coastal areas, several beaches provide complete resort facilities for swimming, scuba diving, meetings, and other gatherings. These are the Treasure Island Catering Services and Beach Club in Balutakay, Hagonoy; the Little Boracay in San Agustin, Sta. Maria; and the Total Beach Resort in Malalag (Table 5.11).

The MBA offers moderate-to-good potential for growth of local tourism. The area's strategic road linkages to major urban centers in the north, south, and west and the development of day-use and overnight tourism attractions and support services (roadside motels, restaurants, car rental, urban entertainment, beach resort, travel and tour agencies, business service centers, etc.) may result in increased regional tourist market attraction.

Table 5.11. Existing tourist spots in the MBA.

Tourist spot	Location	Attraction facilities	Distance from nearest <i>poblacion</i> /accessibility
Leling Beach	Leling, Hagonoy	Clean beach, good for swimming, <i>nipa</i> and bamboo cottages, <i>sari-sari</i> stores	10 km from Digos, about half hour ride by tricycle from Digos central market
Bolinao Beach Resorts (Molina's, Llaban, Baywatch, Yncierto's, and Treasure Island, etc.)	Balutakay, Hagonoy	Clean beach suitable for swimming, open-air cottages	5 km from Digos, about 10 minutes ride by tricycle
Piape Beach	Piape, Padada	Clean beach, good for swimming, open-air cottages with electricity and <i>sari-sari</i> stores	5 km from Padada, about 20 minutes ride by tricycle from Padada Public Market
Dagandang Beach	Sta. Maria	White sand beach, cool water, good for swimming	3 km from Sta. Maria, about 15 minutes ride by tricycle
Giger Beach Resort (Little Dakak)	Sta. Maria	Clean beach suitable for swimming; open-air cottages	15 minutes ride by tricycle from Poblacion, Sta. Maria
Kisulad Beach Resort	Sta. Maria	White beach; overlooking the sea are coconut trees	10 km from Sta. Maria, about 30 minutes ride by tricycle
Mariscal Beach Resort	San Agustin, Sta. Maria	Fine white beach, with open-air cottages and a high mountain overlooking the sea	5 km from Sta. Maria, about 30 minutes ride by tricycle
Almina Beach Resort	Baybay, Malalag	Clean beach suitable for swimming and open-air cottages	2 km from Malalag, about 15 minutes ride by tricycle
Total Beach Resort	Baybay, Malalag	Clean beach suitable for swimming and open-air cottages	2 km from Malalag, about 15 minutes ride by tricycle

Source: PPDO (1996).

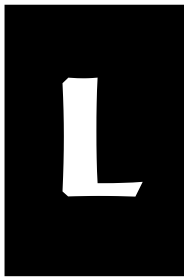
SUMMARY

Malalag Bay, consisting of 65 km² of marine water, supports a coastal population of 36,400 of which 1,611 are fishermen. Aside from the municipal fishery, the bay also supports commercial fishing and is an excellent site for a port, selected industries, and limited coastal tourism businesses.

The aquaculture industry is likewise dependent on the bay which is declining due to the unstable market for seaweed and oysters and the occurrence of a red tide. Only brackishwater aquaculture, primarily for milkfish, is increasing in prevalence as compared with freshwater aquaculture and seafarming.

Chapter 6

INSTITUTIONAL AND LEGAL FRAMEWORK



Laws concerning environmental protection were enforced in the Philippines as early as the pre-Spanish period. The Luwaran Code of Mindanao, the oldest known code of laws in the Philippines, and the Code of Kalantiao penalize improper waste disposal and unnecessary noise in the evening as acts of public nuisance. These may be considered as forerunners of the present regulations on environmental management.

During the Spanish colonial government, environmental laws were enacted dealing with resource extraction and industrial pollution. During the American colonial government, laws were passed governing mineral, forest resources, fisheries and aquatic resources, and land use and water rights.

The period following the Philippine independence can be divided into three eras: pre-martial law, martial law, and the period following the EDSA revolution. From 1945 to 1972, laws known as Republic Acts (RAs) were passed by the popularly elected members of the Congress of the Philippines. The Marcos administration from 1972 to 1986 produced much of the environmental legislation. During this time, law-making power was assumed by the President through the issuance of Presidential Decrees (PDs), Letters of Instruction (LOIs), and Executive Orders (EOs).

In 1987, the new Philippine Constitution took effect and Congress took over the function of legislation. The 1987 constitution embodies explicit provisions on the protection and enhancement of the environment. A fundamental statement of

The new constitution provides explicit recognition to management of coastal resources, linking its use to optimum productivity, sustainability, and equity through democratic process and distributive justice.

policy that “the state shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature” (Article II, Section 16) is embodied in the constitution. Recognizing the State’s obligation to protect and conserve the environment, the constitution instructs Congress to take “into account for requirements of conservation, ecology and development” (Article XII, Section 3) and insists that national parks or reserves (i.e., marine parks/reserve) shall be conserved.

The new constitution also recognizes the obligation of the State to “protect, develop and conserve marine resources (Article XII, Section 7) and protects “the rights of subsistence fishermen, especially of local communities” (Article II, Section 22) and encourages “non-governmental, community-based or sectoral organizations to promote the welfare of the country” (Article II, Section 23).

The new constitution provides explicit recognition to management of coastal resources, linking its use to optimum productivity, sustainability, and equity through democratic process and distributive justice.

The basic legislation governing natural resources and environment predating the new constitution remains in place.

PHILIPPINE COASTAL MANAGEMENT LAWS

There are several laws that pertain to coastal area management, which have been enacted through Presidential Decrees and Congressional approvals. Table 6.1 presents a brief overview of the history of coastal and environmental management laws and their scope.

COASTAL MANAGEMENT ORDINANCES IN THE MBA

The Local Government Code of 1991 (RA 7190) authorized provincial and city government units to enforce and implement laws on the protection of the environment, pursuant to national policies and subject to the supervision, control, and review of the DENR. It also authorized local governing councils (the *Sanggunians*) to enact and enforce local environmental ordinances.

The LGUs in the MBA have issued several ordinances for coastal environmental protection and management for their respective municipalities (Table 6.2). Common to LGUs are fishery ordinances.

Table 6.1. Summary of coastal and environmental management laws.

Law (date)	Area of concern
PD 600 (1974) - Coast Guard Law as amended by PD 601 and PD 979	Marine pollution. Authorized the Philippine Coast Guard (PCG) to enforce laws for marine environmental protection
PD 602 (1974)	Created the National Operations Center for Oil Pollution (NOCOP) in the PCG to respond to problems of oil spills and coordinate efforts for oil containment and recovery
PD 704 (1975) - Fisheries Decree	Pollution from aquaculture operations. Provided guidelines on the management, conservation, development, protection, utilization, and disposition of all fishery and aquatic resources of the country except municipal waters which are under the municipal or city government concerned
PD 705 (1975) - Forestry Code	Contained specific provisions on the classification and permitting system on the use of foreshore areas to include mangrove and <i>nipa</i> swamps and beach fronts
PD 785 (1975) - Revised Forestry Code	The only legal measure to prevent siltation. Provided guidelines on managing, regulating, and monitoring shifting cultivation
PD 825 (1975)	Garbage disposal. Provided penalties on improper waste disposal. Required that all garbage, filth, and waste be placed in proper receptacles
PD 856 (1975) - Sanitation Code of the Philippines	Solid wastes. Prescribed standards for sewage collection, refuse, and excreta disposal
PD 984 (1976)- Pollution Control Law	Abolished the National Water and Air Pollution Control Commission (NWPACC) and created the National Pollution Control Commission (NPCC) with broad powers which include setting standards and imposing penalties for violations
PD 1144 (1977)	Agricultural pollution. Provided guidelines on the proper use of fertilizers and pesticides to mitigate agricultural chemicals
PD 1151 (1977)- Philippine Environmental Policy	Comprehensive policy and program for environmental protection and management
PD 1152 (1977) - Philippine Environment Code	
PD 1251 (1977) - Mine Wastes and Tailing Fees	Imposed semi-annual mine wastes and tailings fees against all operating mining companies
PD 1160 (1977)	Authorized <i>barangay</i> captains to enforce pollution control laws
PD 1586 - Establishing the Environmental Impact Statement System (1978) and Proclamation 2146 (1981)	Required submission of environmental impact assessment for public and private development projects with potentially significant impact on the environment; limited coverage to prescribed environmentally critical projects and environmentally critical areas

continued

Table 6.1. (continued)

Law (date)	Area of concern
EO 192 (1987) - Reorganization of the Department of Environment and Natural Resources (1987)	Established the DENR as the primary agency for environmental protection and management, and created the Environmental Management Bureau and Pollution Adjudication Board, among others
RA 6969 (1990) - Toxic Substances and Hazardous Wastes Control Act	Regulated the manufacture, importation, processing, sale, distribution, use, and disposal of chemical substances and mixtures that present unreasonable risks and/or injury to health or the environment, and entry, even in transit, of hazardous and nuclear wastes
RA 6975 (1990) - Department of Interior and Local Government Act	Created a maritime police unit within the PNP, vested with authority to perform all police functions "over Philippine territorial waters and rivers, coastal areas from the shoreline to one mile inland to include ports and harbors and small islands of two miles in length or diameter with less than 1,000 population"
RA 7160 (1991) - Local Government Code (1991)	Contained provision for pollution control by local authorities subject to supervision, control, and review by the DENR
RA 8550 (1998) - The Fisheries Code	An Act for the development, management, and conservation of the fisheries and aquatic resources, integrating all laws pertinent thereto, and for other purposes. The code recognizes the principles of ensuring sustainability of fisheries resource utilization within ecological limits and of social justice by providing preferential treatment for municipal fisherfolk and their organizations. The code also aims at providing a sound policy and institutional framework for fisheries resource management as well as long-term sustainable development in the sector.

The municipality of Hagonoy passed its first Basic Fishery Ordinance (MO 76-006) on 24 October 1977. This was amended by MO 92-008 on 12 August 1992 to increase the annual fee of catching milkfish fry and to impose penalty with a fine of not less than PhP500 but not exceeding PhP2,500 for violating any provision of the ordinance. In 1983, the Municipal Council declared a portion of the sea along the shorelines of Leling as fish sanctuary.

The municipality of Malalag passed its Basic Fishery Ordinance (MO 81-040) on 14 May 1981. Malalag constituents amended the Municipal Fishery Ordinance on 11 March 1993 wherein Ordinance No. 40 was passed by the Municipal Council or *Sangguniang Bayan* (SB) for the banning of destructive and illegal fishing gear. These include all sorts of commercial fishing, trawls, purse seine (e.g., Danish purse seine), baby trawls, drive in nets, and fishing methods using compressors. Unfortunately, this ordinance was declared "null and void" by the Municipal Circuit Judge of Malalag after a group of fishermen were charged for their operation of *lampornas*. In 1993, the municipality of Malalag established a 50-ha fish sanctuary and in 1997 regulated

Table 6.2. Ordinances for coastal environmental protection and management in the MBA.

Municipality	Number	Title	Date
Hagonoy	92-008	An ordinance amending certain sections of Municipal Ordinance No. 6, series of 1976, regulating fishing and/or fisheries in Hagonoy, Davao del Sur	08/12/92
Hagonoy	83-002	An ordinance requiring all <i>barangay</i> officials of Hagonoy in coordination with government agencies as well as private organizations to implement the provisions of PD 1153 and LOI 1312, particularly on watershed areas and along the banks of rivers, streams, and brooks	
Hagonoy	83-001	An ordinance declaring a portion of the sea along the shorelines of Leling, this municipality as fish sanctuary and prohibiting non-members of the <i>Ilawng Buhay</i> movement to catch fish in the identified site	02/09/83
Hagonoy	76-006	An ordinance regulating fishing and/or fisheries in Hagonoy and for other purposes	10/24/77
Hagonoy	75-024	An ordinance prescribing rules and regulations on fisheries and aquatic resources and the granting of privileges therefor in the municipality	
Hagonoy	75-021	An ordinance requiring all fishing boats and/or <i>banca</i> owner/operators within the jurisdiction of Hagonoy to install plate numbers in their respective fishing boat and/or <i>bancas</i>	
Hagonoy	72-016	An ordinance requiring all operators of fishing nets (for shrimp) operating within the territorial area of Hagonoy to pay to the municipal government a municipal license fee in the amount of PhP200 for the whole year	08/15/72
Hagonoy	72-015	An ordinance requiring any person engaging in the operation of fish corral fishing to pay to the municipal treasurer the reduced rate of license fee in the amount of PhP5 regardless of capital per quarter	08/15/72
Malalag	97-099	Comprehensive Solid Waste Management Ordinance of Malalag	08/06/97
Malalag	97-098	An ordinance prohibiting any person by any means in wounding and killing of birds in Malalag	08/06/97
Malalag	97-097	An ordinance regulating the use of municipal waters for the establishment or operation of fish cages, fishpens, seaweed culture, and providing fees thereof	08/06/97
Malalag	97-095	An ordinance amending Ordinance No. 13, series of 1991, prohibiting the disposal of waste, garbage, molasses, and used lubricants from fishing boats, and industrial waste in Malalag	08/06/97
Malalag	97-094	An ordinance amending section 4 of Ordinance No. 20, series of 1993, otherwise known as "Anti-littering" ordinance	08/06/97

continued

Table 6.2. (continued)

Municipality	Number	Title	Date
Malalag	97-089	An ordinance regulating and controlling the discharge of industrial and other wastes into the atmosphere, air, or body of water and land within the territorial limits of Malalag for the purpose of abatement and prevention of pollution, providing penalties for its violation, and for other purposes	08/06/97
Malalag	93-027	Establishment of a fish sanctuary, its maintenance and protection	09/01/93
Malalag	93-021	Amending Section 15, 4.N of Ordinance No. 40 otherwise known as Municipal Fishery Ordinance, banning the operation of commercial fishing, trawls, purse seine, baby trawls, fishing methods using compressors and <i>hulbot-hulbot</i> , <i>lampornas</i> , <i>bira-bira</i> , and <i>muro-ami</i> in the municipal waters of Malalag	02/11/93
Malalag	93-020	Prohibiting the littering, dumping, and disposing of non-biodegradable garbage i.e., cigarette butts, plastic bags, or containers, tin cans, bottles, and domestic wastes, i.e., chemical solvent as from laundry soaps, and human and animal refuse, and all other forms of wastes in public places e.g., public market, school premises, parks and plazas, gymnasium and sports facilities, streets and roads, rivers, lakes, and waterways, Malalag Bay and its foreshore areas, among other public places within the municipality	02/18/93
Malalag	81-040	An ordinance regulating fishing and/or fisheries in Malalag and for other purposes	05/14/81
Padada	94-006	An ordinance regulating fishing and/or fisheries in Padada and for other purposes	08/10/94
Padada	93-012	An ordinance establishing a Padada fish sanctuary area in Padada	12/15/93
Sta. Maria	96-005	Regulating fishing and/or fisheries in Sta. Maria and for other purposes	06/20/96
Sta. Maria	1995	Municipal Penal Code, series of 1995. An ordinance enacting the revised Municipal Penal Code of Sta. Maria pursuant to Republic Act No. 7160 (Chapter VI - Environmental Protection, Chapter XI - Illegal Fishing)	1995
Sulop	97-011	Amending section 5 of Ordinance No. 92-006 (Basic Fishery Ordinance) and setting henceforth the rules and regulations in the establishment of fish sanctuary at the portion of zones 2, 3, and 4 in the municipal waters of Sulop	09/10/97
Sulop	97-010	Regulating the use of municipal waters for the establishment or operation of fish cages, fishpens, seaweed culture, and providing fees thereof	09/10/97
Sulop	92-006	An ordinance regulating fishing and/or fisheries in Sulop and for other purposes	1992

the use of municipal waters for the establishment or operation of fish cages, fishpens, seaweed culture, and providing fees thereof. Malalag has an ordinance on comprehensive solid waste management, and ordinance regulating and controlling the discharge of industrial and other waste in the atmosphere, air, or body of water and land within the territorial limits of the municipality of Malalag. The municipality of Malalag is serious in funding CRM related projects. It provides an annual operating fund for coastal resource management enforcement as shown in Table 6.3.

The municipality of Padada passed its Basic Fishery Ordinance (MO 94-006) on 10 August 1994. The Municipal Council established a fish sanctuary area on 15 December 1993. This municipality passed two Executive Orders on 3 September 1996 and 3 February 1997: creating the task force for a clean and green Padada and

Table 6.3. Operating funds for CRM implementation in Malalag.

Year	Type	Specific	Amount (PhP)
1998	Maintenance	Registration/repair of patrol boat	10,000.00
	Transportation	Hauling and transport cost	3,000.00
	Equipment outlay	Purchase of handheld radio	12,000.00
	Fuel and oil	Gasoline	10,000.00
	Support services	Security for fish sanctuary area	28,333.33
Total			63,333.33
1997	Maintenance	Registration/repair of patrol boat	5,000.00
	Transportation	Hauling and transport cost	3,000.00
	Equipment outlay	Supplies and materials	6,016.00
	Fuel and oil	Gasoline	10,000.00
	Support services	Security for fish sanctuary area	30,000.00
Total			54,016.00
1996	Maintenance	Repair of pumpboat	3,560.00
	Fuel and oil	Gasoline	7,200.00
	Support services	Security for fish sanctuary area	29,280.00
Total			40,040.00
1995	Maintenance	Repair of pumpboat	6,453.00
	Fuel and oil	Gasoline	7,200.00
	Support services	Security for fish sanctuary area	23,660.00
Total			37,313.00

US\$1 = PhP 25 in 1995; PhP 26 in 1996; PhP 33 in 1997; and PhP 39 in 1998.

creating Municipal Environmental Units, respectively. The municipality has a resolution requesting the Davao Gulf Management Board (DGMB) to declare the municipality of Padada as the provincial fish sanctuary in the Province of Davao del Sur. Other resolutions include a coral reef project, seaweed projects, and construction of a municipal marine watch house.

The municipality of Sta. Maria passed its Basic Fishery Ordinance (MO 96-005) on 20 May 1996. In 1995, the municipality passed an ordinance enacting the revised Municipal Penal Code of Sta. Maria pursuant to RA No. 7160 for the banning of all kinds of trawl fishing and banning of *basnigan* and superlight fishing within the municipal waters of Sta. Maria. This ordinance also disallows outsiders from Sta. Maria to get mangrove seedlings within the municipality.

The municipality of Sulop passed its Basic Fishery Ordinance (MO 92-006) in 1992. This was amended on 9 September 1997 by setting rules and regulations in the establishment of fish sanctuary at the portion of zones 2, 3, and 4 in the municipal waters of Sulop. This municipality has also regulated the use of municipal waters for the establishment or operation of fish cages, fish pens, seaweed culture, and providing fees thereof.

INSTITUTIONS INVOLVED IN COASTAL MANAGEMENT

Environmental management and protection functions, including policy development, planning, monitoring, and enforcement are under the mandates of various national and local government units.

National Government

There are six agencies under the national government that have jurisdiction over coastal resource management: the National Economic and Development Authority (NEDA), the Department of Agriculture (DA), the Department of Environment and Natural Resources (DENR), the Department of the Interior and Local Government (DILG), the Department of Tourism (DOT), and the Department of Science and Technology (DOST).

The NEDA plans for development priorities such as tourism and fisheries to be used for the various areas throughout the Philippines and tries to ensure appropriate and complementary roles for the various areas.

The DA focuses on the sustained yield from the use of resources. It has four units involved in coastal management: the Bureau of Fisheries and Aquatic Resources (BFAR), the Fisheries Resource Management Project (FRMP), the Philippine Fisheries Development Authority (PFDA), and the Bureau of Agricultural Research (BAR).

The BFAR is the agency of the DA responsible for fisheries production. It has a Coastal Resource Management section to advise the DA on coastal management. The PFDA is tasked with the development of fisheries facilities such as fish landing ports, ice plants, and fish processing facilities. The BAR supports the research needs of the DA.

The DENR focuses on conservation and protection of resources. It has four units involved in coastal management: the Parks and Wildlife Bureau (PAWB), the Ecosystems Research and Development Bureau (ERDB), the Environmental Management Bureau (EMB), and the Coastal Environment Program (CEP). The PAWB is responsible for the conduct of protected areas and endangered species. The ERDB supports the various DENR units by conducting research and development activities. The EMB is responsible for water quality and environmental impact assessments. The CEP, established in 1993 through DENR DAO 19 s1993, focuses on the various coastal responsibilities of the various DENR units.

The Philippine National Police (PNP) division of the DILG is tasked with the enforcement of marine and fisheries laws in the coastal zone. It is complemented by deputized fish wardens and, in some areas, *Bantay-Dagat* programs.

The Philippine Tourism Authority (PTA) of the DOT develops policies for coastal protection with an eye to tourism revenues.

The Philippine Council for Aquatic and Marine Research and Development (PCAMRD) of the DOST attempts to coordinate Philippine coastal ecological research and development.

Local Government

The Local Government Code of 1991 (RA 7190) expressly provides for LGUs to share with the national government the responsibility for the management and maintenance of the ecological balance within their territorial jurisdiction. Environmental management and protection functions can now be assumed within the structure of provinces, municipalities, cities, *barangays*, and their respective development councils and *Sanggunians*. The following summarizes the authority vested in each body and the basic environment-related services it should provide, pursuant to the Local Government Code (RA 7160).

1. Province

- Pursuant to national policies and subject to supervision, control, and review of the DENR, enforcement of pollution control law and other laws on the protection of the environment [Section 17 (b)(3)(iii)]; and

- Infrastructure facilities intended to service the needs of the residents of the province and which are funded out of provincial funds including, but not limited to, inter-municipality waterworks, drainage and sewerage [Section 17 (b)(3)(vii)].

2. Municipality

- Extension and on-site research services and facilities related to water and soil resource utilization and conservation projects [Section 17 (b)(2)(i)];
- Solid waste disposal system or environmental management systems and services or facilities related to general hygiene and sanitation [Section 17 (b)(2)(vi)]; and
- Infrastructure facilities intended primarily to service the needs of the residents of the municipality and which are funded out of municipal funds including ... water supply systems [Section 17 (b)(2)(viii)].

3. City

All the services and facilities of the municipality and province [Section 17 (b)(4)].

4. Barangay

Services and facilities related to general hygiene and sanitation, beautification, and solid waste collection [Section 17 (b)(1)(iii)].

5. Local Development Councils

Each level of local government is charged with establishing a local development council for planning purposes, the composition of which is prescribed in the Local Government Code. The development council assists the corresponding *Sanggunian* in setting the direction of economic development, and coordinating development efforts within its territorial jurisdiction [Section 106]. Representatives of NGOs operating within the LGUs are to constitute at least 25 percent of the members [Section 107 (a)(2), (b)(4) and (c)(4)]. Local development councils shall formulate and recommend local investment incentives to promote the inflow and direction of private investment capital [Section 109 (4)]. The local development councils may form sectoral or functional committees to assist them in the performance of their functions [Section 112]. This would include environment and natural resource committees.

6. Sanggunians (*Local Municipal, City, and Provincial Councils*)

The local governing councils (*Sangguniang Bayan, Sangguniang Panlungsod and Sangguniang Panlalawigan*) are the legislative bodies of local government. Their composition is prescribed in the Code, including the process for electing sectoral

representatives. The Code vests in the *Sanggunians* specific authorities to pass ordinances that will protect the environment, and enforce compliance through the issuance of fines and penalties.

7. Sangguniang Panlalawigan (*Provincial Council*)

- Approve ordinances and pass resolutions that will protect the environment and impose appropriate penalties for acts which endanger the environment and other acts which result in pollution, acceleration of eutrophication of rivers and lakes, or of ecological imbalance [Section 468 (a)(1)(vi)];
- Adopt measures and safeguards against pollution and for the preservation of the natural ecosystem in the province, in consonance with approved standards of human settlements and environmental sanitation [Section 468 (a)(4)(i)]; and
- Approve ordinances imposing a fine not exceeding PhP5,000 or imprisonment not exceeding one year, or both at the discretion of the court, for the violation of a provincial ordinance [Section 468 (1)(iii)].

8. Sangguniang Bayan (*Municipal Council*)

- Adopt measures to protect the inhabitants of the municipality from the harmful effects of man-made or natural disasters and calamities [Section 447 (1)(iv)];
- Approve ordinances and pass resolutions to protect the environment and impose appropriate penalties for acts which endanger the environment and other acts which result in pollution, acceleration of eutrophication of rivers and lakes, or of ecological imbalance [Section 447 (1)(vi)];
- Declare, prevent, or abate any nuisance [Section 447 (4)(i)];
- Regulate the disposal of clinical and other wastes from hospitals, clinics, and other similar establishments [Section 447 (4)(iii)];
- Protect the purity and quantity of water supply in the municipality [Section 447 (5)(vii)];
- Provide for the efficient and effective system of solid waste collection and disposal; prohibit littering and the placing or throwing of garbage, refuse, or other filth and wastes [Section 447 (5)(xiii)]; and
- Approve ordinances imposing a fine not exceeding PhP2,500 or imprisonment not exceeding six months, or both in the discretion of the court, for the violation of a municipal ordinance [Section 447 (1)(iii)].

9. *Environment and Natural Resources Officer*

The Local Government Code provides for the optional creation of a position of an Environment and Natural Resources Officer (ENRO) in all municipalities, cities, and provinces [Section 484]. The Code specifies that the individual must have a college degree preferably in environment, forestry, agriculture, or any related course; and a first grade civil service credential. In addition, the ENRO must have acquired experience in environmental and natural resources management, conservation, and utilization, of at least 5 years for province or city and 3 years for municipality.

The responsibilities of the ENRO are to:

- Formulate measures for the consideration of the *Sanggunian* and provide technical assistance and support to the governor or mayor, as the case may be, in carrying out measures to ensure the delivery of basic services and provisions of adequate facilities relative to environment and natural resources services;
- Develop plans and strategies and upon approval by the governor or mayor to implement environment and natural resources programs and projects;
- Establish and maintain, protect and preserve communal forests, watersheds, tree parks, mangroves, greenbelts, and similar forest projects and commercial forests, like industrial tree farms and agro-forestry projects;
- Provide extension services to beneficiaries of forest development projects and technical, financial, and infrastructure assistance;
- Manage and maintain seed banks and produce seedlings for forests and tree parks;
- Provide extension services to beneficiaries of forest development projects and render assistance to natural resources-related conservation and utilization activities consistent with ecological balance;
- Promote the small-scale mining and utilization of mineral resources, particularly mining of gold;
- Coordinate with government agencies and NGOs in the implementation of measures to prevent and control land, air, and water pollution with the assistance of the DENR;

- Facilitate the delivery of services concerning the environment and natural resources, particularly in the renewal and rehabilitation of the environment during and in the aftermath of man-made and natural calamities and disasters; and
- Recommend to the *Sanggunian* and advise the governor or mayor, as the case may be, on all matters relative to the protection, conservation, maximum utilization, application of appropriate technology, and other matters related to environment and natural resources.

Governor Rogelio E. Llanos of the province of Davao del Sur issued Executive Order No. 6 on 27 March 2000. EO 6 strengthened the mandate of the Environment and Natural Resources Office as the lead coordinating office, together with the Provincial Planning and Development Office and Office of the Provincial Agriculturist (OPAG)-Fishery Division, for the CRM activities. ENRO was vested with greater powers and functions for the protection, conservation, rehabilitation, and management of the marine and coastal resources of the province of Davao del Sur, as follows:

1. Develop programs, formulate plans and implement projects on CRM programs in the province;
2. Coordinate with PPDO, OPAG-Fishery Division, DENR, DA-BFAR, LGUs, NGOs, academe and other relevant agencies in the implementation of CRM programs and projects;
3. Update Provincial Coastal Resources Management Council (PCRMC) regarding CRM activities at the provincial level;
4. Develop and implement province-wide Information Education Campaign (IEC) trainings related to marine and coastal environment;
5. Coordinate PPDO and OPAG-Fishery Division in the gathering, updating, consolidating and establishment of province-wide database on the state of the coastal resources of the province; and
6. Formulate planning process anchored on watershed as the basic planning unit;
7. Coordinate with relevant agencies in the enforcement of environmental law and ordinances.

Figures 6.1 to 6.3 show the organizational structures of the ENRO, OPAG, and PPDO.

The local government executives and the *Sanggunians* are directly responsible for the proper use and protection of environmental resources in their locality, following the concept of representative democracy that they are chosen by the people to govern and make decisions for them. Part of that governance is the capacity to plan and implement programs that will protect rivers, coastal areas, air, groundwater, wildlife, forests, and other environmental resources that are vital to keeping public health within an acceptable level.

The DENR retains the overall authority for environment and natural resource matters. The current framework provides a system where the DENR establishes national policies and programs, and delegates to the LGUs the implementation and enforcement of the same. This, however, does not preclude the LGUs and local development councils from formulating plans and policies and the *Sanggunians* from adopting and enforcing local ordinances, provided that such acts are consistent with national programs. This provides for a comprehensive, coordinated, and consistent approach to environmental management in the Philippines.

10. Other Government Organizations

The most significant development in the administration of the Davao Gulf in which Malalag Bay is a part is the creation of the Davao Gulf Management Program (DGMP) in June 1995. The primary goal is to ensure food security and improve the quality of life and sustainable development and management of the Gulf resources.

The Davao Gulf Management Board (DGMB) was organized as a coordinating body to provide general direction in the planning and implementation of the DGMP. The Board is composed of 11 members elected from among the incumbent mayors/ deputy mayors of the Gulf towns/city districts. Figure 6.4 shows the DGMB organizational structure.

The Provincial/City and Municipal/District Coordinating Board was created to carry out its plans and programs in the provincial/city and municipal/district levels. It is composed of the incumbent mayors/deputy mayors and selected NGOs, incumbent *Barangay* Captains and selected NGOs, respectively.

The Technical Secretariat was created to provide professional support in coordinating, planning, implementation, monitoring, and evaluation of DGMP projects. It is composed of line agencies with mandates related to the protection and management of Davao Gulf's resources. These agencies include the DA, DENR, DILG, PNP, PCG, NEDA, and other concerned instrumentalities.

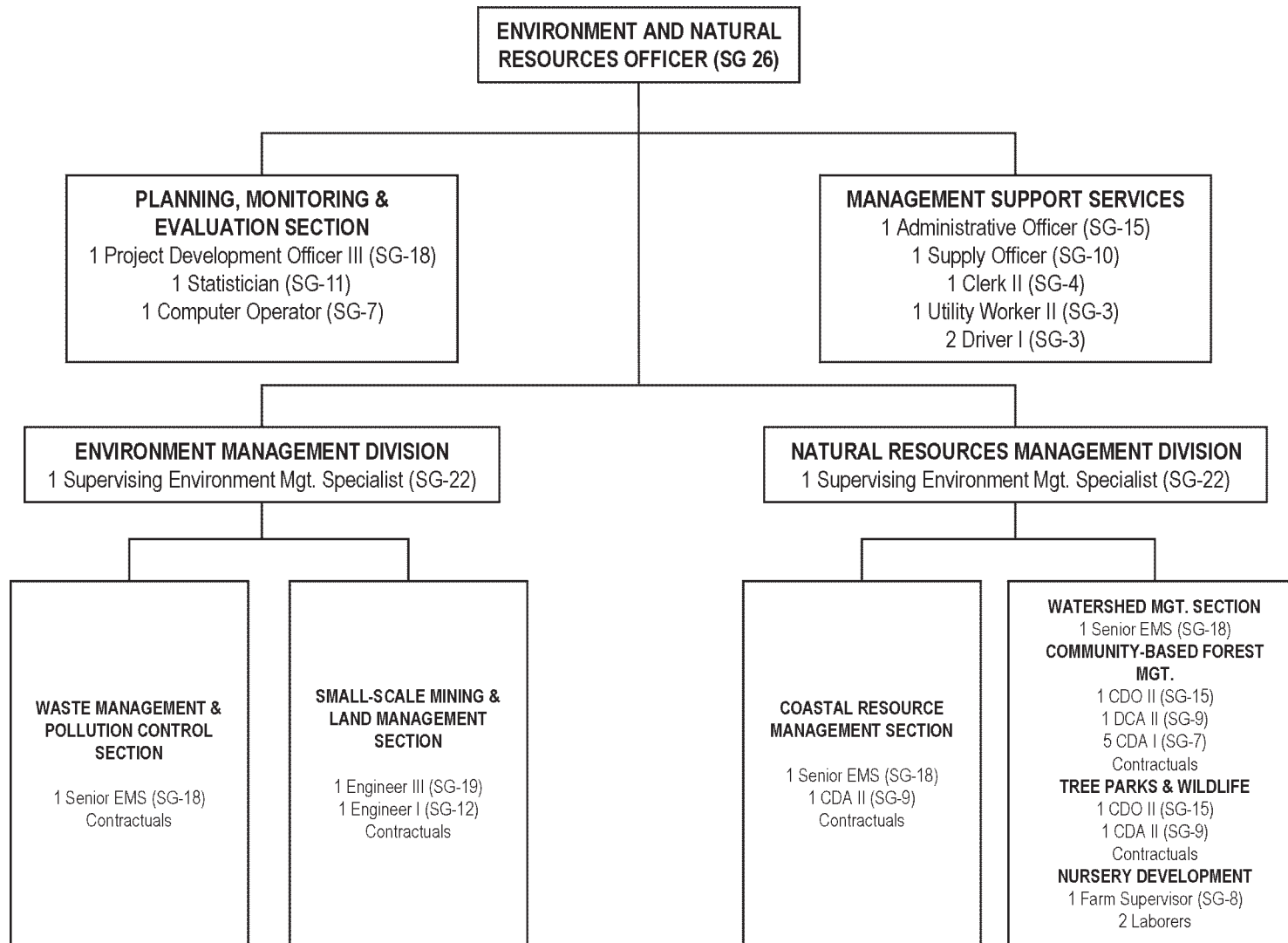


Figure 6.1. Environment and Natural Resources Office (ENRO) organizational structure.

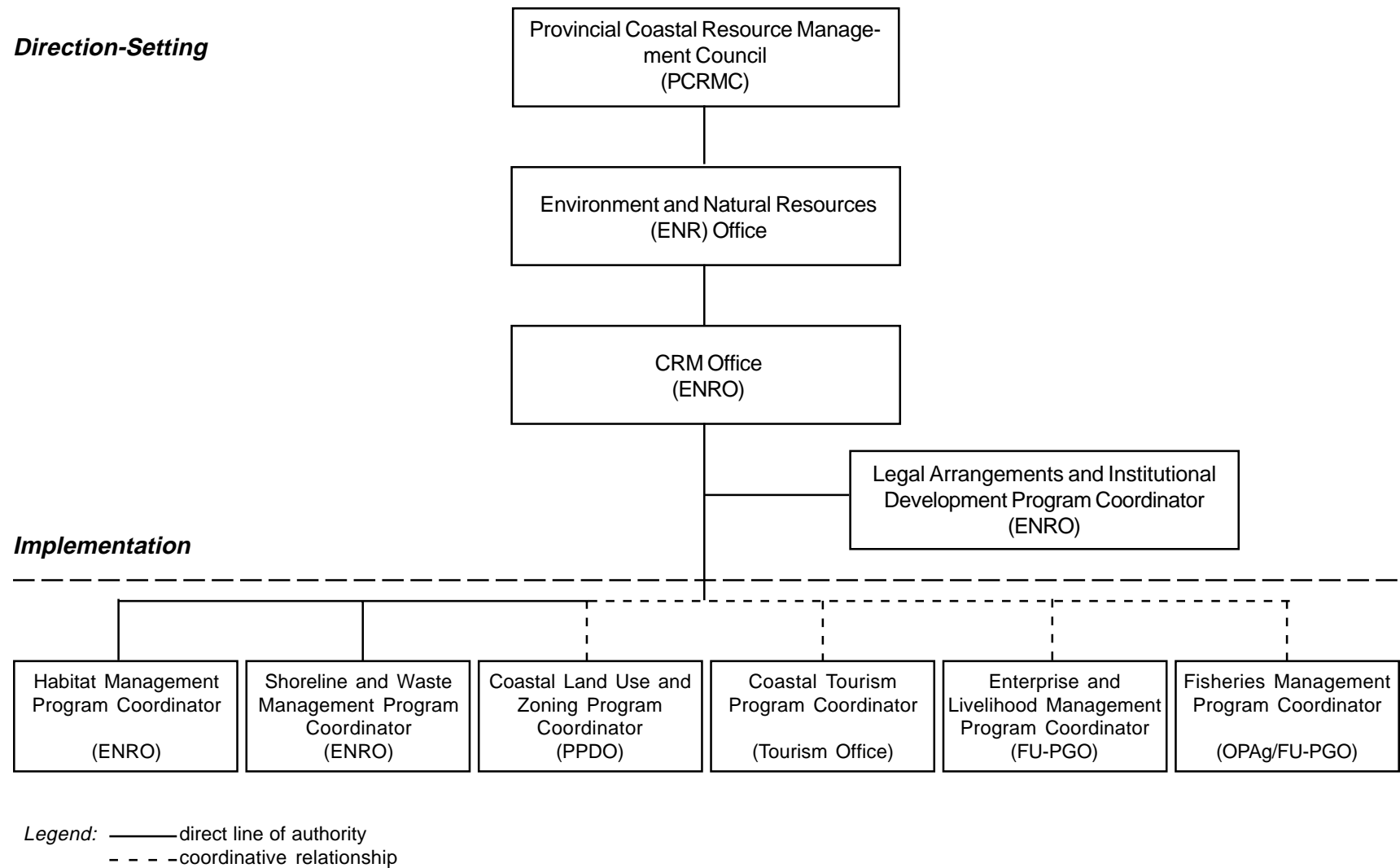


Figure 6.2. Proposed Provincial Coastal Resource Management Implementing Structure.

Source: Draft Provincial CRM Plan, June 2000

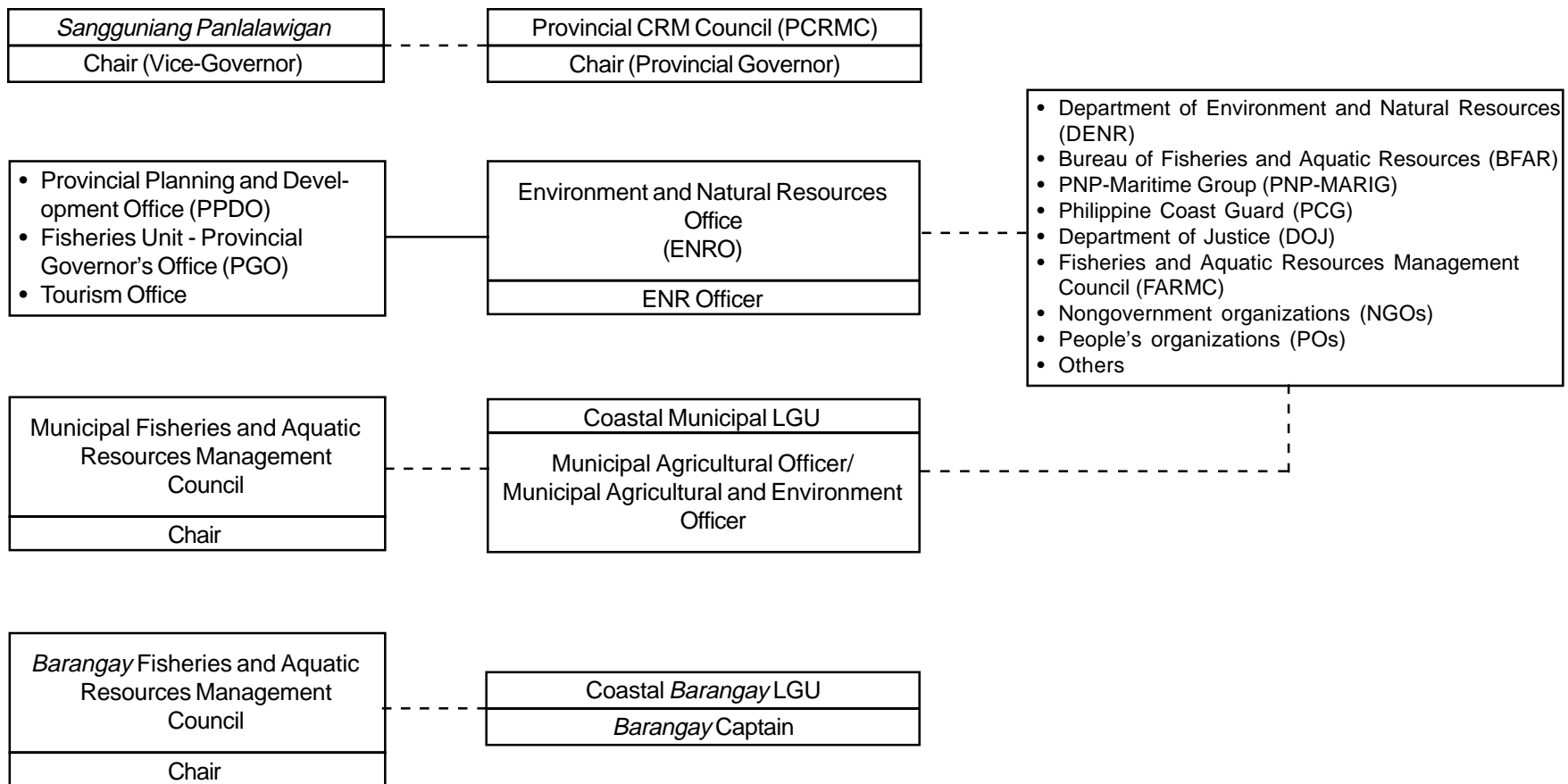


Figure 6.3. Proposed Inter-Agency Coordinating Structure for Coastal Resource Management.

Source: Draft Provincial CRM Plan, June 2000

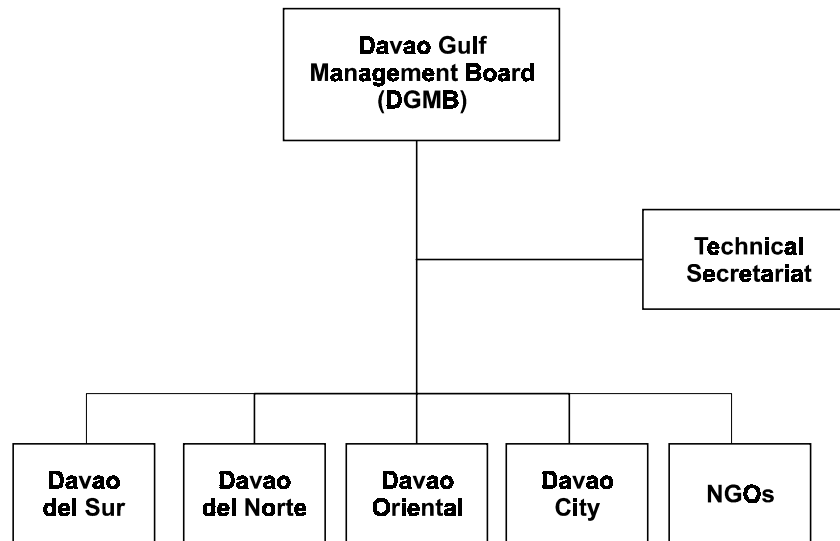


Figure 6.4. Davao Gulf Management Board (DGMB) organizational structure.

Nongovernment Organizations (NGOs) and People's Organizations (POs)

At present, there are established nongovernment organizations (NGOs) operating in the MBA in the pursuit of various projects which complement the efforts of the local government. The Kapwa Upliftment Foundation, Institute of Small Farms and Industries (ISFI) and the Local Development Assistance Program (LDAP) are the NGOs at present helping the LGU in rallying and carrying out environmental concerns in the uplands.

Table 6.4 is a partial listing of organizations in the MBA. A majority of these started out as associations, which eventually developed and evolved to cooperatives. Most are operating cooperative stores while there are a few which expanded either into marketing or credit services and have also entered into livelihood financing schemes in partnership with the Land Bank of the Philippines. The cooperative as a movement has taken off, and a lot of farmers are now encouraged to join as they witness discernible changes from the emerging support of the cooperatives.

The NGO-PO-LGU relationship is faring quite well, but it cannot be denied that there is an apparent lack of capability on both parties with regard to strengthening and institutionalizing people's mechanism. Their complementary roles have to be elevated such that it will support and sustain the development and decentralization effort.

Similar to *barangays*, most of the emerging people's organizations are still in the infancy stage. They need training and capacity support for development of their respective organizations for them to be transformed into self-propelling and self-managing entities.

Community Organizations

In 1997, CRMP began assisting in the formation of Fisheries and Aquatic Resources Management Councils (FARMCs) in the MBA. At present, all coastal *barangays* in the MBA have a FARMC. The formation of FARMCs in all municipalities and cities abutting municipal waters and of integrated FARMCs in bays, gulfs, lakes, rivers, and dams bounded by two or more *barangays* or municipalities was mandated by EO 240, on 28 April 1995, and governed by the Implementing Rules and Regulations issued jointly by the DA and DILG on 25 April 1996. Their creation has also been mandated by the Fisheries Code of 1998 which, in addition to the municipal/city and integrated FARMCs, also call for the establishment of a national FARMC which will be an advisory body assisting the DA/BFAR in the formulation of national policies for the protection, sustainable development, and management of fishery and aquatic resources.

The FARMCs are intended to institutionalize the major role of local fisherfolk and other resource users in the community-based planning and implementation of policies and programs for the management, conservation, development, and protection of fisheries and aquatic resources in municipal waters. Their primary functions include:

- Preparation of the Municipal/City Integrated Development Plan for submission to and approval by the Municipal/City/Provincial Development Council;
- Formulation of recommendation to the Municipal or Provincial Council regarding the enactment of municipal fishery ordinances;
- Enforcement of fishery laws and rules and regulations in the municipal waters; and
- Provision of advice to the Municipality/City or Provincial Council on fishery matters through the Committee on Fisheries, if such has been organized.

The FARMCs are to be provided with technical assistance from the DA, DENR, DILG, Department of Justice (DOJ), and other government agencies, as necessary, to ensure that they are able to contribute knowledge and meaning to the development of fisheries management plans and the guidelines for their implementation.

In 1996, Malalag Bay was selected as one of the six learning areas of the Coastal Resource Management Project (CRMP). Among the primary outputs of the project was the facilitation of the CRM process and conduct of PCRA in all coastal *barangays* resulting in the development and production of resource maps which served as the basis for the *barangay* CRM planning activities currently being conducted.

Table 6.4. Partial listing of NGOs and POs in the MBA.

Municipality	Organizations
Hagonoy	ECJ & Sons Development Employees Cooperative Hagonoy Secondary Teachers and Employees MP Cooperative Sunrise Development Cooperative
Malalag	<p>Bagumbayan Fishermen Consumer Cooperative Inc. Baybay Multi-Purpose Cooperative Bolton Coco-Farmers Multi-Purpose Cooperative Bulacan Coco-Farmers Multi-Purpose Cooperative Caputian Multi-Purpose Cooperative Inc. Ibo Coconut Farmers Multi-Purpose Cooperative Institute of Primary Health Care Institute of Small Farms and Industries Kabalikat sa Kaunlaran ng mga Kababaihan ng Malalag KAMATA Pagkasumbukan Kapit-Bisig ng Mahihirap ng Pilipinas Kapwa Upliftment Foundation Inc. Kumintang Seaside Neighborhood Association Inc. Malalag Christian Cooperatives Inc. Malalag Community Health Volunteers Development Association Malalag Integrated Livelihood Cooperative Inc. Malalag People's Economic Council Malalag Senior Citizens Association Nagkahi-usang Pundok sa Gagmay'ng Mananagat sa Malalag Baybay New Baclayon Coco-Farmers Consumers Cooperative Tagansule Development Cooperative Inc.</p>
Padada	<p>4-H Club of Don Sergio Osmeña 4-H Club of Harada Butai Bagong Silang Women's Multi-Purpose Cooperative Don Sergio Osmena Multi-Purpose Cooperative Future Leaders Incorporated-Anak sa Padada Harada Butal Farmers Association Kasakit Organization Kiblawan Rural Development Foundation, Inc. Knights of Columbus Knights of Rizal L. Katipunan Women's Club Malinao Widows Association Northern Paligue Women's Club Padada Achievers Arts Foundation, Inc. Padada Chamber of Commerce Padada Community Multi-Purpose Cooperative Padada Farmers and Carpenters Multi-Purpose Cooperative Padada Fishermen's Multi-Purpose Cooperative Padada General Service Multi-Purpose Cooperative Padada Irrigation Association Padada Officials, Farmers & Employees Multi-Purpose Cooperative Padada Operators Drivers Multi-Purpose Cooperative Padada Senior Citizens Association Palili Women's Club</p>

continued

Table 6.4. (continued)

Municipality	Organizations
	Perpetual Charity Christian Association of the Philippines Philippine Coconut Authority Piape Mortuary Aid Organization RECON Phoenix Roscom Village Women's Multi-Purpose Cooperative Rural Improvement Club San Isidro Bayanihan Mangrove Multi-Purpose Cooperative San Isidro Catholic Organization Southern Paligue Catholic Association Santa Catalina Organization Southern Paligue Multi-Purpose Cooperative Tulogan Multi-Purpose Cooperative Upper Limonzo Multi-Purpose Cooperative Upper Malinao Marketing Cooperative
Sta. Maria	Basiawan National High School Teachers Commoners Multi-Purpose Cooperative PKEARBI Multi-Purpose Cooperative UNICARBAI Multi-Purpose Cooperative

Note: NGOs/POs in bold letters are relevant to CRM

The project also assisted the Agriculture Office of the LGU in organizing the FARMC and supported a study on the carrying capacity of Malalag Bay specifically on the effects of fish cages and fish pens in the bay. The CRMP through its partner NGO, the ISFI, has facilitated community organizing activities in *barangays* around the bay.

CRM projects such as milkfish production in cages, mangrove rehabilitation, and fish sanctuaries are now evident on the coast of Malalag. Coastal law enforcement has been strengthened as the local government acquired handheld radios and motor-boats for use in monitoring fishing activities within and outside the fish sanctuaries. The *Sangguniang Bayans* have formulated and enacted a number of ordinances to reinforce non-regulatory measures related to CRM. These include a fishery ordinance and an ordinance prohibiting the use of trawls, *lampornas*, and other destructive fishing gear in municipal waters.

The approach is integrated. Aside from projects that directly impact the coastal environment, there are also projects to rehabilitate and develop upland as well as lowland areas. In the uplands, these include agroforestry, community reforestation, watershed rehabilitation, and organization and training of farmers in the production of cash crops and livestock. In the lowlands, major projects involve road greening, stream bank stabilization, and a clean-and-green program. A municipal tree park has been established to serve as buffer in the urbanizing *barangays*.

The effort is multisectoral. NGOs help organize and train farmers and provide them credit for the production of cash crops and livestock, as well as leguminous

seeds, which are used in establishing hedgerows. Even the business sector has been involved. The Malalag Ventures Plantation, Inc. (MVPI), for example, planted bamboo along the river bank that runs through the company's plantation to prevent soil erosion. MVPI, along with the Rural Bank of Malalag, also donated trash cans to schools, the local government, and the public market under the clean-and-green program.

SUMMARY

There are six agencies under the national government that have jurisdiction over CRM in the Malalag Bay Area: NEDA, DA, DENR, DILG, DOT, and DOST. The Local Government Code of 1991 expressly provides for LGUs to take the lead and to share with the national government the responsibility for the management and maintenance of the ecological balance within their territorial jurisdiction. At present, there are established NGOs operating in the MBA in the pursuit of various projects which complement the efforts of the local government. CRMP assisted the Agriculture Office of the LGU in organizing the FARMC and supported a study on the carrying capacity of Malalag Bay.

Numerous policies affecting CRM exist in national laws and municipal ordinances. PD 704 in 1975 is a very comprehensive law affecting fisheries management throughout the Philippines while RA 8550 in 1998 is an act for the development, management, and conservation of fisheries and aquatic resources, integrating all laws pertinent thereto, and for other purposes. The Local Government Code of 1991 authorizes LGUs to enact and enforce local environmental ordinances. LGUs in the MBA have issued various ordinances for coastal environmental protection and management for their respective municipalities. Common to LGUs is the fishery ordinance. Not all municipalities have the same regulations, which makes consistent management and enforcement for the entire bay difficult.

Chapter 7

MANAGEMENT ISSUES AND OPPORTUNITIES



Malalag Bay and Davao Gulf in general share the same environmental problems and concerns as the rest of Mindanao. In 1995, Mindanao State University (MSU) conducted a Rapid Resource Appraisal (RRA) of Davao Gulf covering Malalag Bay. Table 7.1 presents the various components covered by the RRA showing the major coastal resource management issues and their constraints, the strengths of the various stakeholders, the institutional capabilities of concerned government agencies, and the possible management options that can be explored to resolve the issues. The suggested management options were intended to ease the conflicts in each problem area and to relieve the pressures impinging on all resources in the Gulf and Malalag Bay.

Aside from the issues besetting the coastal resources of the MBA, the following presents crucial issues on the environment, economy, political and institutional arrangements that affect the MBA.

ENVIRONMENT

The environment and forestry sector has long been beset with issues concerning denudation of the upland areas to critical levels due to man's misuse and abuse of forest resources. Not only is denudation a problem in the upland but also in the coastal areas where mangroves are also being destroyed. Coastal erosion and siltation are being aggravated by steep topography, erosion in the upland and poor geological condition. All these subsequently lead to marine resource depletion which is complicated by illegal fishing practices such as dynamite fishing.

Table 7.1. Major CRM issues and management options identified by the rapid resource appraisal of Davao Gulf.

Issues/threats	Constraints (C), strengths (S), evidence (E), institutional capability (IC)	Management options
COMMERCIAL FISHERIES		
<p><u>Resource use conflicts</u></p> <p>Commercial fishing boats (>3 GT) operate within municipal waters (15 km from shoreline)</p> <p>Use of modern technology called "superlight" further marginalizes municipal fishermen</p> <p>Monopolies on offshore FADs (<i>payaos</i>)</p>	<p>(C) Dialogue between commercial and municipal fishing sectors is rare or non-existent</p> <p>(C) Large capitalist often controls the fishing sector</p> <p>(C) Lack of data to support allegations against "superlight"</p> <p>(IC) DGMC should explore the possible implementation of FAO 165</p> <p>(IC) This sector is monitored more efficiently</p>	<p>Implement 15 km limit for commercial fishing (RA 165)</p> <p>Ban of large fishing boats (>50 GT) from fishing in the bay</p> <p>Regulate number of <i>payaos</i> owned or operated by a single investor</p> <p>Regulate number of <i>payaos</i> owned or operated by a single investor</p>
MUNICIPAL FISHERIES		
<p><u>Intense fishing pressure</u></p> <p>Unregulated increase in number and type of fishing gear</p> <p>Too many fishermen</p> <p>Unprofitable fishing</p>	<p>(C) Data insufficient to establish growth or recruitment overfishing</p> <p>(E) Low CPUE and low fishermen income</p> <p>(IC) DGMC can provide assistance to fisherfolk</p>	<p>More comprehensive monitoring of fisheries</p> <p>Regulate number of fishermen through limited licensing</p> <p>Restrictions on mesh size and zoning of gear operation</p> <p>Implement TURFs</p> <p>Provision of alternative livelihood to improve income</p> <p>Intensive educational campaign to increase public awareness on consequences of overfishing</p>
AQUACULTURE		
<p>Supply of milkfish fry insufficient to meet local demand</p> <p>Several fishponds remain idle or unproductive</p>	<p>(C) Lack of monitoring of fry production and local fry needs</p> <p>(S) Willingness of fishpond operators to cooperate</p> <p>(C) Mariculture activities limited to a few commodities</p>	<p>Regulate milkfish export from the bay</p> <p>Invest in milkfish hatchery</p> <p>Conversion of idle fishponds to more productive mariculture ventures</p>

continued

Table 7.1. (continued)

Issues/threats	Constraints (C), strengths (S), evidence (E), institutional capability (IC)	Management options
CORAL REEFS		
<p>High siltation</p> <p>Inadequate reef protection and conservation efforts</p> <p>Blast fishing</p> <p>Possible growth and recruitment overfishing</p> <p>Absence of management of artificial reef (AR) projects</p>	<p>(C) Absence of monitoring program probably due to lack of funds</p> <p>(IC) DENR & DA can collaborate on monitoring and implementation of conservation laws</p> <p>(C) Difficulty in assessment of blast fishing</p> <p>(E) High diversity of coral reef fishes monitored in some fish landing areas</p> <p>(C) Cannot evaluate success of AR projects because of absence of monitoring</p> <p>(C) Poor siting of AR projects</p>	<p>Control erosion in upland areas</p> <p>Reduce silt load onto reefs through mangrove reforestation and seagrass bed rehabilitation</p> <p>Declare additional protected areas such as marine parks and sanctuaries (e.g., in Tubalan, Malita; "Coral garden" in Dadatan; Talikod Island)</p> <p>Institute continuous monitoring of protected areas, particularly fish catches from reefs</p> <p>Information drives on importance of coral reef conservation</p> <p>Evaluate AR technology and institute management policies</p>
MANGROVES		
<p>Rapid conversion of mangrove areas into fishponds</p> <p>Poorly managed mangrove reforestation projects</p>	<p>(S) FLAs define the terms of conversion</p> <p>(S) Statutes on mangrove management are available</p> <p>(E) Reduction of mangrove cover by 66 percent since 1988</p> <p>(C) Use of <i>Rhizophora</i> as reforestation organism not appropriate in areas</p> <p>(E) Poor survival of <i>Rhizophora</i> seedlings</p>	<p>Suspend issuance of FLAs</p> <p>Reconserve idle fishponds to reforestation sites</p> <p>Coastal municipalities should implement own reforestation projects (e.g., 5-10 ha)</p> <p>Establish mangrove preservation zones in each province or municipality</p> <p>Utilize endemic mangrove species in reforestation projects</p> <p>DENR should institute more strict evaluation of reforestation projects</p>

continued

Table 7.1. (continued)

Issues/threats	Constraints (C), strengths (S), evidence (E), institutional capability (IC)	Management options
SEaweEDS AND SEagrASSES		
Denudation of seaweed and seagrass beds	(E) Extremely low cover and diversity in many areas (C) Absence of historical data precludes any explanation for such depauperate condition of reef flat vegetation	Rehabilitate seagrass beds, e.g., by transplantation Establish seagrass reserve zones (e.g., in Mabini, Davao del Sur) Cultivate or farm economically important seaweeds
WATERSHED		
Potential decrease in critical water supply	(E) Reduction in forest cover (E) Increased erosion and siltation (C) Restoration of forest cover requires long-term efforts	DGMC should coordinate with DENR for watershed management Empower upland communities to conserve their watershed Strict/militant forest law enforcement
WATER QUALITY		
<u>Degradation of water quality</u> Excessive siltation Pollution from numerous industrial, agricultural, and domestic sources Rapidly increasing beach front use	(E) High sediment loads in rivers (E) Proliferation of several heavy industries (E) Detection of heavy metals (E) High coliform levels in heavily populated areas (C) Occasional sampling failed to detect pesticide residues (E) Increase in number of resorts	Regulate upland mining and agricultural activities Enforce strict penalties for anti-pollution violations DENR should institute regular water quality monitoring program DGMC should review anti-pollution schemes of industries in the Gulf Regular meeting with industry representatives to strengthen cooperation in environmental efforts Strict adherence to and implementation of EIA Government should double efforts on population control esp. in coastal areas Institute proper solid waste disposal Promote ecotourism particularly in island resorts

continued

Table 7.1. (continued)

Issues/threats	Constraints (C), strengths (S), evidence (E), institutional capability (IC)	Management options
INSTITUTIONAL ISSUES		
Weak law enforcement Absence of an integrated coastal management program Lack of institutional capability for monitoring and evaluation Lack of alternative livelihood options for marginal fishermen	(C) Funds are seldom available to LGUs (C) Lack of political will to implement regulation (C) CRM is seldom the priority concern of LGUs (IC) Newly organized DGMC can be a powerful arm of government (S) Fisherfolk are willing to cooperate in CRM efforts (C) Trained manpower is rare (C) Government efforts in this line are not very significant (S) Cooperativism is gaining popularity among fisherfolk	DGMC should develop a funding scheme to support CRM program National mandate to LGUs to put CRM in their priority list Adopt an integrated, community-based approach to management of the Gulf's resources Public environmental education must be a priority program of DECS, CHED, and PIA Tertiary level academic institutions around the Gulf should actively participate in research and public education Create a scientific/assessment pool for continuous monitoring in the Gulf Multisectoral efforts in developing a practical and attractive livelihood program must be pooled Increase investments on post-harvest and other fisheries support facilities

Source: MSU (1996).

Notes:

<i>CHED</i>	<i>Commission on Higher Education</i>
<i>DECS</i>	<i>Department of Education, Culture and Sports</i>
<i>DGMC</i>	<i>Davao Gulf Management Council</i>
<i>EIA</i>	<i>Environmental Impact Assessment</i>
<i>PIA</i>	<i>Philippine Information Agency</i>
<i>TURFs</i>	<i>Territorial Use Rights in Fisheries</i>

Around 33 percent of the families in Davao del Sur fall below the poverty threshold.

The environment, on the other hand, is being endangered by rampant use of agrochemicals (fertilizers and pesticides). Several incidents of fish poisoning especially during heavy rainfall have allegedly been due to chemical leaching that went through the rivers to Malalag Bay.

Solid waste generation in the absence of disposal sites complicates drainage problems as previously pointed out to cause flooding not only in the MBA but also in the low-lying municipalities of Davao del Sur. The existing drainage in Digos is inadequate to drain water during heavy downpour. The affected municipalities in the MBA are Sta. Maria, Padada, Malalag, and Sulop.

With the identification of the MBA as Provincial Agri-Industrial Centers (PAICs) in 1994, the province of Davao del Sur experienced its first generation of industrialization, which is expected to produce a significant impact on the environment. The influx of big businesses, the construction boom, conversion of land uses, the development of housing projects, and the erection of manufacturing and processing firms will definitely result in rapid extraction of minerals and other natural resources which may go beyond the rate of regeneration. These impacts, if not regulated, will cause problems in the sector.

ECONOMIC

Based on the 1994 Family Income and Expenditure Survey (FIES), around 33 percent of the families in Davao del Sur fall below the poverty threshold. This poverty incidence, however, is about 6 percent better than that of 1991, which was placed at around 39 percent. Nevertheless, this is still a cause for alarm as a large portion of these poor families are living in the rural areas of the province. Accordingly, the poverty threshold of the province was placed at PhP8,163 per family of six per year in 1994.

The poverty groups in the MBA are the landless rural workers, lowland coconut farmers, upland farmers, subsistence fishermen, squatters, and underemployed/unemployed and underpaid workers. The landless rural workers are the *kaingeros*, landless families, and farm laborers. They earn a living by selling labor and/or engaging in slash-and-burn activities. The upland farmers of MBA include coconut and corn farmers. Low crop yields, as well as inaccessibility to markets, contribute to their poverty situation.

Subsistence fishermen are predominant in the MBA. They live in one-room houses made of dilapidated indigenous materials, have low literacy levels, have large families, and are dependent on seasonal municipal fishing activities. In their fishing activities, most use non-motorized boats and traditional fish catching methods, like hook and line.

Squatters who live in agricultural lands can be found in the MBA. They live in temporary dwelling units, subsist on hand-to-mouth existence, and have no regular source of income.

The MBA is endowed with diverse agricultural and natural resources and has the potential to produce more. But agriculture alone cannot sustain the growth and development of the economy as it is constantly hampered by product seasonality, vulnerability to natural calamities, and product inelasticity to income and price change. Aside from low production, the agri-sector is disturbed by the reality of having a market system that exerts a bias against it, thus resulting in low income. Production dips further with inadequate infrastructure support facilities and when the inefficiency and backwardness of current technologies is not addressed.

POLITICAL/INSTITUTIONAL

The biggest challenge for coastal area management is the strict enforcement of laws, rules, and regulations. This challenge is created by 1) jurisdictional overlaps and conflicting interpretations of laws affecting the coastal zone, 2) serious practical difficulties of enforcement, 3) unavailability of vehicles for water pursuit of violators; 4) difficulties of determining and providing boundaries and locations in water, 5) distance of the commission of offense from public scrutiny, 6) lack of communication equipment (e.g., radios) for reporting violations, 7) lack of personnel (e.g., *Bantay Dagat* or PNP), and 8) deputy fish wardens being ill equipped to handle legal issues on arrest, search, seizure, and evidence gathering are just some of the hurdles that an effective fishery law enforcement policy has to solve. Even with the proper evidence and known violators, the sluggishness of courts suggests the development of quasi-judicial means for the swift prosecution and punishment of violators. Furthermore, the sharing of revenues from fines should be rechanneled to improve the provision of personnel or equipment to enforce laws in the MBA.

While enforcement may partially be addressed by strong political will, which will depend on the specific site and individual government officials in the area, public education (e.g., ill effects of illegal fishing methods through cross-site visits) and support can also be very effective and relatively inexpensive. With proper education, local POs may improve the enforcement of laws. On the other hand, it must not be forgotten that some of the worst offenders are industrial polluters whose connections and power, as well as economic benefits to the area, make them difficult to prosecute.

To alleviate the present condition of the environment, the LGUs of the MBA will pursue two major strategies. First is the sustainable management and optimal utilization of forest, marine, and other natural resources to address forest denudation, depletion of marine and coastal resources, and illegal extraction of mineral and natural resources. This objective will be achieved through the implementation of development

projects such as Watershed Protection, Rehabilitation and Development, Marine and Coastal Resource Conservation and Rehabilitation, Urban and Social Forestry, Mineral Resource Development, and Fruit Tree Production and will be pursued through:

- Strengthening/enforcement of environmental laws, policies, rules, and regulations;
- Surveillance of illegal forest and marine resource utilization and mineral extraction;
- Development of an effective information dissemination campaign and education system through training, radio broadcasting, film showing, and fora and symposia;
- Establishment and/or development of effective linkages with NGOs, nongovernment agencies (NGAs), LGUs, and other concerned entities; and
- Encouragement/enhancement of the participation by forest occupants and fisherfolk in their communities in resource rehabilitation, conservation, and efficient utilization.

The second is an attempt to integrate the efforts and programs for the management of Malalag Bay. A number of government agencies are tasked to enforce laws and protect the marine environment. Nonetheless, the same agencies adopt sectoral and fragmented approaches to issues and problems; hence, in spite of efforts in the past, problems continue to persist and even get worse. The launching of the pilot project "Coastal Resources Management" sometime in September 1991 in Malalag has made the major stakeholders of the marine ecosystem realize the extent of damage and degradation of Malalag Bay. The project adopts both regulatory and non-regulatory strategies of solving the problems confronting the marine ecosystem. Among the noteworthy accomplishments are the banning of compressor fishing, establishment of a fish sanctuary in a 50-ha area, mangrove planting, and intensified public information including the enactment of anti-littering ordinance.

CRMP has assisted the major stakeholders of the marine ecosystem to realize the extent of damage and degradation of Malalag Bay.

To support the provincial government's emphasis on sustainable agro-industrial development, a strategic plan for the Provincial Agri-Industrial Center (PAIC) of the MBA was completed in June 1994 with funding assistance from the Canadian International Development Agency (CIDA). Relevant programs in support of the establishment of

MBA-PAIC include capability building and entrepreneurial development, agricultural productivity improvement and development, pump-priming rural infrastructure, industry promotion and marketing, credit delivery system, and environmental management and protection. In an effort to reinforce these, several regulatory measures and supportive policies are identified for the local policy makers to enact in order to facilitate the smooth implementation and establishment of the MBA-PAIC. The establishment of the PAIC will be directed towards the attainment of the following development goals:

- The optimum and judicious utilization of resources;
- The provision of additional productive capacity and creation of industrial activities;
- The absorption of surplus manpower and significant reduction of levels of poverty;
- The development of skilled and competent human resources;
- The improvement of purchasing power and redistribution of income and wealth; and
- The achievement of balance between economic growth and environmental management and protection.

Table 7.2 presents the environmental management and protection programs upon the establishment of the PAIC.

Environmental protection is one key contribution of the CRMP to the sustainable use of marine resources in municipal waters. CRMP carries out alternative enterprise development activities under appropriate constraints of the carrying capacity of the water environment. A beneficial component of the activity is the promotion of well-regulated mariculture such as sea farming and ranching and the grow-out of animals in pens and cages.

Malalag Bay has become an area of concern to CRMP because of the observed increasing congestion of floating devices supporting the intensive culture of milkfish by certain entrepreneurs and cooperatives. Since the carrying capacity of the bay has already been surpassed, CRMP assessed the bay considering the impacts of the existing mariculture and pollutants. The study succeeded in determining the health status of Malalag Bay as conditionally suitable for mariculture (pens and cages) activities (Baleña 1998). The analyses indicated that the bay exceeded its environmental limits by about 2.5 times and that an awareness campaign is advisable, precisely to

Table 7.2. 10-Year environmental management and protection program for the MBA.

Project	Immediate concern (1994-1995)	Medium term objectives (1996-2000)	Long term goals (2001-2003)
Municipality of Malalag			
Coastal Resource Management	Established nursery of mangrove and planted at least 3 ha	Expanded mangrove nursery operations Planted at least 6 ha of mangroves	Sustained operations of mangrove nursery Planted 14 ha of mangroves
	Strengthened LGU and fisherfolk partnership in construction and installation of 4 modules of artificial reefs	50 modules of artificial reefs installed	Installed 54 additional modules of artificial reefs (currently banned nationally)
	Acquired patrol boat for surveillance and enforcement of fishery laws and ordinances	Continued surveillance and enforcement of fishery laws and ordinances	Sustained surveillance and enforcement of laws and ordinances
	Developed 50 ha of fish sanctuary	Maintained and upgraded operations of fish sanctuary	Sustained operations of fish sanctuary
	Increased public awareness on CRM and protection	Public should have attained a degree of social responsibility over the coastal resources	Institutionalized public education
	Protect government reservation area for milkfish and other fry	Maintenance	
Upland Rehabilitation	Promote SALT and water and land conservation technologies	Continuous application of SALT and other water and soil conserving technologies	Sustenance
	Coordinate with the DENR for the expansion of Community Reforestation Project Strengthened organizations of forest occupants	Expanded Community Reforestation Project to 200 ha	Maintenance
	Facilitate application and release of Certificates of Stewardship	Facilitate processing of Certificates of Stewardship to those who are interested	Sustenance
	Mobilized <i>barangays</i> , <i>Barangay Advisory Teams</i> for Environment and other NGOs and POs in the watershed establishment per <i>barangay</i>	Rehabilitated 1,424 ha of timberland through the Integrated Social Forestry Project	Sustenance and crop diversification
		Expanded watershed rehabilitation through partnership with the <i>barangays</i> and the people	Rehabilitated at least 300 ha of watershed

continued

Table 7.2. (continued)

Project	Immediate concern (1994-1995)	Medium term objectives (1996-2000)	Long term goals (2001-2003)
Solid Waste Disposal and Management	Formulated solid waste disposal management masterplan	Implemented masterplan for solid waste disposal and management	Sustenance
	Site selection and acquisition of at least 2 ha dumping site	Established and operationalized landfill system	Full operations of landfill system
	Initiated low cost garbage disposal and collection system	Improved system of garbage collection Enforced proper waste disposal in rural <i>barangays</i>	Sustenance
	Acquisition of one garbage truck	Acquisition of additional garbage truck	Sustenance
Municipality of Hagonoy			
Pollution Control	People's awareness and conscientization	People's surveillance and vigilance in abating pollution	Low cost and less pollutive farm chemical inputs
	Farmer's education on hazards of pollution and alternative steps to reduce and minimize effects	Proper use and disposal of farm chemicals (pesticides, weedicides, insecticides, etc.) Propagation of organic fertilizers	Use of organic fertilizers
Coastal Resources Management	Identify and develop potential areas for mangrove development		
	Establish mangrove planting materials nursery Codify integrated fishery ordinance	Develop coastal areas suitable for mangrove planting	Expand when possible planting areas to mangrove
	Deputize coastal <i>barangay</i> officials to enforce fishery laws	Strict enforcement of fishery laws	Acquisition of pump boats for effective and efficient fishery laws enforcement
	Expansion area and laying of additional artificial coral reefs and fish sanctuaries	Municipal policies and strategies formulation and implementation	Maintenance and when possible expansion of coverage
Upland Rehabilitation	Promotion of upland agricultural technologies	Establishment of salt/halt farms in upland <i>barangays</i>	Mobilization of <i>barangays</i> in implementation with technical and other assistance from POs, NGOs, and LGUs
	Promotion of water and soil conservation	Planting and growing of economic trees and bamboos in erosion prone areas	

continued

Table 7.2. (continued)

Project	Immediate concern (1994-1995)	Medium term objectives (1996-2000)	Long term goals (2001-2003)
Solid Waste Disposal and Management	Formulation of solid waste disposal management plan	Implement master plan for solid waste disposal and management	
	Site development for landfill and dumpsite	Operationalize waste landfill	
	Enforcement of Health and Sanitation Code	Enforcement of <i>barangay</i> based waste disposal and sanitation rules	

Source: PSPT (1994).

communicate to stakeholders that Malalag Bay is no longer “healthy” and thus needs to be regulated. To lessen culture intensity by 2.5 times could mean the proportional reduction in area of culture, stocking density, or feeds.

Through CRMP’s participatory planning process, municipal CRM plans in the MBA were completed in 1999. The municipal CRM plans with their objectives, strategies, timeframe, and responsible agencies for its activities are presented in Table 7.3.

In combination with the local community support, the following activities are recommended to lessen the economic pressures placed on the natural resources of Malalag Bay:

- The presence of agricultural plantations in the area is suspected as the source of chemicals detrimental to the sustainability of the fish resources in the area. In order to ensure that the water will be free from toxic effluents, a monitoring station should be operated in the bay.
- To maintain ecological balance and sustainability of resources, mangrove reforestation should be implemented which aims to conserve the soil, water, biodiversity, and other watershed resources for the benefit of upstream and downstream communities and the coastal resources of Malalag Bay.
- The MBA has to be equally prepared for an efficient and responsive solid waste disposal and management as it is already experiencing the ill effects of unregulated solid waste disposal. With the expected urbanization of some *barangays* and the influx of people and industries, it must be able to cope and ably manage the upsurge of garbage and solid wastes.

Table 7.3. Municipal CRM plans (Year 2000-2004) in the MBA.

Program/objectives		Strategies	Responsible agencies
Municipality of Hagonoy			
<p><u>Vision</u> A coastal municipality of regenerated resources, environmentally sound and a well managed ecotourism area in the province for the upliftment of the people</p> <p><u>Mission</u> The municipal government and its instrumentalities are committed to develop itself into a responsive and dynamic catalyst of change and promote the regeneration and development of coastal resources and protect them from abuse and illegal exploitation.</p>	<p><u>Fishery Management</u> To increase fishery and marine resource productivity by regulating access and exploitation of municipal waters reserving them for the benefit of municipal fishers while ensuring its natural and sustainable development and management as well as equity and exploitation</p>	<ol style="list-style-type: none"> 1. Establishment and management of fish sanctuaries 2. Sustainable aquaculture 3. Closed seasons 4. Licensing and permitting system 5. Enforcement of environmental and fishery laws 	<p>MAO, PLGU, DFW, MPDO, SB</p> <p>MLGU, PO, BFARMC, Fishpond Operators, DENR, DTI, DOST, TESDA</p> <p>MLGU, BLGU, FARMCS, BFARMC, BLGU, SB</p> <p>MLGU, FARMC, DFW, MAO, BFARMC, BLGU, SB</p> <p>MAO, PLGU, DA-BFAR, MARINA, MARICOM, MLGU, PLGU, BFARMC, BLGU, MLGU, DFW, DECS, NGOs, DENR, FARMC, PO</p>
	<p><u>Habitat Management</u> To manage, protect, conserve and rehabilitate existing habitat to improve productivity and biodiversity of corals, seagrasses, mangroves and estuaries through community participation</p>	<ol style="list-style-type: none"> 1. Identification of potential fish sanctuary 2. Community-based mangrove rehabilitation and development 3. Linkage with fishpond owner to participate and contribute funds for mangrove planting and development 4. Prevention and control of flood, erosion, and siltation 	<p>MAO, DENR, MLGU, NAMRIA, FARMC, DFW, BLGU</p> <p>PLGU, MLGU, NGO, CENRO, MLGU, FARMC, DENR, DFW, PO</p> <p>PENRO, MLGU</p> <p>MLGU, BLGU, DENR, NGO, FARMC, PO, Concessioners, land owners</p>
	<p><u>Coastal Zone Management</u> To delineate zones for specific uses or activities in the municipal waters to eliminate conflict in utilization and regulate zone activities</p>	<ol style="list-style-type: none"> 1. Formulation of coastal zonation and management plan 	<p>MLGU, MTWG, FARMC, BLGU, PLGU, SB</p>
	<p><u>Shoreline Management</u> To protect the shoreline from further degradation and destruction, especially erosion and siltation, while providing access and maintaining cleanliness and sanitation while regulating foreshore area</p>	<ol style="list-style-type: none"> 1. Pollution control 	<p>MLGU, MTWG, FARMC, BLGU, PLGU</p>
		<ol style="list-style-type: none"> 2. Flood, erosion, siltation control 	<p>MLGU, BLGU, DENR, NGO, FARMC, PO, Concessioners, land owners</p>
		<ol style="list-style-type: none"> 3. Regulation of foreshore area activities 	<p>MLGU, DENR, BLGU, BFARMC, MLGU, SB, BLGU, MPDO</p>
	<p><u>Coastal Tourism Management</u> To upgrade the existing tourism facilities and services initiated by private investors by providing infrastructure support and ultimately transform the area into an ecotourism destination of the province</p>	<ol style="list-style-type: none"> 1. Upgrading of tourism facilities and services 	<p>Resort owners, FARMC, BLGU, MLGU</p>
		<ol style="list-style-type: none"> 2. Provision and improvement of infrastructure support facilities and services 	<p>DPWH, BLGU, MLGU, DASURECO</p>
		<ol style="list-style-type: none"> 3. Ecotourism development 	<p>MLGU, BLGU, FARMC, DFW, PO, COOPS, NGO</p>

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies
Municipality of Hagonoy		
<p><u>Enterprise Development Management</u> To develop environment-friendly alternative sources of income and generate employment opportunities for diverse income of fisherfolk to lessen dependence on fishing</p> <p><u>Waste Management</u> To eliminate or minimize the existing and potential adverse impact and effects of wastes to human and community health</p> <p><u>Legal Arrangements</u> To improve mechanisms, structures, processes, and arrangements for coastal management to enhance community participation and delivery of services and strengthen environmental and fishery law enforcement and networking and linkages</p>	1. Development of environment-friendly alternative source of income	MLGU, MAO, DECS, TESDA, DTI, DOST, LADECO, MBA, PAIC
	2. Employment generation	MLGU, LADECO, MVPI, LSVI, CII, DTI, DOST, LMSTC
	1. Elimination, minimization of existing and potential adverse impacts and effects of waste	MLGU, BLGU, FARMC, DENR, NGO, COOP, PLGU, MTWG, DECS
	1. Institutionalize mechanism, structures, process and arrangement to enhance participation and delivery of services	MLGU, DENR, BLGU
	2. Strengthen environment and fishery law enforcement networking and linkages	MLGU, PLGU, DA-BFAR
	3. Monitoring, control and surveillance (MCS)	MLGU, BLGU, FARMC
Municipality of Malagal		
<p><u>Vision</u> A self-reliant community driven by self-determination and actively pursuing led and sustainable development that will be people-oriented, equity-led and sustainable.</p> <p><u>Mission</u> Implement coastal development that will be people oriented; equity-development programs that will uplift the quality of life of the people and enhance their participation to sustainable management of coastal resources that will ensure food security.</p>	<p><u>Fishery Management</u> To develop monitoring, control and surveillance mechanism and strengthen law enforcement units</p> <p>To regulate the exploitation of fisheries resources and limit fishing effort to sustainable levels</p> <p>To increase productivity of fisheries resources in order to achieve food security</p> <p>To ensure the rational and sustainable development and management of the fishery resources</p>	<p>1. Maintenance/management of fish sanctuary</p> <p>2. Established/organized community-based fish sanctuary management</p> <p>3. Enforcement of environmental and fisheries laws</p> <p>4. Licensing and permitting of fisheries, fishing gear, and fishing boats - Establishment of mariculture units - Establishment of demonstration fish cage - Establishment of 3 units fish shelter - Maintenance of 3 units patrol boat</p>
	FARMC, SB, CRMP, ISFI	
	DFW, FARMC	
	PNP, LGU, DFW, BFARMC, MFARMC	
MAEO, LEEM, OMAD, CRMP, OPAG, BFAR, RFTC, DFW, CG, PNP		

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies
Municipality of Malalag		
<p><u>Habitat Management</u> To restore and rehabilitate, conserve and protect the vital ecosystem To improve productivity and biodiversity of corals, seagrass, mangroves, and estuaries To enhance community participation in the management of the habitats</p>	<ol style="list-style-type: none"> 1. Reforest/replant depleted mangrove areas 2. Legislative measures for FLA relocation of boundaries 3. Buy-back of mangrove propagules 4. Establishment of SALT (Contour) 5. Establishment of maintenance of protected areas (sanctuary, mangrove) 	<p>FARMC, MAEO, PENRO, DENR, DFW, CRMP, MSSD</p> <p>FARMC</p> <p>MAEO, KAPWA, ISFI</p> <p>FARMC, LGU, CRMP, PNP</p>
<p><u>Enterprise and Livelihood Management</u> To develop alternative and supplemental employment to fishers in order to lessen their fishing effort and pressure on the sea To diversify income sources of the fishers to lessen dependence on fishing</p>	<ol style="list-style-type: none"> 1. Networking and linkaging for fund sourcing 	<p>MAEO, BFARMC, MSSD</p>
<p><u>Coastal Zone Management</u> To delineate zones for specific uses or activities in the municipal water To eliminate use conflict in the utilization of the municipal water To regulate activities in the different zones</p>	<ol style="list-style-type: none"> 1. Delineation of municipal water boundaries 2. Designation of zones for specific uses 3. Conduct IEC 4. CO 	<p>MLGU, BLGU, MAEO, FARMC, NAMRIA, OPAG, DENR, DFW</p>
<p><u>Legal Arrangement and Institutional Development</u> To strengthen environmental and fishery law enforcement To strengthen network and linkage with other LGUs, NGAs, international and local organizations, community and NGOs/POs</p>	<ol style="list-style-type: none"> 1. Strengthening of BFARMC, DFW 2. MCS 3. Monitoring and evaluation of laws and ordinances implementation 4. Fund sourcing and leveraging based on planned programs 	<p>FARMC, DFW, OPAG, DENR, PNP, LGU, PENRO, PNP MARINA</p> <p>SB, OMM</p> <p>LCE, SB, NGO</p> <p>MBA-PAIC, MO, SB, MLGU, BLGU</p>
<p><u>Coastal and Upland Greening</u> To rehabilitate upland and coastal vegetative cover</p>	<ol style="list-style-type: none"> 1. Protection and reforestation and upland covers through community participation 	<p>DENR, BFAR, MAEO, LGU, FARMC, PENRO</p>

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies	
Municipality of Padada			
<p><u>Vision</u> A municipality with a healthy and ecologically-balanced coastal environment with disciplined, empowered, motivated people/ community advocating sustainable management and development of coastal resources.</p> <p><u>Mission</u> To implement coastal resource management with active community participation.</p>	<p><u>Fishery Management</u> To regulate fishing activities to sustainable level in order to increase productivity of fishing resources</p>	1. Management of existing fish sanctuary	SB, MLGU, BLGU, DFW, PNP, FARMC, CRMP
	<p>To strictly implement municipal fishery laws, ordinances, and other related environmental laws by strengthening law enforcement units and developing monitoring, control, and surveillance mechanisms</p>	2. Massive IEC campaign	MAO, NGOs, POs, FARMCs
		3. Licensing, permitting of fisher, gear and boats	BLGU, MLGU, MAO, FARMC, PLGU
		4. Enforcement of environmental and fishery laws	PNP, DFW, FARMC, PNP, MLGU
	<p><u>Legal Arrangement and Institutional Development</u> To strengthen environmental and fishery law enforcement</p>	1. Strengthening of BFARMC, DFW	FARMC, DFW, OPAG, DENR, PNP, LGU, PENRO, PNP MARINA
	<p>To strengthen network and linkage with other LGUs, NGAs, international and local organizations, community and NGOs/POs</p>	2. MCS	SB, OMM
		3. Monitoring and evaluation of laws and ordinances implementation	LCE, SB, NGO
		4. Fund sourcing and leveraging based on planned programs	MBA-PAIC, MO, SB, MLGU, BLGU
	<p><u>Habitat Management</u> To conserve and rehabilitate habitats to improve productivity and bio-diversity and enhance/ strengthen community involvement in the management</p>	1. Establishment of marine sanctuary	
		2. Protection of corals, seagrass, mangroves by regulating fishing activities destructive to the habitat	
		3. Enforcement of environmental and fisheries laws	
		4. Conduct massive IEC campaign	
	<p><u>Shoreline Management</u> To regulate activities in the foreshore area and protect from further degradation due to destructive activities</p>	1. Development of a fisherfolk resettlement	NGAs, PLGUs, NHA, SSS, Pag-ibig
		2. Mangrove rehabilitation	DENR, MLGU
		3. Setting up of setbacks on all coastal development	DENR, MLGU, SB
	<p><u>Coastal Zone Management</u> To delineate zones for specific uses in order to eliminate use conflict in the utilization and regulate activities in the different zones of municipal waters</p>	1. Delineation of municipal water boundaries	
		2. Designation of zones for specific uses (for strict protection, rehabilitation of aquaculture, tourism, trade and navigation, etc.)	MLGU, NAMRIA, BFAR
		3. Regulation of fishing and use of fishing gears in every zone	MLGU
		4. Conduct of massive IEC campaign	MLGU

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies
Municipality of Padada		
<p><u>Coastal Tourism</u> To develop local capability in ecotourism projects and provide economic incentives that contribute to better coastal management and community development for the municipality</p> <p><u>Enterprise and Livelihood Management</u> To develop alternative and supplement employment to diversify income source of fishers in order to lessen fishing effort and pressure on the sea</p> <p><u>Waste Management</u> To eliminate or minimize the potential adverse impact of wastes</p>	1. Regulation on the number of tourism facilities and activities	MAO, FARMC, BLGU
	2. Ecotourism product development	PTO
	3. Users fee on appropriate business developed	
	4. Conduct massive IEC campaign	FARMC, POs, BLGU, MAO
	1. Identification and implementation of environment-friendly and economically feasible projects	MAO, FARMC, BLGU, MPDO, PLGU, NGO
	2. Identification of beneficiaries	MAO, FARMC, BLGU, MPDO, PLGU, NGO
	1. Water quality monitoring	DENR, MHO
	2. Domestic and human waste management	BFAR, MLGU
	3. MCS	BFAR, MLGU
	4. Conduct of massive IEC campaign	BFAR, MLGU
Municipality of Sta. Maria		
<p><u>Vision</u> An improved quality of life through empowered coastal communities, benefiting from a well-managed and ecologically-balanced coastal environment.</p> <p><u>Mission</u> Implement development programs aimed to protect, conserve, and manage the coastal resources through partnership of various sectors.</p>	1. Enactment of Municipal Ordinance, regulating fish catch, fishing gear, mesh size, fishing vessels.	LGU, NGA
	2. Implementation of licensing and permitting of fishers, fishing gear, and fishing boats	LGU, NGA
	3. Establishment and management of marine protected areas or fish/marine sanctuaries	LGU, NGA
	4. Enforcement of environmental and fishery laws	LGU, NGA
	5. Conduct of massive IEC campaign	LGU, NGA
	1. Rehabilitation of mangrove areas	LGU, NGA
	2. Establishment of marine reserve	LGU, NGA
	1. Delineation of municipal waters and boundaries	LGU, NGA
	2. Designation of zones for specific uses (for strict protection, rehab. aquaculture, tourism trade, and navigation, etc.)	LGU, NGA

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies	
Municipality of Sta. Maria			
	3. Regulation of fishing activities and use of fishing gear in every zone.	LGU, NGA	
	4. Conduct of massive IEC campaign	LGU, NGA	
	5. Community organizing and formation of fishers' organization for protection and conservation	LGU, NGA	
<u>Shoreline Management</u> To regulate activities in the shoreline that would affect the condition of the shore To protect the shoreline from further degradation due to destructive activities	1. Setting up and maintenance of coastal setback for all development	LGU, NGA	
	2. Development of waste management system	LGU, NGA	
<u>Enterprise and Livelihood Management</u> To diversify income source of the fishers to lessen dependence on fishing To orient community participants re: proper values related to managing enterprise development projects	1. Identification and implementation of environment-friendly and ecologically-feasible projects	LGU, NGA	
	2. Social preparation and values formation		
<u>Legal Arrangement and Institutional Development</u> Institutionalization of CRM in the LGU Formation of municipal core group Strengthening of FARMC, <i>Bantay Dagat</i> and deputized fish warden To increase awareness on CRM programs Information on funding institution	1. Establishment of a CRM section under the OMA	LGU	
	2. Creation of a CRM section and assigning personal	LGU	
	3. Organization of a municipality core group that will conduct IEC activities	LGU	
	4. Formulation of incentive and benefit mechanism to the FARMC, BD, and DFW		
	5. Produce CRM IEC materials		
	6. To link with various funding institutions		
Municipality of Sulop			
<u>Vision</u> Sustained, restored and productive coastal and marine resources of Sulop capable of uplifting the socioeconomic condition of the communities through people participation.	<u>Fishery Management</u> To prevent illegal fishing in order to reduce fishing pressure	1. Management of existing fish sanctuary	MTWG, MO, MAO, BFARMC
		2. Licensing and permitting of fishers, fishing gear, and fishing boat	MAO, MO, MTO, BFARMC
		3. Sustainable management of coastal aquaculture	MTWG, MAO, MPDO, CRM, BFARMC
		4. Enforcement of environmental laws and related ordinances	MO, MTWG, PNP, DFW, DOJ, MAO, BFARMC

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies
Municipality of Sulop		
<p><u>Mission</u> To evolve and implement development alternatives that would continually regenerate, conserve, and promote wise use of the coastal and marine resources</p>	<p><u>Habitat Management</u> Rejuvenate/rehabilitate resource base</p>	1. Setting up of fisheries monitoring mechanism CRM-PL/MAO, MO, MTWG, PNP, DFW, BFAR
	2. Conduct of massive IEC campaign MAO, MO, CRM-PL, BFARMC	
	3. Enforcement of environmental and fisheries laws MO, DFW, MTWG, PNP, MAO, CRM- PL, BFARMC	
	<p><u>Coastal Zone Management</u> To formulate and implement approved unified fishery code and BLUP in order to avoid conflicting uses of different zones</p>	1. Delineation of municipal water boundaries MO, NLA, CRM-PL, MTO, BFARMC, MAO
	2. Designation of zones for specific uses MAO, MPDO, MTWG, SB, MAO, NIA, MTWG	
	<p><u>Shoreline Management</u> To prevent the establishment of dwelling units within the shoreline</p>	1. Protection and conservation of mangrove areas MAO, CRM-PL, NLA
	2. Fisherfolk's settlement area development MAO, MTO, MPDO, MEO, MSWDO	
	3. Setting up and maintenance of coastal setback for all development MAO, MO, MEO	
	4. Construction and maintenance of seawall MAO, NLA, MAO, CRMP-PL	
	5. Conduct of massive IEC	
	6. Strengthening of fishery organization	
	<p><u>Coastal Tourism Management</u> To develop local capability in ecotourism projects that contribute to better coastal management and community development</p>	1. Conduct of massive IEC MAO/CRM-PL
	2. Identification and development tourist destination area MO, MP/MPDO	
	3. Formulation of tourism promotion brochure MPDO, MO Mun. Tourism Com.	
	4. Promotion of tourist destination area MO, MTO	
	<p><u>Enterprise and Livelihood Management</u> To develop alternative source of livelihood for fisherfolk in order to lessen fishing effort and pressure on the municipal water</p>	1. Identification and implementation of environment-friendly and economically feasible projects MAO, MPDO, MTWG, DTI, SB, CRM-PL, SB
	2. Implementation of oyster production and marketing considered environment-friendly enterprise through cooperative interventions	
	<p><u>Waste Management</u> To minimize adverse impact of wastes to human and environment health</p>	1. Water quality monitoring MAO, NLA, DENR, BFAR, DOH, DA, MHO, MTWG
	2. Waste segregation CRMP-PL, MO, MTWG, MHO, MAO	
	3. MCS MTWG, MHO, CRMP-PL	
4. Conduct of massive IEC on waste management MTWG, CRM-PL		

continued

Table 7.3. (continued)

Program/objectives	Strategies	Responsible agencies
Municipality of Sulop		
<u>Legal Arrangement and Institutional Development</u> To strengthen environment and fishery law enforcement	1. Community-based IEC	MAO, MTWG, CRM-PL
	2. Strengthening of FARMC, <i>Bantay Dagat</i> and fish wardens	
	3. Monitoring and surveillance	

Notes:

<i>BFAR</i>	<i>Bureau of Fisheries and Aquatic Resources</i>	<i>MARICOM</i>	<i>Maritime Command</i>
<i>BFARMC</i>	<i>Barangay Fisheries and Aquatic Resource Management Council</i>	<i>MARINA</i>	<i>Maritime Industry Authority</i>
		<i>MBA-PAIC</i>	<i>Malalag Bay Area-Provincial Agri-Industrial Center</i>
<i>BLGU</i>	<i>Barangay Local Government Unit</i>		
<i>BLUP</i>	<i>Barangay Land Use Plan</i>	<i>MCS</i>	<i>Monitoring, Control and Surveillance</i>
<i>CENRO</i>	<i>Community Environment and Natural Resources Office</i>	<i>MEO</i>	<i>Municipal Engineer's Office</i>
		<i>MFARMC</i>	<i>Municipal Fisheries and Aquatic Resources Management Council</i>
<i>CG</i>	<i>Coast Guard</i>		
<i>CII</i>	<i>Cocoa Investors, Inc.</i>	<i>MHO</i>	<i>Municipal Health Office</i>
<i>CO</i>	<i>Community Organization</i>	<i>MLGU</i>	<i>municipal local government unit</i>
<i>CRMP</i>	<i>Coastal Resource Management Project</i>	<i>MO</i>	<i>Mayor's Office</i>
<i>CRM-PL</i>	<i>Coastal Resource Management - Practitioners' League</i>	<i>MPDO</i>	<i>Municipal Planning Development Office</i>
		<i>MSSDO</i>	<i>Municipal Social Service and Development Office</i>
<i>DA</i>	<i>Department of Agriculture</i>		
<i>DASURECO</i>	<i>Davao del Sur Electric Cooperative</i>	<i>MSWDO</i>	<i>Municipal Social Welfare and Development Office</i>
<i>DECS</i>	<i>Department of Education, Culture and Sports</i>		
<i>DENR</i>	<i>Department of Environment and Natural Resources</i>	<i>MTO</i>	<i>Municipal Treasurer's Office</i>
		<i>MTWG</i>	<i>Multisectoral Technical Working Group</i>
<i>DFW</i>	<i>Deputized Fish Warden</i>	<i>MVPI</i>	<i>Malalag Ventures Plantation, Inc.</i>
<i>DOH</i>	<i>Department of Health</i>	<i>NAMRIA</i>	<i>National Mapping and Resources Information Authority</i>
<i>DOJ</i>	<i>Department of Justice</i>		
<i>DOST</i>	<i>Department of Science and Technology</i>	<i>NGA</i>	<i>national government agency</i>
<i>DPWH</i>	<i>Department of Public Works and Highways</i>	<i>NGO</i>	<i>nongovernment organization</i>
<i>DTI</i>	<i>Department of Trade and Industry</i>	<i>NIA</i>	<i>National Irrigation Administration</i>
<i>FARMC</i>	<i>Fisheries and Aquatic Resources Management Council</i>	<i>NLA</i>	<i>national line agency</i>
		<i>OMAD</i>	<i>Office of the Municipal Administrator</i>
<i>IEC</i>	<i>information education campaign</i>	<i>OMM</i>	<i>Office of the Municipal Mayor</i>
<i>ISFI</i>	<i>Institute of Small Farms and Industries</i>	<i>OPAG</i>	<i>Office of the Provincial Agriculturist</i>
<i>KAPWA</i>	<i>Kapwa Upliftment Foundation, Inc.</i>	<i>PENRO</i>	<i>Provincial Environment and Natural Resources Office</i>
<i>LADECO</i>	<i>Lapanday Development Corporation</i>		
<i>LCE</i>	<i>Local Chief Executive</i>	<i>PLGU</i>	<i>provincial local government unit</i>
<i>LEEM</i>	<i>Local Economic Enterprise Management</i>	<i>PNP</i>	<i>Philippine National Police</i>
<i>LGU</i>	<i>local government unit</i>	<i>PO</i>	<i>people's organization</i>
<i>LSVI</i>	<i>Lorenzo and Sons Ventures Inc.</i>	<i>PTO</i>	<i>Provincial Tourism Office</i>
<i>LMSTC</i>	<i>Lapanday Manpower Skills Training Center</i>	<i>RFTC</i>	<i>Regional Fishermen's Training Center</i>
<i>MAEO</i>	<i>Municipal Agriculture and Environment Office</i>	<i>SB</i>	<i>Sangguniang Bayan</i>
<i>MAO</i>	<i>Municipal Agriculture Office</i>	<i>TESDA</i>	<i>Technical Education and Skills Development Authority</i>

- To enhance the livelihood of fishers in the area, the port in Malalag should be improved to better serve the community. It should include a fish landing facility, protective structure, additional building for administration, a cold storage, a processing area, and other support facilities. This will help the local fishers in adding value to their produce and help them compete in the open market.
- Fishery development efforts should be divided toward increased production to meet the recommended nutritional requirements of the growing population. Specifically, the objectives shall be the intensified production of brackish and freshwater ponds, increased catch per unit effort of sustenance fishermen, and rehabilitation of depleted marine grounds.
- Existing areas for milkfish and prawn farms should be maintained. The expansion of areas shall not be encouraged considering the alarming condition of mangrove areas.
- The CRMP should be expanded to cover municipalities along the MBA. This program aims to manage multiple and conflicting uses of the coastal zone which is a priority site for ports, industrial facilities, urban development, agriculture and waste disposal as well as tourism and fisheries.
- Post harvest and credit facilities should be provided to support fishery development. Efforts should be made to rehabilitate coral reefs through the construction of artificial coral reefs along the coastal municipalities.
- Strict enforcement of fishery laws should be strengthened to curb dynamite fishing and other illegal fishing practices.
- Since the marine habitat is already experiencing deterioration, reduction of pressure is an urgent need. This means that land-use planning for industrial uses must be focused on areas far from the coastal zone. Policies must regulate the habitation of the foreshores and coastal lands. To curb the rate of siltation of the bay, it is necessary that the community embarks on stream bank stabilization projects that use natural barriers instead of the purely structural approach.

In an effort to support CRM, the five municipalities in the MBA have enacted their individual fishery ordinances. The CRM best practices of each municipality include:

Hagonoy

- Functional marine sanctuary
- Organization of FARMCs
- Establishment of municipal and *barangay* tree parks, planting of trees and bamboos in critical land areas, particularly river banks
- Strong and functional linkage with POs and the private sector in the implementation of environmental and development programs and projects
- Continuing in-depth studies on sand and gravel extraction
- Mangrove rehabilitation program implemented in partnership with the provincial LGU and the private sector (Malalag Ventures Plantation, Inc. and Lapanday Development Corporation)

Malalag

- Organization of FARMCs and *Bantay Dagat*
- Establishment of fish sanctuary
- Appointment of MBA-PAIC coordinator
- Effective coastal law enforcement program
- Implementation of pollution control and existing ordinances

Padada

- Functional marine sanctuary
- Organization of FARMCs, DPW and *Bantay-Dagat*
- Strict implementation of fishery ordinance

Sta. Maria

- Enforcement of laws against illegal fishing: dynamite, poisoning, and unprescribed fishing gear
- Engagement of fishermen in aquaculture development (e.g., seaweed project jointly implemented with Regional Fishermen's Training Center)
- Implementation of the clean-and-green program of the government

Sulop

- Oyster culture and milkfish production
- Organization of BFARMCs and MFARMCs
- Strict enforcement of fishery laws and ordinances
- Regular patrol boat monitoring operation in Sulop municipal waters

SUMMARY

Malalag Bay typifies a once-rich ecosystem now ravaged by the misuse and abuse of the people who live and profit from the bounty of the sea. The resource and environmental issues of immediate importance for Malalag Bay management are the incidence of destructive fishing and overfishing. Intense exploitation of marine resources has caused the degradation of the coastal environment of the MBA. Malalag Bay's live corals once covered 1,134 ha — this area has been reduced to a mere 113 ha, primarily because of the prevalence of illegal fishing practices, siltation, deforestation, chemical wastes from agriculture and fishponds, and occasional oil spills from docked vessels and motorized fishing boats. To reverse the trend, the government has imposed a ban on compressors, established a fish sanctuary in a 50-ha area, promoted mangrove planting, and intensified public information including an anti-littering ordinance.

Given the management issues and opportunities as discussed in this chapter and the value of resources at stake, appropriate planning for sustainable management is the only alternative for maintaining the viability of the MBA. The plan shall analyze the important issues, the status of the resources, and management opportunities and synthesize this information into actions necessary to halt the degradation of the MBA and its resources. It should be an integrated plan which can only be effective if management is implemented in an integrated manner with strong political support.



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COASTAL RESOURCE
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DEPARTMENT OF
ENVIRONMENT AND
NATURAL RESOURCES



UNITED STATES AGENCY
FOR INTERNATIONAL
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