Coastal Environmental Profile of

Sarangani Bay Area

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COASTAL ENVIRONMENTAL PROFILE
OF THE
SARANGANI BAY AREA
MINDANAO, PHILIPPINES

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Coastal Resource Management Project

of the

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ACRONYMS and ABBREVIATIONS

BFAR	Bureau of Fisheries and Aquatic Resources
BIMP-EAGA	Brunei, Indonesia, Malaysia, and Philippines-East ASEAN Growth Area
CENRO	Community Environment and Natural Resources Office
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
ENRO	Environment and Natural Resources Office
FARMC	Fisheries and Aquatic Resources Management Council
GSC	General Santos City
GSTTEOI	General Santos Traders and Tuna Exporters Organization
GT	gross ton
ha	hectare
km	kilometer
km^2	square kilometer
LBII	Louis Berger International, Inc.
LGU	local government unit
lps	liters per second
m	meter
mg/L	milligrams per liter
MGP	Mindanao Growth Plan
ml	milliliter
MPDO	Municipal Planning and Development Office
mt	metric ton
NGO	nongovernment organization
NIPAS	National Integrated Protected Areas System
PAMB	Protected Area Management Board
PCG	Philippine Coast Guard
PCRA	Participatory Coastal Resource Assessment
PENRO	Provincial Environment and Natural Resources Office
PNP	Philippine National Police
RA	Republic Act
SOCOPA	South Cotabato Purse Seiners' Association
SOCSKSARGEN	South Cotabato-Sultan Kudarat-Sarangani-General Santos City
SUML	Silliman University Marine Laboratory
t	ton
USAID	United States Agency for International Development
UFLA	Umbrella Fish Landing Association

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- Malapatan
- Glan
- Maasim
- Kiamba
- Maitum

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General Santos City Agriculture Office
General Santos City Environment and Natural Resource Office
Provincial Planning and Development Office
Provincial Environment and Natural Resource Office
Provincial Agriculture Office
Bureau of Fisheries and Aquatic Resources (BFAR)
Department of Environment and Natural Resources (DENR) Regions XI and XII
National Statistics Office
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Mr. Bayani Fredeluces, Technical Assistant, Coastal Resource Management Project, Sarangani Province

FOREWORD from the GOVERNOR

As early as 1993, Sarangani Province had assumed the lead role as guardian and overseer of Sarangani Bay. Sometime later, this was acknowledged or affirmed by General Santos City, South Cotabato, and Sultan Kudarat by virtue of a gestured designation.

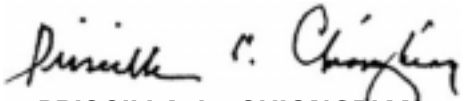
Since then, we have implemented various projects, some of which were carried out with the valued assistance from the United States Agency for International Development (USAID) through the Coastal Resource Management Project (CRMP) of the Department of Environment and Natural Resources (DENR).

The publication of the *Coastal Environmental Profile of the Sarangani Bay Area* will surely help planners, project implementors, and our people as well to forge additional means by which our coastal resources will be effectively managed for sustainable use.

Indeed, this is a welcome and very refreshing development as we move on in our efforts in integrated coastal management. We now take hold of the updated information regarding issues and concerns affecting the bay and this serves as an indispensable tool for future course of action.

It must have been a very straining experience for researchers to come up with this profile. The result is undeniably of tremendous significance—certainly of so much value to all of us whose lives are inevitably connected with the bay's ecosystem.

To all the men and women responsible for the Sarangani Bay Profile, my sincere appreciation and heartfelt gratitude!



PRISCILLA L. CHIONGBIAN
Governor
Sarangani Province

FOREWORD from the MAYOR

Studies and research on the degradation of our coastal habitats and coral ecosystems reveal alarming reports and figures. These statistics are instruments through which the ocean conveys its message. Our seas are crying and we should listen intently to its anguish, or we will wake up one day and hear no more of its cries, because our seas will have dried up.

The Local Government of General Santos City has responded to this juncture with a positive note. Several marine protection programs have been instituted to ensure the sustainability of marine resources. This is the city's modest way of paying homage to the seas for the abundance it has offered. For example, regular funding has been given to the Mangrove Rehabilitation Project in the three coastal *barangays* of the city: Barangays Bula, Baluan, and Buayan. The mangrove habitat has now broadened to 7 hectares. This project is in collaboration with the Coastal Resource Management Project, the Department of Environment and Natural Resources, Bayside Fishermen's Association, and youth clubs from the city's colleges.

Other important marine preservation programs include: the establishment of a fish sanctuary and marine reserve in Barangay Bawing which aims to regenerate fish stocks in the Sarangani Bay and the deputization of fish wardens and the organization of *Bantay Dagat*, which are 2 surveillance and monitoring efforts to control illegal fishing thereby properly implement fishery laws. These projects have been allocated regular funding from the city's Local Development Fund.

I always emphasize the critical importance of a holistic management approach, by preserving and protecting our natural resources, our marine ecosystem for that matter is the fundamental element. Sustainable development is about building a world we can bequeath to our children. The essence of the Sarangani Bay Profile is our regard for sustainability and survival.

If we are resolute in our environmental preservation and protection drive, let us by all means, give conviction to this responsibility. Let us make our ocean breathe again. As Sarangani Province says, "Bring back the fish, bring back the trees, bring back life." Our sea is life itself. We have to co-exist with this life, otherwise, woe will be unto us.

Let this excerpt of a poem from a Burmese book spur hope and incite action:
"Water is far from a simple commodity, water is a sociological complexity... water is life ..."

ADELBERT W. ANTONINO
Mayor
General Santos City

PREFACE

The *Coastal Environmental Profile of the Sarangani Bay Area, Mindanao, Philippines* provides baseline information about the coastal environment of the Sarangani Bay Area and is intended to assist with management planning at the municipal and *barangay* levels within the Sarangani Bay Area. It can also serve as a guide for other coastal municipalities in Sarangani and South Cotabato.

Coastal management problems identified in the Sarangani Bay Area are typical of fast developing coastal areas. Most land areas have been converted to agriculture and fishponds, and very little of the coastal land retains natural vegetation. As a result, the bay suffers from sedimentation. High fishing pressure has also been noted, and there are reports of the use of toxic substance and fine mesh nets, as well as the catching of juvenile fishes in some areas.

The unique biodiversity values of its tropical rainforest and the marine environment make the protection of this integrated ecosystem an urgent task. The Sarangani Bay Area is one of the few areas where endangered marine mammals like the *dugong* (sea cow) and whales are found. The bay is also lined with important coral reef and mangrove habitats that add tremendously to the natural productivity of the bay.

This profile is produced as part of the activities of the Coastal Resource Management Project (CRMP), implemented by the Department of Environment and Natural Resources (DENR), and funded by the United States Agency for International Development (USAID) which aims to develop and encourage leaders among local communities, nongovernment organizations (NGOs), and 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 reached by involving the entire affected community, resource users, local and regional government, NGOs, and the private sector. The aim is to promote an integrated coastal management approach that focuses on sustainability in coastal resource use, and minimizing the direct impacts on coastal resources from fishing, aquaculture, and tourism.

The integrated approach of participatory coastal management for the profile area has proven successful in other areas of the Philippines, and in other Asian countries. This approach depends on the dynamic action of community groups with local and national government agencies responsible for resource utilization in the area. This management 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 Sarangani Bay Area.

COMMONLY USED LOCAL TERMS

Local Terms	English Translation
FISHING GEAR	
Baling	Beach seine
Basnig	Bag net
Bobo	Fish trap or fish pot
Bubo (pangnokos)	Squid trap
Bunsod	Fish corral
Hulbot-hulbot, sinsuro, baling	Trawl
Pahubas, lam-ba, ta-an, pahangga	Bottom set gill net
Palangre, pamirit, undak	Multiple hook and line
Palaran, pokot, patuloy	Gill net
Pamante, pamangsi	Drift gill net
Pamariles, pahawin, bira-bira	Long line
Pana, dimano, pusil-pusil	Spear gun
Panonton, latak, pasol, lagdong, patungkad, pahawin, pataw-pataw, palaran	Single hook and line
Pukot	Fine mesh net
Sadyap, sudsud	Push net
Sikpam	Scoop net
Sinsuro, likom	Ring net
FISH	
Abo	Rockfish, scorpionfish
Alibangbang	Butterflyfish
Aluman	Emperor
Amag	Anchovy
Amag-amag	Right-eye flounder
Anduhaw	Mackerel
Aso-os	Whiting
Ati	Pomfret
Baga	Soldier fish
Baga-baga	Squirrelfish

Local Terms	English Translation
Bagis	Unicornfish
Bagisan	Surgeonfish
Balaki	Goatfish
Bangsi	Flying fish
Bangus	Milkfish
Bantol	Scorpionfish
Bariles	Tuna
Bat-og	Saurie
Ba-ulo	Jack
Bawak	Mullet
Bayang	Batfish
Bilason	Fusilier
Bilong-bilong	Moonfish
Biyad	Tuna
Bokadolse	Threadfin
Bodboron	Tuna
Bodlotan	Scorpionfish
Bolan	Tarpon
Bolinao	Anchovy
Borot	Scad
Bucao	Scorpionfish, big-eye
Bugaong	Tigerperch, therapon
Bulan-bulan	Moonfish
Bulao	Scad
Bulgan	Big-eye
Caraballas	Mackerel
Dalagang bukid	Fusilier
Dali	Sole
Danggit	Rabbitfish
Dapak	Pomfret
Datu	Big-eye
Dayang	Pomfret
Diwit	Hairtail, scabbardfish
Dugho	Swordfish
Ganting	Squirrelfish
Gapas/gapas-gapas	Monocle bream
Gisaw	Mullet
Haan	Snapper
Haol	Herring
Haol-haol	Pilchard
Hasa-hasa	Mackerel
Hinok	Goatfish
Hito	Catfish

Local Terms	English Translation
Ibis	Glassperch
Ilak	Rudderfish
Indangan	Surgeonfish
Ito	Catfish
Karao	Tuna
Katambak	Emperor, surf bream, snapper
Kawa-kawa	Wahoo
Kitang/kikiro	Scat
Kubal-kubal	Scad
Labayan	Wrasse, rainbowfish, tamarin
Lagao	Threadfin bream
Langkoy	Hairtail
Lapis	Mackerel
Lapu-lapu	Grouper, rockcod, seabass
Lawong	Scorpionfish
Latab	Mojarra
Libgao	Anchovy
Liplipan	Billfish, bailfish
Lipte	Sweetlip, grunt
Lupoy	Herring
Malaguno	Scad
Malapati	Scad
Malmal	Scad
Mamsa	Jack
Marang	Marlin
Maya-maya	Snapper
Mol-mol	Parrotfish, wrasse
Mongit	Surgeonfish
Moong	Cardinalfish
Naniw	Halfbeak
Pakol	Triggerfish
Pagi	Stingray
Palad	Dusky sole
Palata	Lanternfish
Pandawan	Dolphinfish
Pata	Damselfish
Pina	Escolar
Pirit	Tuna
Pugot	Triggerfish
Rolyete	Amberjack
Rompe	Barracuda
Saging-saging	Grouper
Sagisihon	Snapper
Sagoksok	Barracuda
Salanga	Devil ray
Salingukod	Whiptail
Salmon	
Sambagon	Tuna
Sapsap	Ponyfish
Sihag-sihag	Anchovy
Sihagan	Anchovy
Silay	Threadfin bream
Solid	Fusilier
Suwasid	Halfbeak
Tabangko	Sillago
Talakitok	Trevally, scad
Tamban	Sardinella, herring
Tanguigue	Mackerel, wahoo
Tatabal-tabal	Saddlegrunt
Tilapiang-dagat	Tripletail
Tiki	Lizardfish, snakefish
Tigi/tigi-tigi	Jobfish
Turnos	Herring
Timbungan	Goatfish, sweeper
Tugnos	Anchovy
Tulay	Scad, flying fish
Tulingan	Tuna
Ubod	Moray eel, conger
Una	Mackerel

CRUSTACEANS

Banagan	Spiny lobster
Kasag	Crab
Hipon	Shrimp
Lambay	Crab
Lokon	Prawn
Ulang	Shrimp

MOLLUSKS

Kubotan	Octopus, cuttlefish
Kugita	Octopus
Labayan	Cuttlefish
Lumagayan	Bigfin squid
Nokos	Squid
Pusit	Squid
Tabugok	Octopus

GLOSSARY of TERMS

Beach seine. This net measures 50-200 m long x 1-5 m deep, with a mesh size of >3 cm. Four to 8 persons in a motorized or non-motorized *banca* use this at an average of 1 operation per day, 5 days per month. The fishing area is 50-100 m from the shoreline at 10-20 fathoms. When a school of fish is detected, a *banca* lays out the net to form a C facing the shore to half-enclose the fishes. Fishermen slowly pull the ends of the net on the shore so that the fishes are driven into the bag (pocket). Upon reaching the shore, the fishes are picked from the bag.

Bottom set gill net. This gear uses nylon size #4, #6, #8, or #10 weaved into a net. The length may vary, but the depth is often 1.5 m only. It is used in shallow waters close to shore, usually in mangrove, seagrass, and coral reef areas. Floats are attached to the top of the net and sinkers at the bottom so that the net stays open in the water with the bottom touching the substrate. Its operation requires 1-2 people only. The net is left for an average of 3 hours after which it is hauled out of the water.

Crab or lobster trap. This is made up of bamboo or wire traps used to catch crabs or lobsters. Soaking time is a few days to a week.

Drift gill net. This is a long net line ranging from 200 to 16,000 m (16 km) long and 2-3 m deep that "drifts" in open waters. The mesh size ranges from 4.5 to 10 cm made of filament size #4. This gear is used with a big motorized "motherboat" and 10 other smaller boats requiring 2-6 persons to operate.

Fine mesh net. This net is made of nylon (filament #4), with length ranging from 139 to 205 m, depth of 18-31 m, and mesh size of 8 cm. Two people operate this gear.

Fish corral. The fish corral or fish pen is made of bamboo poles or brush set on the substrate in shallow waters (5-20 fathoms) to form a circle or square pen surrounded with nets. This is placed usually 20 m from the lowtide line, and shaped to direct the voluntary movement of fishes into the enclosure (Umali 1950). The opening to the corral faces the shore. This requires 12-30 persons to build and ownership is often communal. When fishes have accumulated inside, these are harvested using some other gear type, usually gill or lift net.

Fishing with light. This is used to refer to any type of fishing done at night with the aid of a petromax (kerosene) lamp. The fishes are attracted to the light and gather around the fisher or the *banca* and then can be easily caught with a spear gun or with a scoop net.

Fish trap or fish pot. This is a rectangular bamboo or wire trap used to catch demersal fishes. Soaking time is 1 week.

Gill net. This net is made of a nylon, synthetic fiber or cotton twine #4, #7, #8, or #10. It measures 30-50 m long and 1-2.5 m deep. The sinkers are light so that the net floats in mid-water following the current direction. One to 3 people are needed to operate this gear. This is left in place usually overnight for an average of 8 hours in 3-28 fishing days.

Jigger. There are various modifications of this gear based on the bait used and target species caught. The *saranggat* is made up of a 30-m nylon line (size #4-12) and a bunch of stainless steel hooks (#1-24) arranged with the spikes directed outwards. The hooks are painted white in order to attract red squids (*lumayagan*) which are its target (and only) species. Thus, these are also commonly called squid jiggers. *Kati* or *hayungkong* resembles the *saranggat* in appearance but uses for bait a black cloth and stones fashioned to resemble an octopus, a crustacean, or shrimp (*kauongkong*). This is often used at night with a light. The line is jerked up and down which

attracts octopus and cuttlefish. As this gear is very specific, fishers may not be able to catch squids when these are not in season.

Lift net. Like the scoop net, the lift net is also used together with other gear, usually the ring net and operating from a boat. It is used to transport fishes encircled by the ring net, out of the water into the boat. This net is 4-100 m long and 5-27 m deep and has a small mesh size of 76 mm.

Long line. The *pahawin* is a long line measuring 200 m and is usually kept rolled around a bamboo tube. A large (size #13, #14, #15, or #17) baited hook is attached at the end of this line. A lead sinker attached to the secondary line keeps the line at the bottom. This gear is towed at depths of 100-200 fathoms for 14-18 hours, usually from late afternoon up to early or mid-morning of the following day, by 1 to 2 persons on a motorized boat.

The ***bira-bira*** is used in deep-sea fishing, often with the tuna handline because its target species, which are scads, are used for tuna bait. The long line is 100-300 m long, made of #130 or #160 nylon for the mainline, and #15 nylon for the secondary line. A sinker and colored crystalet bait are attached before the secondary line. One or more hooks size #15 or #19 are used. The line is suspended at depths of 100-200 fathoms, 1-5 km from the shoreline.

Multiple hand line. This is a single vertical line with a series of small barbed hooks attached to it by "spreaders" spaced at regular intervals.

Multiple hook and line. The *undak* is a line with 50-150 hooks attached 1 m from each other on the secondary line, of any or a combination of the following hook sizes: #569, #572, or #571. The gear is towed at 20-30 fathoms in pelagic waters. The *palangre* is a long filament line (thus may also be classified under long lines) measuring from 800 to 2,000 m and uses from 100 to 800 of hooks of any of the following sizes: #15, #565, #567, or #568. Bait is placed at every hook. This contraption is suspended near the bottom at depths of 3-5 fathoms and is allowed to stay from 14 to 18 hours before it is brought in.

Pull or drag net. This net catches fish by horizontally pulling or dragging the gear.

Push net. The push net is a fine mesh net (similar to mosquito netting) used to catch *bangus* (*Chanos chanos*) fry. This is approximately 1 x 5 m, attached at both ends to a bamboo pole, and is pulled by 2 persons parallel to the shoreline. Another modification of the push net has dimensions of 10 m in length, 4 m in width, and 3 m in depth, and has a mesh size of 0.5 cm.

Rentex. This is a fishing line with bunch of colored fine threads at the end serving as bait. Two to 5 people slowly drag this from a non-motorized boat. Belonid fishes are the target species of this gear type.

Ring net. This net combines the features of a round haul seine (which has a bunt at the center and is flanked by 2 wings) and purse seine (Umali 1950). This is made of nylon of filament size #2-12 measuring 30-40 m long x 2-16 m wide x 2-93 m deep, and has a mesh size of about 10 cm. The bottom of the net touches the substrate and may do damage when it scours the bottom as the net is hauled in. This gear is heavy, and its use requires a manpower of 9-14 persons. The ring net is used to encircle schools of pelagic fishes such as scads, mackerels, tunas, and sardines.

Scoop net. Scoop nets generally have a mesh size of 0.2 cm. Scoop nets are oftentimes used together with ring nets or gill nets to scoop out the fishes encircled by these gear or these may be used at night with a petromax lantern that attracts fishes.

Seine net. This is a net with a bunt or bag, flanked at each side by quarters or wings. The gear is positioned as to encircle a shoal or school of fish and the catch is hauled toward the shore or a boat.

Set line. This is a long line oriented horizontally in midwater from which many hooks are suspended vertically close to the substrate. This gear is anchored to the bottom so it does not move with the current. The length varies from 30 to 180 m and a hundred or more hooks are attached to it. This gear is specific for the belonid, *Tylosorus acus melanotus*.

Single hook and line. Gear with 1-5 hooks are classified under this gear type. There are variations of this gear based on the hook number, the size, and weight of the sinker, and modifications in the appearance and use, which are all geared towards catching specific species.

Pamariles or tuna handline is used in commercial fisheries, i.e., on fishing boats of more than 3 GT. The mainline is made of #180 nylon to which a secondary line (#120 or 130) is attached. A sinker weighing 1 kg or more is attached before the secondary line. Smaller fishes, mostly scads, are used for bait. The line is 200-800 m long and is used in pelagic waters from 100 to 300 fathoms, 15 km from the shoreline. The catch includes tuna, Spanish mackerel, marlin, and sometimes dolphins.

In ***panglatak***, a size #21 hook is used. Crystalet or cellophane strips (*limbag*) are used as bait for species such as mackerel, jacks, and other scombrids. This gear is used at depths of 30-50 fathoms.

The ***paniwit*** uses 1 to 2 hooks of sizes varying from #9 to #14 and #21, attached on a single nylon line #130 or #160 that is about 300-600 m long. A sinker (*tulawog*) weighing less than 1 kg is attached to a secondary line of nylon #30. The target species are hairtails (*Trichiurus* spp).

Skylab. This is a relatively new device for fishing. It is made of a net, with 2-cm mesh size, attached at a steel ring of 1.5-2 m diameter. Bait is made to settle on the substrate at the center of the net. When fishes concentrate at the center to feed on the bait, the net is pulled up quickly. One to 2 fishers are needed to operate the skylab.

Spear gun. There are 2 versions of this gear — the *pana* or spear gun and the *diman* or harpoon. The former is fashioned like a gun with rubber band or spring to trigger a sharpened 1-3 m long steel shaft. The latter is a straight steel rod with a 3-pronged end and is hurled toward the fish. Oftentimes, the spear gun is used in *hookah* or compressor fishing wherein a fisher breathes air from the surface through a long tube, thus permitting him to stay longer underwater.

Squid trap. This is a bamboo or wire trap fashioned into a square used specifically for catching squids. Mangrove branches are laid in 5-7 fathoms of water for squids to lay their eggs on. These are then placed inside the trap in order to lure the squids. The soaking time is aproximately three weeks from the full moon to the last quarter.
Trawl. This gear is used within 100 m from the shore and catches all species and all sizes of fish swept along its path as it is dragged along the sea bottom. It also destroys seagrass and coral reef areas. The use of trawl within the bay is considered illegal.

Troll line. The local name for this gear is *subid*. A troll line is composed of a single hook (size #9 or #10) attached to a 120-200 m nylon (filament size #50-160) with a sinker. It is pulled either by a motorized or non-motorized *banca* at 15-40 fathoms, often near fish shelters (*payao*).

Chapter 1
INTRODUCTION

LOCATION

The Sarangani Bay Learning Area of the Coastal Resource Management Project (CRMP) is composed of 6 municipalities and 1 chartered city. These are:

- Alabel
- Glan
- Kiamba
- Maasim
- Maitum
- Malapatan
- General Santos City

The area is located in southeastern Mindanao between 5°33'25"-6°6'15"N and 124°22'45"-125°19'45"E. Figure 1.1 shows the location of the profile area.

General Santos City (GSC) divides the Sarangani Province municipalities, with 3 municipalities on each side of the city. In this setup, GSC serves as the venue of commerce and trade of the surrounding municipalities, while Sarangani Province serves as the provider of agricultural products and manpower needs of the city. Sarangani Province is composed of the municipalities of Alabel, Glan, Kiamba, Maasim, Maitum, Malapatan, and Malungon. However, the Municipality of Malungon is landlocked. GSC is a chartered city belonging to the First Congressional District of South Cotabato.

The area forms part of South Cotabato-Sultan Kudarat-Sarangani-General Santos (SOCSKSARGEN). SOCSKSARGEN is the name for the current development and economic support package provided by the national government and foreign assistance

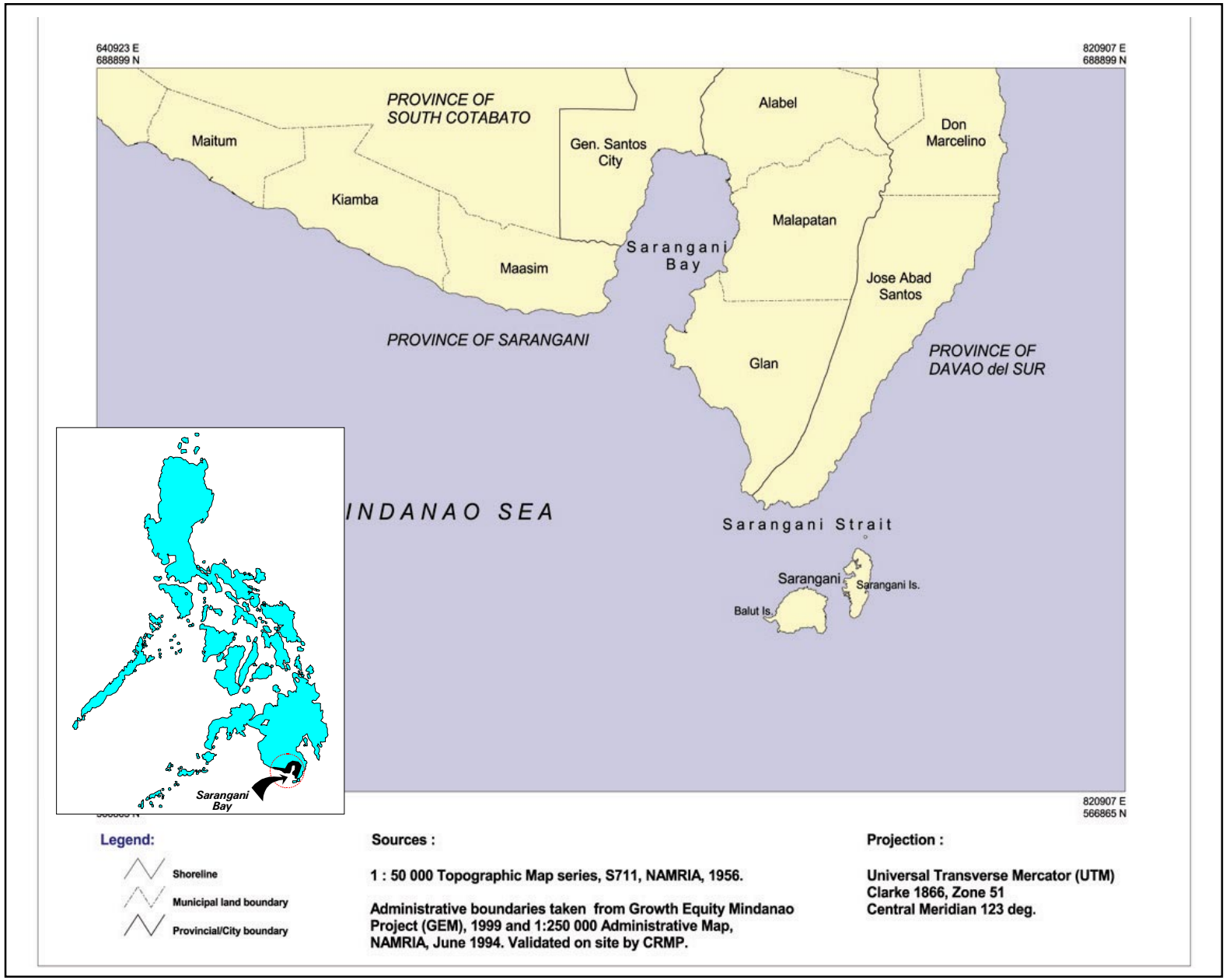


Figure 1.1. Map of Sarangani Bay.

groups. The area was identified as an alternative regional growth center based on its economic potential. In 1988, the United States Agency for International Development (USAID) undertook the funding and commitment to develop the area. Over the years, USAID has given over US$200 million. Aside from this, the area also forms part of the Brunei, Indonesia, Malaysia, and Philippines-East ASEAN Growth Area (BIMP-EAGA). GSC is the nearest Philippine city to BIMP-EAGA, and is being eyed to serve as a hub for various investors entering the BIMP-EAGA market.

SHORT DESCRIPTION OF THE AREA

The entire profile area, with the exception of GSC, is mostly agricultural land. Each municipality has its own product. The most dominant crops produced are banana, coconut, corn, and rice. Aside from agricultural land crops, the area is the center of tuna fishing industry in the country. The newly built fish port situated at Tambler, GSC further improves the handling and transport of fishery products for domestic and international needs.

The coastal areas of the province and city have varied features. Some areas have clean and nice beaches particularly those towards the mouth of Sarangani Bay. Others are fringed with mangrove and coral reefs and some areas have a rocky shoreline. The coastal waters are oceanic in origin, clear and warm.

The whole area has fair weather condition throughout the year. There are no very distinct dry and wet seasons. Rainfall is fairly evenly distributed throughout the year with slightly more rainfall during the southeast monsoon (June to September). The area is safe from typhoons. It is situated near a dormant volcano (Mt. Matutum).

The economy of the profile area, particularly GSC, is growing very rapidly. Trade and investment will continue to grow due to the various infrastructure improvements that have taken place. By 1994, the commitment for infrastructure projects in GSC stood at PhP4 billion. Exports in the area increased by 80 percent in just 4 years (from US$110 million in 1990 to US$198 million in 1994). Since 1996, export value has reached US$228 million. Primary exports include canned tuna, coconut oil, pineapple products, asparagus, bananas, shrimp, copra pellets, frozen and fresh tuna and other fish, and cut flowers.

GSC accounts for the second largest total daily fish landings in the country. It is the leading producer of sashimi grade tuna. This is because of a major tuna migration corridor in the Celebes Sea that has helped the city in its development as a fish processing and exporting center.

Due to the increase in development in the area, the population is also growing more rapidly than the national average. Details are discussed in Chapter 4.

HISTORICAL BACKGROUND

Sarangani Province dates back to the turn of the 15th century when Sarip Kabungsuan of Arabia arrived in Cotabato to introduce Islam. In 1914, the first batch of Christians settled in Glan and peacefully intermingled with the ethnic inhabitants of the province. In 1920, the first Ilocanos reached Kiamba. Between 1914 and 1934, settlers from Luzon and the Visayas began to open the vast lands in the area. Sarangani Province was initially part of South Cotabato, until 1992 when Republic Act (RA) 7228 created the Province of Sarangani. The name Sarangani is derived from a legendary sailor and warrior who lived in an island near the bay. According to legends, he frequently sailed across the bay to the Sultanate of Buayan, a stronghold of the Maguindanaos. His friendship and courage earned the respect of the Maguindanaos so they named the bay after him.

GSC and Sarangani Province have historical similarities primarily because they are in the same area. In 1939, General Paulino Santos, Sr. led 62 settlers under the National Land Settlement Administration's Social Justice Program for Filipino Farmers into the shores of Sarangani Bay. In 1948, RA 82 created the Municipality of Buayan. Six years later, in 1954, the Municipality of Buayan was renamed General Santos through RA 1107. On 8 July 1968, the Municipality of General Santos was converted to General Santos City through RA 5412.

Coastal resource management (CRM) in the area is still in its early stages. The Mindanao Growth Plan (MGP) identified the important coastal resources in the area and determined the main causes of depletion. In 1993, MGP completed a Coastal Area Management Framework Plan for Sarangani Province and GSC. The plan emphasized the active participation of local officials and the community in order to protect and conserve the resources of the bay. CRMP has built on this framework plan to prepare a comprehensive CRM plan.

Present data reveal that nearly half of the dipterocarp forest has been damaged or converted into agricultural land. In addition, more than half of the coral reef area has been damaged due to destructive fishing practices. Based on Department of Environment and Natural Resources (DENR) reports, more than half of the present mangrove forest has been damaged or converted into fishponds.

SUMMARY OF ISSUES

The issues related to integrated coastal management confronting the profile area can be categorized into 3 major issues:

- Environmental quality issues
- Resource exploitation issues
- Legal, institutional, and administrative issues

Sarangani and GSC have been targeted for rapid development. With development comes accompanying problems. Part of the environmental quality issue and one of the major problems is sedimentation. According to persons interviewed, this mainly comes from the upland areas and is due to destructive agricultural practices, illegal logging, and mining operations. This is further discussed in Chapters 2 and 7.

Another issue affecting the area is pollution from domestic wastes. Most coastal households do not have proper waste disposal systems. This contributes to the pollution in the bay. Another issue is industrial pollution. Fish canneries in GSC have been a source of complaint from residents. Pollution management appraisals conducted in 1993 and 1994 have also shown that most of the fish canneries do not have adequate wastewater treatment systems. DENR analysis has shown that discharges from these facilities do not meet the government standards for Sarangani Bay. These issues are discussed further in Chapter 7.

A major issue concerning resource exploitation is the encroachment of commercial fishers in municipal waters. This issue has legal and jurisdictional aspects. Various agencies at the national and local government level are joining hands to solve this problem. Other issues involving resource exploitation include destruction of coral reefs and mangroves, illegal fishing (such as the use of fine mesh nets and dynamite and cyanide), and overfishing.

Although Sarangani Bay was proclaimed as a protected seascape, thereby making it a part of the National Integrated Protected Areas System (NIPAS) of DENR, there seems to be little change in the current management of the bay. This is the main legal, institutional, and administrative issue. Currently, DENR has general administration of Sarangani Bay, but the coastal users believe that DENR is not focusing enough attention on Sarangani Bay as a protected seascape. They point to the fact that the Protected Area Management Board (PAMB) has been very unwieldy as a management group, because of the large number of members. In most cases, the PAMB has not been able to form a quorum.

As in most parts of the Philippines, enforcement of laws is very weak. Sarangani Province and GSC are no exception. In some cases, apprehension has been successful, but the prosecution of the offender is a problem. Details of all the issues are discussed in Chapter 7.

OBJECTIVES

The compilation of this profile for Sarangani is one of the steps taken by CRMP in the formulation of a CRM plan. The profile provides detailed background information and baseline data on Sarangani Bay and the local government units (LGUs) in the profile area. It provides broad information on the physical features, natural resources,

sociopolitical affairs, the local economy, laws and legal framework related to coastal resources and environment, and the prevailing issues and opportunities.

Information was based on various sources, primarily from secondary published and unpublished literature, including the Participatory Coastal Resource Assessments (PCRA), as well as interviews with key players in CRM in Sarangani Bay.

The specific objectives are to:

- Provide baseline information on the Sarangani Bay profile area;
- Determine actual and current conditions of coastal resources in Sarangani Bay;
- Educate readers about the need for CRM in Sarangani Bay and motivate them to take part in CRM;
- Identify additional studies needed or information not currently available, and the next steps that need to be taken;
- Identify the present issues and problems in CRM;
- Determine the present coastal management programs being undertaken by the province, the coastal municipalities, and the city.

SCOPE

The scope of this profile includes the 6 coastal municipalities of Sarangani Province (Alabel, Glan, Kiamba, Maasim, Maitum, and Malapatan) and GSC.

The physical features of the area are discussed in Chapter 2 and these include information on land area, topography, hydrology, soil, land uses, and climate. The natural resources are discussed in Chapter 3 and include mineral resources, forest resources, and coastal resources. Coastal resources are discussed in detail including mangroves, seagrass, corals, seaweeds, fisheries, beaches, and endangered species.

The sociopolitical setting is discussed in Chapter 4. It includes information on the political and administrative boundaries in the profile area, on the area's demography, and growth rate. It also includes age and gender composition, education, labor and employment, income, religion and ethnic groups, dialects, health, sanitation and medical care, settlements (type and ownership), roads, transportation and communication, and other related infrastructure or support systems. When data on coastal areas are lacking, provincial or municipal data are used instead.

Chapter 5 discusses the economy and focuses on coastal-related issues. Topics include fisheries, tourism, industries, agriculture, and forestry. Information on these industries includes the types and location, number of employees, revenues generated, and its social, cultural, and environmental impact.

The institutional and legal framework is discussed in Chapter 6. This includes the current state of the Philippine coastal zone laws. It also discusses the structure of the LGUs down to the *barangay* level. Details of development plans, activities, and projects related to fisheries and other coastal resources are included. Information on the funding for these projects, as well as the budget allocated for coastal activities is also provided.

Chapter 7 discusses management issues and opportunities broken down into environmental, economic, and political and institutional categories.

MAITUM FACTS AND FIGURES

Barangays (19): Bati-an, Kalaneg, Kalaong, Kiambing, Kiayap, Mabay, Maguling, Malag (Pob.), Mindupok, New La Union, Old Poblacion (Maitum), Pangi (Linao), Pinol, Sison (Edenton), Ticulab, Tuanadatu, Upo (Lanao), Wali (Kambuhan), Zion

Coastal *Barangays* (7): Kalaong, Kiambing, Mabay, Maguling, Mindupok, Old Poblacion (Maitum), Pinol

Total Land Area: 324.4 km^2

Coastal Land Area: 66.9 km^2

Length of Coastline: 25 km

Total Population: 35,009

Population of Coastal *Barangays*: 15,472

KIAMBA FACTS AND FIGURES

Barangays (18): Badtasan, Datu Dani, Gasi, Kapate, Katubao, Kayupo, Ling (Lumit), Lagundi, Lebe, Lomuyon, Luma, Maligang, Nalus, Poblacion, Salakit, Suli, Tablao, Tamadang, Tambilil

Coastal *Barangays* (13): Datu Dani, Katubao, Kayupo, Ling (Lumit), Lagundi, Lebe, Lomuyon, Luma, Nalus, Poblacion, Salakit, Suli, Tambilil

Total Land Area: 418.2 km^2

Coastal Land Area: 262.6 km^2

Length of Coastline: 39.6 km

Total Population: 39,717

Population of Coastal *Barangays*: 32,217

ALABEL FACTS AND FIGURES

Barangays (12): Alegria, Bagacay, Baluntay, Datal Anggas, Domolok, Kawas, Maribulan, Pag-Asa, Paraiso, Poblacion (Alabel), Spring, Tokawal

Coastal *Barangays* (3): Kawas, Maribulan, Poblacion (Alabel)

Total Land Area: 540.5 km^2

Coastal Land Area: 42.1 km^2

Length of Coastline: 12.1 km

Total Population: 46,527

Population of Coastal *Barangays*: 21,639

MALAPATAN FACTS AND FIGURES

Barangays (12): Daan Suyan, Kihan, Kinam, Libi, Lun Masla, Lun Padidu, Patag, Poblacion (Malapatan), Sapu Masla, Sapu Padidu, Tuyan, Upper Suyan

Coastal *Barangays* (6): Lun Masla, Lun Padidu, Poblacion (Malapatan), Sapu Masla, Sapu Padidu, Tuyan

Total Land Area: 840.0 km^2

Coastal Land Area: 463.8 km^2

Length of Coastline: 15.3 km

Total Population: 47,911

Population of Coastal *Barangays*: 30,747

MAASIM FACTS AND FIGURES

Barangays (16): Amsipit, Bales, Colon, Daliao, Kabatiol, Kablacan, Kamanga, Kanalo, Lumasal, Lumatil, Malbang, Nomoh, Pananag, Poblacion (Maasim), Seven Hills, Tinoto

Coastal *Barangays* (12): Colon, Daliao, Kabatiol, Kablacan, Kamanga, Kanalo, Lumasal, Lumatil, Malbang, Pananag, Poblacion (Maasim), Tinoto

Total Land Area: 724.4 km^2

Coastal Land Area: 376.2 km^2

Length of Coastline: 43.1 km

Total Population: 31,641

Population of Coastal *Barangays*: 27,000

GSC FACTS AND FIGURES

Barangays (26): Baluan, Buayan, Bula, Conel, Dadiangas East (Pob.), Katangawan, Lagao, Labangal, Ligaya, Mabuhay, San Isidro, San Jose, Sinawal, Tambler, Tinagacan, Apopong, Siguel, Upper Labay, Batomelong, Calumpang, City Heights, Dadiangas North, Dadiangas South, Dadiangas West, Fatima, Olympog

Coastal *Barangays* (13): Baluan, Buayan, Bula, Calumpang, Labangal, Dadiangas South, Dadiangas West, Tambler, Siguel

Total Land Area: 536.1 km^2

Coastal Land Area: 150.9 km^2

Length of Coastline: 27 km

Total Population: 377,034

Population of Coastal *Barangays*: 172,965

GLAN FACTS AND FIGURES

Barangays (29): Baliton, Batotuling, Batulaki, Big Margus, Burias, Cablalan, Calabanit, Calpidong, Congan, Cross, Datalbukay, E. Alegado, Glan Padidu, Gumasa, Kapatan, Lago, Laguimit, Mudan, New Aklan, Pangyan, Poblacion, Rio del Pilar, San Jose, San Vicente, Small Margus, Sufatubo, Taluya, Tango, Tapon

Coastal *Barangays* (12): Baliton, Batulaki, Big Margus, Burias, Cablalan, Glan Padidu, Gumasa, Kapatan, Lago, Pangyan, Poblacion, San Jose, Small Margus, Taluya, Tango, Tapon

Total Land Area: 651.5 km^2

Coastal Land Area: 220.0 km^2

Length of Coastline: 64.3 km

Total Population: 73,768

Population of Coastal *Barangays*: 45,810

Chapter 2
PHYSICAL FEATURES

LAND AREA

The Sarangani Bay Learning Area is composed of municipalities in Sarangani Province and GSC. Sarangani Province is composed of 7 municipalities: Alabel, Glan, Kiamba, Maasim, Maitum, Malapatan and Malungon. All are coastal municipalities except for Malungon. The profile area has a total land area of 4,035.10 km^2 and a coastline of 226.4 km from Pinol Point in Maitum to Tinaca Point in Glan (Table 2.1).

Among the 7 coastal areas mentioned, Malapatan has the largest land area covering 840 km^2 (Figure 2.1), 55 percent of which forms the coastal *barangays*. However, Malapatan also has the second shortest coastline. Glan has the longest coastline at 64.3 km, while Alabel has the shortest coastline at 12.1 km (Figure 2.2). Alabel also has the smallest coastal land area at 8 percent of the total (Figure 2.3).

TOPOGRAPHY

The topographic characteristic of the profile area is from rolling to steep slope. This is due to the presence of mountain ranges found along the land borders of the area. They are Alip Range to the east and Daguma Range, Mt. Parker, and Mt. Matutum to the north. However, none of the peaks of these mountains is within the political boundary of the province and the city. The highest mountain peak, Mt. Busa, situated within the province is about 2,083 m above sea level. Mt. Matutum, with an elevation of 2,286 m, is situated in the adjacent province, South Cotabato.

Table 2.1. Habitat land area per municipality in the Sarangani Bay profile area.

	Alabel	General Santos	Glan	Kiamba	Maasim	Maitum	Malapatan
Habitats (ha)							
Sandy beach	42	470	1,438	890	444	328	99
Rocky shoreline	23	51	187		145	137	78
Inshore flat	7		297		153		43
Seagrass beds	43	105	615	263	96	149	50
Coral reef	34	284	669	459	437	300	110
Estuary	4	68	173	274	88	186	25
Mangrove	27	37	118	96	152		49
Land area (ha)							
Terrestrial							
(incl. islands)						29,019	
(excl. islands)	45,215	62,054	59,891	46,507	40,158	29,018	64,547
Marine	2,831	16,122	72,329	49,782	59,131	35,842	8,797
Length of shoreline (m)							
(incl. islands)						24,506	
(excl. islands)	10,803	30,159	66,167	36,546	44,893	24,243	18,426

Data from the Participatory Coastal Resource Assessment 1998

The lowland or flat areas with slope ranging from 0 to 8 percent are concentrated near the coast. The widest flat areas are situated in GSC (50 percent of the total land area), Alabel (24 percent), and Maitum (23 percent). Kiamba (17 percent) and Maasim (18 percent) have relatively narrow flat areas. Glan (6 percent) and Malapatan (5 percent) have the narrowest flat areas (Table 2.2).

Table 2.2. Slope classification of the coastal municipalities of Sarangani Province and GSC. All values are in km^2.

Slope classification (percent)	Alabel	Glan	Kiamba	Maasim	Maitum	Malapatan	GSC
0 to 3	98.56	33.15	59.14	50.71	68.38	46.08	190.30
Nearly level to level							
3.1 to 7						68.48	78.80
3.1 to 8	32.00	11.56	13.56	79.69	7.30		
Nearly level to undulating							
7.1 to 15						57.60	151.17
8.1 to 15							
8.1 to 18	80.64	105.38	56.32	137.64	69.82		
Undulating to rolling							
15.1 to 25						185.60	71.30
15.1 to 30							
18.1 to 30	20.48	248.58	114.24	181.11	32.35		
Rolling							
25.1 to 50						482.24	44.49
30.1 to 45							
30.1 to 50	68.43	234.32	84.96	202.84	139.48		
Rolling to steep							
45.1 >							
50.1 >	240.34	64.62	9.76	72.44	7.92		
Steep to very steep							
Total	**540.45**	**697.61**	**338.28**	**724.43**	**325.25**	**840.00**	**536.06**

Data from the City Planning and Development Office 1990; Municipal Planning and Development Office 1993; and Provincial Planning and Development Office 1994

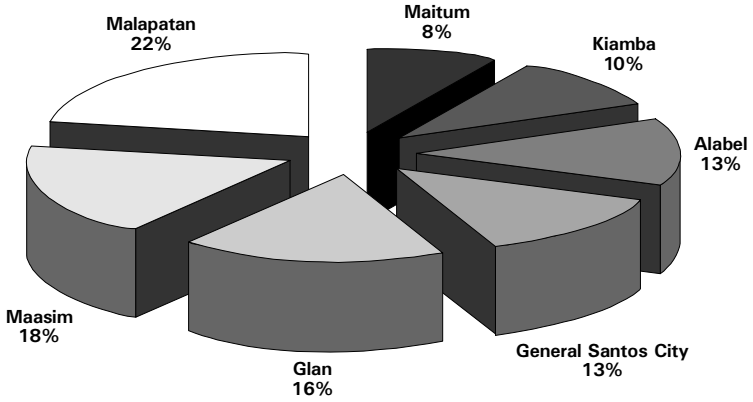


Figure 2.1. Percent land area of each municipality compared to the total land area of the profile area.

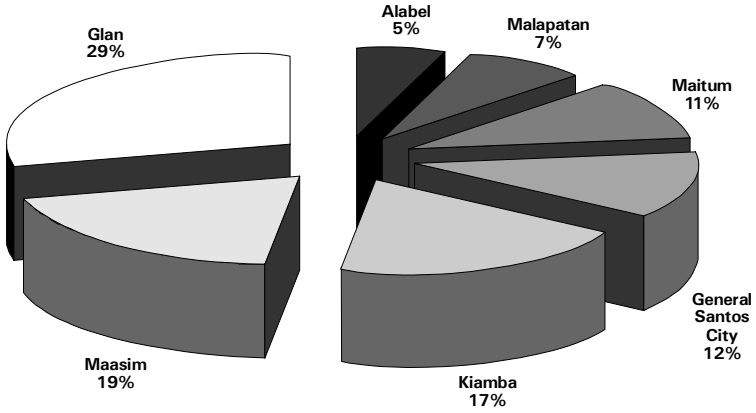


Figure 2.2. Percent of coastline per municipality/city compared to that of the profile area.

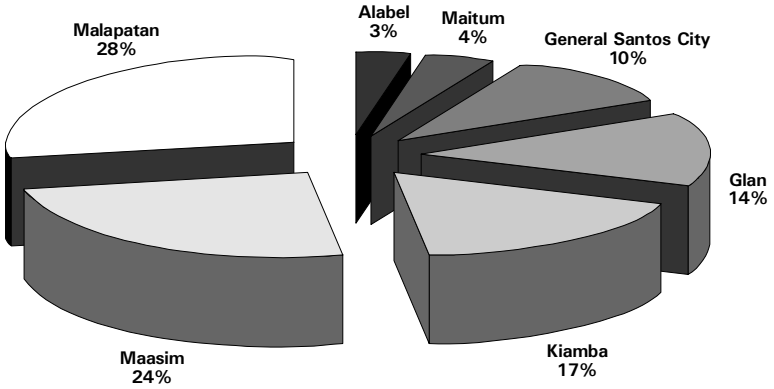


Figure 2.3. Percent coastal land area per municipality/city in the profile area.

Table 2.3. List of watershed areas in Sarangani Province.

Watershed area	Location	Area (km^2)
Kling-Nalus-Tual-Suagen	Kiamba	172.08
Lun Masla-Suyan	Malapatan	23.27
Lun Padidu-Tuyan-Malapatan	Malapatan	82.08
Margus Grande	Glan	21.00
New La Union Barangay	Maitum	0.70
Glan-Malteo	Glan	66.56

Data from the Provincial Environment and Natural Resources Office (1997)

HYDROLOGY

There are about 6 watershed areas identified in the profile area. The largest watershed area is found in Kiamba covering 4 *barangays* with a total area of 172 km^2. The municipalities of Glan and Malapatan each have 2 watershed areas with a combined area of 87 and 105 km^2, respectively (Table 2.3).

Twenty-five percent of the total water consumption of SOCSKSARGEN is supplied by Mt. Matutum. Aside from the 6 watersheds, there are 4 major watersheds which are headwaters and catchments for several important rivers including Silway, Klinan, and Buayan-Malungon which empty into Sarangani Bay through GSC; and Alabel and Taplan-Marbel Rivers which flow to Lake Buluan (Table 2.4). Most of the tributaries of Silway, Klinan, and Buayan Rivers are contributing large amounts of suspended sediment due to severe erosion caused by improper agricultural land uses in the upland areas and deforestation of Mt. Matutum.

Table 2.4. Characteristics of major watersheds.

River	Drainage area (km^2)	Length (km)	Length of catchment (km)	Average basin slope (degree)
Buayan	1,049.30	61	39.00	0.04
Klinan	114.98	27	15.00	0.08
Silway	424.18	39	21.00	16.00
Taplan	63.40	ND	16.90	0.38

ND = no data

There are about 51 rivers and 19 creeks (those that are not dry during dry season) present in the entire area. These rivers include Kraang River, Kalaong River, Siguel River, Buayan-Malungon River, Lun Padidu, Lun Masla, and Glan River. The longest river is Lun Masla River found in Malapatan with a total length of 129 km. The rest of the rivers have lengths of less than 70 km. There are 3 rivers with lengths between 50 and 70 km, 12 rivers with lengths between 20 and 50 km and 28 rivers with lengths less than 20 km (Figures 2.4 and 2.5, Table 2.5).

Table 2.5. Number of rivers and creeks per municipality in the profile area.

Municipality/ City	No. of rivers	Length range (km)	No. of creeks	Length range (km)
Alabel	1	62	9	4-62
Glan	9	5-50	ND	ND
Kiamba	13	8-29	2	14-20
Maasam	7	13-27	1	8
Maitum	8	11-37	1	ND
Malapatan	7	11-129	3	8-14
GSC	6	ND	3	ND

Note: The creeks listed include only those that are not dry during dry season.
ND = no data

On the other hand, the longest creek is Amsikong found in Alabel. It has a total length of 20 km. The rest of the creeks have lengths less than 15 km.

In terms of the water discharge levels of these rivers, very few have available information. Data are available for only 14 rivers out

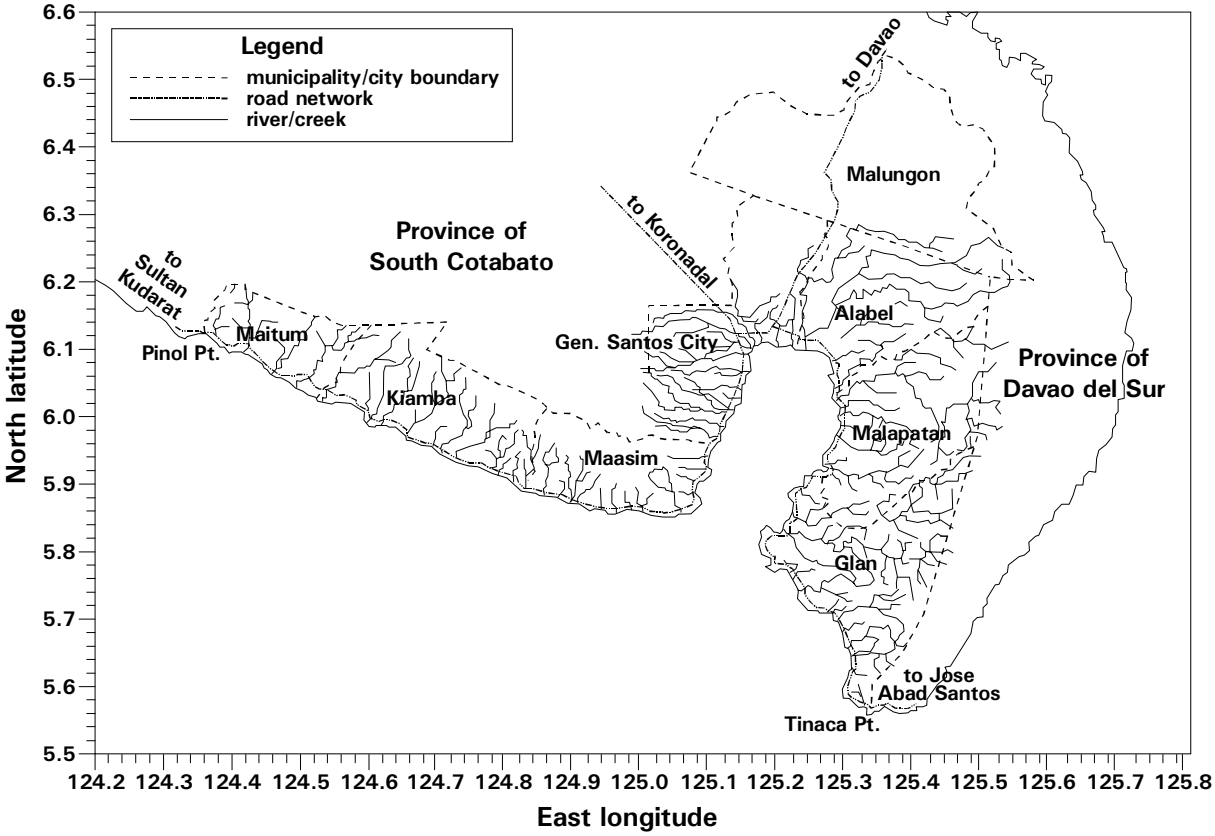


Figure 2.4. Profile area rivers and creeks.

of 51. The rivers with the largest discharge are Pangi River (12,603 liters per second (lps)) in Malapatan, Domolok River (10,213 lps) in Alabel, and Kalaong I River (8,820 lps) in Maitum. The rest of the rivers have discharge levels of less than 6,000 lps (Table 2.6).

The Industrial Environmental Management Project (IEMP) conducted physical, chemical, and biological studies of Sarangani Bay and some of the rivers that drain into the bay in 1997. Table 2.7 shows the analytical results of the samples taken from the bay and Figure 2.6 shows the locations of the stations where the samples were taken.

This means that the water is not potable due to the high level of fecal contamination and heavy silt load deposits. Studies by IEMP (1997) and MGP (LBII 1993) showed elevated concentrations of metals particularly cadmium, copper, and lead.

Table 2.6. Water discharge levels of some rivers in Sarangani Province.

River	River length (km)	Discharge levels (lps)
Domolok	ND	10,213
Baliton	11.25	411
Glan Padidu	16.00	503
Glan	50.50	3,516
Badtasan	12.00	1,133
Kling	ND	3,205
Tambilil	15.75	1,624
Tual	12.75	960
Kalaong	27.00	8,820
Kiayap	ND	131
Luan	16.00	1,066
Pangi	21.00	12,603
Upo	15.50	730
Saub	11.25	1,017

Source: LBII (1993)

Figure 2.5. One of the silted rivers in Maitum flowing into Sarangani Bay.

Results also showed a high concentration of suspended solids that are mostly attributed to the tributaries draining into Sarangani Bay. The suspended solids come from upland activities such as logging, mining, and livestock raising.

Sarangani Bay has an area of about 449 km^2, extending from Tampuan Point in Maasim to Sumbang Point in Glan. The length of coastline between these points is about 79 km. The average depth is 350 m. This, coupled with its wide opening and the low discharge rates of rivers, make Sarangani waters strongly oceanic in salinity. Consequently, the strong density difference between waters of the bay and riverine input inhibits mixing of the 2, leading to the formation of a surface plume which persists in the absence of wind mixing. The absence of wind mixing reduces vertical mixing and the possible dilution of pollutants. Tide generated currents are generally weak, except near the mouth of the bay and are incapable of moving materials more than 1 km. Strong wind-generated currents run along the coast in narrow bands,

Table 2.7. Results of the physicochemical studies of Sarangani Bay, 1997.

Sampling station**	Temperature (°C)		Conductivity (mS/cm)		Turbidity (NTO)		TSS (mg/L)		TDS (mg/L)		Oil and grease (mg/L)		pH		DO (mg/L)		BOD (mg/L)	
	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results
	Class SC		Class SC		Class SC		Class SC		Class SC		Class SC		Class SC		Class SC		Class SC	
1		28.9		46.0		0		36.0		49.0		1.0		8.1		6.6		2.8
2		29.3		45.7		0		52.0		34.4		*6.0*		8.0		6.0		*3.3*
3		29.3		45.9		0		44.0		40.5		*6.0*		8.1		7.0		2.9
4		29.5		45.7		0.1		38.0		56.5		*6.0*		8.1		5.9		2.3
5		29.4		45.8		52.6		163.0		47.4		*3.0*		8.1		5.9		*3.9*
6		28.9		45.6		9.7		30.0		58.0		*5.0*		8.0		6.2		*3.6*
7		28.7		45.5		6.1		42.0		39.2		*4.0*		8.1		6.2		2.6
8		29.1		46.1		9.0		40.0		60.8		*3.0*		8.1		6.2		2.4
9		29.0		45.9		1.1		40.0		54.5		*6.0*		8.1		6.2		2.6
10		28.7		46.2		0.9		50.0		43.4		*2.0*		8.1		6.3		2.9
11		28.9		46.1		0		56.0		55.5		*		8.1		6.3		*3.1*
12		29.0		46.4		13.1		36.0		55.8		*5.0*		8.1		6.1		1.6
13		29.0		45.8		2.4		27.0		53.3		*3.0*		8.1		5.9		*3.4*
14		28.7		45.6		2.8		29.0		54.6		*4.0*		8.1		6.2		2.4
15		30.0		45.9		0		32.0		52.7		*3.0*		8.0		6.7		1.8
Average of results	3°C rise	**29.1**	-	**45.9**	-	**6.5**	<30% rise	**47.7**	-	**50.4**	3	**4.1**	6.5-8.5	**8.1**	5.5	**6.2**	7 (10)	**2.8**

* *Damaged*

\- *No applicable standard.*

Values enclosed in parentheses are maximum values

Values in italics do not conform with Class SA standards

** *Sampling stations are found in Figure 2.6*

Source: IEMP (1997)

SA - marine waters suitable for the propagation, survival, and harvesting of shellfish for commercial purposes; tourist zones, national marine parks and reserves; and coral reef parks and reserves designated by law

SB - marine waters suitable for recreational water Class 1 or areas regularly used by the public for bathing, swimming, skin diving, etc.; and fishery water Class 1 or spawning areas for Chanos chanos *and similar species*

SC - marine waters suitable for recreation water Class 2 or bathing; fishery water Class 2 or commercial and sustenance fishing; and marshes and mangrove areas declared as fish and wildlife sanctuaries

SD - marine waters suitable for industrial water supply Class 2, e.g., cooling and other coastl and marine waters

Table 2.8. Results of the biochemical studies of Sarangani Bay, 1997.

Sampling station	Phenol (mg/L)		Lead (mg/L)		Cadmium (mg/L)		Copper (mg/L)		Mercury (mg/L)		Total Coliform (MPN/100 ml)		Fecal Coliform (MPN/100 ml)		Pesticide	
	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results	Std used	Results
	Class SC		Class SC		Class SC		Class SC		Class SC		Class SC		Class SC		Class SC	
1		-								nd		*1410*		*> 16*		nd
2		*< 0.001*		*0.622*		*0.043*		*0.107*		nd		*1700*		*> 16*		nd
3		--		-		--		--		nd		*4100*		*> 16*		nd
4		-		*0.665*		*0.046*		*0.107*		nd		*		* *		nd
5		*< 0.001*		*0.515*		*0.039*		*0.085*		nd		*7000*		*> 16*		nd
6		*0.002*		*0.622*		*0.03*		*0.086*		nd		*		* *		nd
7		*< 0.001*		*0.644*		*0.151*		*0.107*		0.001		*		* *		nd
8		*< 0.001*		*0.665*		*0.043*		*0.107*		0.001		*		* *		nd
9		*0.006*		*0.601*		*0.033*		*0.107*		nd		*		* *		nd
10		*0.007*		*0.601*		*0.039*		*0.107*		nd		*		* *		nd
11		*0.004*		*0.644*		*0.039*		*0.107*		nd		*		* *		nd
12		*< 0.001*		*0.579*		*0.039*		*0.107*		nd		*		* *		nd
13		*0.002*		*0.622*		*0.056*		*0.107*		nd		*7600*		*> 16*		nd
14		*0.003*		*0.601*		*0.043*		*0.107*		nd		-		--		nd
15		*0.003*		*0.601*		*0.04*		*0.107*		<0.01		*12000*		*> 16*		nd
	-		0.05		0.01		0.05		0.002		5000		-		nd	
Average of results		**0.004**		**0.614**		**0.049**		**0.104**		**0.001**		**5640**		**>16**		**nd**

* *Not present in concentration to affect fish flavor/taste*
** *Sampling bottle was not accepted at the UP Public Health*
\- *Not applicable standard*
-- *No analysis*
nil *Extremely low concentration and not detectable by existing equipment*
nd *Not detected*
Values in italics are not conforming with Class SA standards

Source: IEMP (1997)

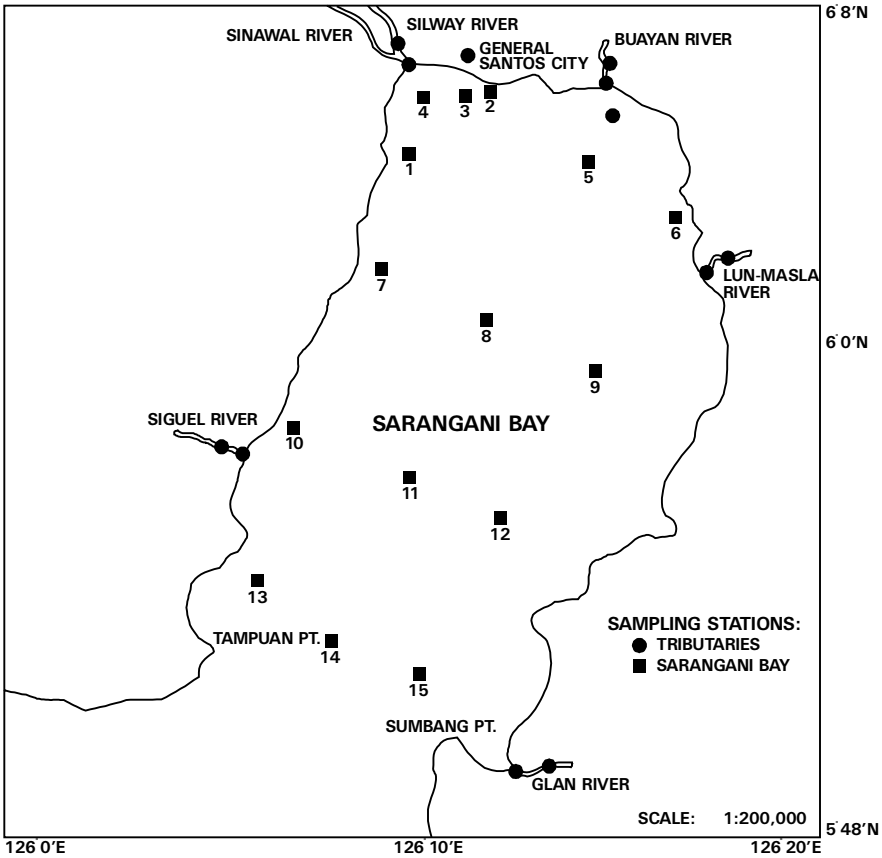


Figure 2.6. Locations of stations for the Sarangani Bay water quality sampling.

increasing interactions among marine ecological communities. Unfortunately, this also makes entrainment of pollutants along the coast more likely, increasing the vulnerability of coastal habitats and aquaculture activities.

Oil and grease seem to be the most common pollutant as almost all stations in the IEMP (1997) study show concentrations ranging from 1 to 6 mg/L. Oil and grease come mostly from shipping activities and from the fish canneries in GSC.

In 1997, the Silliman University Marine Laboratory (SUML) took samples in Sarangani Bay to analyze total coliform. All stations showed positive results. It is assumed that household waste is the major source since most households in the area do not have any toilets nor any proper wastewater drainage. Animal manure and garbage are also thrown into the sea or left unattended along the shore. Another possible cause of the high total coliform is the piggeries upstream that are brought to the bay via the river systems.

SOIL

Table 2.9 shows the soil classification of the province and the city. About 29.49 percent of the land area is classified as clay loam, 11.22 percent as loam, 6.26 percent as silty clay loam, 7.52 percent as sandy loam, 29 percent as mountain clay soil, 23.78 percent as undifferentiated soil, and 0.44 percent as fine sandy loam. Among the soil types mentioned, clay loam soil type is the best suited for agricultural purposes because of its ability to release the water it holds for plant use.

Table 2.9. Soil classification per coastal municipality of Sarangani Province and GSC. All values are in km^2.

Soil type	Alabel	Glan	Kiamba	Maasim	Maitum	Malapatan	GSC
Loam	125.14					232.73	100.00
Sandy loam	33.92	23.00					250.00
Fine sandy loam						17.92	
Silty clay loam		96.00	62.74		96.79		
Clay loam	164.48	578.60			227.56	101.76	131.00
Mountain clay soil			234.24	579.55			55.00
Undifferentiated soil	216.96		121.30	144.88		487.59	
Total	**540.50**	**697.60**	**418.28**	**724.43**	**324.35**	**840.00**	**536.00**

Data from the City Planning and Development Office 1990 and Provincial Planning and Development Office 1994

LAND USES

From the total land area of 4,081 km^2, 1,522 km^2 (37 percent) are classified as alienable and disposable (A&D) land while 2,558 km^2 (63 percent) are classified as forestland.

Furthermore, from the combined forestland of the province amounting to 2,304 km^2 (2,558 km^2 less GSC's 254 km^2), 741 km^2 (29 percent) are classified as protection forest and 764 km^2 (30 percent) as production forest. In 1997, a greater proportion of

the production forest was utilized for agricultural purposes, according to the Provincial Planning and Development Office (PPDO).

The province's A&D land is distributed as follows:

- 54 km^2 as irrigated rice land or fishponds;
- 345 km^2 as land for cultivated annual crops (such as corn, upland rice, pineapple, cotton, vegetables, sorghum, and others);
- 372 km^2 as land for perennial trees (such as fruit trees and coconut) and vine crops;
- 468 km^2 as pasture land (such as cows, horses, goats, and cattle); and
- 48 km^2 as builtup areas.

GSC does not have any protection forest. Most of the forestlands are being utilized for agricultural purposes. Furthermore, a large proportion of its A&D land is being utilized as builtup, agriculture, and pasture lands. There are areas in Sarangani Province that fall within the NIPAS. These are the areas that need to be protected and managed to maintain the natural biological and physical diversities of the environment notably areas with biologically unique features to sustain human life and development.

The province has a total of 741.91 km^2 of protected forestland. Of this, only 48.5 km^2 are within the NIPAS under Proclamation No. 147 and only 12.9 km^2 (26 percent) are within the coastal municipality. This is the Mt. Balabak Forest Reserve in Kiamba (12.9 km^2). The other protected area is Mt. Matutum Protected Landscape found in Malungon (35.6 km^2).

Aside from landscape protection, NIPAS also includes aquatic areas. The whole area of Sarangani Bay and the adjoining municipal waters of Maasim, Kiamba, and Maitum was declared as Protected Seascape by President Fidel V. Ramos on 5 March 1996 under Proclamation No. 756. It covers a total water area of 345 km^2.

In addition to the protected forest and seascape areas covered by the NIPAS, the provincial government of Sarangani has identified areas that limit the expansion of settlements for environmental considerations. These include second growth forest, mangrove forest, fish sanctuaries, and critical watershed areas (Table 2.10). The following is a more detailed listing of areas that have been considered for protection.

Table 2.10. NIPAS and non-NIPAS protected lands per coastal municipality of Sarangani Province.

Municipality	NIPAS (km^2)	Non-NIPAS (km^2)
Alabel	0.00	215.50
Glan	0.00	87.56
Kiamba	12.90	172.08
Maasim	0.00	57.87
Maitum	0.00	117.36
Malapatan	0.00	105.35
Malungon	35.60	111.00
Total	**48.50**	**866.72**

Data from the Provincial Planning and Development Office 1997

- National parks;
- Watershed reserves;
- Wildlife preserves and sanctuaries;
- Aesthetic potential tourist spots;
- Habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna);
- Areas of unique historic and archaeological or scientific interest;
- Areas traditionally occupied by cultural communities or tribes;
- Areas frequently visited or hard hit by natural calamities (geological hazards, flood, typhoon, volcanic activity, and others);
- Areas with critical slopes;
- Prime agricultural lands;
- Recharge areas of aquifers;
- Water bodies which may be tapped for domestic purposes or within the controlled and/or protected areas declared by appropriate authorities or which support wildlife or fishery activities;
- Mangrove areas with primary pristine and dense young growth or adjoining mouth of river system or near or adjacent to traditional productive fry or fishing grounds or which act as national buffers against shore erosion, strong winds, storm floods, and others; and
- Coral reef with 50 percent and above coral cover or spawning and nursery grounds for fish or act as a natural breakwater for the coastline.

CLIMATE

The prevailing wind direction in the area is the northeast monsoon from the months of November to March and the southwest monsoon from the months of June to October. There is no distinct dry and wet season observed for the area. Rainfall is evenly distributed throughout the year. The annual average rainfall for 1996 is 1,184 mm and 626 mm in 1997. The low annual average rainfall in 1997 was attributed to the El Niño phenomenon. The average temperature is around 27°C. Relative humidity is around 78 percent. Compared to 1996, it was expected that annual rainfall would increase in 1998 because of the La Niña phenomenon. Table 2.11 presents the meteorological data for Sarangani Province.

Table 2.11. Average temperature, rainfall, and relative humidity per month in Sarangani Province.

Month	Average temperature (°C)		Average rainfall (mm)		Relative humidity (percent)	
	1996	1997	1996	1997	1996	1997
January	26.3	27.0	85.7	85.6	83.0	79.0
February	27.1	26.9	88.8	42.4	78.0	80.0
March	27.1	27.9	37.5	49.8	74.0	76.0
April	28.5	28.6	74.7	50.3	79.0	77.0
May	27.7	28.4	116.8	44.7	83.0	79.0
June	27.5	27.7	96.1	72.7	76.0	81.0
July	26.8	27.1	176.6	93.1	82.0	84.0
August	27.4	27.8	75.0	34.2	81.0	81.0
September	27.5	27.4	150.3	46.7	82.0	82.0
October	27.7	27.1	159.9	16.7	82.0	80.0
November	27.5	28.5	52.8	26.2	82.0	78.0
December	27.5	28.1	70.0	73.9	79.0	76.0

Data from the Philippine Atmospheric, Geophysical, and Astronomical Services Administration of General Santos City 1996 and 1997

Chapter 3
NATURAL RESOURCES

MINERAL RESOURCES

Sarangani Province and GSC have rich metallic and non-metallic mineral deposits. The metallic minerals include copper, gold, and iron; the non-metallic minerals include cement lime, coal, gypsum, limestone, phosphate rock, and silica. Most non-metallic minerals are of commercial quantities particularly the cement lime, limestone, and silica. However, none of them is tapped for exploration purposes. Other resources found in the area include the guano, sand stone, and white pebbles (Table 3.1).

Sarangani Province has strongly objected to applications for exploration permits of all mining corporations filed with the Mines and Geosciences Bureau (MGB). However, mining activities in neighboring South Cotabato may impact Sarangani Bay due to the sedimentation caused by mining operations.

FOREST RESOURCES

The province has a dipterocarp forest in all of its coastal municipalities except Maasim. Based on land classification, it covers an area of 2,304.23 km^2. Of the total forestland area, 33 percent (753.91 km^2) is considered as secondary growth forest. These areas have been logged or disturbed for some time and were able to recover. In terms of total forest and secondary forestland proportions, Maitum is the largest (71 percent), followed by Kiamba (60 percent), and Alabel (50 percent). However, in terms of total secondary forestland, Alabel is the highest (28 percent), followed by Kiamba (22 percent) (Table 3.2). However, destructive agricultural practices and illegal logging threaten these forest resources.

Table 3.1. Mineral deposits and other resources in the profile area.

Municipality/City	Metallic	Non-metallic	Other resources
Alabel	Copper, gold		Guano
Glan		Phosphate rock, limestone, coal	Guano, white pebbles, sand stone
Kiamba	Iron, copper, gold		
Maasim	Copper, gold, silica	Gypsum, limestone, cement lime, silica	Guano, sand stone
Maitum	Copper, gold, iron		Guano
Malapatan		Phosphate rock, limestone, coal, silica	Guano, sand stone
GSC	Copper, iron, gold silver	Limestone, sulfur, nitrate	Guano

Data from the Provincial Environment and Natural Resources Office and Provincial Planning and Development Office 1994

Once forest cover is depleted, erosion results. This contributes to the sedimentation of the coastal area especially areas near the river mouth. In order to stop this, Sarangani Province is formulating the Provincial Forest Land Use Plan. This will serve as a framework to attain the province's long-term vision of sustainable development and well-managed resources.

Table 3.2. Second growth forestlands of Sarangani Province.

Municipality	Second growth forest (km^2)	Percent composition
Alabel	215.27	28.6
Glan	87.02	11.5
Kiamba	172.08	22.8
Maasim	57.66	7.6
Maitum	117.26	15.6
Malapatan	104.62	13.9
Total	**753.91**	**100.00**

Data from the Provincial Planning and Development Office 1997

As part of improving forest cover, DENR has distributed 1 million forest and ornamental seedlings from 1994 to 1997 for reforestation purposes. The Asian Development Bank (ADB) has also funded the implementation of the Forestry Reforestation and Community Approach Reforestation Schemes. Under this project, DENR has replanted 1,613 ha of forestland (Chiongbian 1998).

The first LGU-led community-based forest management (CBFM) project is in Sarangani. The project area covers 32,000 ha of timberland in Kiamba and Maitum. This is the first CBFM project in the Philippines initiated and generally supervised by LGUs.

COASTAL RESOURCES

Sarangani Province and GSC have a total coastline of 226.4 km (Figure 3.1). Figures 3.2 to 3.8 show the coastal resource maps of the municipalities and city in the Sarangani Bay Learning Area. The figures also present the uses of different areas in their jurisdiction as well as major issues involved for each area. Resources that can be

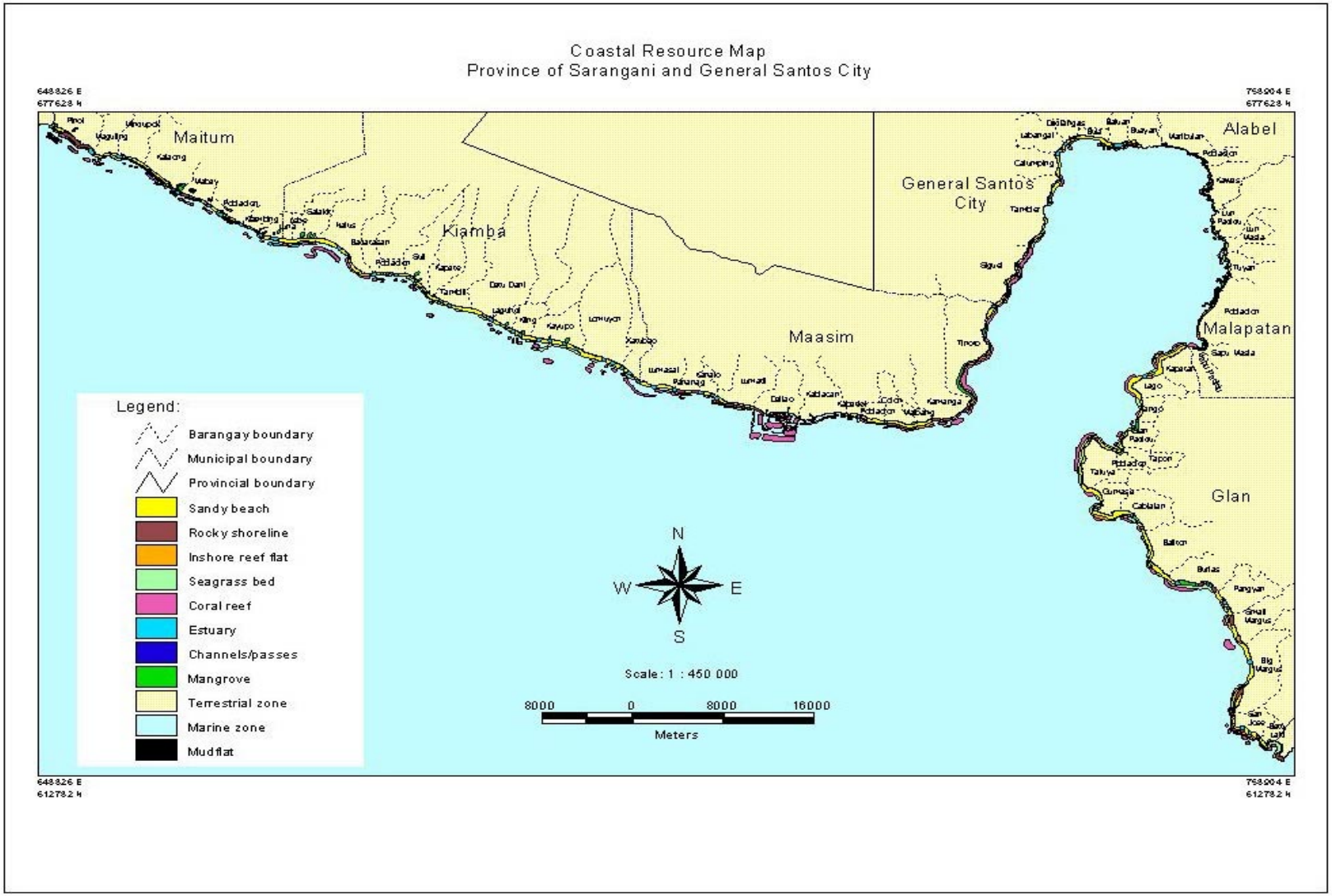


Figure 3.1. Map of Sarangani Province and GSC showing coastal resources such as mangroves, seagrasses, and coral reefs.

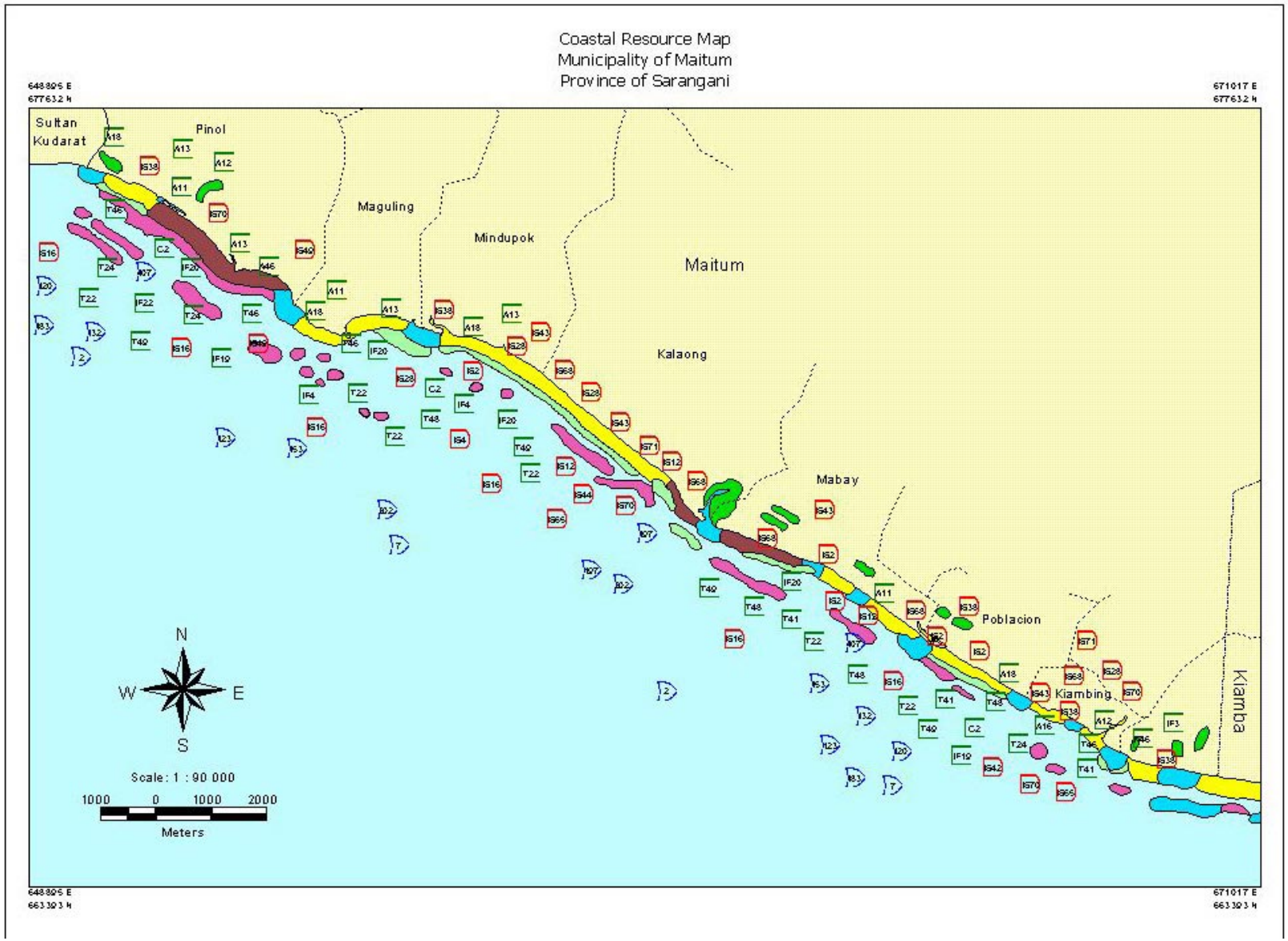
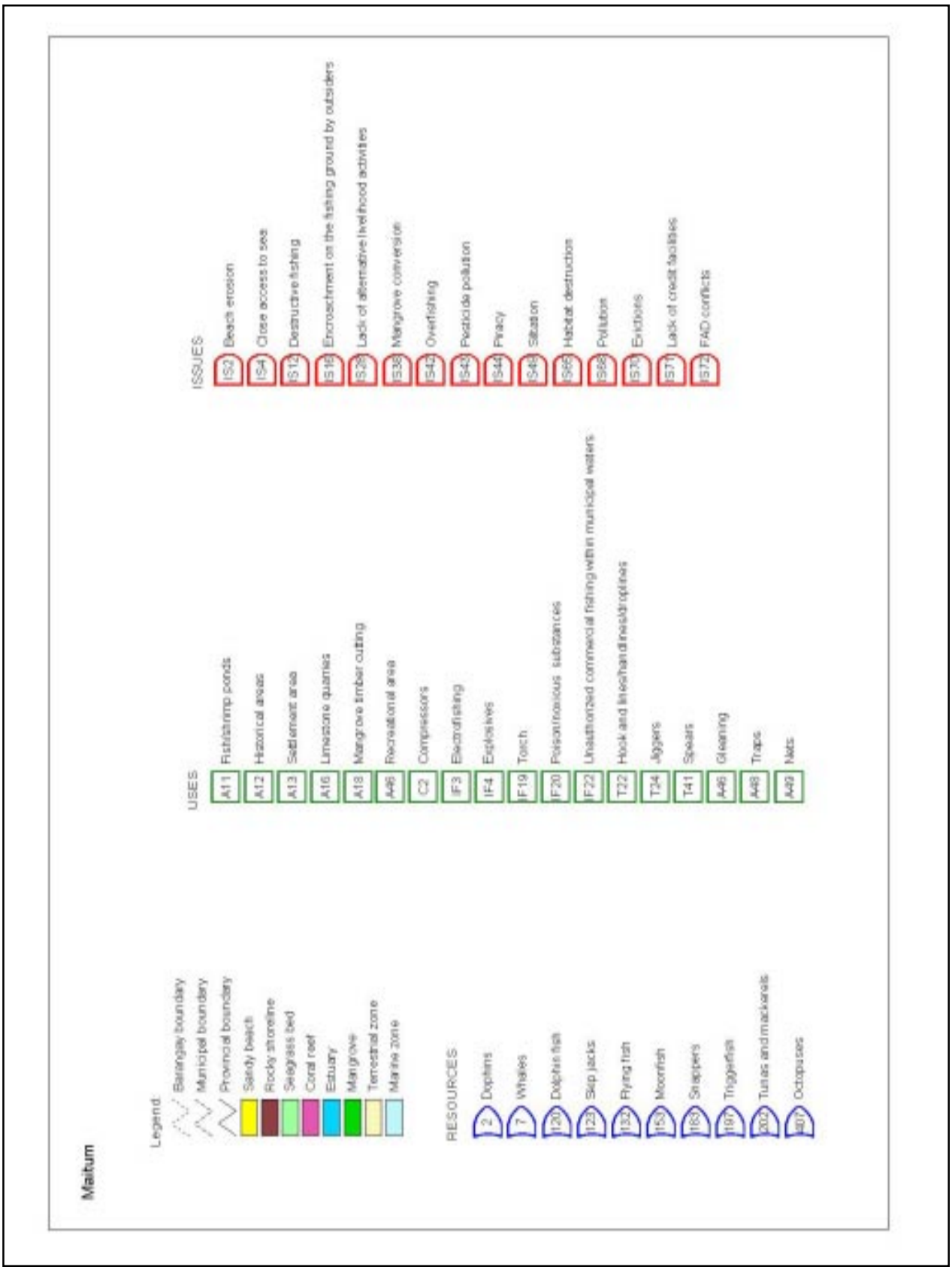


Figure 3.2. Coastal resource map of Maitum, Sarangani Bay.


Maitum
Legend
Barangay boundary
Municipal boundary
Provincial boundary
Sandy beach
Rocky shoreline
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
RESOURCES
2 Dolphins
7 Whales
120 Dolphin fish
123 Skip jacks
132 Flying fish
153 Moonfish
163 Snappers
191 Triggerfish
202 Tunas and mackerels
307 Octopuses
USES
A11 Fish/shrimp ponds
A12 Historical areas
A13 Settlement area
A16 Limestone quarries
A18 Mangrove timber cutting
A46 Recreational area
C2 Compressors
IF3 Electrofishing
IF4 Explosives
IF19 Torch
IF20 Poisonous/noxious substances
IF22 Unauthorized commercial fishing within municipal waters
T22 Hook and line/handline/droplines
T24 Jiggers
T41 Spears
A46 Gleaning
A48 Traps
A49 Nets
ISSUES
IS2 Beach erosion
IS4 Close access to sea
IS12 Destructive fishing
IS16 Encroachment on the fishing ground by outsiders
IS26 Lack of alternative livelihood activities
IS38 Mangrove conversion
IS42 Overfishing
IS43 Pesticide pollution
IS44 Piracy
IS48 Siltation
IS65 Habitat destruction
IS66 Pollution
IS70 Evictions
IS71 Lack of credit facilities
IS72 FAD conflicts

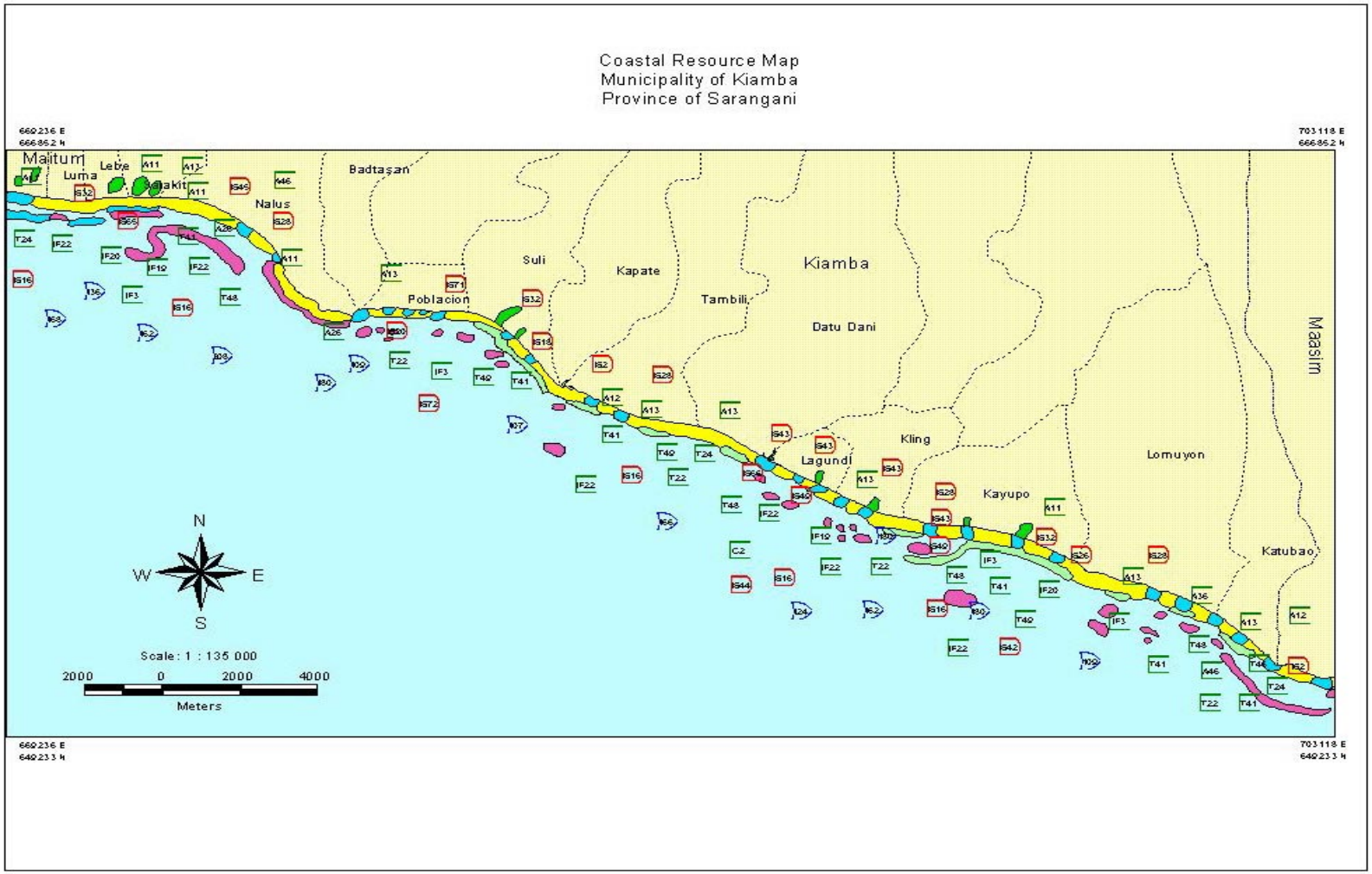
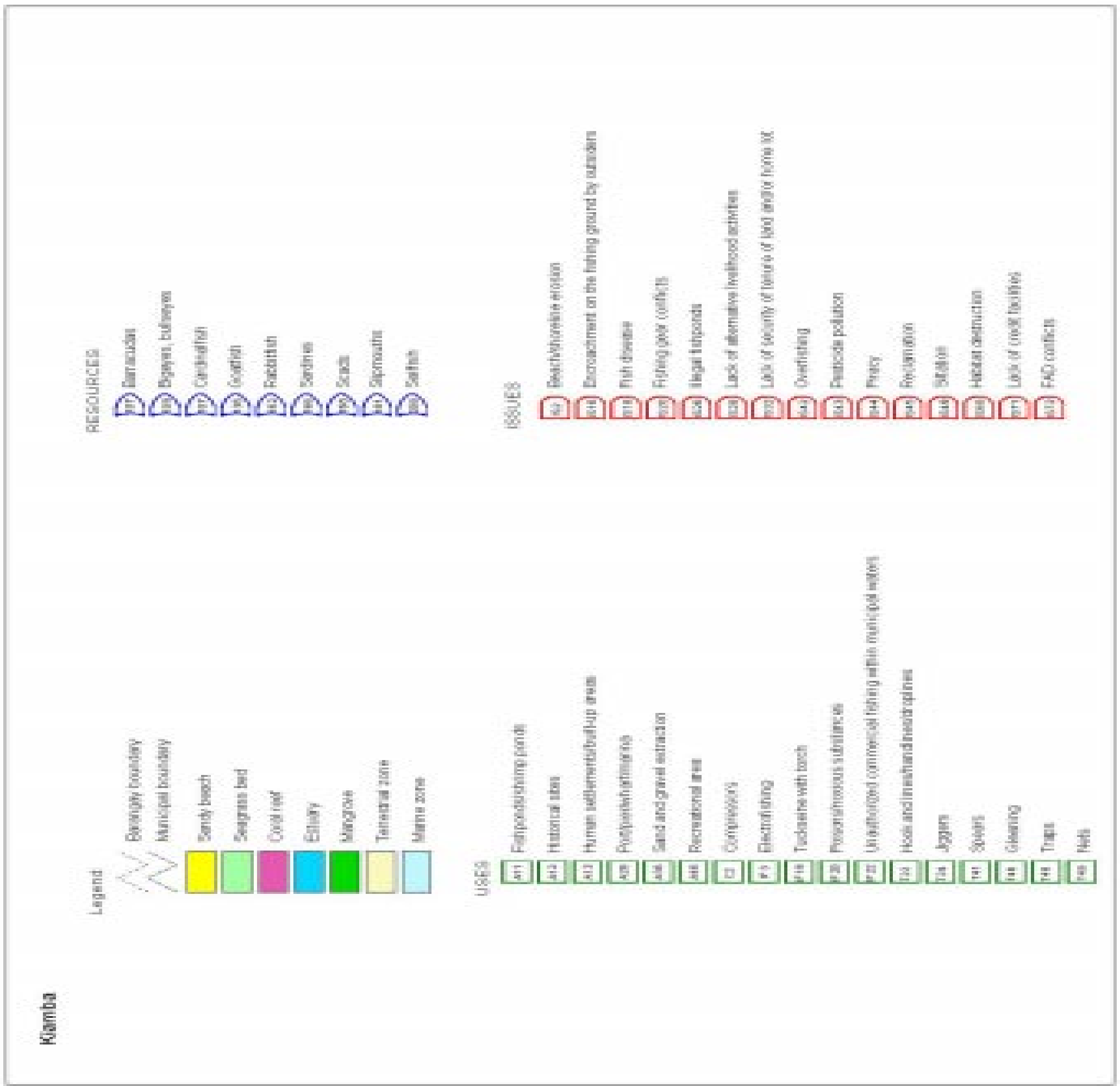


Figure 3.3. Coastal resource map of Kiamba, Sarangani Bay.


Kiamba
Legend
Barangay boundary
Municipal boundary
Sandy beach
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
RESOURCES
Barracudas
Bigeyes, bullseyes
Cardinalfish
Goatfish
Rabbitfish
Sardines
Scads
Slipmouths
Sailfish
USES
Fishponds/shrimp ponds
Historical sites
Human settlements/built-up areas
Port/pier/wharf/marina
Sand and gravel extraction
Recreational area
Compressors
Electrofishing
Tuckseine with torch
Poisons/noxious substances
Unauthorized commercial fishing within municipal waters
Hook and lines/handlines/droplines
Jiggers
Spears
Gleaning
Traps
Nets
ISSUES
Beach/shoreline erosion
Encroachment on the fishing ground by outsiders
Fish disease
Fishing gear conflicts
Illegal fishponds
Lack of alternative livelihood activities
Lack of security of tenure of land and/or home lot
Overfishing
Pesticide pollution
Piracy
Reclamation
Siltation
Habitat destruction
Lack of credit facilities
FAD conflicts

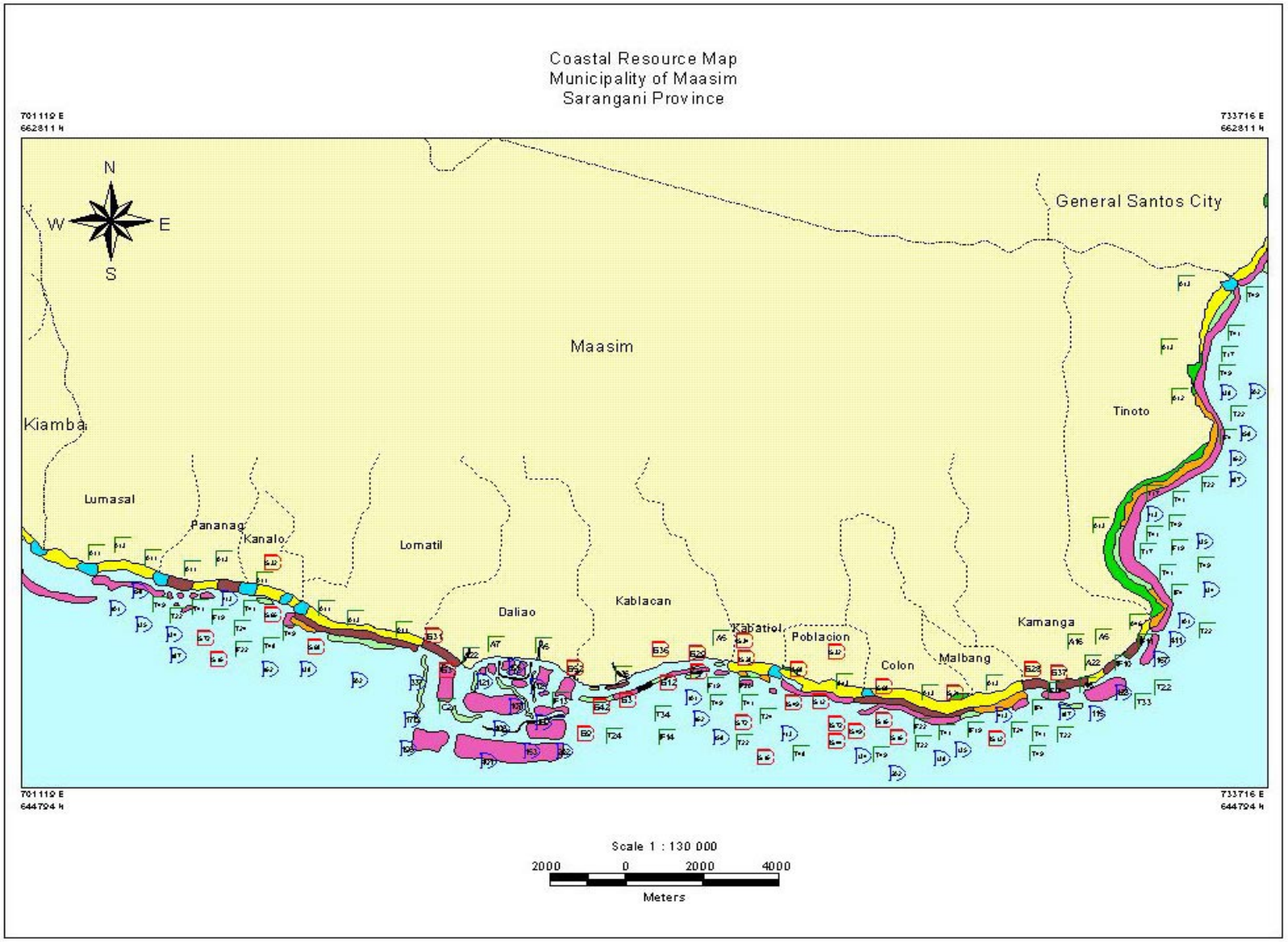


Figure 3.4. Coastal resource map of Maasim, Sarangani Bay.


Maasim
Legend
Barangay boundary
Municipal boundary
Sandy beach
Rocky shoreline
Inshore reef flat
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
Mudflats
RESOURCES
Anchovies
Barracudas, seapikes
Batfish, leatfish
Clownfish, anemone fish
Dottybacks
False whitings, blanquillos
Fusiliers
Garfish
Tun shells
Groupers
Moonfish
Parrotfish
Rabbitfish
Sawfish
Scorpionfish
Shrimpfish, razorfish
Stingrays
Threadfin breams, spinechecks
Tripletails
Tunas and mackerels
Cowries
Coconut crabs
Spiny rock lobsters
Squids
USES
Fish corrals
Hook and lines/handlines/droplines
Reef seines
Jiggers
Ring nets
Spears
Traps
Nets
Explosives
Harvest of helmet shells
Harvest of kapis
Harvest of marine turtles and eggs
Harvest of milkfish
Tuckseine with torch
Poisons/noxious substances
Unauthorized commercial fishing within municipal waters
Coconut farms
Drainage canals
Educational reservations
Fishponds/shrimp ponds
Historical sites
Human settlements/built-up areas
Limestone quarries
Nipa harvesting
Sand and gravel extraction
Recreational area
Compressors
ISSUES
Breakage of corals
Declining fish catch
Destructive fishing
Encroachment on the fishing ground by outsiders
Flooding
Lack of alternative livelihood activities
Lack of law enforcement
Lack of organization
Lack of security of tenure of land and/or home lot
Landslide
Low awareness
Low prices of fishery products
Overfishing
Piracy
Siltation
Upland erosion
Habitat destruction
Pollution
FAD conflicts

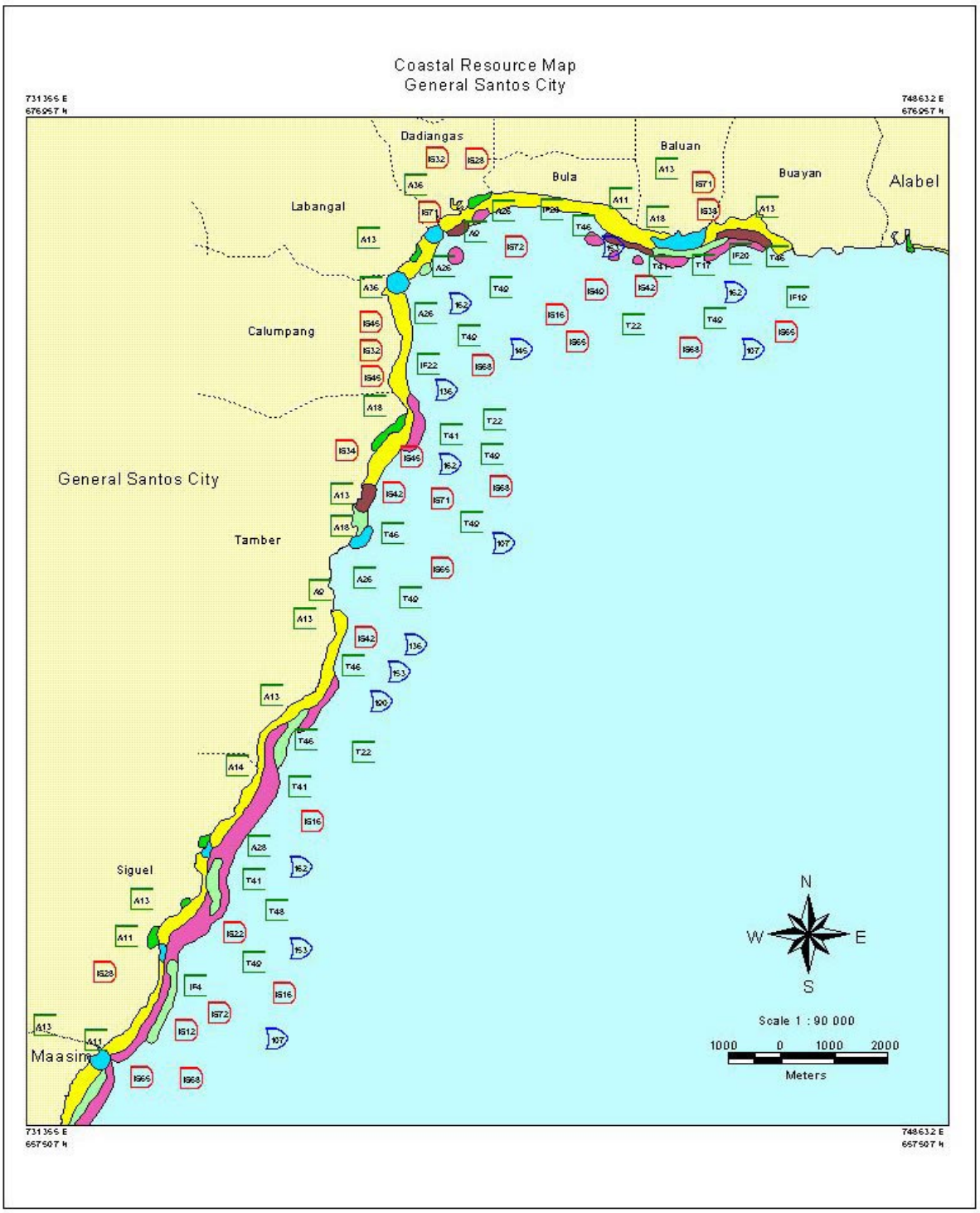
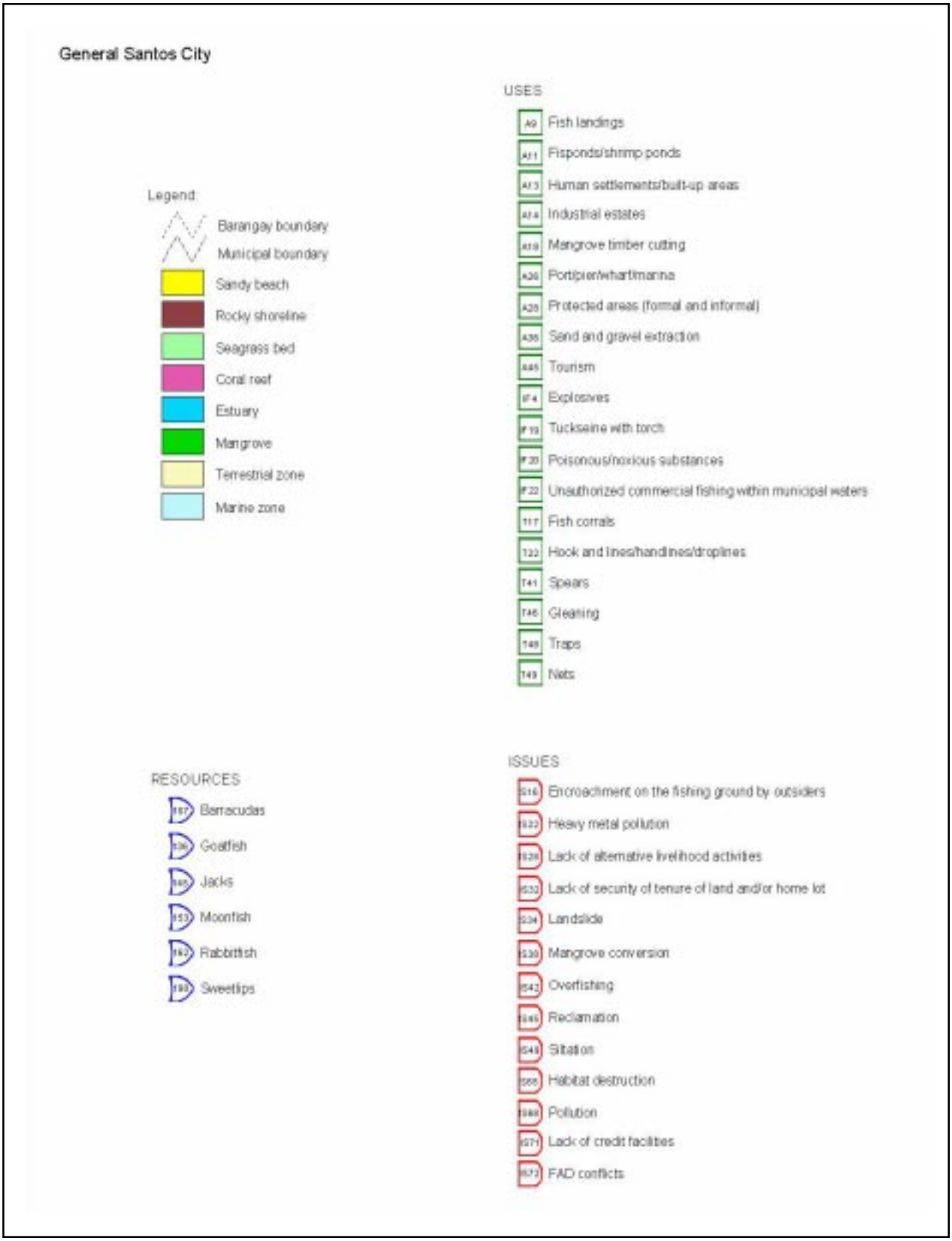


Figure 3.5. Coastal resource map of General Santos City, Sarangani Bay.


General Santos City
Legend
Barangay boundary
Municipal boundary
Sandy beach
Rocky shoreline
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
USES
A9 Fish landings
A11 Fisponds/shrimp ponds
A13 Human settlements/built-up areas
A14 Industrial estates
A19 Mangrove timber cutting
A26 Port/pier/wharf/marina
A28 Protected areas (formal and informal)
A36 Sand and gravel extraction
A45 Tourism
IF4 Explosives
IF19 Tuckseine with torch
IF20 Poisonous/noxious substances
IF22 Unauthorized commercial fishing within municipal waters
T17 Fish corrals
T22 Hook and lines/handlines/droplines
T41 Spears
T46 Gleaning
T48 Traps
T49 Nets
RESOURCES
R57 Barracudas
R36 Goatfish
R65 Jacks
R53 Moonfish
R62 Rabbitfish
R99 Sweetlips
ISSUES
S16 Encroachment on the fishing ground by outsiders
S22 Heavy metal pollution
S28 Lack of alternative livelihood activities
S32 Lack of security of tenure of land and/or home lot
S34 Landslide
S39 Mangrove conversion
S42 Overfishing
S45 Reclamation
S48 Siltation
S55 Habitat destruction
S66 Pollution
S71 Lack of credit facilities
S73 FAD conflicts

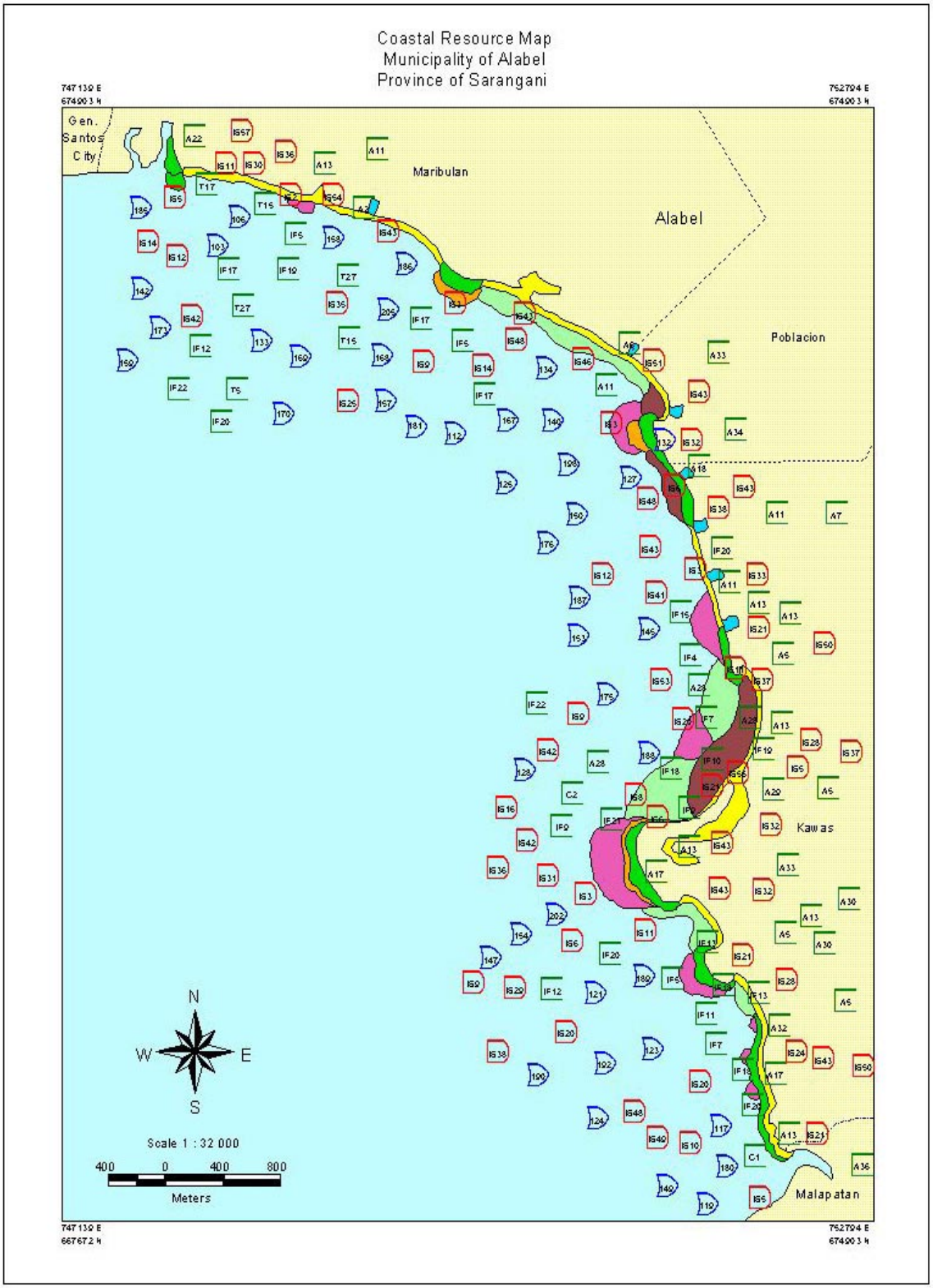


Figure 3.6. Coastal resource map of Alabel, Sarangani Bay.


Alabel
Legend:
Barangay boundary
Municipal boundary
Sandy beach
Rocky shoreline
Inshore reef flat
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
USES
A2 Anchorage
A5 Coconut farms
A8 Drainage canals
A7 Educational reservations
A11 Fishponds/shrimp ponds
A13 Human settlements/built-up areas
A17 Mangrove plantations
A18 Mangrove timber cutting
A23 Nipa harvesting
A28 Protected areas (formal and informal)
A29 Public laundry areas
A30 Public parks/plazas
A32 Resorts
A33 Rice paddies
A34 Roads, bridges
A36 Sand and gravel extraction
C1 Beach seines
C3 Compressors
F4 Explosives
F5 Fine mesh nets (less than 3 cm) for unexempted species
F7 Fishing without license
F9 Harvest of giant clams
F10 Harvest of helmet shells
F11 Harvest of kapis
F12 Harvest of manta rays
F13 Harvest of marine turtle and eggs
F16 Harvest of triton shell
F17 Not honoring closed seasons
F18 Other gears (banned by local legislation)
F19 Tuckseine with torch
F20 Poisons/noxious substances
F21 Superlights within municipal waters
F22 Unauthorized commercial fishing within municipal waters
T5 Bottom set gill nets
T16 Encircling gill nets
T17 Fish corrals
T27 Multiple hook and line
RESOURCES
83 Anglerfish and frogfish
85 Blindfish
112 Bonefish
117 Cornetfish
119 Damselfish
131 Dottybacks
133 Eagle rays and cow-nosed rays
134 Eel blennies
135 Eel-tailed catfish
137 False trevallies
139 False whitings, blanquillos
142 Flying fish
143 Fork-tailed catfish
144 Fusiliers, bananafish
147 Hairtails, cutlass fish
148 Hammerhead sharks
149 Jacks, cavallas, crevallies, trevallies, darts
150 Leatherjackets
151 Manta rays, devil rays
152 Milkfish
153 Moonfish
154 Moorish idols
157 Mullets
159 Parrotfish
161 Pomfrets, butterfish
162 Sawfish
163 Scads
169 Scorpionfish, lionfish, turkeyfish, stonefish
170 Seabasses, sandbasses, sea perches, barramundi
171 Sea-haarders, bonnetmouths
174 Sergeantfish, cobias
176 Sharks
180 Slipmouths, ponyfish
181 Snake eels
184 Spadefish, scats
186 Squirrelfish and soldierfish
187 Stingrays, skates, electric rays
189 Surgeonfish, tangs, unicornfish
190 Sweepers
191 Sweetlips and grunts
192 Tenpounders
195 Tripletails
202 Tunas and mackerels
205 Wolf herrings
ISSUES
I53 Beach/shoreline erosion
I63 Breakage of corals
I65 Coliform pollution
I66 Coral bleaching
I68 Crown-of-thorns epidemic
I69 Declining fish catch
S10 Decreased estuary circulation
S11 Defoliation/loss of vegetation
S12 Destructive fishing
S14 Diversion of fresh water
S15 Encroachment on the fishing ground by outsiders
S20 Fishing gear conflict
S21 Flooding
S24 Hunting
S25 Illegal fishing
S26 Lack of alternative livelihood activities
S28 Lack of law enforcement
S30 Lack of legislation
S31 Lack of organization
S32 Lack of security of tenure of land and/or home lot
S33 Lack of social services
S35 Loss of rare/endangered species
S36 Low awareness
S37 Low prices of fishery products
S39 Mangrove conversion
S41 Oil spills
S42 Overfishing
S47 Pesticide pollution
S48 Red tide
S49 Shellfish contamination
S50 Siltation
S52 Smuggling
S53 Theft of gears and accessories
S63 Use conflicts
S64 Use rights conflicts
S66 Waste dumping
S67 Weak organization

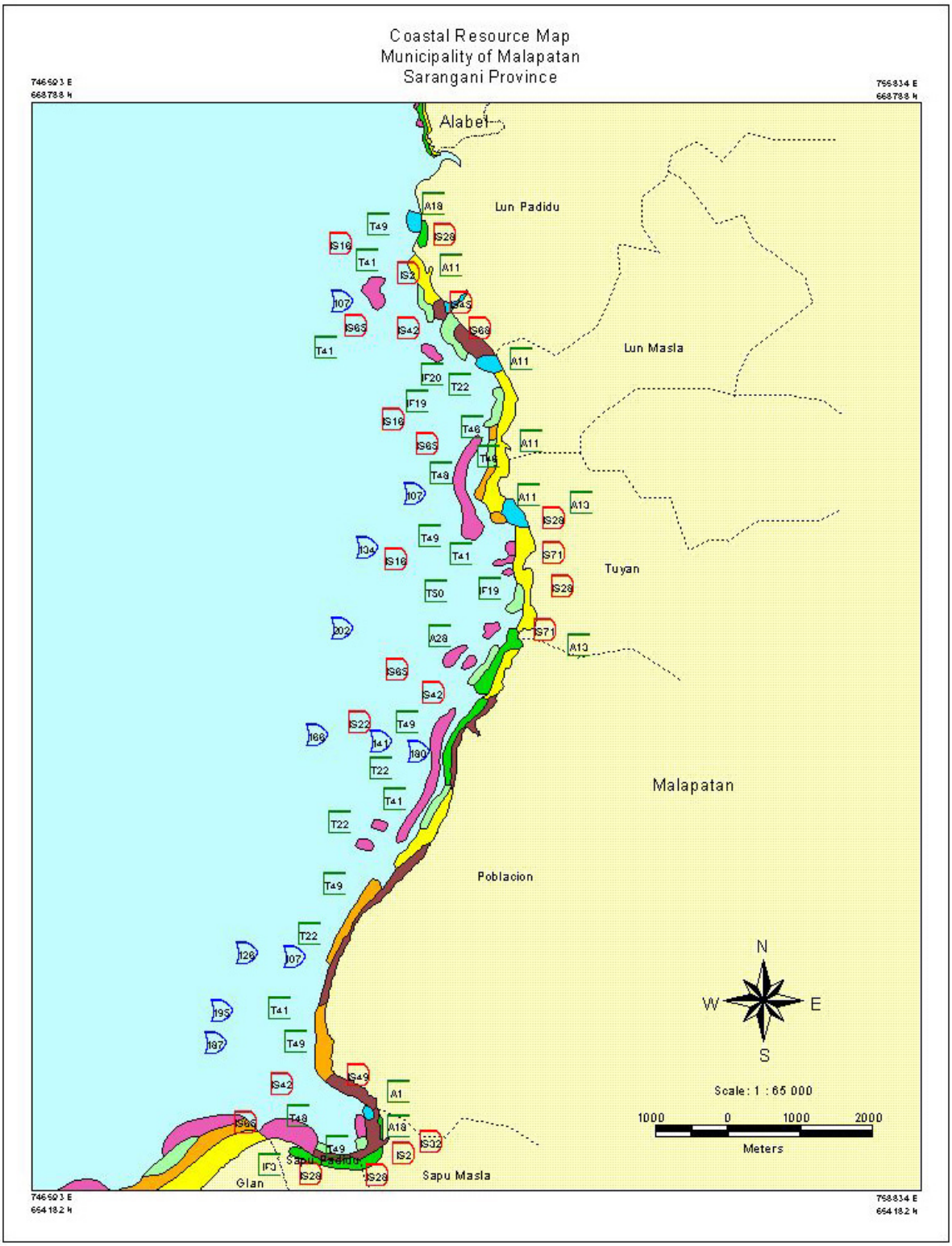


Figure 3.7. Coastal resource map of Malapatan, Sarangani Bay.

Malapatan


Legend:
Barangay boundary
Municipal boundary
Sandy beach
Rocky shoreline
Inshore reef flat
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
USES
A1 Airports
A11 Fishponds/shrimp ponds
A13 Human settlements/built-up areas
A18 Mangrove timber cutting
A28 Protected areas (formal and informal)
F3 Electrofishing
F18 Tuckseine with torch
F28 Poisons/noxious substances
T22 Hook and lines/handlines/droplines
T41 Spears
T46 Gleaning
T48 Traps
T49 Nets
T60 Cuttle traps
RESOURCES
107 Barracudas
126 Emperor breams
134 Fusiliers, bananafish
141 Halfbeaks
166 Sardines
169 Slipmouths
187 Stingrays
188 Threadfin breams
202 Tunas and mackerels
ISSUES
IS2 Beach/shoreline erosion
IS18 Encroachment on the fishing ground by outsiders
IS23 Heavy metal pollution
IS28 Lack of alternative livelihood activities
IS32 Lack of security of tenure land and/or home lot
IS42 Overfishing
IS45 Reclamation
IS46 Siltation
IS65 Habitat destruction
IS66 Pollution
IS71 Lack of credit facilities

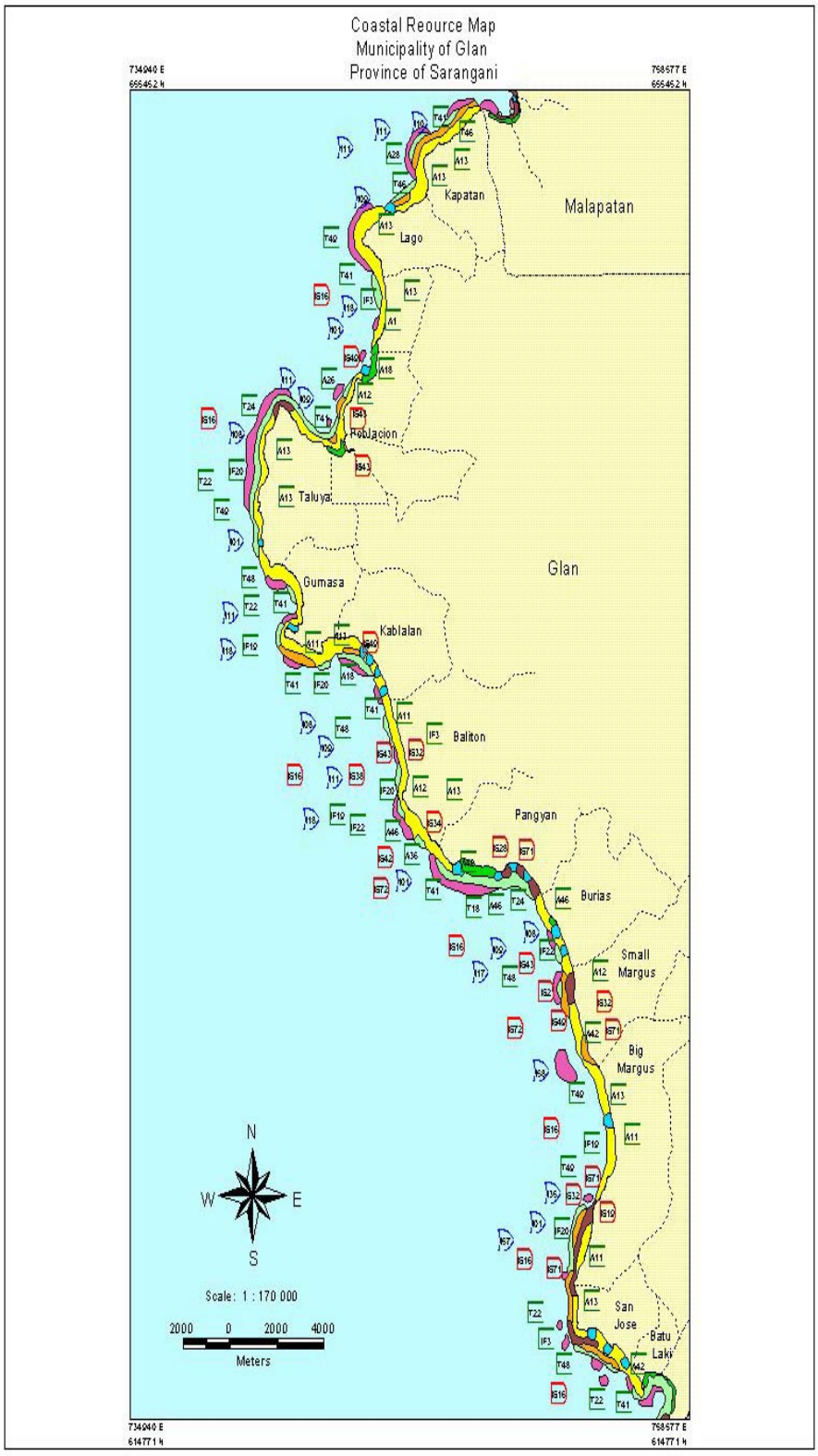


Figure 3.8. Coastal resource map of Glan, Sarangani Bay.


Glan
Legend:
Barangay boundary
Municipal boundary
Sandy beach
Rocky shoreline
Inshore reef flat
Seagrass bed
Coral reef
Estuary
Mangrove
Terrestrial zone
Marine zone
RESOURCES
Anchovies
Batfish
Bigeyes, bulleyes
Billfish
Blennies
Cornetfish
Croakers
Garfish
Mullets
Parrotfish
USES
Airports
Fishponds/shrimp ponds
Historical sites
Human settlements/built-up areas
Mangrove timber cutting
Port/pier/wharf/marina
Protected areas (formal and informal)
Sand and gravel extraction
Agricultural land
Recreational area
Electrofishing
Tuckseine with torch
Poisonous/noxious substances
Unauthorized commercial fishing within municipal waters
Fish pots and crab pots
Hook and line
Jiggers
Spears
Gleaning
Traps
Nets
ISSUES
Beach/shoreline erosion
Encroachment on the fishing ground by outsiders
Fish kills
Lack of alternative livelihood activities
lack of security of tenure of land and/or home lot
Landslide
Mangrove conversion
Overfishing
Pesticide pollution
Siltation
Lack of credit facilities
FAD conflicts

observed along the Sarangani and GSC coastline include the white sand beaches fronting the Celebes Sea and thick mangrove forest in the inner side of Sarangani Bay (Figure 3.9). Other coastal resources found in the area include the following major marine communities: seagrasses, seaweeds, coral reefs, and reef fishes. These major communities have been assessed on separate occasions by the academe, various national government agencies (NGAs), NGOs, and foreign-funded projects such as CRMP and MGP. The results of the survey are presented below.

Figure 3.9. Extensive beach of Barangay Salakit, Kiamba.

Mangrove Community

Mangroves play an important role in the ecological stability of the coastal ecosystem and other nearby ecosystems. They act as buffer zone against typhoons and tidal waves, prevent soil erosion, and serve as land builders through soil accretion. They serve as nursery grounds for marine fishes, crustaceans, and other marine invertebrates. They provide refuge for wildlife such as birds, rodents, reptiles, amphibians, and mammals.

There is inadequate information on the mangrove community in the profile area. Most of the available information focus on species identification and aerial cover estimate.

Table 3.3. Mangrove forestlands of the profile area.

Municipality/ City	Mangrove forest (ha)	Source
Alabel	7.4	Glan CENRO (1996)
Glan	57.0	Glan CENRO (1996)
Kiamba	7.0	CRMP (1998)
Maasim	150.0	MPDO (1994)
Maitum	15.0	CRMP (1998)
Malapatan	22.9	CRMP (1998)
GSC	8.3	City ENRO (1988)
Total	**267.6**	

CENRO - Community Environment and Natural Resources Office
CRMP - Coastal Resource Management Project
ENRO - Environment and Natural Resources Office
MPDO - Municipal Planning and Development Office

For the province, using combined data from municipal profiles and the Provincial Environment and Natural Resources Office (PENRO), the mangrove forestlands were estimated at 267.6 ha. Most of these are situated in the municipalities of Maasim, Malapatan, and Glan.

On the other hand, based on land use statistics used by Louis Berger International, Inc. (LBII 1993),

the area covered with mangrove forest is about 508 ha. However, LBII claimed that this is an overestimate based on aerial survey and ground truthing observations. According to LBII's studies, the existing mangrove forest is found in the following areas: a) at the southwestern coastline in Tinoto Bay and Linao Cove, Maasim and London and Banwalan, GSC; b) at the northern coastline in Bula, Baluan, and Buayan, GSC; and c) at the eastern coastline in Kawas, Alabel, and Malapatan down to Poblacion, Glan (see Figure 3.1).

Studies by Silliman University (SUML 1997) also provided an estimate of mangrove forest area of around 25 ha. However, it covers only the area within Sarangani Bay proper and is less than the area reported by the LGUs to CRMP.

Large tracts of mangrove forest have been cut down to give way to aquaculture ponds. Statistics show that there are 670 ha of fishponds in Sarangani Province. However, it is very hard to estimate how much of these are former mangrove areas. Mangroves are also being used for firewood, notably in Malapatan (Figure 3.10) and Alabel and in some coastal *barangay*s of GSC. Continued destruction of mangrove habitats occurs because of ease in collection by coastal dwellers rather than from a lack of alternative sources and a lack of concerted enforcement effort by the government. In the past 30 years, it has been estimated that the reclamation of mangroves was as high as 50 percent, and this has greatly contributed to the decline of fishery products.

Figure 3.10. Natural growth mangroves in Malapatan-Maasim area.

Based on the surveys conducted, 10 mangrove species were identified within Sarangani Bay (Table 3.4). The most common species belong to the genera *Avicennia* (*api-api*), *Rhizopora* (*bakawan*), and *Sonneratia* (*pagatpat*).

Seagrass Community

Seagrasses are confined to relatively shallow intertidal and subtidal areas. Distribution of seagrass is limited to the narrow shallow area along the coast since steep slopes characterize the bottom topography.

To date, available information on the extent of area covered by seagrasses has been based on the satellite image classified by the National Mapping and Resources

Table 3.4. List of mangrove species in Sarangani Bay.

Mangrove species	Local name
RHIZOPHORACEAE	
Rhizophora mucronata	*Bakhaw baye*
Rhizophora apiculata	*Bakhaw laki*
Ceriops decandra	*Malatangal*
AVICENNIACEAE	
Avicennia marina	*Piape baye*
SONNERATIACEAE	
Sonneratia alba	*Pagatpat*
COMBRETACEAE	
Terminallia catappa	*Talisay*
MYRSINACEAE	
Aegiceras floridum	*Tinduk-tindukan*
EUPHORBIACEAE	
Excoecaria agallocha	*Alipata, Buta-buta*
FABACEAE	
Pongamia pinnata	*Taualis*
LYTHRACEAE	
Pemphis acidula	*Bantigi*

Source: LBII (1993); SUML (1997)

Information Agency (NAMRIA) in 1993. The image was based on spot multi-spectral data taken on 5 April 1987. It covers only the area of Sarangani Bay. Based on NAMRIA's preliminary classification, the shallow reef areas with seagrasses cover an area of 9.81 km^2 from Taliak Point, Maasim to Lefa Point, Glan.

Aside from NAMRIA, LBII (1993) also did visual identification and aerial cover estimates of the seagrass community. The coastal areas identified with seagrass communities include Tinoto, Maasim; Tambler, GSC; Malapatan; Taluya, Gumasa; and Burias, Glan (Figure 3.1). The identified species were *Enhalus acoroides*, *Halophila* spp., and *Thalassia hemprichii* (Table 3.5).

Table 3.5. List of seagrass species identified in the coastal areas of Sarangani Province and GSC.

Seagrass species	Municipalities where they are found
Cymodocea rotundata	Malapatan, Glan, Alabel, Kiamba
Cymodocea serrulata	Glan
Enhalus acoroides	Maasim, Alabel, Glan
Halodule pinifolia	Maasim, Malapatan, Glan, Alabel, Kiamba
Halodule uninervis	Glan, Alabel
Halophila ovalis	Maasim, Malapatan, Alabel, Kiamba
Halophila spinulosa	Kiamba
Syringodium isoetifolium	Maasim, Malapatan, Glan, Alabel
Thalassia hemprichii	Maasim, Malapatan, Glan, Alabel
Thalassodendron ciliatum	Glan

Source: LBII (1993); SUML (1997)

SUML (1997) also did a separate survey of the seagrass community in the area. The survey included the following: Kawas Point, Alabel; Gumasa and Lago Point, Glan; Linao Cove and Tinoto, Maasim; Lun Padidu, Malapatan; and Poblacion, Kiamba. In these areas, seagrass covers an estimated area of 0.27 km^2. Aside from the previously mentioned species, other species observed were *Cymodocea, Syringodium, Halophila,* and *Thalassodendron*. The latter species is rare and can only be found in southern Philippines. Small quantities of this species were observed in Gumasa. However, a wide bed of this species has been found in Batulaki, Glan by the Sarangani CRMP team. The team also observed seagrass communities of *Thalassia* and *Enhalus* in Siguel, GSC.

Siltation coming from the rivers and tributaries emptying into Sarangani Bay poses a major threat to the seagrass ecosystem. Unfortunately, no action has been taken to address the problem. So far, no solution has been implemented for this problem, since some of the sources fall outside of the jurisdiction of Sarangani and GSC.

Coral Reef and Reef Fish Communities

LBII (1993) also conducted coral reef assessment in the area. A total of 28 reef areas along the coasts of Sarangani Province and GSC have been surveyed. Of the 28 sites surveyed, only 8 sites have coral cover exceeding 50 percent; 6 sites between 40 and 49 percent; 2 sites between 30 and 39 percent; and the rest of the 12 sites, below 30 percent. The sites with coral cover greater than 50 percent are found in Tinoto Bay, Maasim; Glan; Alabel; and Malapatan (Table 3.6, Figure 3.1).

Table 3.6. Percentage coral cover, substrate, and algae in the profile area.

Location	Hard corals	Soft corals	Algae	Dead corals	Sand and silt	Rubble
ALABEL						
Kawas Point	58.06	2.80	1.68	11.26	13.52	9.70
GLAN	**37.89**	**15.03**	**4.21**	**12.79**	**12.68**	**13.75**
Burias Point	26.64	12.50	0.60	19.90	20.56	21.80
Sagby Point	46.58	12.44	0.10	18.58	16.70	5.60
Nibong	40.53	21.77	0.00	7.27	21.00	0.00
Taluya Point	11.96	59.36	0.00	18.88	7.30	2.50
Bato Maputi	43.84	29.06	0.00	11.04	10.70	5.36
Lago Point	75.34	0.00	0.00	7.86	9.00	7.70
Hagdan Point	25.96	12.64	16.92	6.76	12.64	19.88
Tinaca Point	29.52	13.24	9.22	6.02	14.46	19.74
Tikang Point	14.83	7.27	7.20	15.03	11.60	39.00
Manibong	46.20	0.00	4.50	20.48	12.84	12.56
Dongon	65.94	3.08	7.14	11.92	3.00	4.92
Gumasa	27.32	8.94	4.88	9.68	12.38	25.96
Batulaki						
GSC						
Tambler	22.41	0.00	0.15	6.01	26.92	29.66
Bual Point						
MALAPATAN	**50.66**	**7.66**	**6.34**	**10.26**	**9.28**	**9.65**
Malapatan (north)	44.88	8.32	7.66	20.52	11.06	5.70
Malapatan (south)	56.44	7.00	5.02	0.00	7.50	13.60
MAASIM	**46.35**	**8.23**	**8.20**	**7.34**	**8.69**	**14.38**
Linao Cove	65.16	0.00	6.42	5.47	0.00	20.28
Malbong	39.05	29.27	1.37	2.90	0.00	24.27
Lumasal	37.80	3.02	5.86	26.34	10.80	4.70
Katubao	27.08	13.44	25.10	3.80	9.04	15.10
Tampuan Point (slope)	16.48	15.58	5.84	1.34	22.70	31.18
Tinoto Bay (mangrove)	55.19	0.00	2.42	2.77	24.93	7.13
Tampuan Point (wall)	63.76	2.36	15.67	6.01	0.12	3.62
Tampat Point	47.34	0.10	7.16	8.56	8.28	17.66
Tinoto Bay (cliff)	65.27	10.26	3.96	8.85	2.33	5.50

Source: LBII (1993)

Based on LBII's report, 42 coral genera were identified. The dominant genera are *Acropora*, *Porites*, *Diploastrea*, *Goniopora*, *Montipora*, and *Favites*.

At the time of the LBII study, dynamite fishing was prevalent. This was the response of subsistence fishers against the purse seine method of commercial fishers.

Both methods are highly destructive to corals. However, based on interviews conducted in 1994, dynamite fishing was not as prevalent as in the past. However, commercial fishing within municipal waters was still a problem.

Other destructive fishing methods used in Sarangani Bay that have caused degradation to the coral cover include *lintig* or *muro-ami* and poison fishing.

Figure 3.11. Excellent cover of *Acropora* (branching corals) found in Tuka Marine Park, Kiamba.

Apart from destructive fishing, there has also been some extraction of corals (Figure 3.11). However, this is not so prevalent. Only a small trade in dried and painted corals by Badjaos exists in resort beaches in the area. This is primarily because tourism is not developed in the area.

Table 3.7 shows that the reefs are heavily exploited. This is indicated by the small size of fish and the scarcity of commercially valuable species. However, abundance and diversity are dependent on coral cover. In all of the sites surveyed by SU, most fish were small with very few species of commercial value. It is obvious that habitat degradation and overfishing have taken their toll.

A major threat to corals as well as the whole coastal ecosystem is the sedimentation due to erosion and siltation of denuded watershed and improper agricultural practices. These threats and issues are described in more detail in Chapter 7.

Table 3.7. Number of fish species, fish abundance, and biomass estimates in Sarangani Province including GSC.

Municipality/City	No. of sites surveyed	Area surveyed (m^2)	No. of fish species	Density (no./m^2)	Range of biomass (mt/km^2)	Commercially important species	
						No. of species	Biomass (mt/km^2)
Alabel	1	500	8	1	1.63	37	10.75
Glan	13	6,100	42	2	9.57	140	3.03-102.22
GSC	1	300	7	1	3.00	30	19.23
Kiamba	2	1,000	7	1	2.39	45	11.65-15.95
Maasim	9	3,900	50	<1	8.16	138	12.75-57.51
Malapatan	2	1,000	9	2	0.36	44	2.56-6.26

Source: LBII (1993). No data collected for the Municipality of Maitum.

Within the reef area surveyed, fish species composition and production value estimates were also conducted (Table 3.7). A total of 191 reef fishes were identified. Fish biomass estimates ranged from 2.56 to 102.22 mt/km^2. The highest fish biomass estimate was observed in Glan, while the lowest was in Malapatan. The highest fish biomass estimates for commercially important species were observed in Glan (9.57 mt/km^2) and Maasim (8.16 mt/km^2) represented by 42 and 50 species, respectively (LBII 1993).

Among the fish species observed, the most represented families are Pomacentridae (42 species), Labridae (34), Chaetodontidae (18), and Acanthuridae (12) (Table 3.8).

Table 3.8. List of fish families and species observed.

Family	Common name	No. of species	
		MGP (1993)	CRMP (1999)
Aulostomidae	Surgeonfish	12	21
Acanthuridae	Cardinalfish	3	9
Apogonidae	Trumpetfish	1	0
Balistidae	Triggerfish	5	7
Blennidae	Blenny	0	1
Caesionidae	Fusilier	4	8
Carangidae	Scad and jack	2	2
Centriscidae	Shrimpfish	1	1
Chaetodontidae	Butterflyfish	18	23
Cirrhitidae	Hawkfish	3	5
Dasyatidae	Stingray	1	1
Diadontodae	Porcupine fish	0	2
Ephippidae	Batfish	0	2
Fistulariidae	Flutemouth	1	2
Gobiidae	Goby	1	0
Haemulidae	Sweetlip	1	4
Holocentridae	Squirrelfish	4	8
Labridae	Wrasse	34	38
Lethrinidae	Emperor	1	1
Lutjanidae	Snapper	5	6
Microdesmidae		2	0
Monacanthidae	Filefish	2	5
Mullidae	Goatfish	9	9
Muraenidae	Moray eel	2	2
Nemipteridae	Threadfin bream	1	4
Ostraciidae	Boxfish	1	3
Pinguipedidae	Sandperch	1	3
Plotosidae	Sea catfish	1	1
Pomacanthidae	Angelfish	7	6
Pomacentridae	Damselfish	42	50
Priacanthidae	Big-eye	8	5
Scaridae	Parrotfish	6	11
Scorpaenidae	Scorpionfish and stonefish	0	0
Serranidae	Grouper	8	21
Siganidae	Rabbitfish	0	0
Sphyraenidae	Barracuda	1	0
Syngnathidae	Seahorse	1	0
Synodontidae	Lizardfish	0	3
Tetraodontidae	Pupperfish	3	4
Zanclidae	Moorish idol	1	1
		193	**269**

Source: LBII (1193) and Participatory Coastal Resource Assessment 1998-99

The family Pomacentridae (damselfishes) is the most numerous fish species. This includes the following species: *Chromis ternatensis* (18 percent of the total numerical abundance), *Neoglyphidodon melas* (13 percent), *Chromis atripectoralis* (8 percent), *Acanthochromis polyacanthus* (7 percent), *Pomacentrus coelestis* (7 percent) and *Pomacentrus moluccensis* (6 percent). The most dominant species by biomass are represented by the species *Neoglyphidodon melas* (22 percent of the total biomass), *Taeniura lymma* (12 percent), *Chromis ternatensis* (8 percent), *Ctenochaetus striatus* (5 percent), and *Pomacentrus moluccensis* (3 percent).

Seaweeds

The only available seaweed information in the area came from the studies conducted by SUML (1997). Sixty-six species were identified belonging to division Chlorophyta (green algae), Cyanophyta (blue-green algae), Phaeophyta (brown algae) and Rhodophyta (red algae).

The most common seaweed species sold in the market are *Caulerpa* sp. (*lato*) and *Eucheuma* sp. (*guso*). In Kawas, Alabel, fisherfolk allege that there is a bed of *Caulerpa* sp. covering an area of at least a hectare at 70 ft deep. However, this has yet to be verified.

Other Marine Fauna

LBII (1993) has indicated that marine mammals such as whales, dolphins, and sea turtles are common in the area. The Earth Island Institute (EII) confirmed this report and indicated that there are 5 species of whales and 7 species of dolphins in the area. However, there is no available listing of species observed. Sharks have also been observed in the area, particularly, the whale shark (*Rhincodon typus*).

Dugong (*Dugong dugon*) is present in the area particularly in Glan and Kiamba (Figure 3.12). Researchers of the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) and other agencies who monitor Sarangani Bay have verified this. *Dugong* have also been found beached in the coastal areas of Glan.

Figure 3.12. *Dugong* washed on the shoreline of Sarangani Bay in Glan.

Surfacing sea turtles is a common sight in the coastal waters of Sarangani. The most

Figure 3.13. Newly hatched green sea turtles found in Lomuyon, Kiamba.

common species is the green sea turtle (*Chelonia mydas*) and on some occasions the hawksbill (*Eretmochelys imbricata*). The presence of sea turtles in the area was also verified by the CRMP team which saw the animal above and underwater in Kawas, Alabel, and Kiamba, respectively (Figure 3.13).

Tuka Marine Sanctuary, Kiamba

One marine sanctuary in Sarangani Bay has been carefully monitored since 1997 with the assistance of UP-MSI and CRMP in collaboration with local government and academia in Sarangani. The Tuka Marine Sanctuary in Kiamba covers about 10 hectares of coral reef area and was marked with buoys and signs in 1998. Although the ordinance was only recently passed, the sanctuary has been practically enforced since 1997 and has demonstrated the positive results of coral reef protection. The living hard corals inside the santuary have improved from an average cover of 42.7 percent in 1998 to 55 percent in 2001 (Figure 3.14). Similarly, the abundances of fish inside and outside of the sanctuary have increased substantially over the 3 year period (Figure 3.15).

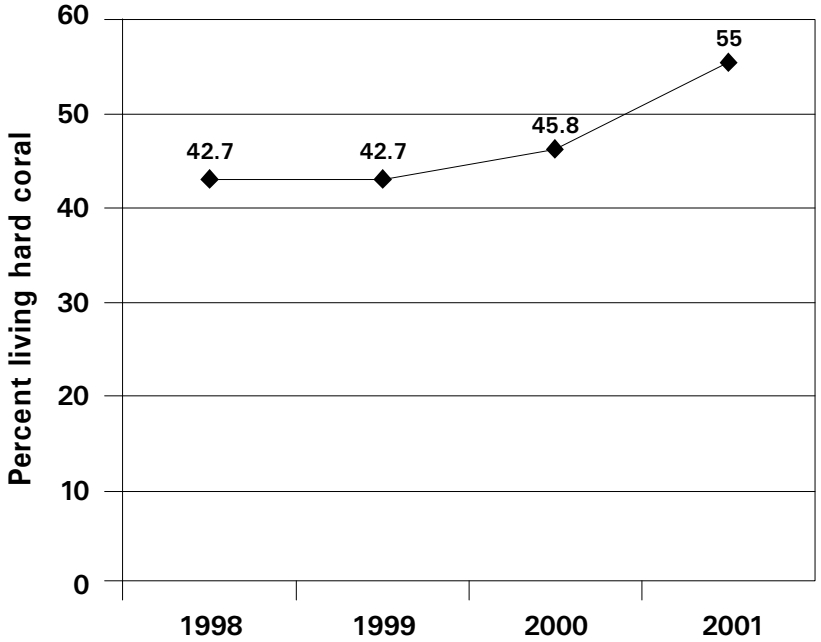


Figure 3.14. Change in living hard coral cover inside the Tuka Marine Sanctuary from 1998 to 2001.
Source: Uychiaoco et al*. 2001*

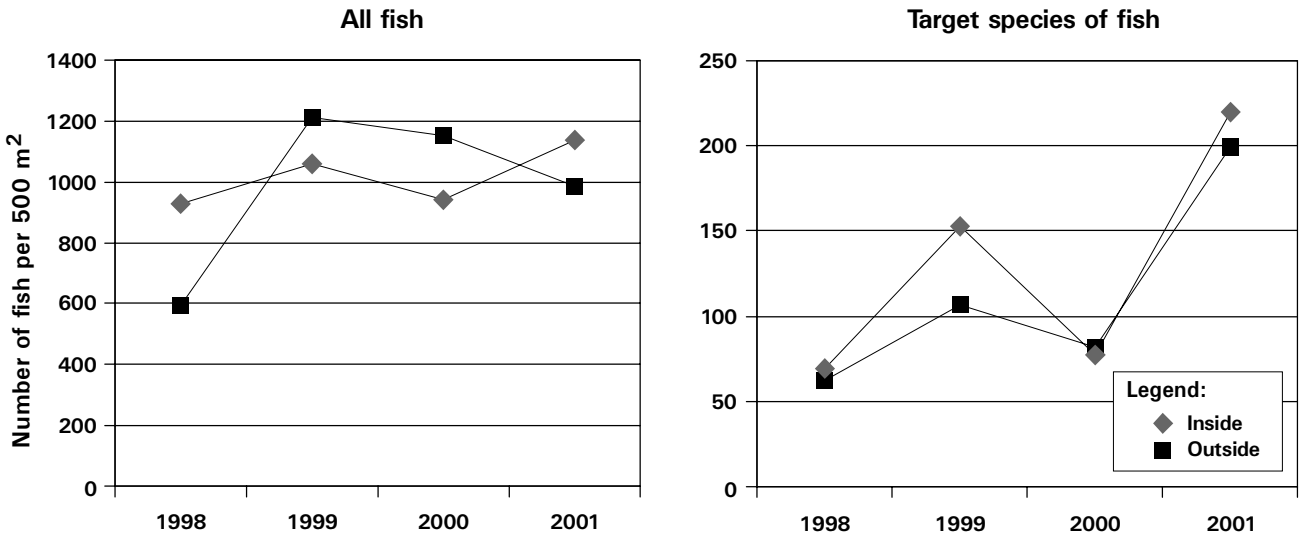


Figure 3.15. Change in fish abundances (number of individuals within 500 m^2 area) inside and outside of the Tuka Marine Sanctuary from 1998 to 2001.
Source: Uychiaoco et al*. 2001*

SUMMARY

The rich coastal and marine resources of Sarangani Bay are being increasingly impacted by development. Trends indicate declining coral reef and mangrove areas and deteriorating water quality. The productive coastal ecosystems require protection and management and stabilization of water quality to ensure long-term fish production and access to the other associated benefits of these valuable coastal resources.

Chapter 4
SOCIOPOLITICAL SETTING

POLITICAL/ADMINISTRATIVE BOUNDARIES

Sarangani Province is bounded on the north by the Province of South Cotabato, on the east by Davao del Sur, on the south by the Celebes Sea, and on the west by Sultan Kudarat. The 6 municipalities of Sarangani Province are politically and physically divided into 2 clusters with 3 municipalities in each cluster. The cluster on the eastern side is composed of Alabel, Malapatan, and Glan while the cluster on the western side is composed of Maasim, Kiamba, and Maitum. Dividing the 2 clusters are the GSC on land and Sarangani Bay on water (see Figure 1.1).

The number of coastal *barangays* in the municipalities of Sarangani is shown in Figure 4.1. Glan and Kiamba have the highest number of coastal *barangays*, while Alabel has the least. There are 67 coastal *barangays* in total.

The municipality, city, and its coastal *barangays* are shown in Figures 4.2 to 4.8. A strip of area at the border of Malapatan and Davao del Sur is a disputed land. However, the PPDO does not mention the total area involved in the dispute.

DEMOGRAPHY

The demographic data presented in this section are taken from the results of the 1990 and 1995 census conducted by the National Statistics Office (NSO) and the municipal Integrated Rural Accessibility Planning (IRAP) data of 1993.

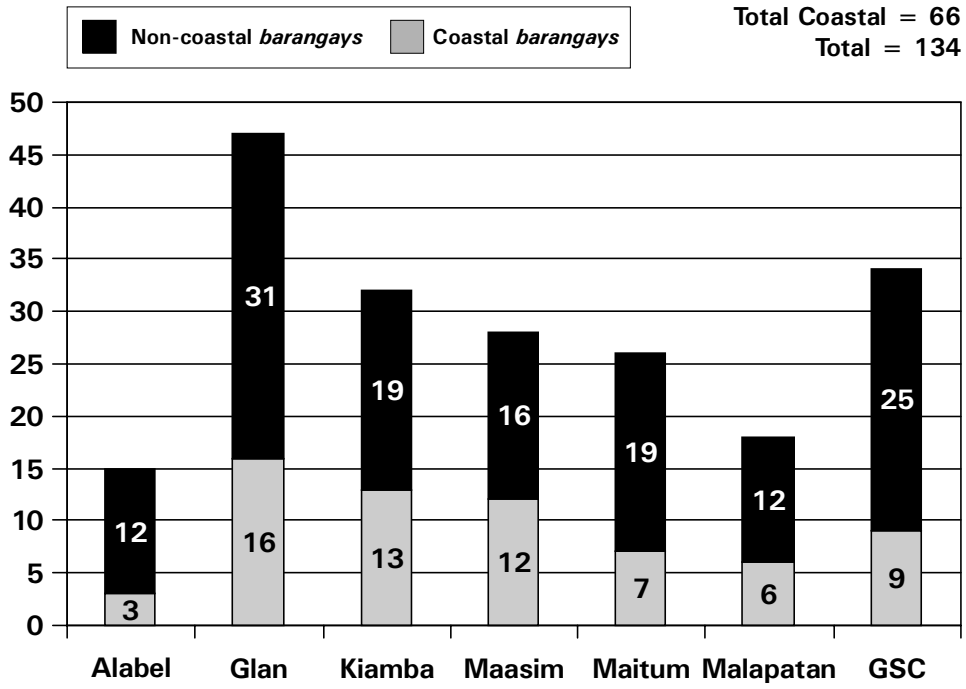


Figure 4.1. Number of coastal and total *barangays* in the profile area.

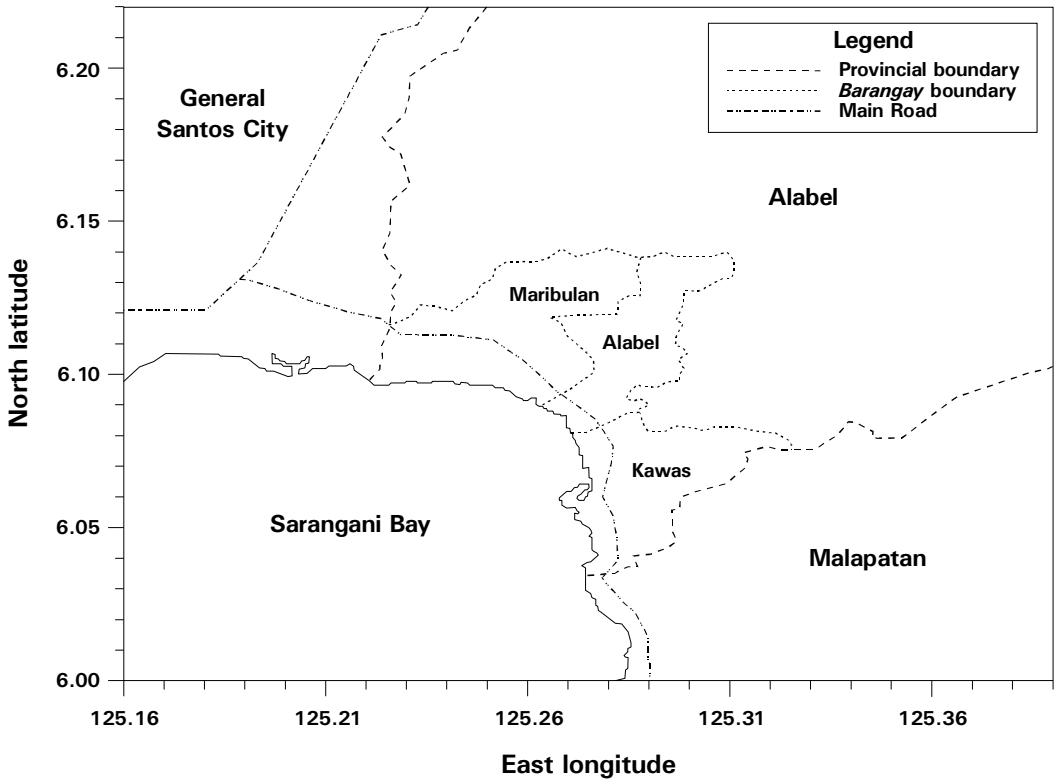


Figure 4.2. Alabel coastal *barangays*.

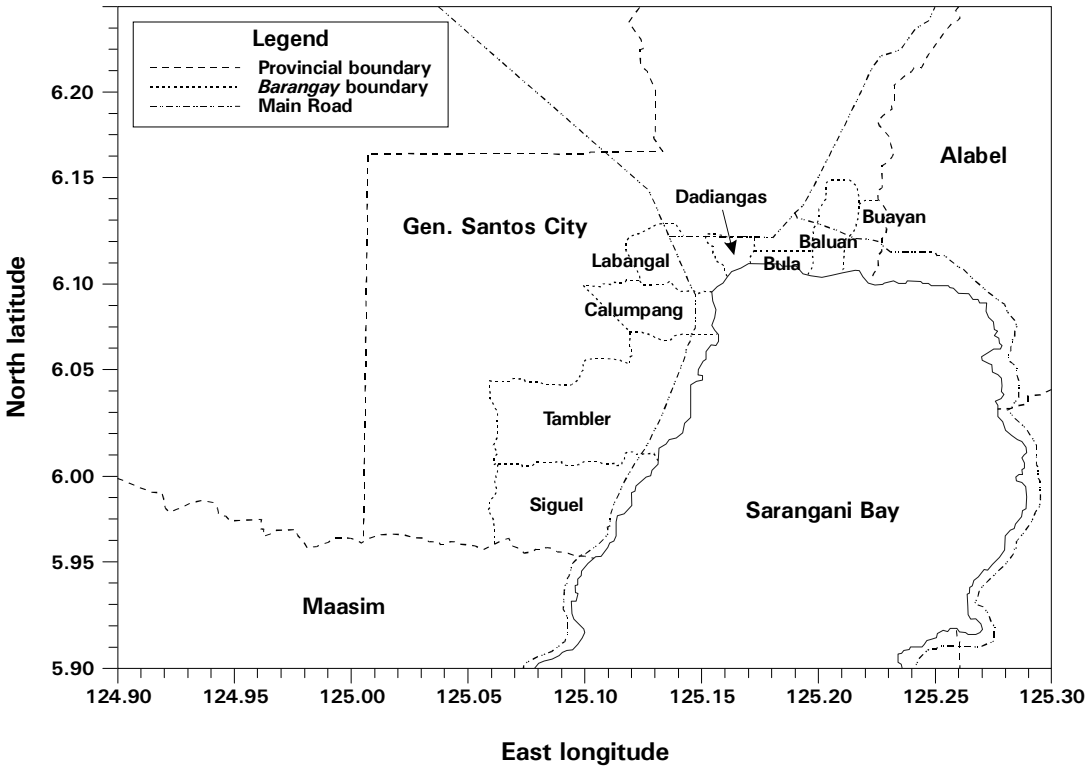


Figure 4.3. GSC coastal *barangays*.

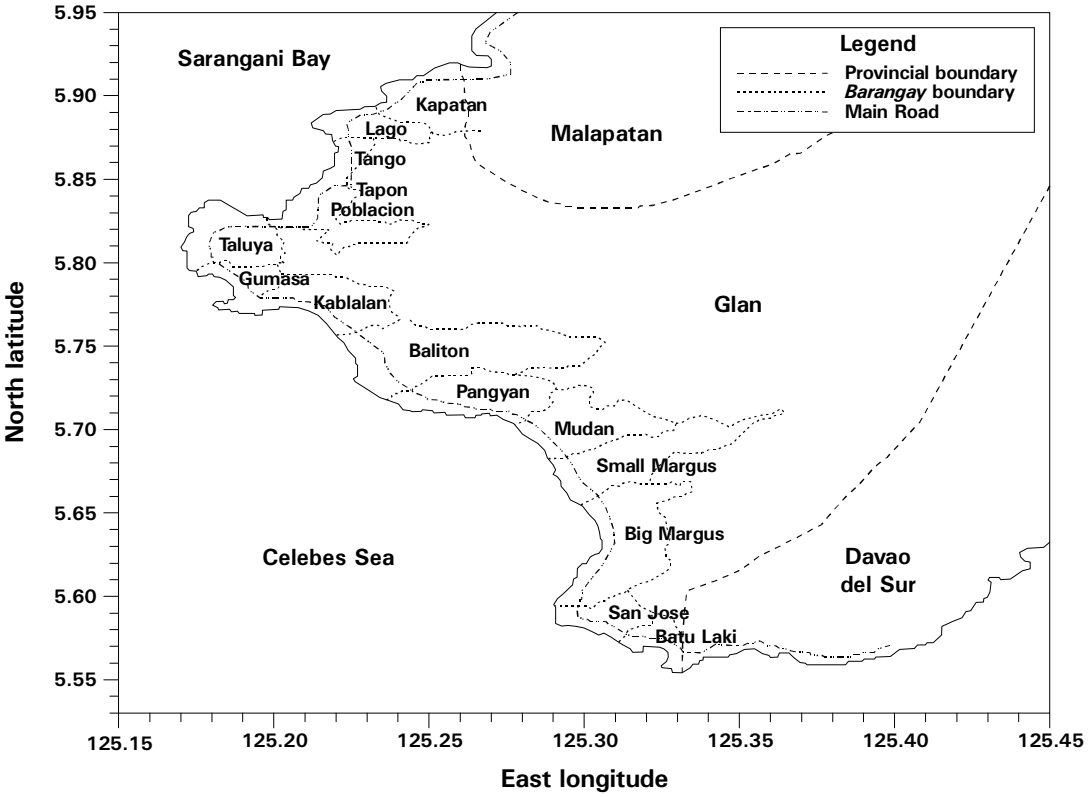


Figure 4.4. Glan coastal *barangays*.

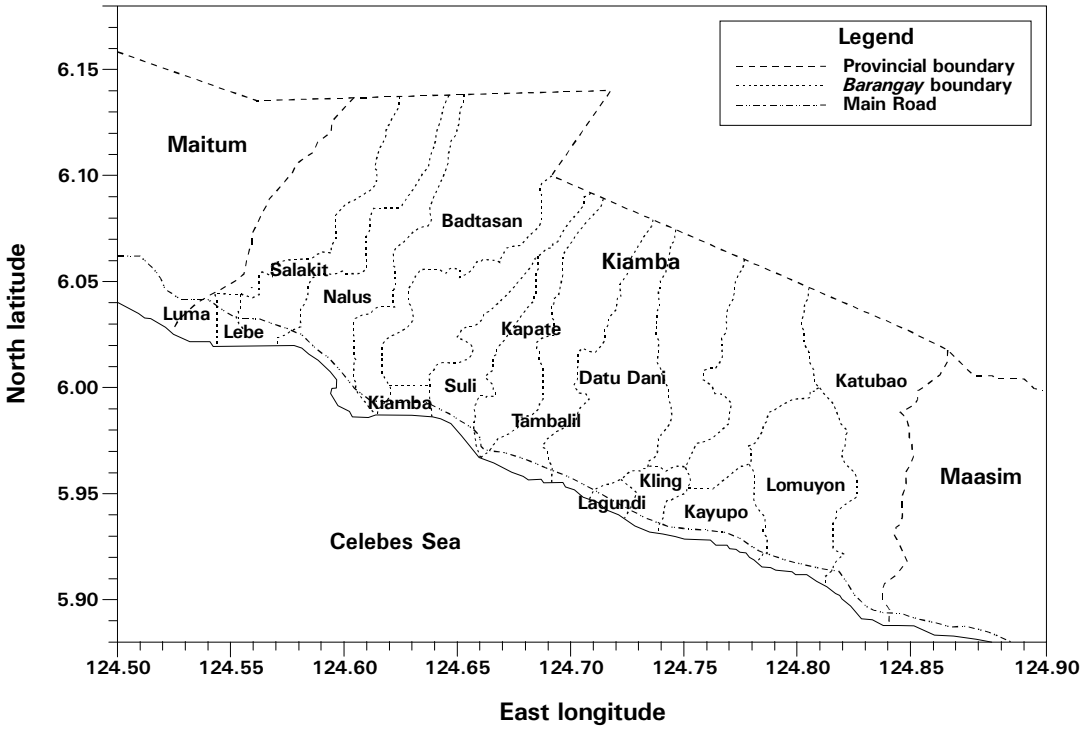


Figure 4.5. Kiamba coastal *barangays*.

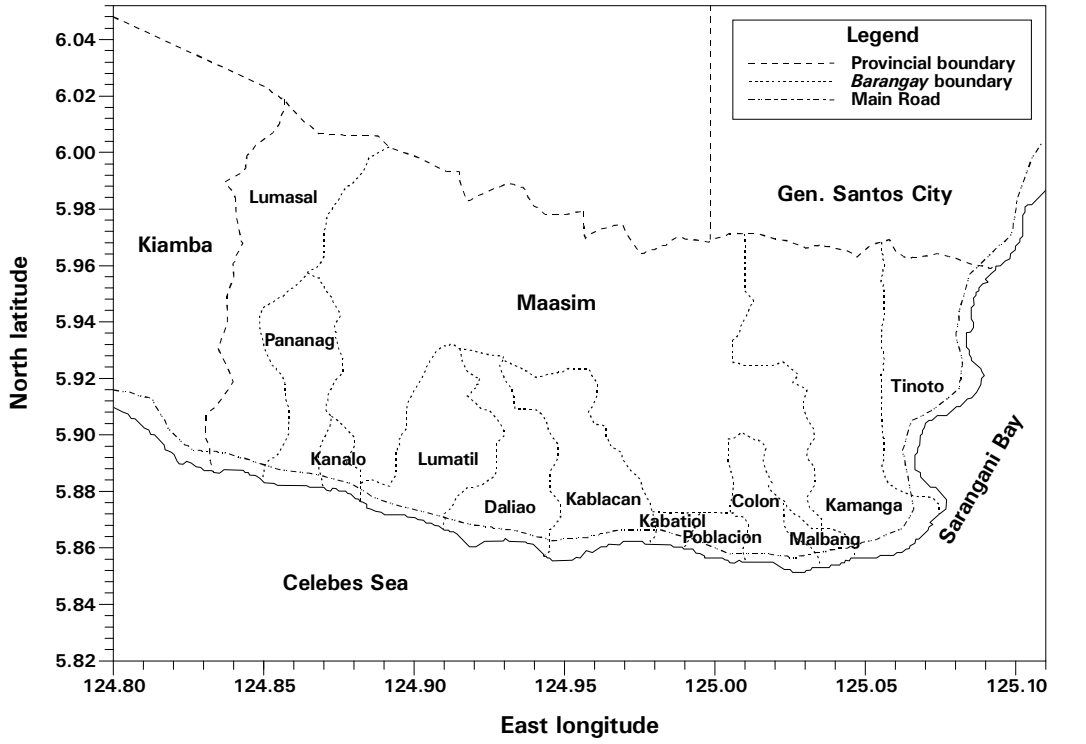


Figure 4.6. Maasim coastal *barangays*.

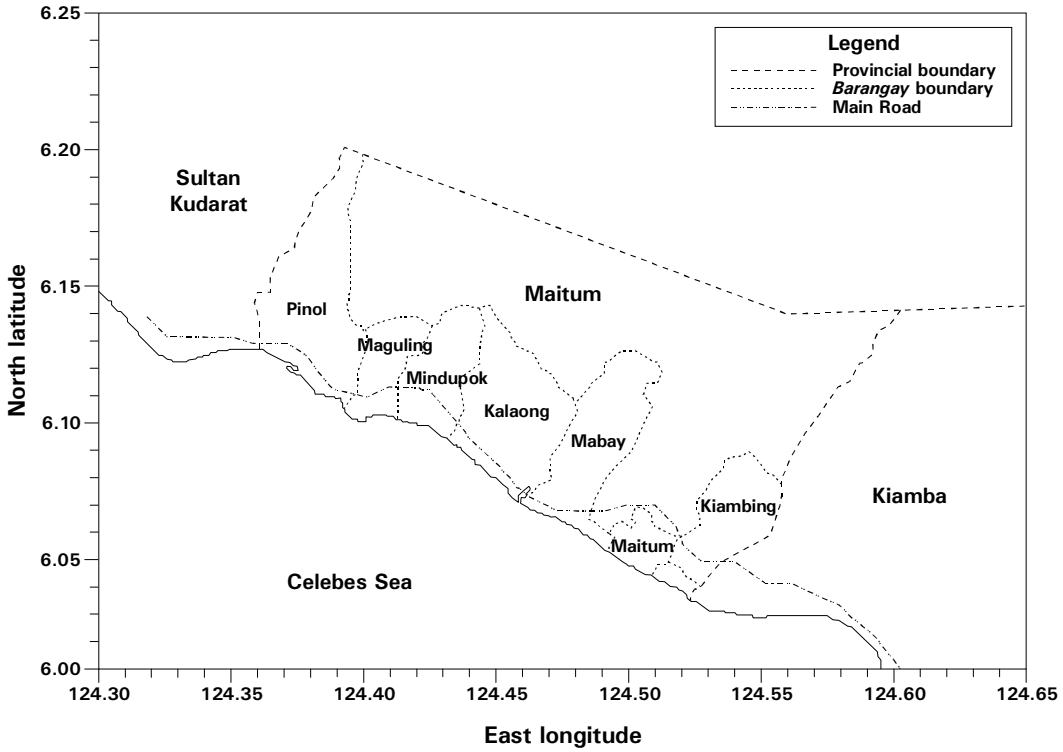


Figure 4.7. Maitum coastal *barangays*.

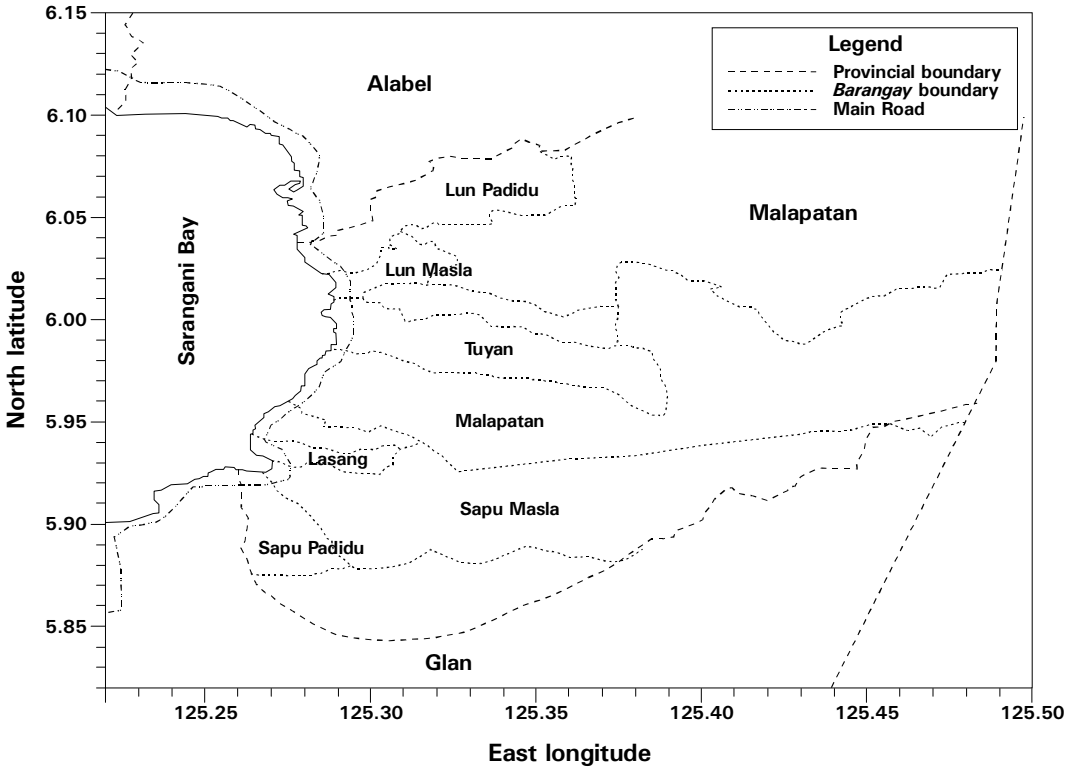


Figure 4.8. Malapatan coastal *barangays*.

Population Size, Density, and Growth Rate

The 1995 total population of the 6 municipalities and 1 city in the profile area is 603,741. Of this, 69 percent live in coastal *barangays*. This is up by more than 10 percent from the 1990 data (Table 4.1).

Table 4.1. Population size, density, and growth rate of the coastal municipalities of Sarangani Province and GSC, 1990 and 1995.

Municipality/ City	Population		Annual growth rate (percent)		Population density (persons/km^2)	
	1990	1995	1980-90	1990-95	1990	1995
Alabel	40,730	46,527	4.74	2.53	75	86
Glan	60,375	73,768	2.14	3.83	87	106
Kiamba	35,386	39,717	2.21	2.17	85	95
Maasim	26,725	31,641	1.55	3.21	37	43
Maitum	25,619	35,009	0.30	6.96	79	108
Malapatan	36,230	47,911	1.92	5.37	48	63
GSC	249,678	327,173	5.26	5.55	466	674
Total/Average	**474,743**	**601,746**	**2.60**	**4.23**	**125**	**168**

Source: NSO (1992)

The growth rates exhibited by Malapatan, Maitum, and GSC are way over the national growth rate for the same period, which is 2.32 percent. This is primarily due to the rapid growth and urbanization occurring in GSC, which is attracting a lot of in-migration. Sarangani is also the fastest growing province in Region XI with an annual growth rate of 4.98 percent, while GSC has the highest annual population growth rate in the region.

The growth rate in Alabel seems to have decreased by 2.21 percent compared to the previous decade.

Population density is below the national figure of 228 persons/km^2, except for GSC. However, if one takes into account the coastal *barangays* only, one will note a general increase in population density, with Alabel, Glan, and GSC going over the national figure. This suggests that more people tend to live in the coastal areas.

Based on Tables 4.1 and 4.2, one can see that the population is highly concentrated in the coastal *barangays*.

Households

Table 4.3 compares household size and number from the 1990 and 1995 census. The table shows that household size is decreasing. However, in line with the population increase, the number of households has also increased. While population has increased by 20 percent, households have increased by 25 percent. This is consistent with national figures, which show a trend of decreasing household size. In 1980, the average

Table 4.2. Population size and density of coastal *barangays* per municipality of Sarangani Province and GSC.

Municipality/ City	Total population of coastal *barangays*		Population density of coastal *barangay* (persons/km^2)	
	1990	1995	1980-90	1990-95
Alabel	18,226	20,087	433	477
Glan	39,398	45,810	179	275
Kiamba	30,222	32,217	115	123
Maasim	22,516	26,752	60	71
Maitum	11,997	12,899	179	193
Malapatan	23,180	30,747	50	66
GSC	101,183	150,090	985	994
Total/Average	**246,722**	**318,602**	**86**	**314**

Data from NSO (1996) and the Provincial Planning and Development Office 1994

Table 4.3. Household size and number of households per municipality/city.

Municipality/ City	Household size		No. of households	
	1990	1995	1990	1995
Alabel	5.4	5.0	7,564	9,384
Glan	5.4	4.9	11,197	13,919
Kiamba	5.4	5.3	6,616	8,019
Maasim	5.3	4.9	4,812	6,076
Maitum	5.6	5.2	5,134	6,691
Malapatan	5.0	5.2	6,554	9,177
GSC	5.4	5.0	46,144	65,509
Average/Total	**5.4**	**5.1**	**88,021**	**118,775**

household size in the Philippines was 5.6. In 1990, it became 5.3 and in 1995, the figure was 5.1.

Age and Gender Composition

The population across age groups is gradually decreasing (Figure 4.9). This is an indication that there has been no epidemic or catastrophic event in the area for the past decades. The population shows a normal age distribution where the younger population dominates. In the entire area, 72 percent of the population is below 30 years old, indicative of a very young community.

In Sarangani Province, the population of the productive age group (15 to 64 years old) accounts for 39.5 percent of the population, while in GSC, it accounts for 54.1 percent. The dependency ratio for Sarangani is 84.9 percent, while that of GSC is lower at 70.6 percent. The productive population for the whole area accounts for 56.79 percent, which is higher than the national average of 42 percent. This validates the fact that the area is indeed a center for economic growth. The 65+ group for the profile area city/municipalities accounts for only 2.14 percent of the total population, which is lower than the national average of 3.4 percent (Table 4.4).

The male to female sex ratio for the entire area is almost even with the number of males slightly higher than the number of females. The Sarangani figures are also slightly higher than the national figures (101 males to 100 females). There are 107 males for every 100 females in Sarangani. Even in GSC, the figures are still slightly above the average at 102 males for every 100 females.

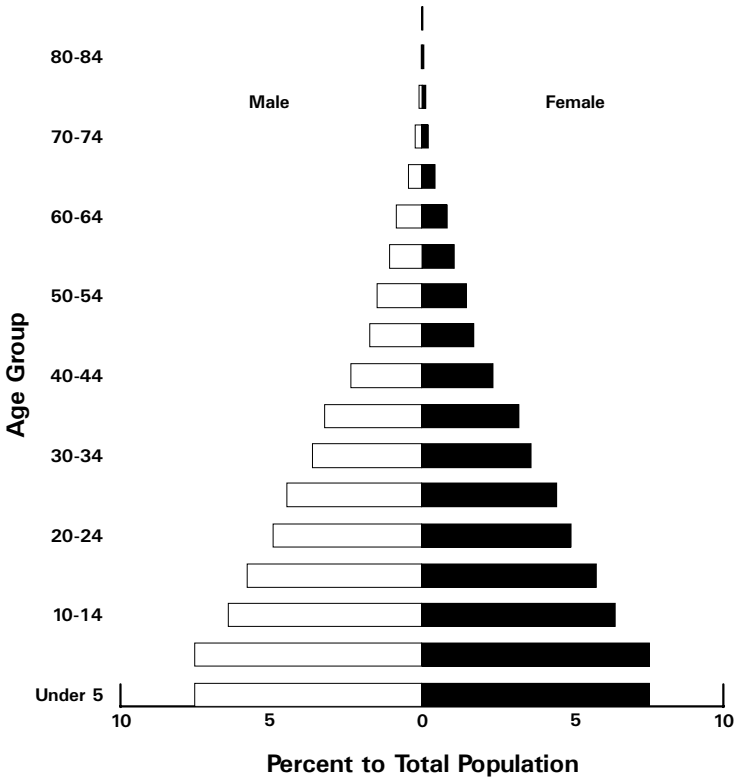


Figure 4.9. Age-sex population pyramid, Sarangani, 1995.

Urban and Rural Population Distribution

There are no urban and rural population distribution data in the 1995 census. The 1980 and 1990 censuses were used instead (Table 4.5). From the data, most of the population in Sarangani Province live in rural areas and only Malapatan has greater than half of its population living in urban areas. As expected, most of GSC's population (98 percent) live in urban areas.

Education

Forty percent of the population 5 years old and over attended or completed elementary education in GSC. Sarangani has a much higher figure of 56 percent. However, in Sarangani, a much higher percentage of population has no grade completed (12.6 percent), while GSC only has 2.5 percent. Those who reached or completed high school in GSC comprise 33.7 percent of the population (5 years and over), while in Sarangani it is 20.8 percent. Academic degree holders are 6.5 percent of the population in GSC and 2.1 percent in Sarangani Province. Only a very small percentage of the population has any post-baccalaureate degree (0.1 percent for Sarangani and 0.2 percent for GSC). The complete breakdown is shown in Figure 4.10.

Table 4.4. Age group breakdown per municipality/city, 1995.

Municipality/ City	Age group						Total	
	0 to 14 years		15 to 64 years		65 years and above			
	Population	% Total	Population	% Total	Population	% Total	Total Population	% Total
Alabel	20,046	43.1	25,385	54.6	1,096	2.4	46,527	100
Glan	32,246	43.7	39,819	54.0	1,703	2.3	73,768	100
Kiamba	16,780	42.2	21,659	54.5	1,278	3.2	39,717	100
Maasim	13,903	43.9	17,022	53.8	716	2.3	31,641	100
Maitum	14,374	41.0	19,704	56.38	931	2.6	35,009	100
Malapatan	20,748	43.1	26,292	54.9	871	1.8	47,911	100
GSC	129,086	39.4	191,833	58.6	6,254	2.0	327,173	100
Total per age group	**247,183**		**341,714**		**12,849**		**601,746**	
% of Total per age group		**41.1**		**56.8**		**2.1**		**100**

Table 4.5. Urban and rural population breakdown, 1980 and 1990.

Municipality/ City	Urban population		Rural population		Average growth rate	
	1980	1990	1980	1990	Urban	Rural
Alabel	8,181	11,457	17,439	29,273	3.43	5.32
Glan	7,215	14,696	41,667	45,679	7.37	0.92
Kiamba	5,432	12,464	23,035	22,922	8.66	-0.05
Maasim	3,529	8,714	19,386	18,011	9.46	-0.73
Maitum	2,461	7,900	22,835	17,719	12.37	-2.51
Malapatan	8,240	18,483	21,725	17,747	8.41	-2.00
GSC	94,176	243,702	55,222	5,976	9.97	-19.94
Total/Average	**129,234**	**317,416**	**201,309**	**157,327**	**8.52**	**-2.71**

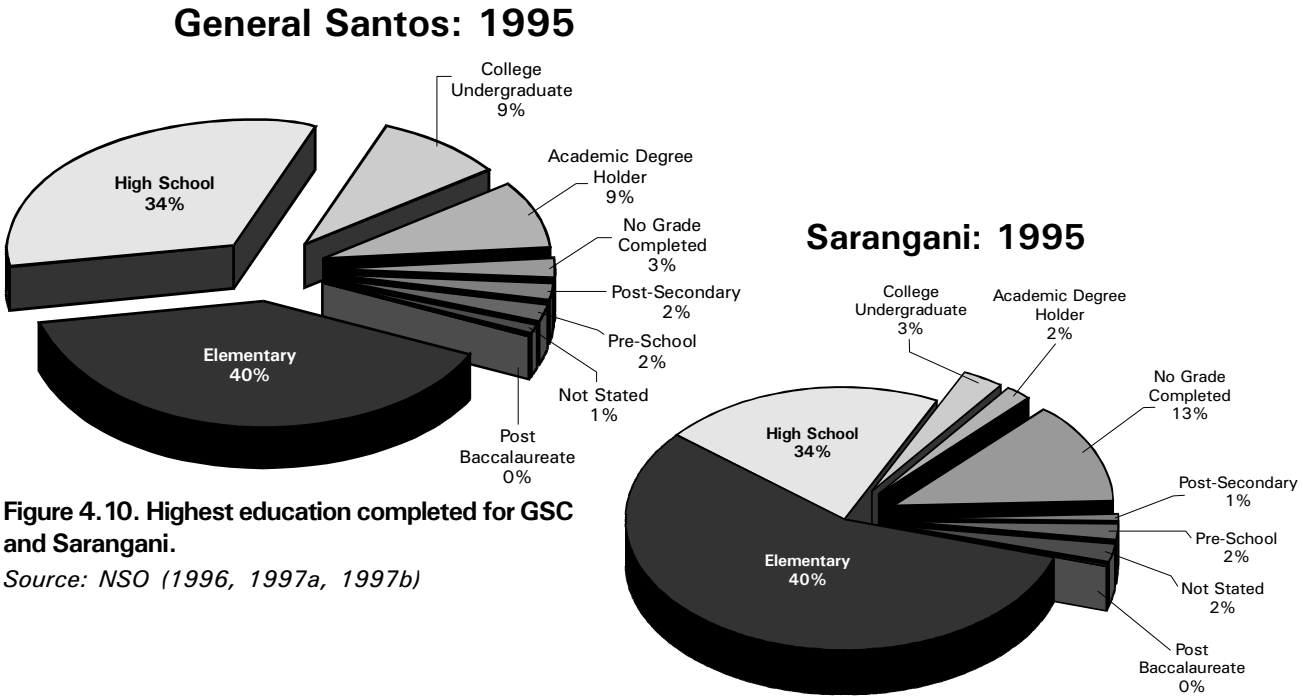


Figure 4.10. Highest education completed for GSC and Sarangani.

Source: NSO (1996, 1997a, 1997b)

The literacy rate for Sarangani is 85.7 percent. GSC has an urban literacy rate of 96.3 percent and a rural literacy rate of 78.1 percent. The national literacy rate is 89 percent.

Sarangani Province has 180 elementary/primary schools, 17 secondary schools, and 2 vocational schools. There is also 1 university that offers various courses. In addition to these, Sarangani has 95 non-formal adult education classes.

GSC has 24 private pre-schools, 54 public schools, and 23 private elementary schools. There are also 16 public/state secondary schools, 6 private secondary schools, 5 colleges, and 14 technical and vocational schools.

Labor and Employment

The NSO data on labor and employment take into consideration the portion of the population 15 years old and over. In Sarangani, it comprises more than 55 percent of the total population, while in GSC it is 58 percent. In GSC and Sarangani, the most common trade skill involves driving and mobile machinery operations. The least common trade involves plant and related operations (Figures 4.11 and 4.12).

However, based on a limited survey by LBII, the coastal households are dependent on fisheries for employment. More than a third of the livelihood in coastal *barangays* are dependent on fisheries-related activities. Table 4.6 shows the result of the LBII survey in 1994.

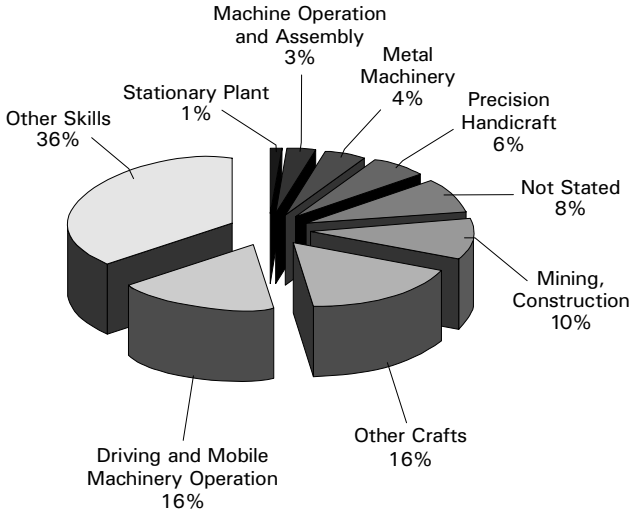


Figure 4.11. Household population 15 years old and over by trade skill, Sarangani, 1995.
Source: NSO (1996, 1997a, 1997b)

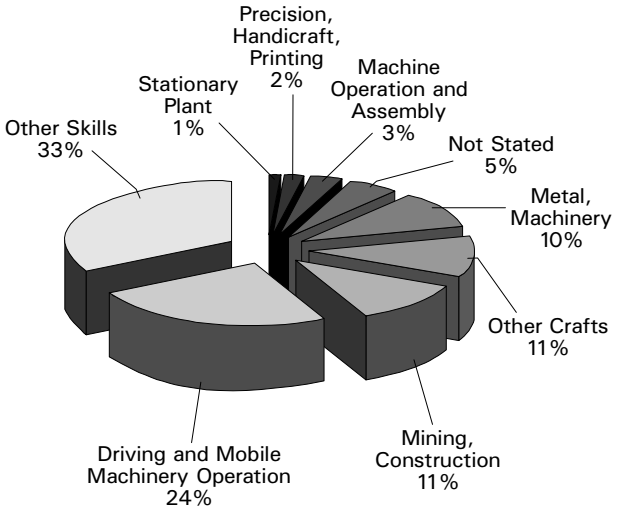


Figure 4.12. Household population 15 years old and over by trade skill, GSC, 1995.
Source: NSO (1996, 1997a, 1997b)

Table 4.6. Distribution of occupation in coastal *barangays*.

Occupation	Distribution (percent)
Municipal fishing	26
Commercial fishing	26
Fish vending	23
Other fishery-related occupations (boatmaking, boat rental, *bangus* fry gathering, and others)	17
Farming/store owner	8

Source: LBII (1993)

Usually, the male members of the household fish while the women sell the catch and tend to be active in fishery associations. Farming or running convenience stores supplement the income derived from fisheries.

In GSC, the majority of the labor force is engaged in services (35.3 percent). Fishing comprises 19.9 percent. In Sarangani Province, agriculture accounts for 70.2 percent. Agriculture also covers the hunting and forestry sector. The fishing sector accounts for 8.2 percent.

In Sarangani Province, the employment rate is 94.7 percent and it has a labor for participation rate of 83.4 percent. Unemployment in the province is 5.3 percent, and visible underemployment is at 16.5 percent. In GSC, the employment rate is 89.4 percent. The national employment rate is 91.3 percent; unemployment rate is 8.7 percent; and underemployment rate is 23.1 percent.

Religious and Ethnic Groups

There are 29 different religious groups in Sarangani and GSC based on the 1990 census. For the province, the most common is the Roman Catholic (63 percent of the population). Other religious groups are Islam (9 percent), Protestant (6 percent), United Church of Christ in the Philippines (6 percent), Alliance of Bible Church Community (3 percent), and Iglesia ni Kristo (2 percent) (Figure 4.13).

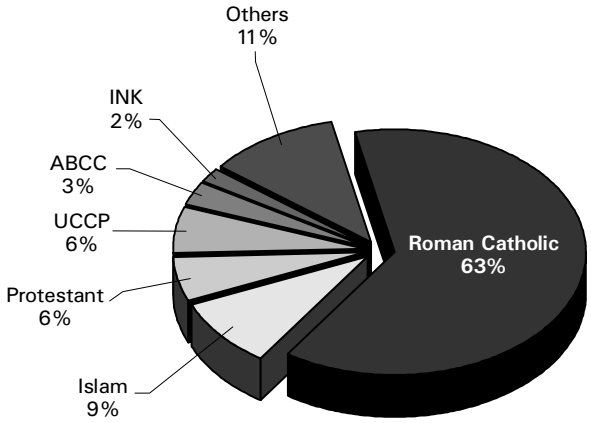


Figure 4.13. Composition of religious groups in Sarangani Province.

In terms of ethnic delineation, there are 5 major groups for the province. These are the Cebuano and Waray (from Cebu, Leyte, Bohol, Negros Oriental, and others), Hiligaynon (from Negros Occidental, Romblon, Antique, Iloilo, Aklan, and Capiz), cultural minorities (such as B'laan, Manobo, T'boli, Tagacaolo, and Dabaweno), Muslim group and tribe (Maguindanao, Maranao, Kalagan, Tausug, Badjao, Sangil, and others), and the Luzon group (Tagalog, Ilocano, Pampangueño, and others). The most numerous group is the Cebuano and Waray (52 percent) followed by the cultural minorities (21 percent), Hiligaynon (9 percent), Muslim group (8 percent), and Luzon group (7 percent).

Dialects

Ninety-four local dialects and 4 foreign languages are being spoken in the entire Sarangani Province. The foreign languages are Chinese, English, German, and Indonesian. English is widely spoken and taught in school. The Indonesian language also has considerable influence. The speakers of this language are concentrated in the municipalities of Glan and Maasim. The Indonesian-speaking people are actually foreigners, many of whom are fishers. However, the legality of their stay in the Philippines has not been ascertained.

For the local dialects, the most spoken is Cebuano (55 percent of the provincial population). Other dialects with large users are Hiligaynon (11 percent), Badjao (10 percent), Maguindanao (5 percent), Ilocano (4 percent), T'boli (3 percent), and Tagalog (3 percent). However, at the municipal level, the distribution is different. Although Cebuano is the major dialect, some dialects also dominate such as Ilocano and T'boli in Kiamba and Maitum. T'boli is also spoken by many people in Maasim. Figure 4.14 shows the distribution of spoken dialects.

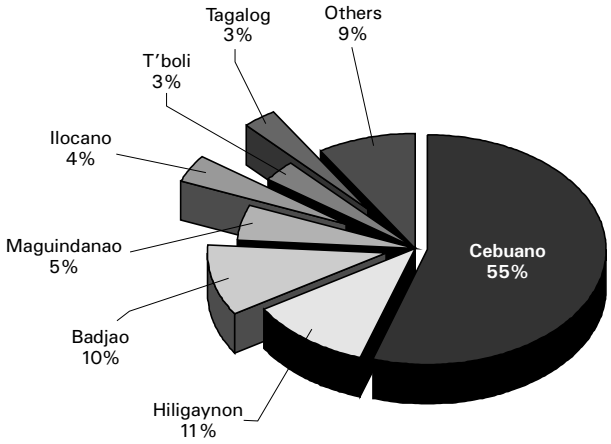


Figure 4.14. Dialects spoken in Sarangani Province.

HEALTH, SANITATION, AND MEDICAL CARE

There are 4 primary (10-bed capacity) and 1 secondary (25-bed capacity) hospitals in Sarangani Province. The district hospital is located in Kiamba. Only the municipalities of Alabel and Malapatan do not have primary hospitals. However, all municipalities have rural health centers. There is also a medicare hospital located in Glan with a 15-bed capacity.

The entire province has 14 medical doctors, about 32 nurses, 93 midwives, 5 pharmacists, 7 medical technologists, 10 sanitary inspectors, 2 nutritionists, 8 dentists, 2 X-ray technicians, and 629 *barangay* health workers. Most of them are in secondary hospitals and in private clinics. Medical doctors visit rural health centers on a sporadic basis. However, a nurse or a midwife stays at these centers during regular working days.

In GSC, there are 4 tertiary, 1 secondary, and 2 primary hospitals equipped with modern health facilities and medical personnel. Each tertiary hospital has at least a 100-bed capacity while the primary hospitals complementing them have at least a 10-bed capacity. There are also 62 clinics in the area.

SETTLEMENTS

Houses in the coastal areas of the province can be classified as made from light materials, semi-permanent, or permanent (concrete) residences. Majority of the houses are made of light materials (83 percent) and only 4 percent are permanent. In terms of ownership, 90 percent own their house. In terms of lot ownership, only 32 percent own lots (Table 4.7). The problem of land tenure and squatting in coastal areas will become more of an issue as increasing land development takes place.

In the survey conducted by LBII, majority (45 percent) of coastal dwellers live in wooden/mixed houses. Thirty-three percent live in huts made of light materials like *nipa* and bamboo, while the remainder live in makeshift houses.

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

Sarangani Province's 2,691.4-km road network consists of 270.97-km national road, 454.5-km provincial road, 162.44-km municipal road, and the rest are *barangay* roads. GSC, on the other hand, has a 434.118-km road network. Thirteen percent of this are national roads, while 43 percent are city roads.

Table 4.7. Percentage composition of house types and ownership in some areas in the coastal municipalities of Sarangani Province.

House type and ownership	Linao Point	Tinoto, Maasim	Kawas Point, Alabel	Lun Padidu	Suli	Lago Point	Gumasa	Total
No. of respondents	16	54	23	40	44	40	35	252
House type								
Light materials	94	78	78	63	91	90	97	84
Semi-permanent	6	15	22	23	9	10	0	12
Permanent	0	7	0	15	0	0	3	4
House ownership								
House owned	56	98	100	97	84	77	100	87
House owned by relative	38	2	0	3	13	23	0	11
Land ownership								
Lot owned	36	40	33	28	17	30	39	32
Lot owned by relative	64	60	67	72	83	70	61	68

Source: SUML (1997)

The road network includes an all-weather 178-km road network connecting 10 major municipalities to GSC (Figure 4.15). This network was completed in 1994 at a cost of US$63.3 million. This project has significantly reduced travel time, fares, and hauling costs in the area.

Figure 4.15. Part of the 178-km road network connecting GSC to the 10 major municipalities.

In Sarangani, Land Transportation Office records show a total of 3,180 registered motor vehicles. Of these, 1,184 are cars/jeeps, 1,499 are motorcycles, and 497 are trucks, buses, and trailers. GSC, on the other hand, has 19,610 registered motor vehicles. Of these, 6,566 are cars and jeeps, 11,593 are motorcycles, and 1,451 are buses and trailers. GSC has a larger vehicle count since most vehicle owners in Sarangani register in GSC. At least 5 major taxi and rent-a-car companies operate in the city.

The Department of Public Works and Highways reported in 1993 that Sarangani Province has a total of 43 bridges with a total length of 2,117.81 m. This includes permanent and temporary bridges, concrete, bailey, timber, and RCIB bridges.

Sea transport including cargo loading and passenger traffic in the area is through Makar Wharf. Four major shipping lines (William Lines, Inc., W&GA Company, Sulpicio Lines, and Negros Navigation) ply the Manila-GSC Route with varying stopovers. Travel time ranges from 35 to 56 hours.

To support Makar Wharf, secondary ports will be developed in Alabel and Glan. This is supposed to handle short-haul domestic inter-island shipping. A port in Glan already exists, but it needs to be completed including yard expansion and pier widening. There is also a small port in Kiamba, but this only caters to fish landing and farm produce.

The GSC International Standard Airport serves as a jump-off point to both the city and Sarangani. The airport costs US$50 million and includes a 3,200-m runway, 2 taxiways, 1 apron, a terminal building, flight and emergency service stations, hangar and fueling station, cargo handling equipment, and cold storage.

The airport can be reached via a 1.5-hour flight from Manila. There are also direct flights to the city from Davao, Cagayan de Oro, Zamboanga, and Cotabato. In 1997, the Air Transportation Office reported that passenger traffic through the airport stood at 142,537 while cargo was at 3,587,105 mt.

GSC has modern telecommunication facilities that include international direct dialing (IDD) and national direct dialing (NDD) telephone service, public call offices, and telegram systems. These include such companies as Pilipino Telephone Corporation (PilTel), Philippine Telegraphic and Telecommunications Company (PT&T), and RCPI. Facsimile services, cellular telephones (Smart, Mobiline, Globe-Telecom), pager systems (Easycall, Pocketbell, Mobiline), VHF radio systems, and Internet service providers (ISPs) are available. In 1996, PilTel installed 8,606 residential lines and 3,534 business lines. Sixty pay phone stations were also installed along with 32 business trunk lines.

In Sarangani, only Alabel, Malapatan, and Glan have PT&T public calling offices. PilTel has begun installing telephone lines in Sarangani under the Executive Order 109 program. The program involves the installation of 1,280 lines in Alabel, 3,200 in Glan, 640 in Maasim, 640 in Maitum, and 640 in Kiamba at a cost of US$16.2 million.

Aside from the ports previously mentioned, there is a fish port complex located in Tambler, GSC. The fish port complex costs US$33.3 million and includes 748 m of landing/preparation area; 383 m of wharf; preparation facilities which include cold storage, brine freezer, air blast; and contact freezer with 1,500-t capacity and a 60-t per day ice plant. It also includes more than 4,000 m^2 of market halls, fishing gear maintenance sheds, fish container storage yard, maintenance sheds, power and water utilities system, roads and parking areas, drainage and wastewater treatment plants, and fuel supply facilities.

National and regional dailies and weeklies are available in the profile area. There are 9 regional weeklies based in GSC. Broadcast media services in the area are extensive

and quite modern. There are 2 television stations and a 24-channel cable TV network. There are also 10 AM and 7 FM radio stations serving the area.

SUMMARY

The Sarangani Bay Coastal Area is rapidly developing with a sound foundation of sociopolitical information and monitoring. Key trends include:

- There are 66 coastal *barangays* out of a total of 134
- Population density in coastal *barangays* is high (above the national average for all *barangays*) and increasing
- Average family size is less than 5.1, down from 5.3 in 1990
- Literacy rate is about 90 percent but few graduate from college
- Employment rates are above the national average
- Infrastructure of roads, ports, electricity, and phones is well developed and modern
- Politically, Sarangani is only marginally affected by the problems in western Mindanao

Chapter 5
ECONOMIC SECTOR

FISHERIES

The fishery resources of Sarangani Bay and adjoining waters are derived from capture fisheries and aquaculture. Based on Presidential Decree 704, capture fisheries can be classified as commercial or municipal fisheries. The 2 differ in terms of boat tonnage person power involved and the fishing grounds where each can operate. Commercial fishers use boats with a gross weight of 3 t or over and fish in areas farther than 15 km from the coast. In contrast, municipal fisheries involve fishing in coastal waters less than 15 km from the shore and in inland waters, use of vessels not greater than 3 GT, or fishing without the use of vessels. In reality, however, many commercial and municipal fishers fish in all areas of the bay, regardless of the distance from the shore (Figure 5.1).

Figure 5.1. Commercial fishing boats still fish in municipal waters of Sarangani Bay.

Aquaculture is the raising of aquatic and marine plants and animals in enclosures, usually freshwater and brackishwater ponds,

fishpens and cages, or with the use of stakes and hanging lines as in the culture of mollusks (such as oysters and mussels) and seaweeds. Aquaculture is practiced in the coastal areas of Sarangani Bay and Celebes Sea. Construction of fishponds in the area has been a major issue due to the denudation of mangrove areas.

Based on national figures, the fisheries sector provides direct and indirect employment to over 1 million people, or about 5 percent of the national labor force of whom 65 percent are in municipal fishing, 25 percent in aquaculture, 5 percent in commercial fisheries, and 5 percent in ancillary activities including post-harvest handling, processing, transport, marketing, boat-building and repair, and manufacturing/ distribution of fisheries-related activities.

Capture Fisheries

In the Philippines, municipal fishing has been in a steady downtrend. Its contribution to total production decreased from 57 percent in the early 1970s to just 30 percent in 1996. In general, production growth has been very minimal over the last 5 years, averaging 1.5 percent per year while catch per unit effort (CPUE) has steadily declined (White and Cruz-Trinidad 1998) (Figures 5.2 and 5.3). Nevertheless, fishing remains a major activity of residents in coastal areas, and GSC is the second major fish landing in the Philippines.

The succeeding discussions are based on the studies of MSU-SUML (1997), and the results of the PCRA activities. Based on the PCRA, the most common fishing method is hook and line/handline/dropline. This type of fishing method accounts for 65 percent of all the methods used. Drift gill nets account for 22 percent. This is true for all cities and municipalities except for Alabel. In Alabel, 9 out of 10 respondents admitted that illegal or controversial fishing is practiced in their coastal area (Table 5.1). However, it is very difficult to generalize from these data due to the small sampling size.

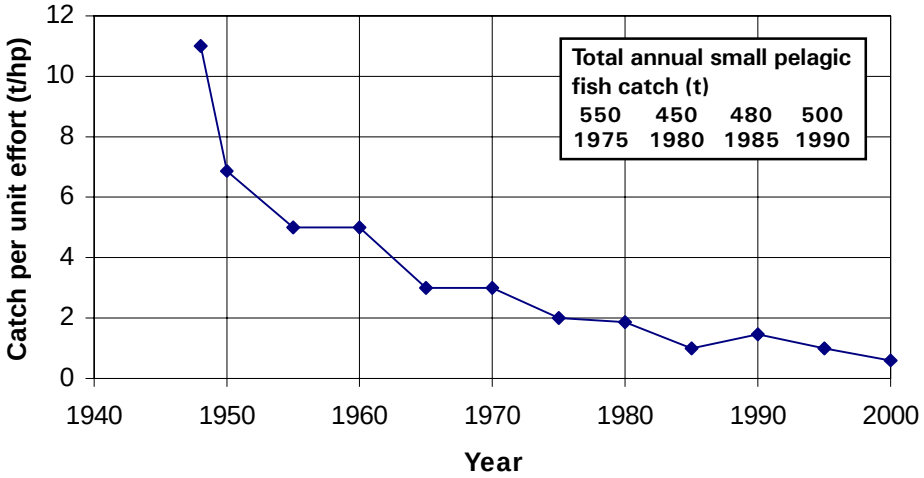


Figure 5.2. Trend of catch per unit effort for small pelagic fisheries since 1948.
Source: White and Cruz-Trinidad (1998)

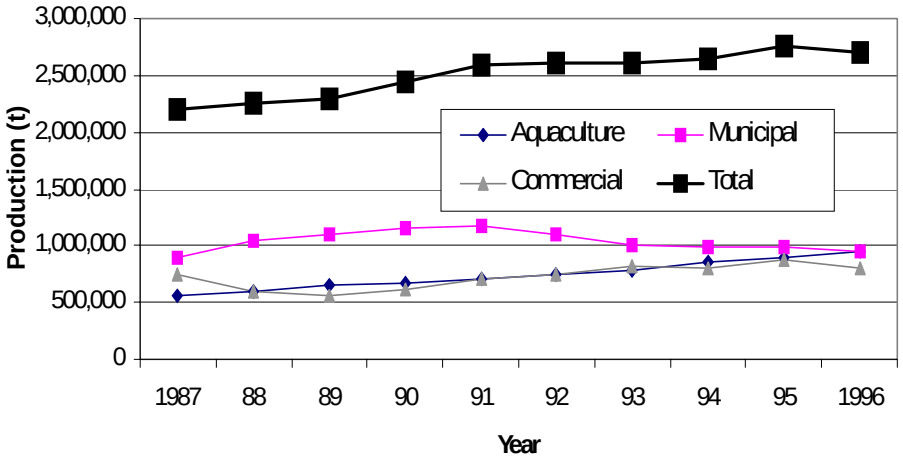


Figure 5.3. Trends in Philippine fish production, 1987-1996.
Source: White and Cruz-Trinidad (1998)

Table 5.1. Most common fishing methods used and frequency of use in the profile area.

Fishing method	Glan	Malapatan	Alabel	Maasim	Kiamba	Maitum	GSC	Total
Hook and line/handline/ dropline	262	96		223	92	53	402	1,128
Drift gill net	98	37		74	31	41	108	389
Trawl	2	1	1	2	2	2		9
Muro-ami	1		1		1			3
Kayakas	1		1		1	3		6
Fishpot and crab pot	10	1			5	4	8	29
Compressor	5		7	1	2		1	9
Spear	25	1		6	5	1	6	51
Beach seine	1							1
Multiple hook and line	4			1				5
Cast net	2						1	3
Fish shelter				3				3
Scoop seine					2			2
Push net							28	28
Jigger				4				4
Total	**411**	**136**	**10**	**314**	**141**	**104**	**554**	**1,670**

Data from the Participatory Coastal Resource Assessment 1998

Table 5.2 presents the most commonly used fishing methods in 1 week. As in Table 5.1, the most popular fishing gear are hook and line/handline/dropline and drift gill net. Spears, although the third most used, are more commonly used once to thrice a week. The hook and line/handline/dropline is used 3, 4, and 7 times a week.

There seems to be some confusion among respondents in what is considered a good or bad fishing method (see Table 5.3). Some 92 to 93 percent of the respondents believe that the most common fishing gear used in the area are good practices while 7 to 8 percent believe that they are not. On some controversial fishing methods, the

Table 5.2. Number of times fishing methods are used in a week.

Fishing method	Once	Two	Three	Four	Five	Six	Seven
Hook and line/handline/ dropline	115	101	156	179	129	72	237
Drift gill net	62	28	44	60	51	19	59
Trawl	1		4		1		1
Fish pot and crab pot	10	5	2	3			7
Spear	9	11	6	3	4	4	1
Compressor	2		2		1		2
Fish shelter					1		
Beach seine							1
Kayakas							
Cast net	1	5	1				
Muro-ami		2					1
Set long line					1		
Scoop seine							2
Push net			2	3	9	12	2
Multiple hook and line			3		1		
Jigger		2		1	1		

Data from the Participatory Coastal Resource Assessment 1998

Table 5.3. Fishing methods identified as either good or bad.

Fishing method	Good		Bad	
	No.	Percent	No.	Percent
Hook and line/handline/dropline	989	64.59	84	5.48
Drift gill net	377	24.61	29	1.89
Trawl	7	0.46	3	0.19
Fish pot and crab pot	28	1.83	2	0.13
Spear	7	0.46	4	0.26
Compressor	11	0.72	10	0.65
Push net	12	.078		
Scoop seine	4	.026		
Muro-ami	1	0.06		
Kayakas	3	0.19	6	0.39
Multiple hook and line	4	0.26		
Jigger	4	0.26		

Data from the Participatory Coastal Resource Assessment 1998

respondents are evenly split. For instance, more than half believe that the use of compressors is a good fishing method. Seventy percent of the respondents believe that the use of trawls is a good fishing practice. With regard to illegal fishing practice, one respondent believes this is good. A majority believe that *kayakas* is a bad fishing practice.

Table 5.4 shows the various fishing methods that the family members of fishers also know how to use. This table is similar to Tables 5.1 and 5.2 except for jiggers, which figured prominently in this table. The use of explosives, considered the primary cause of coral destruction in the past years, occurs for the first time in Table 5.4.

Table 5.5 shows similar results in terms of the most popular fishing method in the area. Gleaning seems to be popular with women, particularly wives. However, overall, the results show similarities with the previous tables. Table 5.5 also shows that it is the father and the children who are the most active in fishing. Mothers usually gather shells, crabs, and fishes in the mangrove area together with their children. The catch from mangrove areas are generaly consumed rather than sold.

Table 5.4. Fishing methods used by other members of the family.

Fishing method	No. of fishermen	Percent
Hook and line/handline/dropline	767	50.06
Drift gill net	241	15.73
Jigger	159	10.38
Spear	67	4.37
Lights	56	3.65
Trawl	85	5.54
Scoop	33	2.15
Reef seine	31	2.02
Gleaning	15	0.90
Scoop seine	30	1.96
Push net	27	1.76
Fish pot and grab pot	26	1.70
Stop seine	15	0.98
Multiple hook and line	112	7.31
Troll line	28	1.83
Encircling gill net	5	0.33
Beach seine	2	0.13
Cast net	2	0.13
Set long line	2	0.13
Fish shelter	1	0.06
Explosives	1	0.06

Data from the Participatory Coastal Resource Assessment 1998

Table 5.5. Fishing methods used by various members of the fisher's family.

Fishing method	Family Members					
	Father	Mother	Children	Sibling	Wife	Husband
Hook and line/handline/dropline	353	44	134	8		5
Drift gill net	157	14	60	3	12	23
Trawl	17	2	12	1	1	1
Fish pot and crab pot	15		7			
Beach seine	2					
Jigger	14		2			
Multiple hook and line	44		18		7	
Cast net	2					
Set long line	2		1			
Spear	36	2	13	5		
Gleaning	5	2	21		24	
Fish shelter	1		1	4		
Scoop seine	5	3	17		5	
Light	3		1			2
Push net	27		5			

Data from the Participatory Coastal Resource Assessment 1998

Figure 5.4 shows the amount of time spent by fishers in fishing. A majority of the fishers fish from 1 to 6 hours. A few spend the whole day and night fishing, while there are also few who only fish for a few hours. More time is spent fishing than before because of fewer fish. However, no quantitative data are available to compare with the PCRA data.

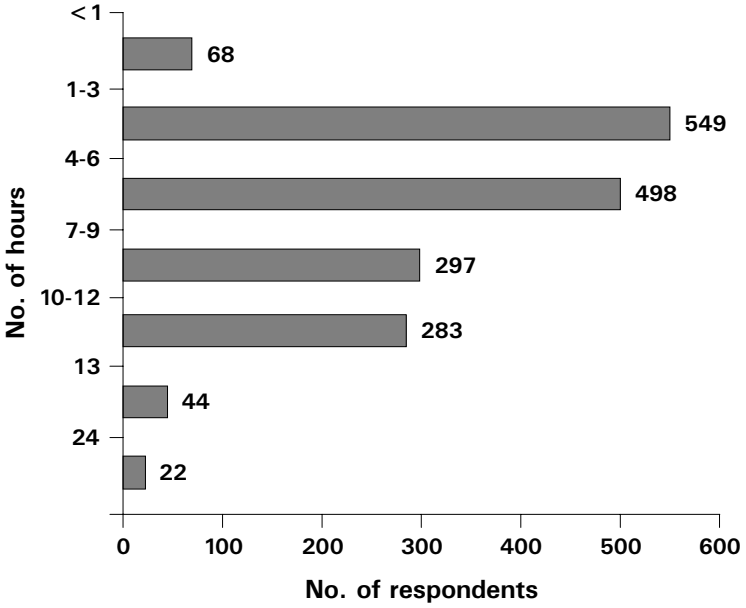


Figure 5.4. Number of hours spent by fishers catching fish.

SUML (1997) showed that 80 percent of the fishers work full-time and only 19 percent are part-time fishers. Figure 5.4 seems to corroborate this with only 68 respondents fishing less than 1 hour. However, the SUML studies covered only the major fishing villages in the municipalities of Alabel, Glan, Kiamba, Maasim, and Malapatan. PCRA data also show that fishers usually fish 7 times a week.

Full-time means that the income is entirely derived from fishing or fishing-related activities; part-time is defined as income derived from 2 sources: fishing and a non-fishing-related occupation such as farming, financing, teaching, convenience store business, or other.

Table 5.6 shows persons who accompany the fishers when he goes fishing. The results show that most fishers fish alone; they are accompanied, it is usually by their children. Interestingly, in GSC, there is a large proportion of passengers in fishing boats compared with the other municipalities.

Table 5.6. Persons who accompany fishers during fishing.

Person	Glan	Malapatan	Alabel	Maasim	Kiamba	Maitum	GSC	Total
None	127	48	2	154	37	26	172	566
Operator				3		1	22	26
Passenger			1	8			77	86
Children	61	9	3	59	37	22	82	273
Wife	11		4		3		6	24
Husband					2		10	12
Father	18	3		31	7	19	5	83
Mother							5	5
Grandparent		4					2	6
Sibling	13	2		6	2	8	17	48
Neighbor	19	1		30	1	1	3	55
Friend	3			16		1	4	24
Relative/in-law	4			4			2	10
Acquaintance		5				2		7
Total	**256**	**72**	**10**	**311**	**89**	**80**	**407**	**1,225**

Data from the Participatory Coastal Resource Assessment 1998

The data also show that 92 percent of the boats are engaged in municipal fishing and only 8 percent are engaged in commercial fishing. Of the 92 percent municipal boats, more than half (55 percent) are non-motorized (see Table 5.7).

Table 5.7. Number of fishers and *bancas* based on household interviews from the 5 municipalities of Sarangani Province.

Municipality	No. of fishers			No. of boats			
	Actual fishers*	Full-time	Part-time	Actual boats*	Commercial	Municipal	
						Non-motorized	Motorized
Alabel							
Kawas	70	18	4	28	1	13	5
Glan							
Gumasa	nd	10	7	nd	4	10	5
Lago	40	17	9	40	1	17	8
Kiamba							
Suli	90	30	6	90	3	22	17
Maasim							
Linao	50	13	2	60	2	9	4
Sinalang	100	1	2	62	3	12	3
Tinoto	35	35	4	nd	nd	16	22
Malapatan							
Lun Padidu	295	18	2	295	1	6	11
Total	**680**	**142**	**36**	**575**	**15**	**105**	**75**
Percentage		**805.0**	**18.9**		**7.8**		

**Actual values as reported by the resource person.*
Source: SUML (1997)

Based on data from the Office of the Provincial Agriculturist in 1993, the number of fishers and motorized and non-motorized boats are presented in Table 5.8. The highest number of fishers are in Glan (1,057), followed by Maitum (350), and Maasim (328).

The fishing effort for commercial fishing gear particularly the purse seine requires 46 to 90 fishers per operation. The rest of the gear require only from 1 to 20 fishers per operation. All the gear are used at least once a day for about 20 days a month.

The highest effort recorded regardless of the gear operation is as follows: purse seine (23,499 person-hours), drift net (202 person-hours), ring net (188 person-hours), single hook and line (151 person-hours), and lift net (148 person-hours). The lowest effort is for: jigger (3 person-hours), scoop net (5.7 person-hours), bottom set gill net (6.5 person-hours), set gill net (8.2 person-hours), and spear gun (9 person-hours) (Table 5.9).

Table 5.10 shows the average CPUE and income per unit effort (IPUE) per year. The gear with the highest CPUE are fish corral (165 kg/person-hour) and scoop net

Table 5.8. Number of fishers and motorized and non-motorized boats per coastal municipality of Sarangani Province and GSC.

Municipality	*Barangay*	No. of fishers	Motorized boat	Non-Motorized boat
Alabel		283	124	154
	Ladol, Poblacion	165	60	100
	baybay Kawas, Kawas	54	4	50
	Lago	64	60	4
Glan		1,157	298	822
	Baliton	21	4	26
	Batulaki	62	32	44
	Big Margus	79	26	47
	Burias	69	12	69
	Cablalan	136	7	127
	Elaya	24	0	0
	Glan Padidu	57	22	43
	Gumasa	58	19	68
	Kapatan	63	21	54
	Lago	83	13	67
	Pangyan	31	31	15
	Poblacion	105	35	95
	San Jose	52	27	27
	Small Margus	61	18	38
	Taluya	91	27	61
	Tango	54	4	37
	Tapon	11	0	4
GSC		nd	nd	nd
Kiamba		1,567	316	619
	Datu Dani	65	12	29
	Gumasa	28	2	22
	Katubao	98	17	47
	Kayupo	145	31	52
	Kling	6	0	6
	Lagundi	90	24	18
	Lebe	38	4	26
	Lomuyon	130	15	85
	Nalus	219	38	105
	Poblacion	412	112	76
	Salakit	45	8	21
	Suli	163	26	85
	Tambalil	128	27	47
Maasim		nd	328	661
Malapatan		nd	167	410
Maitum		nd	350	258

Data from the Municipal Planning and Development Ofice 1993 and the Office of the Provincial Agriculturist 1993

(17 kg/person-hour). In terms of IPUE, the highest are also fish corral (PhP1,958/person-hour), scoop net (PhP384/person-hour), and ring net (PhP280/person-hour).

SU reports about 120 fish species are caught based on the combined catches of all gear. Among the commonly used gear, multiple hook and line has the most number of species caught (60 species) dominated by scombrids (*Auxis thazard*) and clupeids (*Sardinella* sp.). This is followed by gill net (49 species) dominated by the same species plus a carangid (*Decapterus macrosoma*). The single hook and line catches about 32 species dominated by scombrids (*Thunnus thynnus* and *Auxis thazard*). Species-specific gear are squid jigging and a type of fish net that targets needlefishes (*Strongylura* sp.) and halfbeaks (*Hemiramphus* sp.).

Table 5.11 presents the most common catch, tuna and mackerel based on interview results during the PCRA. This is expected considering that GSC has the largest tuna landing in the Philippines. Scads are the second most common catch, followed unexpectedly by squids. This is due to the large number of respondents (150) in Maasim who identified squid as one of the most common coastal and marine resources they catch.

Table 5.9. Fishing effort of the common gear in the 5 municipalities of Sarangani Province and GSC.

Gear type	No. of samples	No. of hours per trip	Effort (person-hour)	No. of trips per day	Catch (kg/trip)
Beach seine	1	2.00	10.00	1.00	2.00
Bottom set gill net	2	6.50	6.50	1.00	8.75
Drift gill net	6	12.40	201.92	1.00	459.17
Fish corral	3	2.50	16.50	1.00	4,451.25
Fish net	1	12.00	36.00	1.00	10.00
Fish trap	1	3.00	12.00	1.00	4.00
Gill net	57	9.53	29.93	1.08	130.40
Jigger	1	3.00	3.00	1.00	0.31
Lift net	5	12.58	148.37	1.25	425.56
Multiple hook and line	77	11.50	14.75	1.54	36.34
Purse seine	4	436.40	23,499.00	0.67	2,478.50
Ring net	3	12.83	188.22	1.00	2,277.22
Scoop net	4	3.67	5.71	0.83	76.58
Spear gun	4	3.67	9.04	1.67	4.08
Set gill net	2	4.12	8.25	1.00	4.95
Single hook and line	38	33.45	150.77	1.16	1,100.94*

All values are average data.

* This large kg/trip for single hook and line includes several boats catching large tuna in 1 trip. Without this the average would be 26.2 kg/trip

Table 5.10. CPUE and IPUE per gear.

Gear type	No. of samples	Average CPUE		Average IPUE	
		(kg/trip)	kg/person-hour	PhP/trip	PhP/person-hour
Beach seine	1	2.00	0.20	48.00	4.80
Bottom set gill net	2	8.75	1.05	298.75	36.00
Drift gill net	6	459.17	4.56	11,710.35	93.89
Fish corral	3	4,451.25	165.02	52,695.83	1,958.18
Fish net	1	10.00	0.28	350.00	9.72
Fish trap	1	4.00	0.33	257.00	21.42
Gill net	57	130.40	2.82	2,187.38	78.30
Jigger	1	0.31	0.10	80.57	26.86
Lift net	5	425.56	8.14	13,992.40	221.84
Multiple hook and line	77	36.34	3.07	1,854.99	156.06
Purse seine	4	2,478.50	6.00	11,120.62	41.79
Ring net	3	2,277.22	11.16	58,079.64	280.61
Scoop net	4	76.58	17.42	1,387.29	384.64
Spear gun	4	4.08	0.71	131.82	23.38
Set gill net	2	4.95	1.03	299.17	50.99
Single hook and line	38	1,100.94	7.46	3,599.32	47.34

Source: SUML 1997

Table 5.12 shows that 77 percent of fishers catch only 1 to 20 kg per day. This suggests that the majority of the fishers living in the area are municipal or subsistence fishers.

Table 5.11. Fish species caught in the profile area and the number of respondents in each municipality and city that identified the species accordingly.

Fish	Glan	Malapatan	Alabel	Maasim	Kiamba	Maitum	GSC	Total
Tuna and mackerel	47	9	1	98	26	27	265	473
Runner	5						1	6
Goatfish	4			9		5	2	20
Milkfish	6			1			1	8
Damselfish				2			1	3
Rabbitfish	7						3	10
Dolphinfish	2							2
Slipmouth, ponyfish	1							1
Jack, cavalla, crevalle, trevally, darts	5				1	10	12	28
Sardine, herring, sprat gizzard shad	2	6		1	1	8	10	28
Fusilier, bananafish						3		3
Shark							5	5
Whiting, sillago							2	2
Moonfish	2						2	4
Squid		2	1	150		12	1	166
Octopus	11						1	12
Billfish		3		2			37	42
Scad	43	30	1	98	15	24	43	254
Hairtail, cutlass fish	10						28	38
Mullet							23	23
Therapon, tigerfish							17	17
Parrotfish	14	1		8	2	22	26	73
Spadefish, scat							3	3
Emperor bream	16					2	1	19
Glassyfish							1	1
Mud/mangrove crab							1	1
Squirrel, soldierfish	2					2		4
Anchovy	2			3				5
Garfish, needlefish	3							3
Flyingfish	34	1		12	3	29		79
Threadfin bream and spinecheek	4							4
Halfbeak	2					1		3
Triggerfish, filefish	5			1		1		7
Snapper, sea pearch		5			1	9		15
Barracuda, seapike	2							2
Cardinalfish	1							1
Grouper, seabass, perchlet	8							8

Data from the Participatory Coastal Resource Assessment 1998, as enumerated by fishers.

The PCRA data reveal that most of the fishers sell 80 to 100 percent of their catch. Fishers from Sarangani usually fish within Sarangani Bay in the areas of their respective municipalities. In GSC, many of the fishers catch fish in Indonesia. This is probably because most of the boats in GSC are for deep-sea fishing. This is consistent with Table 5.9 (also from PCRA results). Although there are more fishers in GSC who fish 0 to 10 km from the shoreline, the city also has the most number of respondents by a wide margin who fish more than 15 km from the shore. Respondents who fish more than 15 km from the shore may actually be fish workers and not fishers. These fish workers work for big fishing corporations and receive wages for the work they render. Overall, most fish near the shore (0 to 10 km) (Table 5.13).

Table 5.12. Weight of fish caught in 1 day in the profile area.

Weight (kg)	Glan	Malapatan	Alabel	Maasim	Kiamba	Maitum	GSC	Total
1 to 20	323	102	12	249	64	121	291	1,162
21 to 40	12			21	7	37	77	154
41 to 60		1		47	1	2	48	99
61 to 80	1			5	1	1	1	9
81 to 100	1			1			28	30
>100	4			1	3	2	28	38

Data from the Participatory Coastal Resource Assessment 1998

Table 5.13. Distance from the shoreline where fishers catch their fish.

Distance (km) from shoreline	Glan	Malapatan	Alabel	Maasim	Kiamba	Maitum	GSC	Total
0 to 10	290	77		186	50	91	205	899
11 to 20	6	17		57	10	11	27	128
21 to 30	5		2	55	7	34	3	106
31 to 40	1			7		1	4	13
41 to 50	1			13	9	1	11	35
51 to 90	11		3		3		4	21
91 to 100	2		2			1	5	10
101 to 501	2		4	1			11	18
>501	1					3	93	97

Data from the Participatory Coastal Resource Assessment 1998

Table 5.14 presents the monthly production from municipal fisheries in 1999. Most fishers usually fish in municipal waters where they live although sometimes they fish in neighboring municipalities. Fishers from Davao also fish in the area, particularly in the municipal waters of Maasim. Indonesian and Taiwanese fishers have also been reported fishing in Sarangani Bay. Most of the fishers who live in the profile area report that only 1 to 10 fishers from outside the municipalities are seen fishing in municipal waters. These fishers usually fish from 1 to 12 hours in municipal waters. They use drift gill nets, hook and lines/handlines/droplines, and ring nets. There have also been reports of illegal fishing methods such as dynamite, *muro-ami*, and poisons and noxious substances.

Another important fishery harvest in the area is the *bangus* (milkfish) fry. *Bangus* fry gathering is seasonal with peaks during the months of July and August. During peak season, almost all members of the households both male and female, young and adult are involved in the activity. In Maasim alone, about 1,500 households (31 percent of the total households) are engaged in *bangus* fry gathering. The total average catch per year is 12 million fry. The value of a single fry ranges from PhP0.45 to 1.00. Other municipalities that are actively engaged in *bangus* fry gathering are Alabel, Kiamba, and Maitum (Figure 5.5). GSC is also engaged in *bangus* fry gathering. However, no harvest data are available for this area (Table 5.15).

Table 5.14. Monthly production from municipal fisheries in 1999.

Month	No. of municipalities	No. of cooperators	No. of *barangays*	Total target		Fishing gear (types)	Catch data	
				Motorized (no.)	Non-motorized (no.)		Motorized (kg)	Non-motorized (kg)
January	6	39	22	151	64	10	36,983.0	5,532.5
February	6	69	20	145	71	10	53,898.0	6,518.0
March	6	63	19	138	60	10	52,220.0	7,960.0
April	6	52	23	180	99	10	25,854.6	2,703.9
May	6	50	16	169	85	10	28,325.8	2,211.1
June	6	43	16	190	80	10	32,574.2	3,854.5
July	6	51	17	169	95	12	24,769.1	2,517.8
August	6	51	14	177	135	8	18,838.0	3,340.8
September	6	54	19	176	131	12	49,319.0	3,254.9
October	6	45	27	163	133	12	27,069.5	3,349.9
November	6	44	25	145	100	8	24,755.4	3,485.6
December	6	46	18	138	99	8	23,278.0	4,104.8
Total				**1,941**	**1,152**		**397,884.6**	**48,833.8**

Most of the fish caught are sold in the *barangays* where the fishers belong, in the *poblacion* markets of the respective municipalities, and in GSC. Sometimes the financier (person who finances the fishing trip in exchange for payment) of the fishers buys the fish that are caught. Sixty percent of the fishers in Sarangani Province reported that they have a regular buyer for their fish. However, majority of the fishers in GSC have no steady buyer for their fish. The most common complaint of the fishers about their steady buyer is the low price at which the fish is bought. In GSC, the financier buys the fish if there is no regular customer. This is expected since this is where the shipping operators reside. In Sarangani Province, the neighbors in the *barangay* and retailers buy the fish. In some cases, the financier or the regular buyer serves as the fish vendor. In the event that the fish is not sold, the fishers will sell even at a low price, at almost give-away prices. Fish are also processed or dried for future use.

The operating and maintenance costs of fishers seem to be small. Most of the repondents say monthly expenses for boats and other equipment range from PhP1 to 500 only.

Over 75 percent of the fishers in Sarangani Province have observed destructive fishing methods being used in Sarangani Bay. However, in

Figure 5.5. Bamboo stakes where fisherfolk hang their torch to attract *bangus* fry in Kiamba.

GSC, only 40 percent of the fishers have seen destructive fishing methods being used in the bay. The most common destructive fishing methods observed in the bay are dynamite fishing and use of poison and noxious substances (including cyanide). Other common illegal or controversial methods include beach seines, compressors, and ring nets. Most of the respondents in Sarangani Province believe that there has been no strict enforcement of the laws concerning illegal fishing. In GSC, fishers believe that it is all right to fish as long as they do not go beyond the municipal boundary. Lack of enforcement also seems to be the major reason why illegal fishing continues. Some fishers from Sarangani point to the lack of concern from the government, and to the fact that very few illegal fishers have been caught. Other issues include: there are no guards (Maitum); and illegal fishers are not caught because influential people protect them. Fishers in GSC, on the other hand, say that nobody is caught because of the lack of personnel to enforce the laws and they point to the difficulty in making a living in the area. Fishers point to poverty as a major reason for illegal fishing. Using destructive fishing methods allows fishers to catch more fish in the short run, hence enabling them to make ends meet.

Table 5.15. Number of *bangus* fry concessionaires and their annual harvest.

Municipality/ City	No. of concessionaires	No. of *bangus* fry harvested per year (in millions)
Alabel	7	ND
Glan	11	ND
Kiamba	9	25
Maasim	11	12
Maitum	10	ND
Malapatan	ND	ND
GSC	ND	ND

Data from the Municipal Planning and Development Office 1993 and the Office of the Provincial Agriculturist 1993
ND=no data

Aquaculture

The aquaculture industry in the province is concentrated in the culture of milkfish (*Chanos chanos*), tilapia (*Oreochromis niloticus*), and prawn (*Penaeus monodon*). Table 5.16 shows aquaculture data for Sarangani Province. The municipalities and cities with the largest pond areas are Alabel, Glan, and GSC. Most of the fishponds in these 3 areas are semi-intensive. Overall, the practice is traditional.

Milkfish culture is common in the profile area and most ponds are privately owned (Figure 5.6). Food comes from the production of green algae, assemblages of phytoplankton and zooplankton, or a combination. Culture practices include the use of organic fertilizer such as chicken manure and the application of commercial fertilizers. Sun drying is

Figure 5.6. Fishponds near the pier in Glan.

Table 5.16. Monthly aquaculture production in 1999.

Month	No. of municipalities	No. of cooperators	No. of farms	Total targeted area (ha)	Culture system	Total area stocked	No. of fingerlings stocked	Total area harvested (ha)	Total volume harvested (kg)
January	7	60	32	210.98	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	33.76	3,334,300	18.91	82,533
February	7	62	34	215.23 +12 cages	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	36.38 + 2 cages	7,657,100	25.16	16,953
March	7	64	36	203.85	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	25.94 + 2 cages	2,426,550	24.16	88,383
April	7	72	201.74 244.9 + 12 cages	201.74	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	19.56	1,171,600	32.16	146,458
May	7	78	57	11.15	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	21.83 + 2 cages	629,650	21.69	78,184
June	7	85	20	211.72 + 12 cages	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	19.56 + 2 cages	902,680	24.91 + 1 cage	122,113
July	7	54	20	233.01	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	35.11	9,454,636	23.5	114,119
August	6	45	35	225.09	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	35.06	2,495,530	27.72	124,330
September	7	47	54	231.88	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	48.69	3,843,830	42.49	266,709
October	7	53	37	225.79	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	58.58	6,093,130	44.63	46,953
November	7	37	14	211.67	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	68.85	4,768,910	32.54	35,420
December	6	31	799.64 + 12 cages	186.65	1. Brackish (intensive & extensive) 2. Freshwater (traditional)	42.85	2,038,250	24.65	24,590
Total				2,382.13 + 24 cages		454.06 + 8 cages	44,816,166	340.72 + 1 cage	1,146,745

common. Milkfish fry are available in nearshore waters. No standard stocking density is observed. Predation is a major problem of fry operators and leads to low survival of fry and fingerlings (LBII 1993).

Production of milkfish is very low, sometimes reaching only 50 kg/ha/year. Low production results from a lack of technical know-how, low inputs to production, wrong practices, and wrong site locations in some areas.

The yearly harvest ranges from 415 to 488 mt/km^2 for prawn, 142 to 298 mt/km^2 for *bangus*, and 89 mt/km^2 for *tilapia*. Assuming a kilogram costs PhP70 for prawn, and PhP40 for *bangus* and *tilapia*, the total earnings for the entire area are: PhP114 M for prawn, PhP35 M for *bangus*, and PhP0.028 M for *tilapia*.

TOURISM

The tourism industry in the province and GSC is confined mostly to beach resorts. Its coastline has some white sand beaches with abundant marine life. There are a number of falls and caves to see and explore but these are not fully utilized due to the absence of roads and transport system (Table 5.17). Another problem that inhibits potential tourist growth is the perception that there is an existing peace and order problem in the area. There are also a number of hotels and recreational facilities in GSC but their potential has not been optimized.

Other issues that contribute to the low level of tourist activities in the area are:

- Piracy;
- Beach sanitation and the problem of squatter habitation around beaches;
- Dynamite and other destructive fishing activities that extensively degrade reef areas; and
- Lack of investors.

Due to the low level of tourist activity in the area, environmental and socio-cultural impacts are minimal. However, once the Department of Tourism (DOT) properly promotes the area, and once the necessary infrastructure is in place, tourism has the potential for both positive and negative impacts, which include:

- Employment generation;
- Revenue earnings;
- Wastewater and other wastes from hotels and resorts; and
- Increased tourist population

INDUSTRY

Industrial establishments are generally concentrated in GSC. These include the 10 fish processing plants, which are often the subject of complaint because of the effluent that they discharge. Other food processing industries can also be found in the area.

Table 5.17. List of tourist attractions in Sarangani Province and GSC.

Name	Location
Marcom Falls	Sitio Rabaylon, Alabel
Lucirene Falls	Little Baguio, Alabel
Markom Falls	Prk. Cabugao, Paraiso, Alabel
Tapikong Falls	Datal Pon. Paraiso, Alabel
Matlisay, Tubay and Matnayan Falls	Datal Anggas, Alabel
Nalus, Badtasan and Salakit Falls	Kiamba
Domolok Lake	Sitio Rabaylon, Alabel
Anggas Lake	Datal Anggas, Alabel
Aspoton Lake	Spring, Alabel
Beto Lake	Poblacion, Alabel
Salimama Katimbol	Datal Anggas, Alabel
Ingay Lake	Datal Bukay, Glan
Ladol Beach	Sitio Ladol, Poblacion, Alabel
Kawas Beach	Kawas, Alabel
Alefre Summer Resort	Little Baguio, Alabel
Beehive Peak	Sitio Rabaylon, Alabel
Kiambing Beach	Kiambing, Maitum
Yabes Beach	Mabay, Maitum
Maguling White Sand	Maguling, Maitum
White Beach	lago, Gumasa, Burias, B&S Margus
Reyes Beach	Gumasa, Glan
BDC Beach Resort	Tango, Glan
Tuka White Sand Beach	Kiamba
Coastal areas of Tambler and Siguel	General Santos City
Napnap, Salimana, and Kawasan Caves	Datal Anggas, Alabel
Zion Cave	Zion, Maitum
Ayub Cabe	Pinol, Maitum
Lumasad	Lumasad, Maasim
Nomoh	Nomoh, Maasim
Poblacion	Poblacion, Maasim
Tinoto	Tinoto, Maasim
Amsipit Hot Spring	Amsipit, Maasim

The industrial site in GSC comprises the areas of Labangal, Calumpang, and Tambler. In and around the area are huge container yards of major shipping companies, fishing firms, and multinational corporations exporting agri-based products to Asia and the Pacific.

Newly registered business establishments in 1997 totalled 3,071 compared to 2,675 in 1996 posting an increase of 15 percent. Capital infusion of newly registered business establishments in 1997 reached PhP11.8 billion which has doubled compared to the previous year's PhP5.13 billion. Among the existing major industries, fishing ranks first with 49 companies, followed by tuna canning/processing with 10 companies. There are also 2 prawn hatcheries and 2 oil mills in the city.

The Espina Industrial Center in Makar is a 625-ha complex with provisions for institutional, residential, and recreational areas (Table 5.18). A number of foreign and domestic firms engaged in labor-intensive and export-oriented activities have shown

interest in setting up establishments in the area. The industrial center is less than 1 km from Makar Wharf and 5 km from the new international airport.

The banana plantation of Dole Philippines is located in Alabel. A potential issue is the use of pesticides on the plantation. However, previous sampling results in rivers in Sarangani and in Sarangani Bay show no trace of pesticides.

Table 5.18. Espina Industrial Center land use.

Land use	Land area (ha)
Institutional	19.80
Commercial	60.00
Residential	229.05
Industrial	200.35
Forest park	52.40
Golf course	57.00
Buffer zone	5.25
Parks/playground	2.20
Total	**626.05**

Another industry found in the province is salt making in Alabel. These are the San Andres Fishing, Inc. with an area of 0.53 km^2 and the Clemente Salt Farm with an area of 0.03 km^2. Their annual harvests are 144 mt/year and 72 mt/year, respectively. Other small-scale industries are mining of sand and gravel, hollow block making, cottage industries such as basket making, and rattan and wooden furniture.

The most significant industrial impact comes from the canneries primarily located in Tambler, GSC. The wastewater coming from this industry tends to have high biochemical oxygen demand, suspended solids, and oil and grease.

AGRICULTURE

The economy of GSC and Sarangani is primarily agri-based. As part of SOCSKSARGEN, it has contributed to the area's emergence as a leading producer of at least 8 major commodities.

At least 26 percent of the total land area of Sarangani is classified as suitable for agriculture. Crops account for 50 percent; livestock, 35 percent; and fisheries, 15 percent. Ricelands account for only 5 percent of the total cropland. Coconut has always been first; corn or cotton, second and third; followed by rice.

Due to its rich soil, good rainfall, and typhoon-free climate, SOCSKSARGEN accounts for 29.4 percent of the country's yearly corn production, 9.62 percent of its coconut and copra production, and 40 percent of the total pineapple production. In 1996, it supplied 99 percent of the country's asparagus and 20 percent of the total rice production with a 30 percent target increase in the year 2000. The area produces other high value crops such as exotic fruits, potatoes, vegetables, and cut flowers.

The major activities of Sarangani Province are crop production, livestock production, and fisheries. The essential agricultural products are coconut, corn, rice, and copra.

Palay production in Sarangani Province was 11,535 mt in 1997. Corn production reached 30,437 mt. Copra production was 116,042 mt. In GSC, rice production was 7,855 mt; corn production, 25,673 mt; and coconut, 10,356 mt. For the entire province, yearly production of rice was 2.20 mt/ha; corn, 1.38 mt/ha; and coconut, 4.63 mt/ha.

Aside from these major agricultural products, there are also many fruit tree products harvested in the area. These are banana, lanzones, jackfruit, rambutan, papaya, star apple, peanut, guava, atis, and citrus. The agricultural products of the province are abaca, cacao, coffee, cotton, sorghum, and rattan.

About 150 farms are engaged in livestock production. Many grassland areas are leased for cattle pasture. Cattle accounts for 42 percent of livestock production. In Maasim, there are about 17 sites or owners leasing a total land area of 104.46 km^2. The total number of cattle for 1994 is about 18,250 heads (Table 5.19). Hog raising is concentrated in Maitum, while ducks are raised mostly in Kiamba.

Table 5.19. Livestock and poultry production per coastal municipality of Sarangani Province, 1993-1994.

		City/Municipality						
Livestock	**Year**	**Alabel**	**Glan**	**Kiamba**	**Maasim**	**Maitum**	**Malapatan**	**Total**
Swine	1993	4,728	7,890	3,288	1,904	3,500	1,580	22,890
	1994	63,317	2,800	3,288	2,096	3,550	1,880	76,931
Cattle	1993	3,744	2,150	2,155	2,887		430	11,916
	1994	3,784	4,150	2,155	3,090	550	530	16,259
Goat	1993	3,078	3,700	1,400	2,566	2,550	2,300	14,044
	1994	4,103	3,100	1,400	2,600	1,000	2,850	15,253
Carabao	1993	2,530	1,705	1,580	774	1,025	292	7,906
	1994	2,530	3,205	1,580	1,096	1,025	442	9,878
Horse	1993							0
	1994	1,667	655	650	1,985	800	550	6,307
Poultry	1993	24,975	10,815	7,880	7,530	7,880	6,000	65,080
	1994	20,995	3,900	7,800	7,530	4,850	4,500	49,575
Duck	1993							0
	1994	1,100	2,500	5,378	9,138	7,830	750	26,696
Turkey	1993							0
	1994	2,150	500	385	500	275	120	3,930

Data from the Office of the Provincial Agriculturist 1994

SUMMARY

The most important industry after agriculture is capture fisheries in Sarangani Province. Most production is from commercial fishing operators. Tuna accounts for the largest portion of catch and supports 10 processing plants. Unfortunately, signs of overfishing are evident and many commercial size boats are fishing in foreign waters (mostly Indonesia). Aquaculture is also important accounting for more than 1 million kg annual production of mostly prawns, *bangus*, and *tilapia*. Tourism is not yet developed in Sarangani although a significant potential exists.

Chapter 6
INSTITUTIONAL and LEGAL FRAMEWORK

INTRODUCTION

Sarangani Bay is one of the few areas in the Philippines to fall under RA 7586 or the NIPAS Act of 1992. On 5 March 1996, President Fidel V. Ramos signed Proclamation 756, which established Sarangani Bay and portions of the municipal waters of Maitum, Kiamba, and Maasim as a protected seascape. The purpose is to protect and conserve the coastal and marine resources within the area.

Aside from Proclamation 756, the management and use of the coastal resources in the profile area are governed by various national and local policies through laws that are being implemented by different government institutions. These include the following:

- Department of Environment and Natural Resources (DENR);
- Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR);
- Department of the Interior and Local Government (DILG);
- Department of Transportation and Communication (DOTC);
- Philippine Coast Guard (PCG); and
- Department of Science and Technology-Philippine Council for Aquatic and Marine Research and Development (DOST-PCAMRD).

Each of these agencies has roles to play in CRM. In some cases, roles and jurisdiction overlap. A more detailed discussion on this may be found in the *Legal and Jurisdictional Guidebook for Coastal Resource Management* (DENR *et al*. 2001). This chapter only discusses the roles of these agencies in relation to the profile area.

The Local Government Code (RA 7160) has devolved some responsibilities to LGUs in CRM previously dispensed by national agencies. This chapter also discusses the LGU's response to the decentralization of certain CRM functions in the profile area as well as the various roles, activities, and programs of NGOs working in Sarangani Bay.

CURRENT STATE OF THE PHILIPPINE COASTAL ZONE LAW

This section briefly discusses the legal framework for CRM. A more comprehensive discussion can be found in the *Legal and Jurisdictional Framework for Coastal Management* (DENR *et al*. 2001).

The Philippine Constitution establishes sovereignty over natural resources through Article XII, Section 2: "All lands of the public domain, waters, minerals, coal, petroleum, and other mineral oils, all forces of potential energy, fisheries, forests or timber, flora and fauna, and other natural resources are owned by the State. The exploration, development, and utilization of natural resources shall be under the full control and supervision of the State. The State shall protect the nation's marine wealth ... and exclusive economic zone and reserve its use and enjoyment exclusively to Filipino citizens." The Philippine Constitution also protects the right of the people to organize and participate in social, political, and economic decision-making.

The Philippine Constitution is very specific in protecting the rights of subsistence fishers, especially of local communities. It provides for preferential use of communal marine and fishing resource.

The following presents a chronological overview of the state of legislation regarding CRM starting in 1975, when the fisheries decree was promulgated.

- In 1975, the rules and regulations on the fishing industry were developed, upholding provisions of the Fisheries Act of 1932. Mangrove forests were placed under the jurisdiction of the DENR but fishponds were retained under BFAR.
- In 1976, the marine pollution decree was passed. Commercial trawls and purse seines were banned within a distance of 7 km from the shoreline in north and south Leyte, Samar, and Sorsogon. Penalties provided for under Presidential Decree 704 (Fisheries Decree of 1975) for certain forms of illegal fishing and dealing in illegally caught fish and others were increased. The DENR created the National Mangrove Committee. Following the examples set by Leyte, Samar, and Sorsogon, commercial and other fishing gear operating within a distance of 7 km from the shoreline may be banned by the President of the Philippines upon the recommendation of the Secretary of Natural Resources.
- In 1977, the promotion and regulation of the exploration, exploitation,

utilization, and conservation of coral resources, existing beneath territorial waters in the marine economic zone of the Philippines, and the protection of these resources were ensured as provided for under existing laws. Coral gathering was limited to educational and scientific purposes. The Secretary of Natural Resources was assigned to train *barangay* officials as deputy fish wardens or deputy wardens.

- In 1978, the Philippine Environment Code was passed. In the same year, the Philippine exclusive economic zone (EEZ) was established.
- In 1979, a Coastal Zone Management Committee composed of 22 government agencies was formed.
- In 1981, the Province of Palawan declared certain parcels of public domain as mangrove swamp forest reserves.
- In 1984, fisheries and aquatic resources were required to be issued permits prior to exportation.
- In 1985, distant water fishing fleets were encouraged.
- In 1986, the gathering, taking, and collection of *kapis* shells and the collection of *kapis* less than 80 mm in size were prohibited. The operation of commercial trawl and purse seine in marine waters within 7 km from the shoreline of all provinces in the Philippines was banned. *Muro-ami* and *kayakas* were prohibited from operating in Philippine waters. The gathering and transporting of mollusks belonging to the genus *Triton* or *Charonia* and *Cassis* were also prohibited.
- In 1987, BFAR's administration, regulatory, and enforcement functions were abrogated and subsumed under the DA. The National Mangrove Research Program merged with the Forest Research Institute (FORI) to form the Ecosystems Research and Development Bureau (ERDB). The DENR and BFAR were given mandates for fisheries development during the same year.
- In 1990, rules and regulations governing the gathering, culture, and export of shelled mollusks (Phyllum Mollusca) were established. The Presidential Commission on Illegal Fishing and Marine Conservation was constituted to coordinate all government and nongovernment efforts in the planning and implementation of a national program for the conservation of marine and coastal resources.
- In 1991, 7 fish sanctuaries were established. Congress passed the Local Government Code (RA 7160).
- In 1992, the NIPAS Act was passed.
- In 1993, the Coastal Environment Program of the DENR was established.
- In 1994, some regulatory functions pertaining to fishing regulations were devolved to LGUs.
- In 1995, Fisheries and Aquatic Resources Management Councils (FARMCs) were created. The coordinating mechanism and funding were provided for the implementation of the Monitoring, Control and Surveillance for the

Figure 6.1. Fish sanctuary established in Alabel by the DA and LGU.

Conservation and Protection of Renewable Resources (MCS-CPRR) system for the Philippines.

LOCAL GOVERNMENT

The local government in each coastal municipality of Sarangani Province and GSC issued several ordinances for the protection and management of their coastal areas. Figure 6.1 is an example of protection of the coastal resources through the establishment of a fish sanctuary. This is a sign that LGUs are taking an active part in CRM. All of the LGUs assigned a fisheries technician to handle fishery and coastal resources issues.

Glan provides for a variety of ordinances covering the various aspects of CRM. Quarrying, mangrove protection, and establishment of fish sanctuaries are regulated through various ordinances. Fisheries is a major concern of this municipality as shown by the wide number of ordinances that regulate fishing methods, types of fish caught, and commercial fishers fishing in municipal waters. Municipal fishers are also required to secure a permit before fishing in municipal waters.

Ordinances in Malapatan primarily focus on the regulation of commercial fishers, registration of municipal vessels, classification of municipal waters, and dumping of garbage along the shoreline. As an example, the municipal CRM budget for Malapatan is itemized in Table 6.1.

Table 6.1. 1998 CRM budget for Malapatan.

Item	Cost (PhP)
Maintenance and logistics of 2 patrol boats	
Fuel and spare parts	11,250
Supplies and materials	11,250
Procurement of binoculars and radio hand sets	37,500
Training and IEC	
Supplies and materials	7,500
Means and snacks	15,000
Honoraria	3,750
Educational tours to CRM sites	
Transportation/lodging/meals	15,000
Establishment of ARs, ADs and other fishery projects	
Supplies and materials	45,000
Mangrove rehabilitation/reforestation	
Supplies and materials	15,000
Incentives of deputy fish warden	
Seaborne patrol and apprehension	11,250
Total	**172,500**

Resolutions and ordinances issued by Alabel focus on similar issues as the

previous municipalities. The municipality established fish sanctuaries and prohibited commercial fishers in their municipal waters. Additionally, the municipality issues privileges in operating fish corrals, oyster culture bed, and the gathering of *bangus* fry or fry of other species for propagation within Alabel. The municipality also has strong linkages with CRMP.

Kiamba is also active in instituting CRM-related ordinances and resolutions. The focus is similar to other municipalities (prohibition of commercial fishing in municipal waters and the use of illegal fishing methods, and establishment of fish sanctuaries). This municipality also has strong institutional linkages with CRMP. Ordinances require persons bringing fish outside of the municipality to pay an inspection fee. Ordinances also regulate *bangus* fry gatherers, including one that prohibits discarding fry of any species ashore. The municipality also provides for special treatment for organizations and cooperatives in the acquisition of *bangus* fry in the municipal waters of Kiamba. It is also one of the few municipalities which have created a municipal environmental protection and management committee.

Maitum has addressed similar issues; however, it has more ordinances regulating the catching of *bangus* fry. The *barangays* in the municipality are also active in CRM and have created *barangay* CRM teams. This municipality also has ordinances that regulate the price of fish and meat in the municipality.

In Maasim, *payao* owners are not allowed to install within 3 km from the shoreline of Maasim at high tide. Some fishing methods such as *licum* are prohibited. *Bangus* fry harvesting is also regulated.

GSC has different priorities compared to the municipalities in Sarangani Province. This is due to the degree of development in the city compared to the outlying municipalities. The city takes the lead in the protection of the coastal resources in the whole Sarangani Bay through various resolutions requesting the national government to provide support or guidance (such as declaration of Sarangani Bay as a protected seascape). Its focus is more on garbage dumping, wastewater discharge, and regulating fish landing sites and payment of fees, rather than on commercial fishing (majority of commercial fishers dock in GSC).

As a whole, Sarangani Bay is a protected seascape and falls under the rules and regulations of RA 7586 or the NIPAS Act of 1992. As such, Sarangani Bay falls under the general administration of the DENR. A Protected Area Management Board (PAMB) has been formed to manage Sarangani Bay under the guidance of the DENR with the full participation of all concerned LGUs.

NGOs INVOLVED IN INTEGRATED COASTAL MANAGEMENT

Several NGOs directly or indirectly work on coastal zone management. Table 6.2 presents the names of the NGOs with their goals, objectives, and target beneficiaries.

The roles of these NGOs are:

- Advocacy for the rights of the poor and the under-represented;
- Community mobilization and organization;
- Capability building and skills development;
- Participation in research and studies;
- Provision of access to resources; and
- Provision of linkages and communication between various stakeholders.

Figure 6.2. Newly renovated patrol boat for Sarangani Province currently in drydock in GSC.

Other NGOs have previously worked in the area. According to Olive (1993), organizations that have been successful in asserting their rights for access and control have some sort of assistance from NGOs. Table 6.3 presents some of the NGOs that have worked in the Sarangani area. Most of the funding for NGOs focusing on fisheries are from USAID or other donors.

Table 6.2. List of academic and nongovernment organizations working on integrated coastal zone management.

NGO	Thrust	Area concerned
Mahintana Foundation	Community organizing	Alabel, Malapatan
Maguindanao Development Foundation	Community organzing	Alabel, Malapatan
Mindanao State University Foundation	Fishery assessment	Sarangani Bay
South Cotabato Foundation	Community organizing	Alabel, Malapatan
Tambuyog Development Center	Community-based CRM	Katubao, Kiamba

COMMUNITY ORGANIZATIONS

Community organizations in the area have mostly been formed by NGOs. Various cooperatives in the area are being assisted by NGOs. Some large fishers' organizations in the profile area include the South Cotabato Purse Seiners' Association (SOCOPA) which was established mainly to combat sea piracy. Other associations include the

Table 6.3. Past fishery NGO work in Sarangani, type of assistance offered, and sources of funds.

NGO	Target groups	Type of assistance	Main source of funds for fishery groups
Structural Alternative Legal Assistance for Grass Roots (SALAG)	Small-scale Muslim fishers	Loans; legal and organizational assistance	Law graduates from Ateneo de Manila
Mahintana Foundation, Inc. (MFI)	Small-scale fishers	Grants; technical and organizational assistance	Dole Philippines and USAID
South Cotabato Foundation, Inc. (SCFI)	Small-scale fishers	Loans; technical and organizational assistance	USAID and international church groups
Fisheries Research and Development Center (FRDC)	Small-scale fishers	Research, legal and organizational assistance	Agro-aquatic Services Association, Inc. (AASA)
Business Resource Center (BRC)	Small-scale fishers	Loans; research and financial management assistance	USAID and Notre Dame of Dadiangas College
Sarangani Bay Marine and Inland Resource Conservation Foundation			
Earth Island Institute, Philippines			
Fisherfolk Resource and Developement Center of GSC			

General Santos Traders and Tuna Exporters Organization (GSTTEOI) whose members are also members of SOCOPA and the Umbrella Fish Landing Association (UFLA) that provides fishers ready buyers for their catch.

CRMP has assisted in the formation of 29 *barangay* teams out of the 64 coastal *barangays* prior to the formation of FARMCs. In 1997, CRMP began assisting in the formation of FARMCs. During the year, CRMP assisted in the formation of 21 *barangay* FARMCs, 1 city FARMC, and 1 municipal FARMC. FARMCs are intended to institutionalize the major role of local fisherfolk and other resource users in community-based planning and implementation of policies and programs for the management, conservation, development, and protection of fisheries and aquatic resources in municipal waters. The functions of the FARMC include:

- Preparation of the municipality/city integrated fishery development plan for submission to and approval by the municipal/city/provincial development council;
- Formulation of recommendations 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 municipal/city or provincial council on fishery matters through the committee on fisheries.

FARMCs are to be provided with technical assistance from the DA, DENR, DILG, Department of Justice (DOJ), and other government agencies. Unfortunately, in the profile area, FARMCs have been discouraged due to conflicts with LGUs and some powerful people with vested business interests in coastal resources. FARMCs have become a political issue in Sarangani because the FARMC has the power to screen and approve CRM-related projects. Some LGUs see this as infringing on their responsibilities.

As a protected seascape, Sarangani Bay is managed by a Sarangani Bay PAMB with the executive committee comprised of 29 members representing LGUs, the DENR, NGOs, other national government agencies, the academe, people's organizations, and others. Thus far, several meetings have been held and more are programmed to finalize the Sarangani Bay Integrated Coastal Management Plan. However, Sarangani Bay is now under the jurisdiction of Region 12 although the Chair of the PAMB is still DENR Region 11. The PAMB Chair of DENR Region 11 Technical Director for the Ecosystems Research and Development Sector has his office in Davao City, a 3-hour land trip from GSC. According to some people, this is one of the reasons why DENR has not been able to give the necessary attention and importance to Sarangani Bay. There is a DENR PENRO based in Alabel but it has other priorities and a very limited budget. DENR personnel cite the size of the protected area makes it very difficult to cover.

The PAMB can be the multiple use marine reserve development authority that is recommended by the MGP. MGP envisions this body to (1) be the venue for discussion of CRM issues; (2) decide matters relating to planning the conservation, protection, and utilization and development of coastal marine resources; (3) coordinate the enforcement of fishery and environmental laws; (4) decide on proposals, work plans, action plans, and guidelines for the management of coastal and marine resources; (5) promulgate initial policies, rules and regulations, and promote sustainable development programs; and (6) ensure the implementation of CRM programs.

SUMMARY

Although there has been a lot of support in the formation of community organizations (primarily by NGOs), these organizations do not seem to have a profound impact on bay-wide management activities. Most of the organizations, once formed, remain inactive primarily due to lack of funds and the lack of attention given to it by its members. The active adoption of the Sarangani Bay-wide Plan by the PAMB will provide an excellent opportunity for the implementation of an integrated management plan that can complement the CRM efforts of the LGUs.

Chapter 7
MANAGEMENT ISSUES and OPPORTUNITIES

ENVIRONMENTAL ISSUES AND OPPORTUNITIES

Various environmental issues affect Sarangani Bay. The foremost is the siltation of rivers, which discharge to Sarangani Bay. This has led to the sedimentation of coral reefs and seagrasses. This has also led to high concentrations of total suspended solids (TSSs) in shore areas near the river mouths. Downstream concentrations range from 253 to 301 mg/L. Studies show that when TSS concentration is increased to 80 mg/L, the macroinvertebrate population will decrease by 60 percent. TSS in coastal waters exerts many harmful effects on the marine environment. When in suspension, it reduces the penetration of sunlight, becomes carriers of toxic substances and pathogenic organisms over great distances, and affects fish and filtering species sensitive to the blocking of branchiae. When it settles, it clogs spawning grounds inhibiting the reproduction of fish and it forms sludge blankets causing asphyxiation to the benthic environment.

This is particularly prevalent in the coastal area around Buayan River where one can see the discharge plume from the river as it joins Sarangani Bay. Fishers in the area attribute this to upland activities. They say that the sediments come from manure from the livestock industry and erosion caused by deforestation and destructive farming practices. Analyses of suspended solids in the sampling station nearest to Buayan River yielded alarming results (163 mg/L) compared to the 14 other stations (concentration ranges from 27 to 56 mg/L).

LGUs have yet to find a long-term solution to the sedimentation entering Sarangani Bay. The CRM director under the Office of the Provincial Agriculturist of Sarangani Province identified this as one of the major problems facing the coastal areas of Sarangani Bay. The major stumbling block to effectively stopping sedimentation is the lack of jurisdiction of the affected communities. The sediments probably come from upland areas where logging, destructive farming methods, and mining are prevalent. In some cases, these take place outside Sarangani Province in neighboring South Cotabato.

There is no easy solution in resolving the issue of sedimentation. There should be strong coordination and communication between the provinces of South Cotabato and Sarangani on the effects of sedimentation on the coastal ecosystems. The information, education, and communication (IEC) campaign should be focused on the coastal areas and the upland areas. Aside from Sarangani Province and GSC, the IEC campaign should also address South Cotabato Province. The government (both local and national) should address all the causes of siltation simultaneously. These are mining, logging, and discharges of the livestock industry.

It is difficult to estimate the contribution of the mining industry to the sedimentation in Sarangani Bay. At this time, it is probably smaller than logging or mining.

Industrial pollution is mainly a local issue in GSC, since the outlying municipalities generate little industrial pollution. Pollution seems to be concentrated in Tambler, where the fish canneries are located. The DENR is allegedly having difficulty in stopping their operations because its regional office is in Davao. Most of these fish canneries do not have adequate wastewater treatment facilities (WTFs). The fish canneries complain of the high costs in constructing and maintaining WTFs. In one instance, the government closed a tuna processing firm by issuing a cease-and-desist order (CDO); however, the firm continued operation in the middle of the night. Eventually, the firm was allowed to operate while a WTF was being constructed.

Domestic pollution is another issue that needs to be addressed. As shown in Chapter 2, laboratory analyses of samples taken in Sarangani Bay indicate high levels of total coliform. The assumption is that the major causes of this are the households without any toilets. As population increases, the total contribution of domestic waste to the pollution going into Sarangani Bay will increase exponentially. LGUs should improve current sewerage systems in their respective city and municipality. Coliform bacteria associated with domestic waste are by themselves not pathogenic, but they can cause urinary bladder infections. The presence of coliform implies that there could be a health risk because pathogens could infect a person via food ingestion. Skin disease and intestinal disorder can result from swimming in coliform infested waters.

Another source of coliform bacteria is livestock waste. Livestock waste in rivers entering Sarangani Bay has been associated with siltation. Small-scale livestock farms have no wastewater treatment systems (WTSs). It is difficult to force these small farms to construct any viable WTS because the costs in constructing and maintaining these systems are prohibitive from the point of view of these farmers. Studies should be conducted to provide these small-scale farmers with an option of treating waste before its discharge to the various rivers. One possible option is a centralized WTS, but this option needs further study. In the meantime, pollution prevention measures could be implemented to reduce wastewater discharge.

Overfishing, illegal fishing, encroachment of commercial fishers in municipal waters, and use of destructive fishing methods are all major issues. Fisheries technicians are particularly concerned with the economic effects of these problems on the municipal fishers living in their areas of jurisdiction.

Dynamite fishing used to be prevalent in the area, but it is not as extensive as it used to be although it still occurs. Various other illegal fishing methods are used such as the use of fine mesh nets, superlights, and *muro-ami*. Some of these fishing methods result in coral reef destruction and all result in overfishing. The PCRA identifies these as the most pressing problems facing the area.

MGP recommends that the following measures be taken to reduce overfishing in the area:

- Certain times of the year should be closed season for certain species to allow for spawning;
- Mesh sizes should be increased to allow immature individuals to escape; and
- Presidential Decree 704 should be strictly enforced to ease the pressure on big-eye scad (*Selar crumenophthalmus*) population.

Although mangrove destruction is not a major issue in the area, it is a long-term concern of environmental managers. Mangroves are an ecological habitat for various organisms including commercially valuable species. Mangroves, like their upland counterparts, prevent erosion.

To address mangrove destruction and as part of the reforestation efforts of the DENR and Sarangani, the Mangrove and Marine Resources Research and Development Training Center was established in Glan. However, other mechanisms need to be put in place in order to curb mangrove destruction. As mentioned earlier, Silliman University reports only 25 ha of mangrove areas left in Sarangani Bay. Questionnaire updates provided by CRMP report that the total mangrove area is around 200 ha. Assuming that the figure reported in 1993 of 508 ha of mangroves was an overestimate, it is still

higher than the 25 ha of mangrove reported by Silliman. Whatever the case, it is clear that mangrove denudation is occurring and needs to be immediately addressed.

LGUs should implement a moratorium on fishpond construction. In implementing this strategy, LGUs should have a strong political will, as some fishpond owners have strong political influence or are political figures themselves. The DENR should strictly enforce and monitor mangrove cutting for firewood. Reforestation also seems to be a problem, because of high mortality of replanted seedlings. The DENR needs to study the cause of the high mortality rate of the seedlings to determine what is needed to ensure the success of rehabilitation projects.

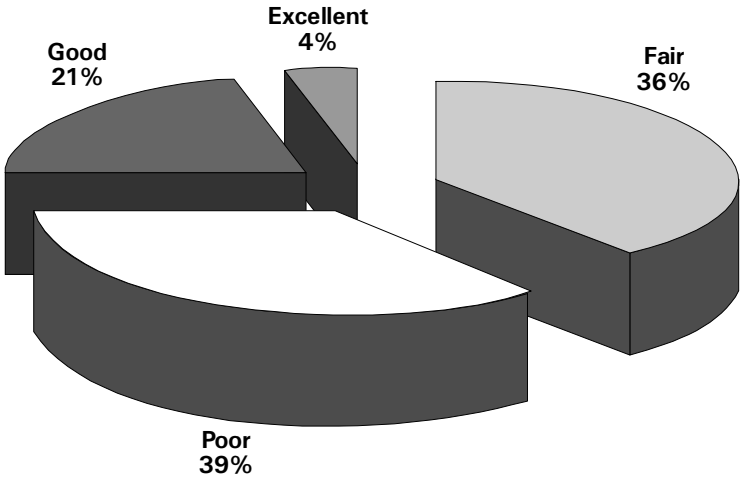


Figure 7.1. Status of coral reef ecosystem in Sarangani Bay.
Data from the Earth Island Institute, 1997

Destruction of coral reefs is also a concern. Fishers are now realizing that coral reefs protect the shore and maintain marine biodiversity. Coral reefs also ensure sufficient increase in fish catch. Artificial reefs and fish attracting devices have enhanced previously damaged reefs. The Earth Island Institute reports that only 4 percent of the coral reefs are in good condition while 39 percent are in poor condition (Figure 7.1). The main causes of degraded reefs are extensive dynamite fishing and sedimentation. There are also reports of coral extraction. However, this is not as extensive, and is limited only to some beach resorts.

ECONOMIC ISSUES AND OPPORTUNITIES

The issue of sedimentation also has its roots in the economic condition of the people living in upland areas. Logging has been an established industry in the whole of Mindanao ever since the timber boom in the early 1960s. So many people depend on the logging industry, and even with the selective logging ban, some people still cut logs because of the lucrative market. Most of the people who log do not know of any other livelihood. Government should address this issue by providing other sources of income.

The conditions are the same for people who use destructive farming methods such as the *kaingin* (slash-and-burn) system. These people live a hand-to-mouth existence. In order to make ends meet, they maximize production to the point of

causing environmental degradation. Slash-and-burn farming involves burning large tracts of forestland for farmers to have a cleared fertile land for planting. Once the produce is harvested, the farmer leaves the place to look for another area to burn. This leaves the previous area denuded and unable to maintain soil stability, leading to erosion and sedimentation in the rivers and ultimately in Sarangani Bay.

According to provincial officials, *kaingin* is almost non-existent and illegal logging is not as rampant as before. However, the damage has been done. The effects of previous logging activities are being felt to this day.

Mangrove destruction does not seem to be a major economic issue among coastal dwellers. This is probably the reason why it is not a major concern in Sarangani Bay. Nevertheless, the people should be made aware of the significance of mangroves in the long term. The loss of mangroves translates into loss of commercially viable fishes, and therefore, income. Around 800 ha of coastal area is used for aquaculture ponds in Sarangani. It is difficult to gauge exactly how much of this area was previously mangrove forests, but it is likely that most was mangrove forest.

The provincial government is implementing an IEC campaign on mangrove protection. It also provides limited financial and technical support for management and reforestation.

Figure 7.2. Project evaluators discussing the problem of limited entry with residents of Sapu-Padidu, Glan.

Socioeconomic issues identified in the PCRA include lack of fishing gear and very few fish. Fishing grounds are getting farther and farther from the shore, as the fishing grounds near the shore become more overfished. Overfishing often results from the difficult living conditions of marginal fishers and their competition with commercial fishers (who are also overfishing). These fishers need to be educated on the long-term effects of overfishing and need to be taught sustainable fishing methods. New entry to fishing must be discouraged (Figure 7.2).

Fish canneries in Tambler employ many workers, provide income to the city government, and are symbols of the economic growth being experienced by GSC. However, a balance between economic growth and protecting the environment needs to be maintained.

Almost all the roots of environmental and coastal degradation lie in economics. Some destroy because of actual need, others because of greed. Most do it unknowingly, while some know what they are doing but are left with no choice. Almost all can stop actual environmental degradation and pursue sustainable development if educated, and additional sources of income that are not so resource-dependent are provided.

POLITICAL AND INSTITUTIONAL ISSUES AND OPPORTUNITIES

Local government should prepare profiles for priority projects (protected areas, fisheries, and pollution), identify proponents, budget estimates, and potential funding agencies. Priority projects should include rehabilitation of mangrove forests, rehabilitation of coral reefs and reef fish production, environmental education, establishment of community-based enterprises, and zonation. Fisheries programs should include fish stock assessment, development of cooperatives, squid drying for women entrepreneurs, deep-water hand reel fishing, alternative *banca* material, cage culture of siganids and groupers, aquaculture capability building, *bangus* fry banking, and seaweed production. Environmental quality management programs should include a sanitary landfill, water supply to outlying *barangays*, domestic sewage treatment systems, institutional monitoring capability, and selection of pilot industry for development of waste disposal systems.

It is fortunate that the current provincial government of Sarangani follows a policy that objects to all applications for exploration permits filed with the Mines and Geosciences Bureau. However, other provinces in the area need to follow the example of Sarangani. The national government must also support these initiatives of LGUs, as they try to balance ecological preservation and economic development.

To avert further destruction by illegal logging and to reforest previously logged areas, the DENR, in cooperation with the Provincial Government of Sarangani are implementing various projects. These include CBFM in Kiamba and Maitum and reforestation under the Forestry Approach Reforestation and Community Approach Reforestation Schemes.

There are already existing laws regulating most of the environmental issues. However, due to the lack of resource of both national government agencies and LGUs, the enforcement of these regulations is spotty at best. Both the PCG and the Philippine National Police (PNP) Maritime Command have limited manpower and resources, particularly patrol boats and gasoline. They also have more pressing issues to contend with, particularly seajacking, contraband smuggling, and drug smuggling. These laws are not only environment- or coastal resource-related, but also include other major crimes and violations. Although most municipalities have deputized *bantay dagat* or fish wardens, their effectiveness is hampered by their lack of knowledge of the law and procedures of arrest. The fish wardens or *bantay dagat* also lack incentives. The

government hardly pays them, and usually they do not have the necessary equipment such as radios and fast boats to go after the illegal fishers who are oftentimes better equipped and armed.

Additionally, politicians, police, local officials, and fishers do not fully understand the laws and procedures or, when convenient, pretend not to understand. Furthermore, the agriculture officers devolved to the LGUs are trained in upland agricultural practices. Very few of them have fishery backgrounds and the rest do not have training in fishery management. In most cases, the government acts only when it receives a complaint with enough influence. Even when the government has patrol boats, these are usually too slow to catch illegal fishers. Some municipalities were given patrol boats; however, after a few years, these became inoperable due to lack of maintenance and repair. Some powerful or influential people are also at the heart of water pollution and commercial fishing in municipal waters.

Recently, the Sarangani Province bought a patrol boat to be used in patrolling municipal waters.

Seajacking is also a major issue identified in the PCRA (Figure 7.3). Although the various cooperatives and associations have been effective in combatting pirates, small fishers are still falling prey to this thievery sometimes not only losing their catch but also their lives.

Figure 7.3. Technical working group drawing the PCRA maps that identified issues such as seajacking.

It would seem that the *bantay dagat* could best only serve as a watchdog alerting the authorities such as the PNP and PCG who should make the actual arrest of illegal fishers. A study is needed to show how an effective network of *bantay dagat* could be established to support local law enforcement agencies responsible for coastal law enforcement.

Fishing effort should be reduced within the bay waters. Laws should be enforced which prohibit commercial fishers from fishing within municipal waters. Alternative sources of livelihood should be found for subsistence fishers, such as *sari-sari* stores and pig fattening.

Encroachment of commercial fishers in municipal waters seems to be the most common complaint of fisherfolk in the municipalities of Sarangani. This is a result of a perceived open-access system. In recent years, several boats whose ownership is outside of the GSC and Sarangani Province have begun to fish in the bay. Local residents claim that these non-resident fishers use illegal methods that are efficient in catching fish such as fine mesh nets.

PCRA results show that the fishers still trust that the government will help them in their plight, particularly in regard to illegal fishing. They believe that the government will be able to enforce the laws and arrest and imprison illegal fishers. In a case study by Olive (1993) in Sarangani, municipal fishers reported commercial fishers in municipal waters. The mayor got the local police to arrest the 30 fishers and to confiscate their boat. However, after a few days, the mayor was forced to release them because the local government could no longer afford to feed them.

Figure 7.4. More marine sanctuaries are being established in the bay area.

Management zones should be classified as sanctuary or preservation zones, buffer zones, sustainable use zones, rehabilitation zones, and recreational zones (Figure 7.4). Areas south of Pampang Point should be classified as a preservation zone.

Fishers also believe that establishing fish sanctuaries is a solution to overfishing by providing fish with a breeding ground in municipal waters.

The framework for the coastal area management plan for Sarangani and GSC recommends the establishment of Municipal CRM Boards. These bodies can: (1) provide the necessary direction of various CRM programs and projects; (2) provide a venue for the integration and coordination of various CRM efforts; (3) provide a venue for stronger community participation in CRM planning and decision-making process; and (4) raise local community environmental concerns.

Most of the people seem to be concerned more with the economic impacts of the issues, rather than their environmental effects. These people see environmental degradation as affecting their source of income, and are more worried about its effect on the money that they earn rather than on actual protection of the environment.

SUMMARY

The Sarangani baywide management plan, to be endorsed in 2001, reflects many of the issues and solutions discussed in this chapter. The planned activities follow:

Summary of Management Programs and Activities for Sarangani Bay

Habitat Enhancement

- Profiling and assessment of natural habitats including major rivers
- Mangrove rehabilitation and replanting
- Establishment of new and/or enhancement of existing marine protected areas in the bay
- Rehabilitation of major rivers
- Implementation of adopt-a-shoreline and adopt-a-river projects
- Resource use inventory and zoning
- Monitoring and evaluation

Fisheries

- Baseline information gathering
- Periodic fish stock assessment
- Conduct of feasibility study on open-closed seasons and other possible fisheries management tools
- Implementation of fisheries management tool(s) best suited in Sarangani Bay
- Feasibility study on assigning property or access rights to community organizations
- Monitoring and evaluation

Pollution and Water Quality

- Baseline information gathering
- Establishment of water quality laboratory and monitoring system
- Economic analyses and valuation of environmental costs
- Conduct of environmental policy research studies and application of market-based instruments for pollution control
- Construction of appropriate pollution control devices
- Conduct of IEC activities that also include concerns on policies and standards
- Monitoring and evaluation

Shoreline Waterfront Development

- Baseline information gathering
- Establishment of necessary buffer zones and setting up of corresponding demarcations
- Development of sea-use plan
- Monitoring and evaluation

Community Development

- Baseline information gathering
- Community organizing and strengthening of existing POs
- Conduct of leadership enhancement and planning and management skills training
- Conduct of training courses on ICM and related matters
- Conduct of social mobilization activities
- Monitoring and evaluation

Population and Settlements in Coastal Areas

- Baseline information gathering
- Formulation of policies and settlement plans for coastal municipalities and *barangays*
- Construction of sanitary toilets for coastal communities
- Development of a coastal solid waste management program
- Development of a potable water program
- Development of a coastal resettlement program
- Monitoring and evaluation

Tourism and Enterprise Development

- Baseline information gathering
- Conduct of feasibility and viability studies
- Identification and implementation of appropriate tourism and other enterprise activities
- Skills development and training
- Development of linkages and/or partnerships with appropriate groups
- Monitoring and evaluation

Information, Education, and Communication

- Baseline information gathering
- Establishment of an Environmental Conservation and Protection Center
- Preparation of IEC and advocacy materials
- Networking of local academic and research institutions to help implement appropriate plan activities
- Establishment of the Sarangani Bay management information system/ geographic information system
- Training support to different projects and activities
- Monitoring and evaluation

Strengthening the Legal and Institutional Component

- Baseline information gathering
- Review of pertinent laws and regulation (environmental/coastal)

- Conduct of general IEC activities on law enforcement and coordination with law enforcement agencies as well as for communities
- Conduct of regular/programmed meetings of the different law enforcement agencies and meetings with the community
- Conduct of research on the optimum level of law enforcement personnel and their logistic requirements
- Conduct of project activities that would increase the number of law enforcement personnel (or deputized wardens)
- Acquisition and maintenance of logistics facilities including petrol and speed boats
- Monitoring and evaluation

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