The Lingayen Gulf Coastal Area Management Plan

NATIONAL ECONOMIC DEVELOPMENT AUTHORITY
REGION I
PHILIPPINES

THE LINGAYEN GULF COASTAL AREA MANAGEMENT PLAN

National Economic Development Authority
Region I, Philippines

1992

Association of Southeast Asian Nations/United States
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ASEAN	Association of Southeast Asian Nations
BFAR	Bureau of Fisheries and Aquatic Resources
CAM	coastal area management
CAR	Cordillera Autonomous Region
CPM	common property management
CRM	coastal resources management
CRMP	Coastal Resources Management Project
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DLG	Department of Local Government
DMMSU	Don Mariano Marcos State University
DOST	Department of Science and Technology
DOT	Department of Tourism
DPWH	Department of Public Works and Highways
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
EIA	environmental impact assessment
EMB	Environmental Management Bureau
FA	fishermen's association
GIS	Geographic Information System
GISCAMP	GIS Coastal Area Management and Planning Project
GT	gross ton
HLURB	Housing and Land Use Regulatory Board
IAD	integrated area development
ICLARM	International Center for Living Aquatic Resources Management
IDA	Institute for Development Alternatives
IEC	information, education and communication
LGCAMP	Lingayen Gulf Coastal Area Management Plan
LGCC	Lingayen Gulf Coordinating Committee
LGU	local government unit
M&E	monitoring and evaluation
MEY	maximum economic yield
MOE	maintenance and operating expenses
MSY	maximum sustainable yield
NCO	National Coordinating Office
NEDA	National Economic Development Authority
NEPC	National Environmental Protection Council
NGO	nongovernmental organization
NMC	National Mangrove Committee
NPCC	National Pollution Control Commission
NRO	NEDA Regional Office
PCAMRD	Philippine Council for Aquatic and Marine Research and Development
PCC	Provincial Coordinating Committee
PD	Presidential Decree
PMO	Project Management Office

PSU	Pangasinan State University
RA	Republic Act
RDC	Regional Development Council
RPFP	Regional Physical Framework Plan
SB	Sangguniang Bayan (i.e., municipal council)
SL	Sangguniang Panlalawigan (i.e., provincial council)
SP	Sangguniang Panlungsod (i.e., city council)
SRDC	Seafarming Research and Development Center
TFA	Telbang Fishermen's Association
UPMSI	University of the Philippines Marine Science Institute
UPVCF	University of the Philippines in the Visayas College of Fisheries
USAID	United States Agency for International Development
WCU	waste compacting unit

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FOREWORD

The coastal waters of Southeast Asian countries have some of the world's richest ecosystems characterized by extensive coral reefs and dense mangrove forests. Blessed with warm tropical climate and high rainfall, these waters are further enriched with nutrients from the land which enable them to support a wide diversity of marine life. Because economic benefits could be derived from them, the coastal zones in these countries teem with human settlements. Over 70% of the population in the region lives in coastal areas where resources have been heavily exploited. This situation became apparent between the 1960s and 1970s when socioeconomic pressures increased. Large-scale destruction of the region's valuable resources has caused serious degradation of the environment, thus affecting the economic life of the coastal inhabitants. This lamentable situation is mainly the result of ineffective or poor management of the coastal resources.

Coastal resources are valuable assets that should be utilized on a sustainable basis. Unisectoral overuse of some resources has caused grave problems. Indiscriminate logging and mining in upland areas might have brought large economic benefits to companies undertaking these activities and, to a certain extent, increased government revenues, but could prove detrimental to lowland activities such as fisheries, aquaculture and coastal tourism-dependent industries. Similarly, unregulated fishing effort and the use of destructive fishing methods, such as mechanized push-nets and dynamiting, have seriously destroyed fish habitats and reduced fish stocks. Indiscriminate cutting of mangroves for aquaculture, fuel wood, timber and the like has brought temporary gains in fish production, fuel wood and timber supply but losses in nursery areas of commercially important fish and shrimp, coastal erosion and land accretion.

The coastal zones of most nations in the Association of Southeast Asian Nations (ASEAN) are subjected to increasing population and economic pressures manifested by a variety of coastal activities, notably, fishing, coastal aquaculture, waste disposal, tin mining, oil drilling, tanker traffic, construction and industrialization. This situation is aggravated by the expanding economic activities attempting to uplift the standard of living of coastal people, the majority of whom live below the official poverty line.

Some ASEAN nations have formulated regulatory measures for coastal resources management (CRM) such as the issuance of permits for fishing, logging, mangrove harvesting, etc. However, most of these measures have not proven effective due partly to enforcement failure and largely to lack of support for the communities concerned.

Experiences in CRM in developed nations suggest the need for an integrated, interdisciplinary and multisectoral approach in developing management plans that will provide a course of action usable for the daily management of the coastal areas.

The ASEAN/United States (US) Coastal Resources Management Project (CRMP) arose from the existing CRM problems. Its goal is to increase existing capabilities within ASEAN nations for developing and implementing CRM strategies. The project, which is funded by the US Agency for International Development (USAID) and executed by the International Center for Living Aquatic Resources Management (ICLARM) in cooperation with ASEAN institutions, attempts to attain its goals through these activities:

- analyzing, documenting and disseminating information on trends in coastal resources development;
- increasing awareness of the importance of CRM policies and identifying, and where possible, strengthening existing management capabilities;
- providing technical solutions to coastal resource-use conflicts; and
- promoting institutional arrangements that bring multisectoral planning to coastal resources development.

In addition to implementing training and information dissemination programs, CRMP also developed site-specific CRM plans containing integrated strategies that are appropriate to the prevailing conditions in each nation.

In the Philippines, the Lingayen Gulf coastal area is an ideal site for the pilot testing of resource management initiatives that can be adopted to other coastal areas of the country. It is the major fishing ground of northwestern Luzon. The majority of the populace in surrounding towns is dependent on coastal resources, especially living marine resources, for food, income and employment. The capture fisheries, aquaculture and tourism sectors of the gulf are important to the regional economy.

Several agencies participated in the project under the coordination of the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) of the Department of Science and Technology (DOST). During the planning phase, the National Economic Development Authority (NEDA), Region I assumed a lead role.

Foreword

This management plan is an attempt to lay the foundations for the sustainable development of the Lingayen Gulf coastal area. It contains a brief review of the more important resource management issues, programs and projects to assess these issues, and institutional arrangements for plan implementation. This first generation plan is by no means perfect. But it is hoped that those who will take part in its implementation will find it a useful framework and that it can be refined or adjusted to changing conditions.

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FOREWORD

Often, in our drive to get the most economic gains from the least investments in the shortest possible time, we are limited by the narrow trichotomy of production, object and consumption. We fail to see that unplanned natural resource use for economic development results in future socioeconomic losses. We forget that production and consumption processes take place in a time-space continuum.

Such is the essential history of the degradation of the aesthetic quality and functional integrity of Lingayen Gulf. It started out with seemingly small and harmless economic activities in the coastal area of the gulf. Eventually, the resource exploitation reached the remotest uplands until it strained nature's regenerative capacity. And time is now charging us for these abusive practices.

In the same manner that the problems in Lingayen Gulf started long ago, the solutions were conceived in the past. Fragmentary, painstaking research activities by PCAMRD-DOST and ICLARM evolved into a coherent management plan.

The problems of Lingayen Gulf remain. It is up to us to take up the challenge and follow through the implementation of *The Lingayen Gulf coastal area management plan* in a strong and unprecedented partnership with the private sector.

Honorable Aguedo Agbayani
Governor, Pangasinan

Honorable Justo O. Orros
Governor, La Union

EXECUTIVE SUMMARY

The coastal area of Lingayen Gulf represents a continuum between land and sea. It is characterized by highly productive ecosystems which are greatly influenced by terrestrial and marine events. It is a resource system: human activity interacts with natural forces in complex ways to affect its health. A healthy gulf contains rich fishing grounds, productive brackish culture systems and natural attractions for tourism.

The gulf's resource use problems are interlinked; each will not be resolved if addressed in isolation.

Overfishing, pollution from the coast, siltation from denuded watersheds, poor land and water use now threaten the gulf's resources. These destructive human activities have degraded the resource base and broken down its delivery systems. Over time, the damage will become too costly to repair. Unless this trend is reversed, Lingayen Gulf's resources will be so badly damaged they will lose the ability to support communities around it.

The gulf's resource use problems are interlinked; each will not be resolved if addressed in isolation. Only if factors affecting the gulf are managed in an integrated way can its problems be solved.

The gulf's resources should be managed to obtain sustainable development. This can be achieved by a scientific and comprehensive management of the key factors that affect the gulf's resources. It means limiting the resource harvests to sustainable levels. It means encouraging natural growth processes. It means controlling land and water use. Fig. A.1 shows the 8 programs and 20 projects that will make this development possible.

Sustainable development can be achieved by a scientific and comprehensive management of the key factors that affect the gulf's resources.

The proposed programs will be implemented in two phases: an interim period (Phase I) of 2 years and Phase II of 3-5 years in which full implementation will take place. The National Economic Development Authority (NEDA) Regional Office (NRO) shall serve as technical secretariat to oversee the overall implementation of the Lingayen Gulf Coastal Area Management Plan (LGCAMP) in the first 2 years. It will report directly to the Lingayen Gulf Coordinating Committee (LGCC) which will be created within the Regional Development Council (RDC) of Region I. The LGCC shall be chaired by a governor of La Union or Pangasinan, who may rotate the chair among themselves. By Year 3 of plan implementation, it is suggested that RDC create a Project Management Office (PMO) by administrative order to take over the functions of the NRO Technical Secretariat for Lingayen Gulf.

All necessary preparations for large-scale projects will be completed in Phase I. In that period, NRO will submit proposals for Phase II projects to funding sources. Selected demonstration projects of an urgent nature will then be implemented. The major projects of Phase II will culminate in the establishment of a gulfwide common property management (CPM) system.

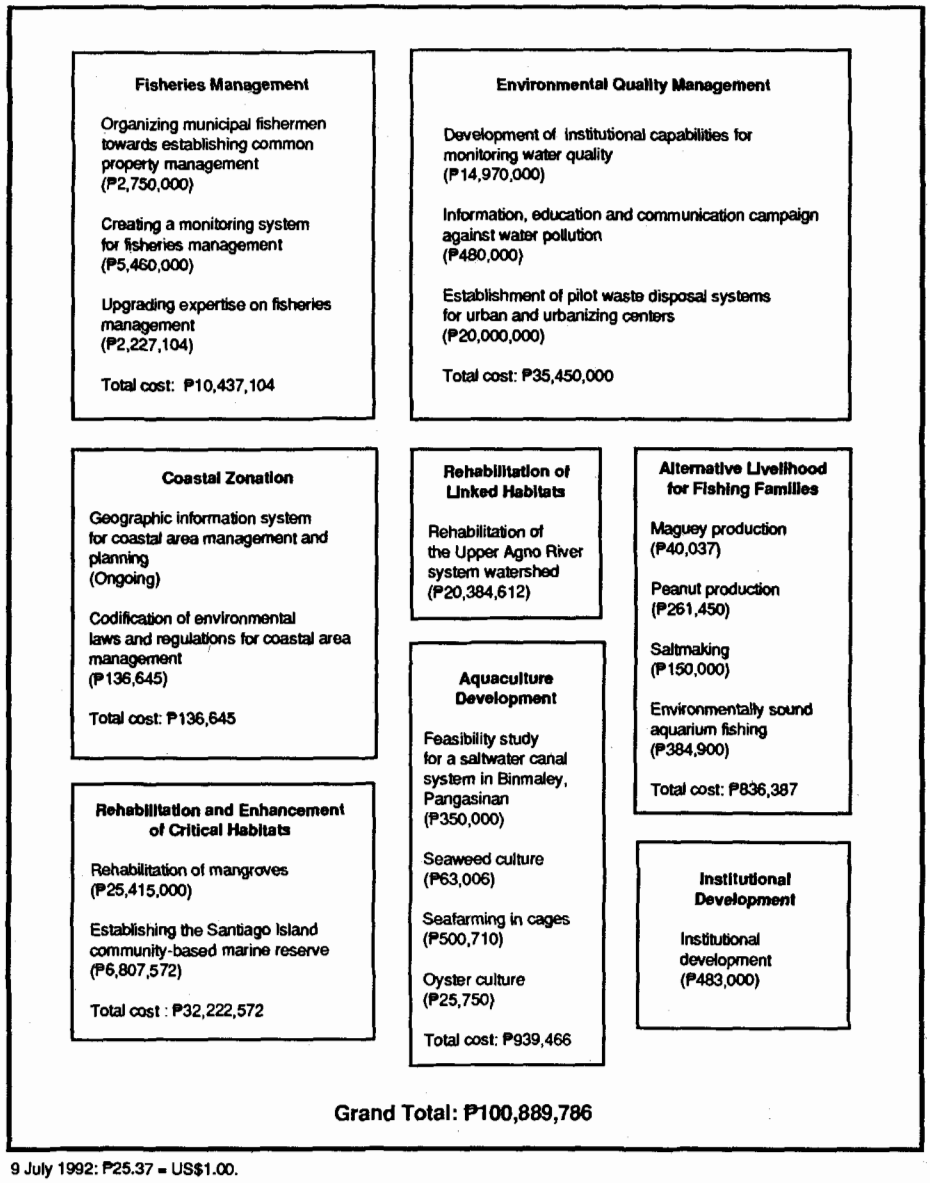

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Fig. A.1. Programs and projects of LGCAMP.

The CPM will devolve the responsibility for managing the gulf's fisheries to municipal fishermen's organizations. By providing municipal fishermen with tenure over resources, CPM will create the incentive for conservation. Trawlers will be gradually phased out of the gulf.

CHAPTER 1

INTRODUCTION

BOUNDARIES OF THE LINGAYEN GULF COASTAL AREA

In defining boundaries, this plan uses the coastal zone definition of the National Environmental Protection Council (NEPC) (1983) with modifications for administrative tractability. The NEPC defines the boundaries of the coastal zone as follows:

> The outermost limit is the 200-meter (100-fathom) isobath ... The innermost boundary is 1 km from the shoreline, except at places with reliable indicators of maritime influences ... in which cases the 1-km distance shall be reckoned from such features.

The seaward boundary of the coastal area in this plan approximates the 100-fathom isobath with straight lines (Fig. 1.1). The landward boundary coincides with the municipal boundaries of coastal towns or inland municipalities that contain brackishwater fishponds with connections to the gulf. The coastal area includes 17 coastal municipalities and the coastal city of Dagupan, plus 5 noncoastal municipalities with brackishwater fishponds. The coastline measures 160 km from Cape Bolinao to Poro Point in San Fernando. The waters enclosed by the coastline and the seaward boundary have a total area of 2,610 km^2.

SUMMARY PROFILE OF THE LINGAYEN GULF COASTAL AREA

Physical and Socioeconomic Characteristics

Lingayen Gulf is located off the coast of Pangasinan and La Union Provinces in northwestern Luzon (Fig. 1.1). Basically agricultural provinces, their important economic activities are rice production and fishing. The topography of Pangasinan is generally flat with 74% of its area having slopes of 0-18%. Hilly/mountainous areas are located at the eastern (Cordillera mountain ranges) and western (Zambales mountain) parts of Pangasinan. The topography of La Union varies from level to undulating and rolling with the hilly/mountainous portions concentrated in the intermediate hillsides of the Cordillera mountain ranges. About 51% has 0-18% slope. The climate of the western part of La Union is arid (the ratio of the number of dry to wet

months ranges from 1.00 to 1.67), while its eastern part and the whole of Pangasinan is dry (the ratio is from 0.60 to less than 1.00). The total annual rainfall in these provinces is 2,409 and 2,335 mm, respectively. In both, January is the driest month while maximum rainfall occurs in August. Mean annual air temperatures are 27.3 and 25.8°C, respectively (Alabanza et al. 1989).

Three major river systems drain into Lingayen Gulf, namely, Agno, Pantal-Sinocalan and Cayanga Pantalan. These river systems drain watersheds that span eight provinces in Regions I, II and III. The most important is Agno River whose 574,900-ha watershed includes the mining district of Benguet Province.

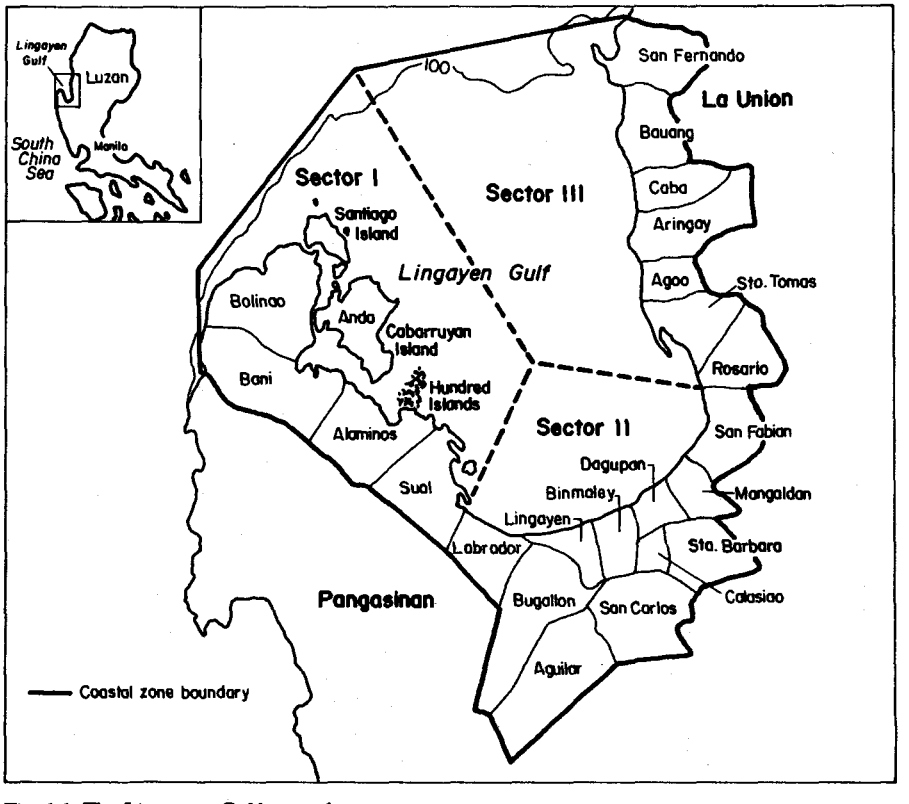

Fig. 1.1. The Lingayen Gulf coastal area.

Previous studies subdivided the gulf into three sectors according to a scheme devised by Mines (1986) (Fig. 1.1). Sector I is characterized by hard-bottom, coralline substrates and uneven topography. The gulf's coral reefs, seagrass beds and algal flats are concentrated in this sector. Sector II has mostly soft and muddy substrates and shallow, gradually sloping depths. Extensive areas of brackishwater fishponds are found inland. Sector III has sandy substrates. Compared with Sectors I and II, the depths at Sector III drop considerably near the shore.

The gulf provides more than half of the livelihood in coastal villages.

Dagupan City and the 17 municipalities surrounding Lingayen Gulf have a total population of about 799,000 (Table 1.1 and Fig. 1.2). About 40 % are concentrated in coastal villages, i.e., those that are next to the shore. The population in coastal municipalities grew at an annual rate of 3.2% from 1985 to 1988 (RDC 1986). In comparison, the annual growth rate (AGR) in coastal villages is estimated at a high 12.1% (UPCSWCD 1988). Higher population growth rates and higher densities in coastal villages seem to indicate a tendency for populations to concentrate toward the coastline.

Table 1.1. Population statistics for coastal municipalities and villages in Lingayen Gulf.

Population/AGR	Sector I	Sector II	Sector III	All sectors
Population				
Municipalities[a]	181,220	312,100	305,630	798,950
Villages[b]	87,950	138,310	93,320	319,580
% in villages	48.5	44.3	30.5	40.0
Density (persons/km^2)				
Municipalities[a]	234	902	560	479
Villages[b]	291	1,908	1,196	706
AGR				
Municipalities[a]	2.7	2.6	4.2	3.2
Villages[b]	9.2	13.3	13.3	12.1

Sources: [a]RDC (1986).
[b]UPCSWCD (1988).

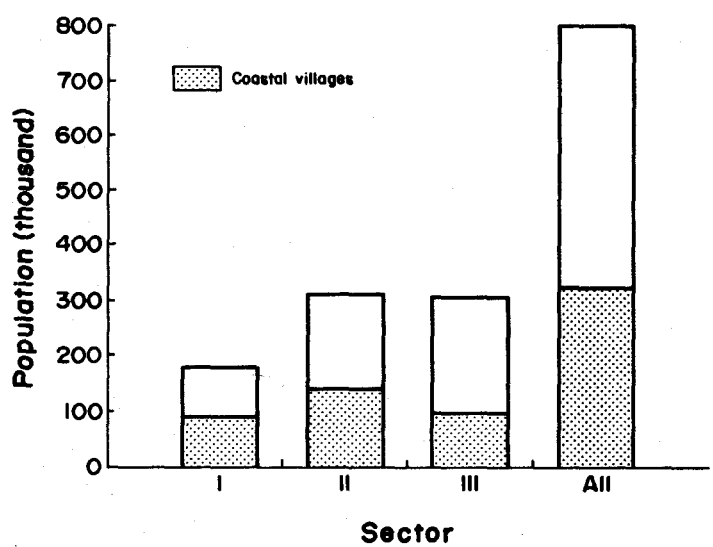

Fig. 1.2. Population in coastal municipalities by sector (UPCSWCD 1988).

The gulf provides more than half of the livelihood in coastal villages (Table 1.2 and Fig. 1.3). Sector III is most dependent on fisheries for employment. Most household heads qualify for little else, since more than 50% of them have had only an elementary level of education (UPCSWCD 1988).

Table 1.2. Percentage distribution of occupations of household heads in coastal villages by sector.

Occupation	Sector I	Sector II	Sector III	All sectors
Fisherman	39.6	53.6	71.3	49.6
Fish processor	0.9	0.7	0.0	0.7
Other fisheries-related occupations	5.7	7.9	11.3	7.3
Total fisheries-related occupations	46.2	62.2	82.6	57.6
Other occupations	13.9	28.6	10.0	17.8
Farmer	35.1	4.3	2.5	19.8
Combination	4.8	5.0	5.0	4.9
Total	100	100	100	100

Source: UPCSWCD (1988).

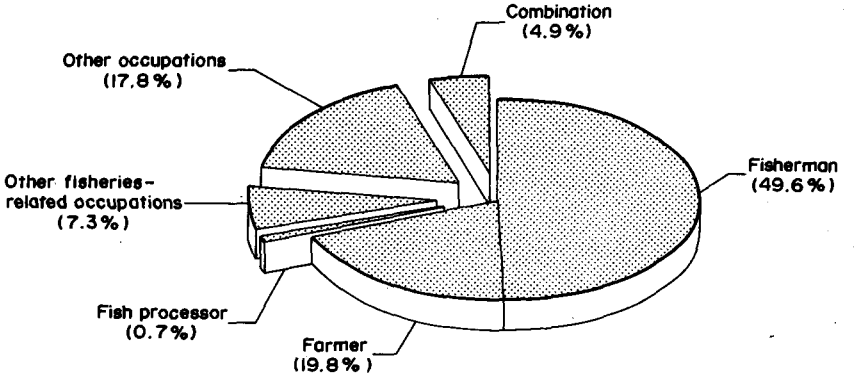

Fig. 1.3. Occupations of household heads in coastal villages (UPCSWCD 1988).

Major Resources

Fisheries

Lingayen Gulf is the major fishing ground of northwestern Luzon. It has two distinct fishing sectors, commercial and municipal. The Fisheries Decree of 1975 (or Presidential Decree [PD] 704) defines commercial fishing as fishing with vessels of more than 3 gross tons (GT). Municipal fisheries or fishing with vessels of 3 GT or less or without vessels, is synonymous with artisanal, small-scale and marginal fisheries. From 1976 to 1984, the annual landings of

Lingayen Gulf is the major fishing ground of northwestern Luzon.

these sectors reached 7,500-11,800 t of fish and invertebrates valued at ₱110-150 million/year at 1984 prices. The municipal sector accounted for 75-80% of the total landings while commercial sector landed the rest (Silvestre and Palma 1990). From May 1987 to April 1988, both sectors landed 14,400 t of fish and invertebrates worth ₱200 million, with the municipal sector contributing 78% of the landings (Table 1.3) (UPV 1990).

Table 1.3. Relative contribution of municipal and commercial sectors to annual marine landings in Lingayen Gulf, May 1987 to April 1988.

Sector/gear type	Landings (t)	% of total landings	% of sector landings
Municipal	11,265	78.0	100.0
Gill net	4,004	27.7	35.5
Blastfishing	2,679	18.5	23.8
Long line	1,636	11.3	14.5
Danish seine	530	3.7	4.7
Hook and line	478	3.3	4.2
Lift net	381	2.6	3.4
Beam trawl	335	2.3	3.0
Spear fishing	302	2.1	2.7
Shrimp trawl	280	1.9	2.5
Others	640	4.4	5.7
Commercial	3,181	22.0	100.0
Medium trawl	2,633	18.2	82.8
Large trawl	548	3.8	17.2
Total	14,446	100.0	-

Source: Calud et al. (1989) and Ochavillo et al. (1989), cited in Silvestre et al. (1991).

In 1985, there were about 12,500 municipal fishermen in the gulf. About 46% resided in Sector I, 36% in Sector II and 18% in Sector III (BFAR 1985a; 1985b; and 1985c). They used about 28 types of fishing gear (Silvestre and Palma 1990). The gill net was the most widely used gear, contributing 28% of the total landings and 36% of the municipal landings in 1987-1988 (Table 1.3). Municipal fishermen used three kinds of gill nets: bottom-set, surface/mid-water/drift and tuna drift gill net. The fishing grounds of these nets are shown in Fig. 1.4. In 1987-1988, blastfishing, the most common illegal fishing activity in the gulf, ranked second to the gill net in production. It is practiced in all sectors (UPV 1990).

Trawling is the only form of commercial fishing in the gulf. In 1987, the trawl fleet consisted of 24 medium (10-20 GT) and 2 large (20-40 GT) trawlers, and directly employed about 220 fishermen. The fleet contributed 22% of total landings (Table 1.3). Trawlers operate in soft-bottom areas less than 50 m

deep (Fig. 1.4) (UPV 1990). In 1990, there were 49 trawlers operating in the gulf, with 38 units based in the gulf and 11 from outside. The gulf's trawl fleet increased to 82 units (55 based within and 27 based outside the gulf) in 1991. Most of the new trawlers came from Manila Bay after the trawl ban in that area (BFAR Acting Regional Director Candido M. Ramos, pers. comm.).

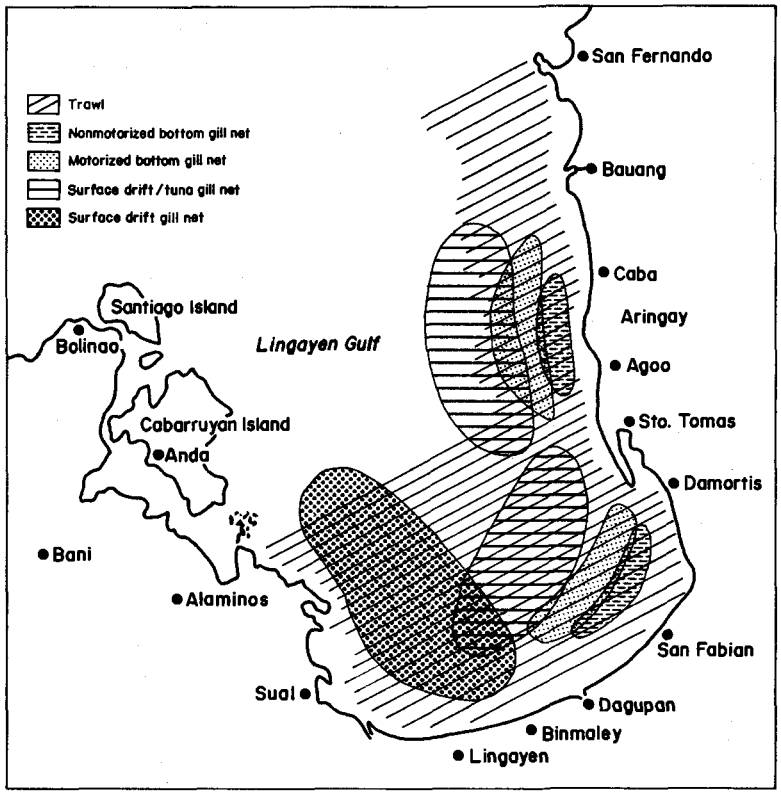

Fig. 1.4. Fishing grounds of trawls and gill nets in Lingayen Gulf (Calud et al. 1991).

Coralline resources

Coralline or reef areas include coral reefs, seagrass beds and algal flats. The major reefs fringe the islands of Santiago and Cabarruyan in Sector I (Fig. 1.5). These reefs provide year-round fishing grounds to residents and fishermen from Sectors II and III, producing harvestable resources of at least 29.3 t/km^2/year. Thirty-nine percent of these is finfish; 33%, invertebrates and 28%, seaweeds. The estimate of the reef finfish production of 11 t/km^2/year is on the low end of the Philippine range for reef fish yields. Yet, the total reef production including invertebrates and seaweeds is relatively high, reflecting the importance of reef organisms other than fish (McManus et al. 1989).

Fish harvested from these reefs account for 25-56% of the total fish landings in Sector I and up to 85% of the fish sold during a typical day in Bolinao (Meñez et al. 1991). An aquarium fish industry based in Bolinao ranked as the country's third largest source of aquarium fish (Albaladejo 1986).

Among invertebrates, gastropods are the most abundant, contributing up to 28% of the reefs' total harvestable resources. Shell gathering is done all year-round on the shallow reef flats and provides raw materials to the shellcraft industry. Other invertebrates include octopi, sea cucumbers, cuttlefish, squid and mollusks. Shrimps and oysters are found in the channel waters, especially in the Tambac Bay area between Bani and Cabarruyan Island. Species once abundant in the area include giant clams, rock lobsters and the sea cucumbers.

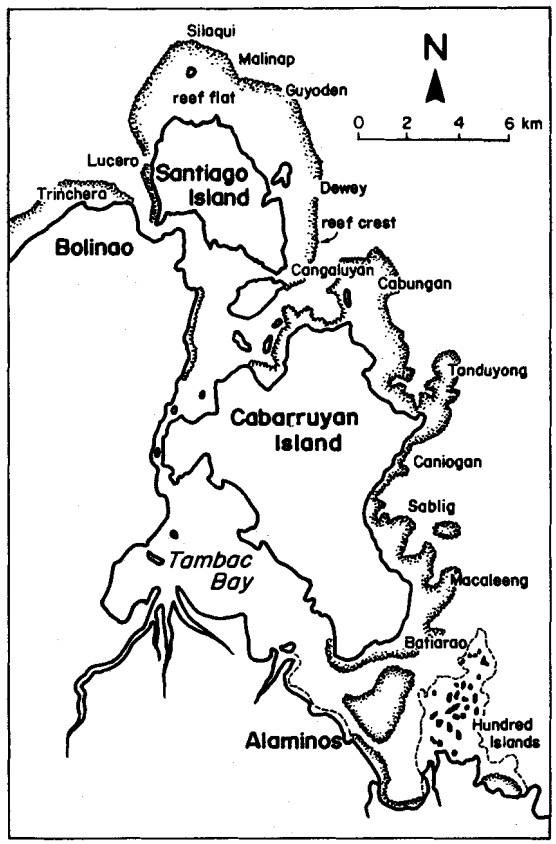

Fig. 1.5. Reefs fringe the islands of Santiago and Cabarruyan located at the northwestern section of Lingayen Gulf (Meñez et al. 1991).

Commercially important seaweeds in the area include *Caulerpa lentilifera*, *C. racemosa* and *Hydroclathrus* sp. Years of intense harvesting have almost wiped out valuable stocks of *Eucheuma* sp. and *Gracillaria* sp. (UPMSI 1988b).

The amount of live coral cover is an indicator of the reef health. Reef condition can be rated as follows: excellent, with live coral cover greater than 75% of the surveyed areas; good, less than 75% but greater than 50%; fair, 25% to 50%; and poor, less than 25% (UPMSC 1978). Table 1.4 shows reef conditions at selected sites in Santiago and Cabarruyan Islands. In general, these reefs

Table 1.4. Percentage composition of benthic components of selected reefs and general condition of the area.

Site	Live coral	Dead coral	Algae	Other live	Nonliving	Reef condition
Santiago Island, Bolinao						
Trinchera	43.8	29.1	3.5	7.6	14.5	Fair
Lucero	40.3	15.2	7.1	8.2	7.0	Fair
N. Silaqui	29.5	6.6	46.6	1.8	4.2	Fair
Malinap	51.0	26.7	7.4	2.2	10.2	Good
Guyoden	49.6	18.3	18.3	1.1	6.3	Fair
Dewey	34.2	45.2	2.3	2.8	10.0	Fair
Cabarruyan Island, Anda						
Cangaluyan	50.4	29.9	4.9	3.5	5.3	Good
Cabungan	42.0	37.6	9.0	1.8	6.5	Fair
Tanduyong	32.9	33.8	18.5	1.2	3.2	Fair
Caniogan	27.8	24.1	5.8	3.0	8.3	Fair
Sablig	43.4	22.8	13.4	2.4	4.9	Fair
Macaleeng	47.2	21.1	21.5	2.2	6.8	Fair
Batiarao	44.1	25.1	19.5	1.5	10.8	Fair

Source: Meñez et al. (1991).

are in fair condition. Only two sites--Malinap off Santiago Island and Cangaluyan off Cabarruyan Island--barely made a good condition rating. Most reefs are dominated by low-lying coral species that do not provide much topographic relief for fish habitat. The high percentages of dead corals at Dewey, Cabungan and Tanduyong result from rampant blastfishing. The highest living coral cover of 51% in the gulf is much lower than most reefs in Southern Philippines (UPMSI 1988b). Below Cabarruyan Island, the coral reefs of the Hundred Islands are generally in poor condition because of siltation. Some reefs at the northern tip of the Hundred Islands are in fair to good condition (UPMSC 1978).

Aquaculture

The predominant aquaculture activities in the gulf are brackishwater pond aquaculture and oyster culture. Culture of fish in cages (e.g., groupers, snappers and siganids) is limited, being a recent development. Seaweed culture is in the experimental phase.

Brackishwater fishponds cover 15,450 ha in Pangasinan and 792 ha in La Union (Fig. 1.6) (BFAR 1986). Table 1.5 shows the distribution of privately owned fishponds in the coastal municipalities of Pangasinan. Most of these are small, with an average size range of 1.0-2.0. Table 1.6 summarizes some culture practices in eight coastal municipalities in Pangasinan. Fishpond operation is largely a family enterprise. Most operators are full-time fishfarmers. About 81.6% of the fishponds engage in the monoculture of the milkfish *Chanos chanos*, with heavy pesticide and fertilizer inputs. Average production is about 900 kg/year. Management of most fishponds is extensive. The immediate availability of fingerlings and the fishfarmer's financial

capability determine stocking density rather than the pond's optimum carrying capacity. A few fishfarmers practice polyculture with different combinations of milkfish, siganid and shrimp (Palma 1989). Many ponds have recently shifted to shrimp monoculture, using semi-intensive to intensive culture methods.

On a regional basis, Region I, particularly Pangasinan, is the top producer of oysters in the country, contributing 63.4% (7,888 t) of the total oyster production in 1988 (Paw and Palma 1991). Oyster farms in Pangasinan have a total area of about 38 ha and are operated by about 600 people. These farms are small, with an average size of about 100 m^2. Most farms are concentrated at the rivers in Binmaley and Dagupan. *Crassostrea iredalei* and *C. cuculata* are the most common species cultured, typically by hanging method (Palma et al. 1989).

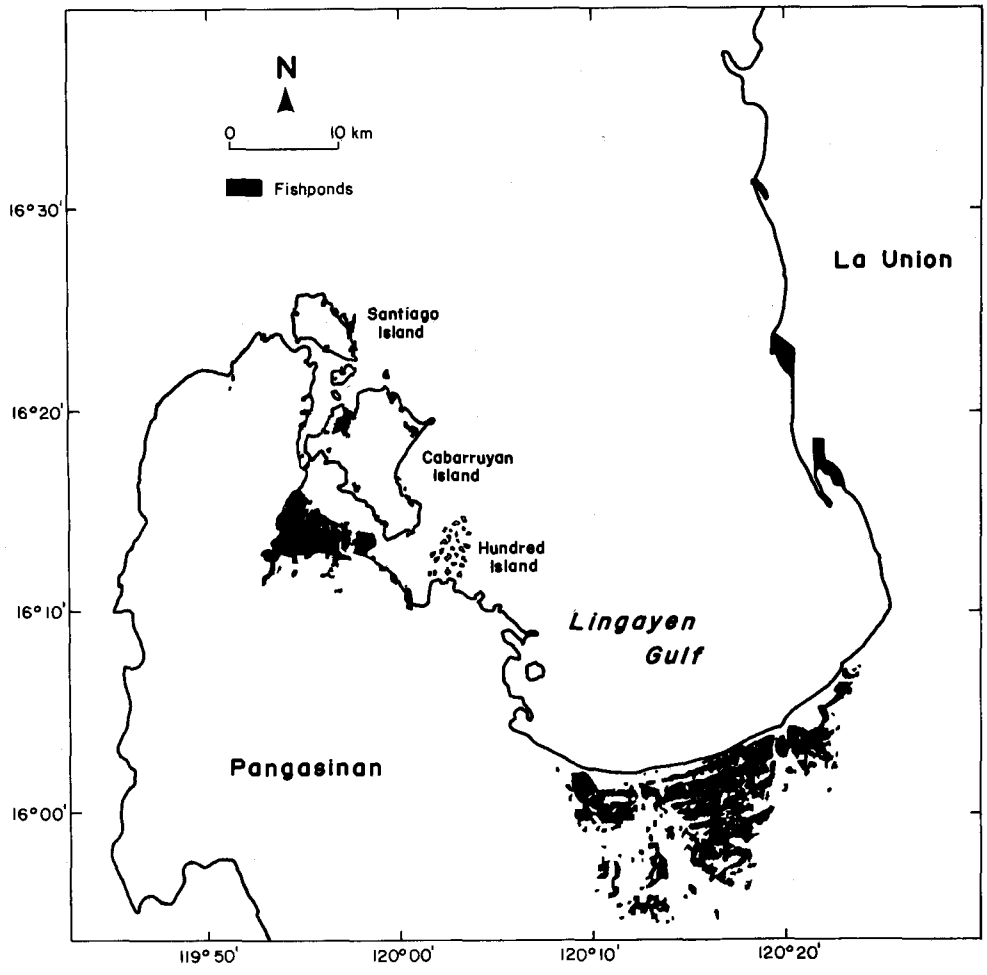

Fig. 1.6. Brackishwater fishponds in Lingayen Gulf.

Table 1.5. Distribution of privately owned brackishwater fishponds in the coastal municipalities of Pangasinan.

Municipality	Total area (km^2)	Area of fishponds (ha)	No. of fishponds
Bolinao	236	55	50
Anda	91	881	137
Bani	153	1,328	205
Alaminos	167	1,200	305
Sual	159	112	61
Labrador	183	153	138
Lingayen	47	1,729	2,337
Binmaley	50	3,728	3,721
Dagupan	44	3,830	2,693
Mangaldan	41	157	71
San Fabian	81	279	324
Total	-	13,452	10,042

Source: Modified from Palma (1989).

Table 1.6. Percentage of fishfarms utilizing various aquaculture practices at selected coastal municipalities in Pangasinan, July 1987 to March 1988.

Municipality	Aquaculture practice: Culture system		Fertilizer		Pesticide		Average yield (kg/ha/year)
	Monoculture	Polyculture	User	Non-user	User	Non-user	
Bani	98.2	1.8	98.2	1.8	100.0	0	1,266
Alaminos	100.0	0	100.0	0	100.0	0	1,122
Labrador	97.4	2.6	92.1	7.9	89.5	10.5	725
Lingayen	98.5	1.5	93.2	6.8	100.0	0.0	888
Binmaley	70.4	29.6	73.5	26.5	96.9	3.1	1,090
Dagupan	95.1	4.9	90.1	9.9	99.0	1.0	947
Mangaldan	100.0	0	95.2	4.8	100.0	0	488
San Fabian	90.0	10.0	90.0	10.0	100.0	0	744

Source: Palma (1989).

Tourism

In 1988, the tourist areas of the gulf attracted 111,778 visitors. The most important tourist destinations are the beach resorts at Bauang, which is an hour's drive from Baguio City, and the Hundred Islands National Park in Alaminos. The beaches of San Fabian have become popular among tourists lately. Dagupan City contains lodging houses and small hotels and serves as a jump-off point to other destinations in the gulf.

Issues and Problems

The ability of Lingayen Gulf to support multiple uses of its coastal resources is today in question. The problems and issues related to resource use in the

Lingayen Gulf coastal area are summarized below (Luna 1992; Luna and Quitos 1992). The interrelationships among these problems and issues are shown in Fig. 1.7.

The total fishing effort has been estimated at more than three times the maximum sustainable level. Blastfishing and siltation have destroyed large areas of coral reefs. Water quality is deteriorating. The potential production of aquaculture is not realized. Tourist establishments have been damaged by coastal erosion.

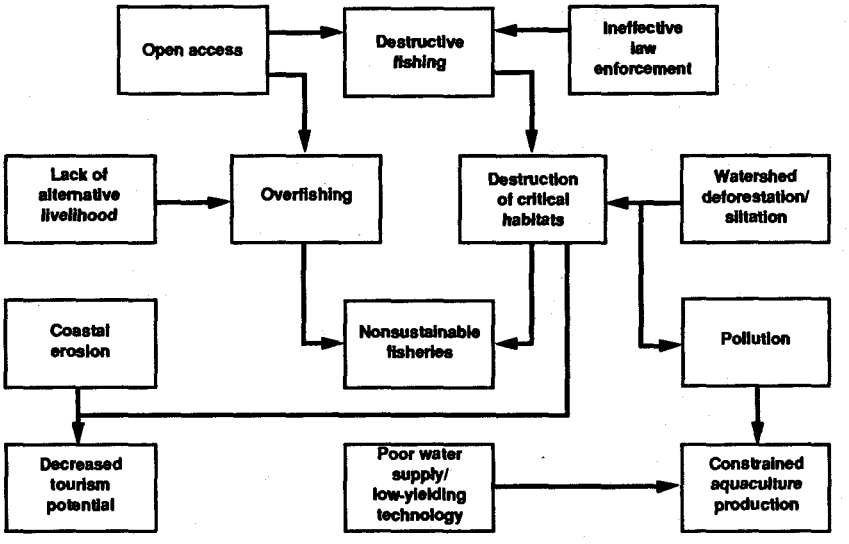

Fig. 1.7. Issues and problems in Lingayen Gulf (Luna and Quitos 1992).

Overfishing

From 1987 to 1988, the total fishing effort exerted by the commercial and municipal fisheries sectors was almost three times more than the maximum sustainable level (UPV 1990). The situation is probably worse today with the increase in the number of trawlers. The number of municipal fishermen is also likely to have increased because of the lack of alternative livelihood opportunities. The two sectors engage in intense competition, with an 87% overlap in species caught. Trawlers often intrude in waters reserved by law to municipal fishermen, destroying gear and provoking violence. There is a popular clamor for a trawl ban in the gulf, since trawlers employ less than 220 people but harvest 20-25% of the total catch.

Destruction of critical habitats

With intense competition, many have turned to "more efficient" but highly destructive methods, such as blastfishing and the use of poisons. Law enforcement capabilities are inadequate to deal with these practices. Blastfishing has destroyed large areas of coral reefs. Siltation also destroys reefs, particularly those at the Hundred Islands in Pangasinan. In addition, most mangroves in the gulf were converted into fishponds during the 1950s (Paw et al. 1992). Thus, fisheries resources are simultaneously subjected to excessive effort and the destruction of critical habitats.

Pollution

Although presently not seriously polluted, the waters receive mine tailings from the mining district in the uplands and silt from the denuded watershed. From the lowlands come agricultural runoff and sewage from urban centers. Cadmium, lead, phosphates and suspended solids (SS) including coliforms have exceeded the standards for coastal and estuarine waters (UPMSI 1988). Recently, lahar from Mt. Pinatubo has threatened to spill into the gulf.

Constrained aquaculture production

Brackishwater aquaculture remains traditional and extensive. Fishfarmers have not adopted modern culture technology to keep pace with developments in aquaculture. Many fishponds do not have access to good water supply. Thus, the production potential of most fishponds is not realized. Likewise, seaweed and fishcage culture have room for expansion, given proper incentives.

Coastal erosion

Most of the eastern coast of the gulf is suffering from coastal erosion, which has damaged several beach resorts, severely affecting La Union's tourism industry. New setback lines must be established and enforced. Little is known about the dynamics of the erosion that is also affecting other areas along the coast of northwestern Luzon.

HISTORY OF THE PLANNING PROCESS

The plan to rescue Lingayen Gulf began in 1986 when the six ASEAN member-countries launched CRMP to initiate coastal zone planning and management in Southeast Asia. The project, funded by ASEAN governments and USAID, used national institutions to execute projects in collaboration ICLARM. The ICLARM provides technical assistance and links the national institutions and USAID. In 1986, the Philippine project was led by PCAMRD of DOST. They chose Lingayen Gulf because of its importance and the great threat to its resources.

From 1986 to 1988, four institutions collected planning information. The College of Fisheries of the University of the Philippines in the Visayas (UPV) studied the commercial and municipal fisheries; the UP Marine Science Institute (UPMSI), investigated the coral reef fisheries and resources; the Bureau of Fisheries and Aquatic Resources (BFAR) assessed the status and potential of the aquaculture sector; and the UP College of Social Work and Community Development (UPCSWCD) examined related sociocultural, socioeconomic and institutional problems. Their findings were incorporated in a planning exercise in late 1988. The NEDA formed task groups to examine specific issues and prepare sector-specific proposals. Members included representatives from regional line agencies, academic institutions, local non-governmental organizations (NGOs) and technical personnel who had prepared the background research. The task forces completed the action plans in late 1989. The NEDA Region I also produced an integrated management plan. This plan was further refined by PCAMRD and ICLARM and subjected to a technical review by selected experts.

GOAL OF THE PLAN

The goal of this plan is to promote the sustainable development of Lingayen Gulf through integrated resources management.

This plan is consistent with the Regional Physical Framework Plan (RPFP) 1990-2020 Region I (Pangasinan-Ilocos) of RDC (1991). The RPFP has adopted a resource-based management strategy which recognizes the need to preserve the environment. It has grouped areas with similar environmental characteristics in the region into three planning zones: upland, lowland and coastal subregions (RDC 1991).

Based on previous planning results and pursuant to RPFP policies, the goal of this plan is to promote the sustainable development of Lingayen Gulf through integrated resources management. Endangered coastal resources must be rehabilitated by local government and private organizations, and thereafter used in accordance with government rules which allow only sustainable use and encourage correct user behavior.

But regulation is not enough. The RPFP recognizes that "providing immediate relief ... to the degraded marine resources in the Lingayen Gulf" will be "feasible only ... with the provision of ... alternative livelihood to ... subsistence fishermen" (RDC 1991). Therefore, ecologically sound economic activity must be promoted to ease the pressure on the damaged environment.

CHAPTER 2

MAJOR PROGRAMS AND PROJECTS

The coastal resources of Lingayen Gulf have been degraded and depleted by the unremitting pressure of a growing population of fishermen and coastal residents. The failure of inland activity to provide jobs and the improper use of the gulf's watershed and basin have put great pressure on its fisheries and water quality. Also, man-made activities in distant mountains and farms have poured chemically laden silt and eroded soils into rivers which flow into the gulf. Effluents from homes and factories just outside the coastal zone also drain into the gulf. Any effort to improve the gulf's environmental quality and to save its resources should include not only the coastal zone, but also areas beyond. While some problems originate inland, most difficulties--overfishing, destructive fishing and the worst pollution--come from within the coastal zone itself.

The LGCAMP is composed of 20 projects grouped under 8 programs.

Several projects were submitted to NEDA during the planning process. These have been grouped into eight absolutely essential programs whose adoption is critical to the survival of the gulf. These programs and their constituent projects will make the greatest contribution to the long-term rehabilitation and development of the Lingayen Gulf coastal area. These programs are:

1. fisheries management;
2. rehabilitation and enhancement of critical habitats;
3. rehabilitation of linked habitats;
4. environmental quality management;
5. coastal zonation;
6. alternative livelihood for fishing families;
7. aquaculture development; and
8. institutional development.

The programs will reinforce each other in addressing the problems and issues in Lingayen Gulf, making management cost effective (Fig. 2.1).

FISHERIES MANAGEMENT

The state manages the coastal zone through BFAR and the Department of Environment and Natural Resources (DENR). The central government formulates and enforces rules and regulations on resource use through field

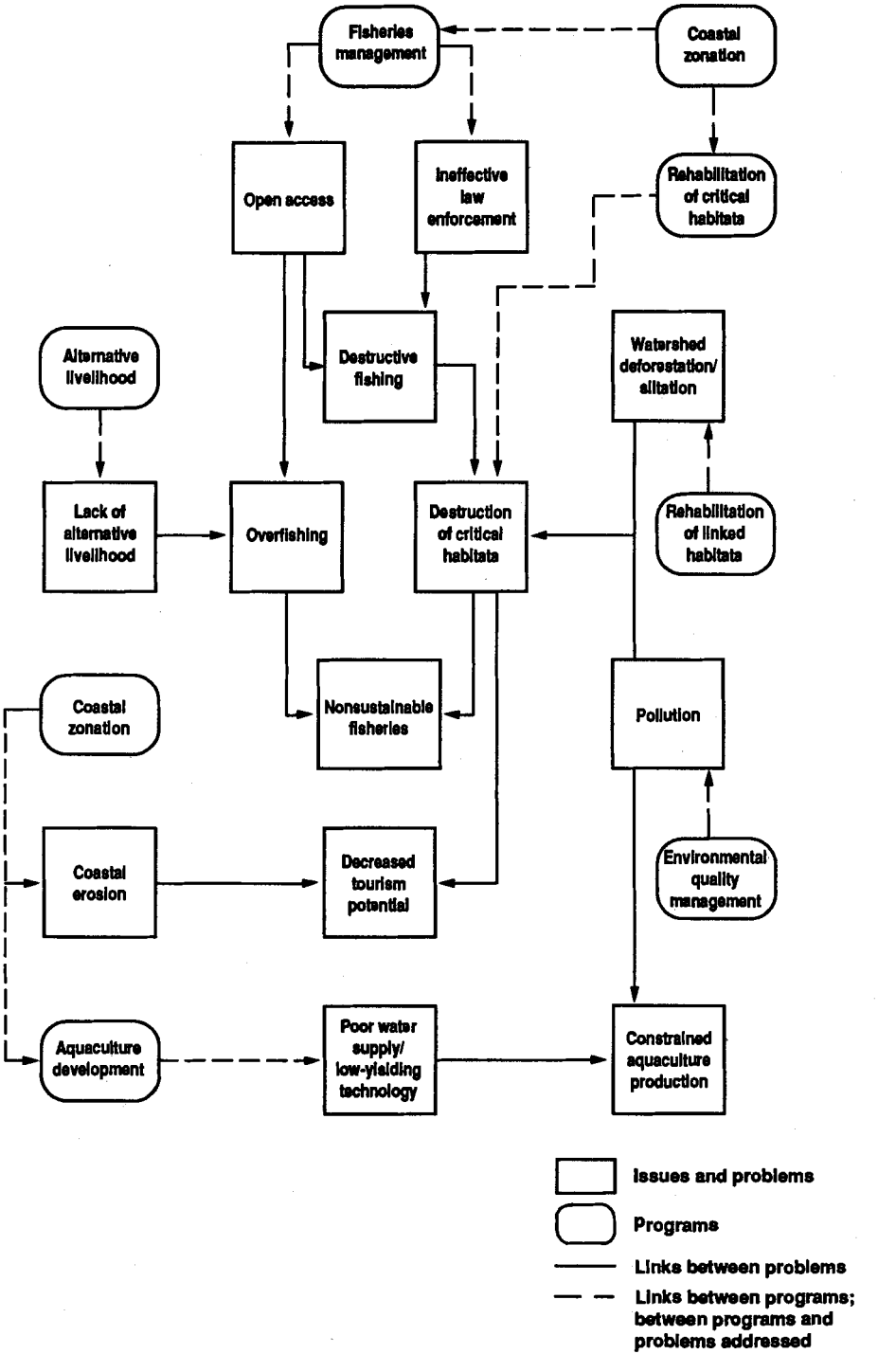

Fig. 2.1. The integrated approach of LGCAMP (Luna 1992).

offices in the locality. Municipal governments exercise some control over municipal waters. Under the Local Government Code (LGC) of 1991 (Republic Act [RA] 7160), towns have the exclusive authority to grant fisheries privileges in municipal waters and impose corresponding rentals, fees or charges. (See Appendix A for the relevant legal provisions).

Although the gulf is supposed to be managed by the state, in practice it is open to all comers. Commercial trawlers are legally barred from fishing closer than 15 km from shore, within which municipal fishermen have exclusive access. In reality, trawlers compete with municipal fishermen for the remaining productive fishing grounds within the 15-km limit, sometimes destroying municipal fishermen's gear in the process. These lead to violent skirmishes which the Coast Guard seems powerless to stop. Technical studies show that Lingayen Gulf is severely overfished. Harvest rates are estimated to be 2-3 times more than sustainable levels. An unabated trend may drive certain species to extinction and lead to a long-term decline in total catch in the gulf. Unless this is reversed, its fisheries will severely decline. Banning trawling from the gulf is not enough: the catch by municipal fishermen must be halved for the fisheries to be sustainable. With 78 fishermen and 44 boats per kilometer of coast, the density of municipal fishermen in the gulf is one of the highest in the country (Silvestre et al. 1991). Moreover, many municipal fishermen use explosives or poisons. Blastfishing has already destroyed large sections of the reef in the western gulf. The total number of municipal fishermen, or their catch, must be gradually reduced to permit the fisheries to recover.

The fisheries management program will gradually reduce the number of fishermen in Lingayen Gulf.

The following projects were selected to help solve these problems.

PROJECT 1: Organizing municipal fishermen towards establishing common property management.

Rationale

This project will attempt to reduce fishing effort in Lingayen Gulf to sustainable levels. Phasing out trawlers will reduce resource use conflicts between trawlers and municipal fishermen. The elimination of destructive fishing (which requires the cooperation of organized fishermen) will stop the damage to marine habitats. These two measures by themselves, however, will not completely reduce fishing effort in the gulf. Even if trawling and destructive fishing are totally eliminated, the remaining municipal fishing effort must be reduced by at least 50% to attain sustainable harvest rates (Silvestre et al. 1991). This reduction requires alternative livelihood to draw a large number of fishermen away from fisheries and the establishment of CPM to replace the present open access regime.

Objectives

1. Organize all municipal fishermen in the gulf.
2. Encourage the acceptance of the CPM concept.
3. Establish a federation of fishermen's organizations.
4. Test run the CPM regime.

Description

A CPM system will be implemented in the gulf. A CPM allots a definite body of water for the exclusive use of a precisely identified group of fishermen. By providing a group of fishermen with tenure over resources, it creates the incentive for the conservation and efficient use of the fisheries resources. The CPMs are best suited to areas with easily defined boundaries (such as reefs and lagoons) and where outside pressures are not particularly great (FAO-IPFC 1987). Lingayen Gulf's boundaries are clear, although outside pressure on it is considerable. But with some effort, a CPM can be implemented to regulate overfishing by municipal fishermen. The establishment of a CPM will be opposed by commercial trawlers, but since the previous 7-km ban on trawling has proven too difficult to enforce, no alternative remains but to eventually close the gulf to trawlers.

The CPM concept is a framework whose many operational details have yet to be worked out and evolved largely by fishermen themselves. This project will cover all aspects of organizing fishermen to the point of institutionalizing CPM in the gulf.

Activities

The job of organizing municipal fishermen will be contracted out to qualified NGOs who must have a good track record in community-organizing. Previous experience in working in the gulf and/or with fishermen is a desirable but not requisite qualification. The NGOs will concentrate on fishermen who are not organized and who presently comprise 70% of the total. The organizing activities will revolve around cultivating acceptance of the CPM concept and building consensus on the rules and details to operationalize CPM, including:

- how to prevent encroachment by commercial fishing operators who might not abide by the phaseout;
- how to close the fisheries to new entrants;
- which gear to regulate and what regulations to apply; and
- which fishermen's groups will ultimately be allowed to remain in the fisheries.

The mass media will be used to gain acceptance for CPM. In the final phase, a federation will be formed to aggregate the concerns and decisions of the fishermen's organizations. The CPM will then be ready for a test run.

Resource requirements

Annual funding estimates are:

Year	Cost (₱)
1	750,000
2	750,000
3	500,000
4	500,000
5	250,000
Total	2,750,000

PROJECT 2: Creating a monitoring system for fisheries management.

Rationale

Managing Lingayen Gulf fish stocks on a sustainable basis requires timely information on stock status and the economic and social aspects of the fisheries. Data must be collected regularly to obtain annual estimates of maximum sustainable yield (MSY) and maximum economic yield (MEY). Properly analyzed data can also suggest the likely impacts of proposed management measures.

The BFAR in Region I presently monitors aspects of gulf's fisheries. It is, however, unable to obtain estimates of MSY, MEY and other needed information due to inadequate survey procedures, lack of manpower and expertise, and other constraints. It has been suggested that the monitoring task be given to local academic institutions. Yet, these institutions cannot be expected to withstand the pressure that will come from "losers" in allocation decisions to be based on the results of the monitoring activities. Also, after a few years, academic institutions will probably lose interest in monitoring and pursue more stimulating research.

With the help of local institutions, the much needed information can be obtained while BFAR strengthens its in-house monitoring capabilities. In addition, the project will boost fisheries research among local institutions and set the stage for the future in which BFAR will perform routine monitoring while the academic institutions conduct basic fisheries research.

Objectives

1. Improve the capabilities of BFAR Region I in data collection and analysis for fisheries management.
2. Involve local academic institutions in fisheries data collection and analysis.
3. Make annual MSY and MEY estimates.
4. Recommend measures to ensure the sustainability of the gulf's fisheries.

Description

This three-year project will build on the regular monitoring activities of BFAR. Local academic institutions will collaborate with BFAR in monitoring

the biological and socioeconomic aspects of the gulf's fisheries and establishing a database. During the course of the project, BFAR will make preparations to institutionalize the monitoring system and to eventually assume major or sole responsibility for it. After the three-year period, local academic institutions will have access to the continuing database to support their more specialized research activities.

Activities

The two main activities are training courses on various aspects of fisheries management (e.g., stock assessment) and regular monitoring and establishment of a database. With PMO's guidance, BFAR Region I will plan and execute the project in cooperation with the Don Mariano Marcos State University (DMMSU), the Pangasinan State University (PSU) and UPMSI in Bolinao, Pangasinan.

The academic institutions and BFAR will each set up teams that will attend training courses and divide the landing points and fishing communities to be monitored. For gulfwide surveys (e.g., trawl surveys), BFAR will take the lead. Each participating institution will have a computer for storing data collected in its area of responsibility. Academic institutions will use modems to send data and access the central database to be housed in BFAR. The BFAR will be responsible for maintaining the complete database. It will also sponsor regular meetings and/or workshops for data analysis and interpretation.

The monitoring teams will attend short training courses on survey methods, database management and data analysis. Courses will be conducted by UPMSI, ICLARM or other capable institutions. The courses will be conducted during the first six months of Year 1, with additional courses scheduled as needed.

An overall monitoring and database management system will be devised by UPMSI, possibly with assistance from ICLARM or other institutions. Data to be collected monthly will include: catch and harvests of major gear types, catch composition, length frequencies of important species, effort (number of units of competing gear types, number of trips per year), prices by major species, and costs and earnings of major gear types. Trawl surveys will be conducted regularly.

Resource requirements

These are allotted for three years and four teams.

Budget item	Cost (₱)
Equipment	1,000,000
Salaries	1,300,000
Training	500,000
Monitoring and operating expenses (MOE)	2,160,000
Contingencies	500,000
Total	5,460,000

PROJECT 3: Upgrading expertise on fisheries management.

Rationale

This project will supplement the fisheries management monitoring system which includes short-term training courses for monitors in data gathering and assessment. The monitors will have the ability to recognize obvious implications of the data, but the depth of their analysis will be limited. Consequently, they may not have the flexibility to deal with complex fisheries management issues. What is needed is a core of local experts who can do more than just monitor the status of the gulf's fisheries.

Objective

Develop a core of local experts in fisheries biology, marine biology and resource economics who can perform more sophisticated fisheries data analysis.

Description

Scholarships will be given to qualified personnel of BFAR, PSU and DMMSU to pursue masteral studies in fisheries biology at UPV, marine biology at UPMSI and resource economics at the UP School of Economics or other suitable local institutions. The BFAR will get two slots in each of the three fields of study, while PSU and DMMSU will get one slot per field. As a preparation for the master's program, candidates may enroll for an additional year of nondegree courses to strengthen their background in certain subject areas.

Resource requirements

The annual cost of one scholarship in Year 1 is estimated thus:

Budget item	Cost (₱)
Tuition	8,000
Book allowance	3,000
Stipend	30,000
Thesis expenses	10,000
Miscellaneous expenses (e.g., field trips)	4,000
Total	55,000

The total cost of 12 scholarships, each lasting 3 years (i.e., 1 year nondegree plus 2 years to complete the master's program) with 12% yearly inflation follows:

Year	Cost (₱)
1	660,000
2	739,200
3	827,904
Total	2,227,104

REHABILITATION AND ENHANCEMENT OF CRITICAL HABITATS

Coral reefs and mangroves contribute significantly to fisheries. The rehabilitation of these habitats is a must.

Coral reef areas and mangroves are considered critical habitats because they play important roles in maintaining the health of coastal ecosystems. Coral reefs recycle and concentrate nutrients from nearshore areas and the open sea. They are highly productive, supporting diverse communities of aquatic organisms. Reefs also protect the shoreline from erosion due to wave action. Mangroves function as nurseries of fishes and various invertebrates. They serve as habitat for wildlife (e.g., birds, reptiles, etc.) and are a source of detritus and nutrients that form part of the base of the food web of marine organisms. The decline of the gulf's fisheries resources is due in part to the degradation of coral reefs and the conversion of mangroves to fishponds. To restore the gulf's productivity, coral reefs and mangroves must be rehabilitated.

PROJECT 1: Rehabilitation of mangroves.

Rationale

The loss of the once verdant mangrove forests along Lingayen Gulf can be attributed to factors from the mangrove overexploitation for timber, fuelwood and charcoal-making to the conversion of estuarine areas to fishponds and saltbeds. Rapid population growth has exacerbated the situation. The establishment of mangrove plantations will not only accelerate forest renewal but also restore coastal protection, and provide nursery grounds for economically important species and habitat for other wildlife.

Families living along the gulf need alternative sources of income. The mangrove rehabilitation project will reduce unemployment through the contract reforestation scheme/mangrove stewardship agreement and help develop proper attitude toward the environment through the participants' involvement in project activities. The project should spur government institutions to develop an effective mangrove rehabilitation database and an efficient information exchange network. With supporting laws, official guidance and appropriate information campaign, the sustainable exploitation of mangrove resources can be achieved.

Objectives

1. Rehabilitate the mangrove areas of Lingayen Gulf.
2. Provide appropriate alternative livelihood for residents in the area.
3. Inform and educate the people adequately about the benefits to be gained from the environment and their corresponding responsibilities.
4. Involve the people actively in mangrove reforestation activities, including the monitoring phase.
5. Cooperate with community groups and NGOs in carrying out the plan's community organization.
6. Establish an effective database for mangrove rehabilitation and facilitate an efficient information exchange relevant to CRM among users.

Description

The project will be located in municipalities where suitable areas are found. Reforestation will be instituted through DENR's contract reforestation scheme/mangrove stewardship agreement, which will also provide technical assistance. Depending on conditions, contracts/stewardships may be awarded to families or individuals. Awardees must train before embarking on any specific task. Community groups and NGOs will be asked to help organize the people effectively. The DENR will improve its mangrove rehabilitation database.

The project aims to rehabilitate the coastal area by restoring the lost vegetative cover of mangrove/swamp sites. First, a list of potential sites will be drawn up using available maps and satellite imagery. Ground truthing will verify whether these potential sites are indeed suitable. The public lands will be sorted from private lands. It will also be necessary to cross-check which areas are actually covered by similar programs (e.g., existing reforestation contracts with DENR) before proceeding. Depending on the case, sites covered by other programs can be expanded or offered supplementary support. These can then be demonstration sites for future activity.

An information campaign will start simultaneously with community organizing. A notice of available mangrove reforestation opportunities will be posted so qualified residents can apply. The DENR can process applications and set about forming the management plan (complete with technical details such as species suitability, source of propagules, spacing, etc.). Contracts or stewardships can then be awarded, after which site preparation can take place, followed by plantation establishment, maintenance and protection in succeeding years. The delimitation of boundaries is necessary to avoid future conflicts. Monitoring will be performed in the later stages.

Government agencies should team up with local academic or research institutions to fill information gaps (e.g., environmental parameters such as pH and soil salinity), help in monitoring activities and improve the database. Interagency monitoring teams and training teams can be formed. This project will also strengthen the capability of concerned government institutions, especially at local levels.

Activities and resource requirements

Activity	Estimated one-year cost (₱)
Ground truthing	50,000
Information campaign	100,000
Community organizing activities	100,000
Total fixed cost	250,000
Actual site development per hectare	
Year 1	8,206
Maintenance, protection and administrative costs for Years 2 and 3	1,860
Total variable cost/ha	10,066
Total cost for 2,500 ha	25,415,000

Ground truthing will only be done in Year 1. But the information campaign and community organizing activity will continue throughout the project phase or when the desired results have already been accomplished. The budget for the campaign includes expenses for educational and monitoring materials, training courses, training allowances and field trips. Expenses for community organizing, on the other hand, should include a backstop fund for consultations other than for transportation, supplies and the like. The budget for other supplies and equipment is excluded pending possible arrangements which can be made by participating individuals and agencies.

PROJECT 2: Establishing the Santiago Island community-based marine reserve.

Rationale

Though national law prescribes the careful management of coral reefs such as those of Santiago Island, there is no management control of coral reef and related resources. Low income and the lack of other livelihoods have spurred local residents to resort to destructive fishing methods. Explosive and sodium cyanide use has destroyed the coral cover, causing species depletion and undermining the source of the very income that destructive fishermen seek. Open access to the reef contributes to its overexploitation and the destruction of marine resources.

The municipal government and the fishing communities do not have trained, organized groups which can manage Santiago Island's resources correctly. Line agencies do not have enough trained personnel to set up and enforce the needed management rules and regulations.

Objectives

1. Regulate and control destructive fishing activities in the area.
2. Establish a marine sanctuary.
3. Increase fish stock density and diversity in the area.

Description

This project will establish a community-based municipal marine park in Santiago Island, Bolinao, Pangasinan. It will demonstrate the capability of local communities to protect their own marine resources. Community-based organizations will be established in Barangays Lucero and Binabalian. The project will last three years with possible extension of seven. The Bolinao municipal government will be primarily responsible for this project with assistance from the Department of Agriculture (DA)-BFAR and UPMSI.

Activities

Activity	Implementation schedule
Orientation and integration of field workers into the community	3 months
Socioeconomic and attitudinal survey and biological data collection	
Marine education program through print and broadcast media	1 month
Marine park establishment	2 years and 8 months
Subzoning of the northern waters of Santiago Island	
Formation of Marine Park Management Committee	
Formalizing and strengthening of community organizations	
Drafting and ratification of marine parks sanctuary laws	
Installation of markers and signs	
Visitors/meeting/guardhouse construction	
Community development	
Outreach and replication	

Resource requirements

Budget item	Seven-year cost (₱)
Personnel services	4,256,000
1 manager	
2 field workers	
1 accountant	
1 project officer (logistics)	
MOE	2,209,652
Training	35,720
Transportation and per diem	156,200
Evaluation	150,000
Total	6,807,572

REHABILITATION OF LINKED HABITATS

The watershed and offshore areas are examples of habitats linked to the coastal area by physical processes. Harmful activities in linked habitats can produce negative impacts on the coastal area so severe that actions beyond the planning area become necessary. This is the case with the denudation of the watershed of the gulf. The lone project under this program would initiate the rehabilitation of the gulf's watershed.

PROJECT 1: Rehabilitation of the Upper Agno River system watershed.

Rationale

Watershed rehabilitation is needed to arrest flooding and siltation of the coastal area.

The destruction of watersheds that drain into Lingayen Gulf causes frequent floods and the silting of farmlands, river channels and coral reefs as well as top soil loss and decreased groundwater supplies. The rehabilitation of these watershed areas is urgent. The cost of rehabilitating the entire watershed is so high there is a need to prioritize rehabilitation areas and concentrate initial efforts on critical areas which pose the greatest threat. In Lingayen Gulf's case, rehabilitation should start with the steeply sloping grasslands of the Agno River watershed, the biggest river which drains into the gulf.

Objectives

1. Prepare a rehabilitation plan for the critical areas of the Agno River watershed.
2. Rehabilitate these critical areas through contract reforestation.

Description

The ten-year project will rehabilitate the parts of the Agno River watershed most susceptible to erosion. Ideally, all denuded areas with slopes greater than 15% should be rehabilitated, with priority given to grasslands, followed by brushlands and finally to built-up areas. Based on preliminary estimates (which exclude the watershed of the tributaries in Tarlac), however, grasslands on slopes greater than 40% alone have a total area of 55,560 ha. With the cost of rehabilitation reaching an estimated ₱10,000/ha, some means of further prioritizing areas for rehabilitation must be found.

The project will rehabilitate selected areas through a contract rehabilitation scheme with NGOs. In Year 1, the project team will formulate a plan which will identify rehabilitation sites and contain the details of the contract reforestation scheme, a training plan for NGOs, a structural layout (e.g., sites for foot trails, greenbelts, firelines, etc.), nursery establishment, a system for monitoring and evaluation (M&E), and others. The project team will contract NGOs and train them on reforestation in Year 2. The NGOs will prepare detailed workplans for their specific sites in the same year. In Year 3, nurseries will be established and infrastructure will be constructed. Actual reforestation will start in Year 4.

Activities

Activity	Schedule (year)
Plan preparation	1
Mapping; technical surveys	
Socioeconomic survey	
Integrating results; finalizing plan	

Plan implementation

Contracting NGOs/training/ preparation of detailed workplans	1-2
Nursery establishment	2-3
Infrastructure development (e.g., firelines, foot trails)	2-5
Reforestation	3-10
M&E	4-10

Resource requirements

Budget item	Five-year cost (₱)
Fixed cost for personnel services	
1 project leader	1,143,513
1 engineer	1,048,220
2 foresters	1,905,854
3 community workers	2,287,025
MOE	1,500,000
Variable rehabilitation cost (1,000 ha x ₱10,000/ha)	10,000,000
Contingencies	2,500,000
Total	20,384,612

ENVIRONMENTAL QUALITY MANAGEMENT

The environmental quality management program will address problems of deteriorating water quality, lack of solid and liquid waste disposal systems and low awareness of environmental issues among the coastal communities.

The gulf's waters are used as a cesspool for domestic and industrial waste from nearby cities and towns. Agricultural waste, including pesticide and toxic mine tailings from as far as Benguet also drain into the gulf. Levels of total phosphates (TP), heavy metals and SS including coliforms in the gulf exceed the standards prescribed by the National Pollution Control Commission (NPCC), now called the Environmental Management Bureau (EMB). The excessive amounts of phosphates come from sewage, fertilizer runoff from fishponds and agriculture, mine-generated wastes and industrial activities. Raw sewage dumped into Pantalan and Dagupan Rivers has caused very high concentrations of coliform bacteria exceeding NPCC standards for waters for shellfish cultivation and human use (UPMSI 1988a). The quality of river water flowing into the gulf must be monitored so that corrective measures can be taken.

PROJECT 1: Development of institutional capabilities for monitoring water quality.

Rationale

An acceptable level of environmental quality, particularly water quality, is a basic requirement for human health and the sustainability of fisheries, aquaculture, tourism and other economic activities in the coastal area. The waters

of Lingayen Gulf are not yet seriously polluted. But a UPMSI study conducted in 1987-1988 indicated that levels of phosphates, heavy metals and coliforms exceeded the water quality standards set by EMB. The study attributed these symptoms to various factors including the inflow of fertilizers and pesticides from agriculture and aquaculture, and the disposal of untreated sewage and waste from mining (UPMSI 1988a). Given increasing population and intensifying economic activities, the potential for serious water pollution clearly exists.

To safeguard public health and to assure the continuance of various coastal-dependent economic activities, there is a need for a warning system that can detect serious water quality deterioration so that appropriate management responses can be devised.

Objectives

1. Formalize interagency cooperation, define responsibilities clearly, minimize overlaps and fill in the gaps among the government offices and academic institutions involved in various aspects of water quality management in Lingayen Gulf.
2. Establish a system for monitoring the water quality of the major river systems and coastal waters of the gulf.
3. Upgrade laboratory facilities and field equipment for water quality monitoring.
4. Upgrade technical capabilities of the staff of regulatory agencies through training.

Description

For interagency cooperation, a series of workshops will be held in Year 1. Invited institutions will include (but will not be limited to) local government units (LGUs), EMB, UPMSI, and the Seafarming Research and Development Center (SRDC) of the Philippine Human Resources Development Center. The UPMSI and SRDC can contribute in terms of training and possibly monitoring, since they have laboratories in the gulf which are technically capable of performing the necessary analyses. The EMB and LGUs (by virtue of LGC must enforce environmental laws and regulations, and build monitoring capabilities so SRDC and UPMSI are not burdened. The EMB and the LGUs must devise policies and procedures so that results from the monitoring system are rapidly translated into appropriate enforcement.

These same agencies will formulate a long-term monitoring program that will include: a sampling scheme that will identify sampling stations, regularity of sampling, etc., a list of required facilities and equipment, proposed short-term training courses and nominees for medium-term scholarships. Funding will be provided to upgrade or purchase the necessary facilities and equipment.

The following is a minimum listing of water quality parameters that must be monitored:

General water quality parameter	Nutrient	Heavy metal	Fecal coliform
Salinity	Nitrates	Mercury	*Escherichia coli*
Temperature	Nitrites	Cadmium	*Salmonella* sp.
pH	Ammonia	Lead	Others
Dissolved oxygen	Total nitrogen	Zinc	
Transparency	Phosphates		
SS	TP		

Short- and medium-term (master's level) training will develop local expertise in water quality monitoring. Short-term training courses will concentrate on sampling, laboratory methods, data handling and analysis. The medium-term training component will provide three scholarships to the Master of Science (M.S.) Chemistry or Chemical Oceanography program, two scholarships to the M.S. Microbiology program and one scholarship to the M.S. Physical Oceanography program at UP, Ateneo de Manila University or at a similar university. Each scholarship will cover three years--two years in the graduate program and one year of optional preparatory courses to strengthen the academic background of the scholar. The scholars will form a core group of local water quality monitoring experts.

Activities

Activity	Schedule (year)
Formalize institutional linkages; plan activities	1
Upgrade facilities and equipment	2
Short- and medium-term training	1-3
Conduct regular monitoring of water quality	2-6
Strictly enforce water quality standards	2-6

Resource requirements

Budget item	Five-year cost (₱)
Workshops	300,000
Facilities/equipment	7,000,000
Training: short-term	500,000
medium-term	810,000
MOE	2,500,000
Personnel services	2,500,000
Contingencies	1,360,000
Total	14,970,000

PROJECT 2: Information, education and communication campaign against water pollution.

Rationale

No conservation plan can succeed unless the public is taught to respect the environment. An information, education and communication (IEC) campaign to instruct law enforcers and resource users in proper resource use is needed. In Region I, 255 firms are identified sources of land, air and water pollutants. Industrial and commercial establishments indiscriminately dump waste in rivers that flow into the gulf. Coastal resource users do not feel responsible for protecting and conserving the environment and the importance of a healthy coastal ecosystem to economic activity is not appreciated. Environmental education must heighten awareness of the damage to private and public property resulting from environmentally disruptive activities.

Objectives

1. Increase public awareness of the ill-effects of pollution caused by industrial firms in Region I.
2. Warn that the discharged pollutants level is nearing critical levels.
3. Campaign for the strict enforcement of all antipollution laws.

Description

The Philippine Information Agency and DENR in cooperation with sectors like the Provincial Water Districts, Department of Health, the police and the military, including the media, will promote strict law enforcement to minimize industrial pollution. The factories and the affected general public, will be the targets of the IEC campaign. The plan will demonstrate ways to increase public awareness of water pollution and what can be done to reduce this environmental threat.

A five-month information campaign against water pollution will be launched in Region I.

Activities and resource requirements

Activity	Cost (₱)
Preparation of communication plan	20,000
Setting of organizational structure, briefing and orientation of agency officials	10,000
Briefing of private media, secretariat, documentation and monitoring groups	20,000
Briefing of local government officials	15,000
Production and packaging of IEC materials	150,000
Delivery/distribution of IEC materials	20,000
Materials broadcast (news, jingles, plugs)	50,000

Press releases, government publications, posters and streamers	50,000
Symposia, special events	50,000
Special show	30,000
Folk show	20,000
VTR-film showing	30,000
Implementation of antipollution laws against pollution sources	15,000
Total	480,000

PROJECT 3: Establishment of pilot waste disposal systems for urban and urbanizing centers.

Rationale

The project is necessary to minimize the environmental hazards posed by the enormous amount of waste dumped. This also means enhancing the general aesthetic quality in centers including adjacent municipalities. The project encourages interagency collaboration in problem solving and aims at generating community consciousness and cooperation for the maintenance of environmental quality conducive to socioeconomic development.

Existing laws with national and local application are the legal basis for the implementation of this project. In particular, PD 1151 provides for various incentives to government entities and NGOs to undertake projects that enhance environmental quality.

Objectives

1. Build provisions for sanitary landfill sites into the land use plans of identified urban/urbanizing centers.
2. Train a core group to manage and operate a garbage compacting machine to process waste into materials appropriate for sanitary landfills and beach/riverbank erosion control purposes.
3. Institutionalize sanitary landfill projects in the waste disposal system of urban/urbanizing centers.
4. Install a medium-sized waste compacting unit (WCU) in each urban/urbanizing center for waste processing.
5. Promote interagency and multisectoral collaboration in solving environmental quality problems by sharing of resources and expertise.

Description

This project addresses the problem of indiscriminate waste disposal in urban or urbanizing centers in Lingayen Gulf. It is an effort to reduce further deterioration of environmental quality in the area. The project requires institutionalized and systematic waste collection in each center so that nonbiodegradable waste can be processed into asphalt-coated cubes which can

be used for sanitary landfills and for protecting critical beach and riverbanks from erosion. The sanitary landfill sites, which are to be identified in each center's land area plan, shall be established by concerned LGUs. The project goal is to enable at least two urban/urbanizing centers in the Lingayen Gulf coastal area to establish and manage a pilot waste disposal system for the improvement of environmental quality in their respective jurisdictions.

The two priority sites are Dagupan City, Pangasinan and San Fernando, La Union. The former is the premier commercial and industrial center in Pangasinan. The latter, besides being the capital of La Union, is the government center for the Ilocos Region.

This project will be proposed for funding, implementation and maintenance on a long-term basis. The pilot and funding-assisted phase will last at least five years, after which LGUs should continue to manage it as a public service.

Activities

- Implement a waste disposal system as a component of public service.
- Provide continuing appropriation for the management and maintenance of the waste disposal system.
- Provide continuing appropriation for the personnel services required by WCU and support staff.
- Implement an acceptable land use plan that incorporates sanitary landfill sites and uses compacted waste as sanitary landfill or for beach/ riverbank erosion control material.
- Provide continuing appropriation for WCU's operation and maintenance.
- Establish linkage with other government agencies and NGOs to share resources and expertise in establishing and managing a waste disposal system.
- Assume a reasonable portion of WCU's acquisition cost and MOE.

Resource requirements

Budget item	Cost (₱)
WCU capital outlay	15,000,000
Training cost for the core group, including salaries	1,000,000
MOE	4,000,000
Total	20,000,000

A core group of ten in each center, trained in waste processing (compacting and coating) and in the management of sanitary landfills, are needed for this project. The core group will be supported by the existing garbage collection crew under the supervision of LGU.

Besides a specified waste compacting site, various machinery and equipment are neeeded in each center. The following equipment is basic to the project:

1. Medium-sized garbage compacting machine with a daily output of 100 pieces of asphalt-coated cubes of compacted waste. Each cube measures 1m x 1m x 1m (to be acquired).
2. Mounted mechanical crane (can be shared by the LGU engineering motor pool).
3. Bulldozer (may be shared by the LGU motor pool).
4. Garbage trucks (may be shared by the LGU garbage collection unit).

COASTAL ZONATION

Zonation is necessary because of the intensity and diversity of coastal zone activity. Some activities conflict with each other while others are harmful. Zonation involves the designation of areas where certain uses are encouraged while damaging or incompatible activities are regulated or banned, based on ecological and other considerations. To ensure success, zonation regulations must manage specific resources in order to achieve sustainable development. (See Chapter 5 for zonation guidelines.)

Zonation involves the designation of areas where certain uses are encouraged while damaging or incompatible activities are regulated or banned.

PROJECT 1: Geographic information system for coastal area management and planning.

An inventory of gulf resources to determine their interaction and use is best determined by plotting them on a map. The NEDA and ICLARM are cooperating on a project to gather the necessary information, produce a geographic information system (GIS) and formulate an operational zonation scheme by the end of 1993. This project already exists and does not require a project proposal. The results of this project and Project 2's will be the basis for implementing the zonation guidelines in Chapter 5.

PROJECT 2: Codification of environmental laws and regulations for coastal area management.

Rationale

During the past years, laws on environmental protection have been passed, but no attempt has been made to reconcile and codify these laws. As a result, some laws either contradicted or overlapped each other, creating confusion among enforcement agencies. Lingayen Gulf is the subject of much legislation aimed at minimizing resource degradation. But the noncodification of these laws has rendered much of legislation inoperative. By codifying environmental protection laws, and categorizing them by usefulness, relevance and effectivity, government and the general public can better carry them out.

Description

This project intends to collect and evaluate all the environmental laws and regulations which bear upon reducing pollution and preventing damaging economic activity. This information will help line and local government agencies to decide upon which violations to prosecute and where to emphasize their effort.

Objectives

1. Identify overlapping or inconsistent laws.
2. Identify gaps in legislation.
3. Effect a more systematic enforcement of existing laws.

The project aims to codify all national laws and local ordinances on coastal area management (CAM) within a year. It requires extensive research into environmental laws, and regulations which pertain particularly to the gulf's protection. The implementing agency will be DENR.

Activities

Activity	Schedule (month)
Enumerators' training	1
Data gathering and analysis	8
Compilation and computerization of data	3

Resource requirements

Budget item	One-year cost (₱)
Personnel services	78,000
1 project leader	
3 research assistants	
MOE	32,645
Capital outlay	26,000
Total	136,645

ALTERNATIVE LIVELIHOOD FOR FISHING FAMILIES

The provision of alternative livelihood for fishing families is perhaps the most effective strategy for reducing fishing pressure.

Fishing and farming are the most common occupations in the gulf. Only half of household heads have an elementary education and less than one-third, a high school education. Very few have finished college or vocational courses. Incomes are very low in coastal villages. The overpopulation of municipal fishermen has led to low catch rates per unit effort. The average gulf fishermen's family annual income of ₱6,360 is far below regional and national levels and can only drop further. Yet the fishermen persist in their trade despite exceedingly low incomes, perhaps to satisfy basic food requirements.

These projects will be encouraged in order to provide jobs which will reduce the pressure on endangered resources. They will provide income to improve the standard of living of the coastal poor. They will demonstrate and encourage the adoption of environmentally sound technologies for livelihood.

PROJECT 1: Maguey production.

Rationale

Maguey production is an economic activity fishermen can engage in. Maguey will grow in any type of soil and does not need intensive land preparation. It grows well in idle and open land along coastal stretches where no other crop can thrive. Maguey has a life span of 15-25 years and its fiber is used in the manufacture of binder twine, cords, rugs, ropes, carpets, doormats, bags, sacks, paper and hammock. Maguey production can provide not only additional income but also supply vegetative cover to lessen soil erosion.

Objectives

1. Provide more income to fishermen from maguey-based products.
2. Supply maguey and its by-products to industries with a demand for it.

Description

The five-year project will be located in Bolinao, Alaminos, Bani and Sual, and involve the production of maguey fiber for use by rope/twine makers in the province, region or in Manila. A two-day training will be conducted for prospective beneficiaries. They will be formed into an association which will eventually maintain and manage the project. The DA-Fiber Industry Development Authority staff will carry out the preparatory steps. Labor for planting, harvesting and marketing of products will be the counterpart share of the beneficiaries.

Activities

Activity	Schedule
Site and beneficiary/identification	1 week
Consultation/dialogue with beneficiaries	1 week
Training of beneficiaries	1 week
Procurement of tools, equiptment and plant materials	1.5 weeks
Site survey and layout	
Farm establishment	3 weeks
Harvesting	3 weeks
Marketing	1 week
M&E	monthly
Collection of payment to capital	4th-5th year

Resource requirements

Budget item	Five-year cost (₱)
Establishment	2,820
MOE	299
Capital outlay	300
Harvesting/drying	18,201
Marketing	200
Fixed cost	1,250
Contingencies	2,282
Training cost	14,685
Total	40,037

PROJECT 2: Peanut production.

Rationale

Some fishermen augment their income by farming on a part-time basis. These fishermen can be encouraged to go into farming full-time if assistance is provided to make farming more profitable than fishing. Priority should be given to financial support in the production of crops currently planted by fishermen.

Objective

Provide startup capital for a peanut-raising income-generating project for 73 target beneficiaries.

Description

The project will be undertaken by 73 fishermen from San Roque East and San Manuel Norte, Agoo. They have been producing peanuts for a long time, so training is not needed, though capital assistance to procure peanut seeds is. Each fisherman will get 0.5 ha for peanut production, or a total of 36.5 ha for all 73. The project will be implemented by DA and the Municipal Development Staff.

Activities

Land preparation
Planting
Fertilizer application
Cultivation
Spraying
Harvesting
Drying/packing

Resource requirements

Budget item	Cost (₱)
Labor	3,300
Inputs	3,222
Management fee	641
Project cost for 1 ha	7,163
Cost of 36.5 ha	261,450

PROJECT 3: Saltmaking.

Rationale

Salt production is a profitable enterprise that uses low-cost technology and local resources to promote cooperativism and offer job opportunities to village folk. The project aims to develop and enhance their socioeconomic status for self-sufficiency.

Objectives

1. Generate additional income for the beneficiaries.
2. Enhance salt production through supportive measures.

Description

This project will involve an association whose members have produced salt for years but only on a small scale. Operation will take place in the dry season from November to May, to be undertaken by 25 proponents in Lawis, Labrador, Pangasinan.

The proponent will implement and manage the project with the supervision and the technical and monitoring assistance of the implementing agency. A project manager, bookkeeper/cashier, purchasing officer, marketing officer and warehouseman shall be appointed from among the cooperative members to oversee the whole operation and record all financial transactions. Training will be conducted to equip the proponents fully on project management.

The produce is cooked salt, which is fine and free from impurities and foul odor. Primary target outlets are *bagoong* (fish paste) factories in adjacent Labrador, Lingayen and Binmaley. Secondary markets are neighboring households and retailers. The selling price will be based on the existing retail or wholesale price. The expected output of the project is 6,000 sacks of cooked salt in Year 1 of operation with total sales of ₱540,000.00.

Activities

Unrefined salt, the main raw material, is dissolved in fresh seawater. Brine is poured into a filtration basket. The filtered brine is boiled in cooking vats for 3-4 hours using 1.5 m^3 of rice hull fuel daily. Rice hull fuel is available free of charge from rice millers in San Jose, Lawis and Uyong, Labrador. Transportation costs, however, will be incurred in handling or hauling from the rice millers to the project site. Expenses are estimated at ₱3,500/month for the whole association.

The expected production volume is 2-3 cavans of cooked salt/member daily. Operations will be 12 hours a day for 120 days in Year 1 of implementation. There will be a preoperating period for the construction of warehouses and other structures. In succeeding years, operations will be 180 days/year.

A 6 m x 10 m-warehouse shall be constructed to serve as storage for the cooked salt. It will be made of wood, with nipa shingles for the roof and hollow blocks/cement for walling/flooring. Sacks will be sourced from local traders. Some 6,000 sacks will be used in Year 1 and 9,000 in Year 2. One 2 m x 2 m-housing unit in the area of operation, made of light materials, shall be constructed for each proponent. This will house equipment such as stainless steel cooking vats, two bamboo baskets with different filters and a clay cooking oven made by the proponent. The housing unit and the oven will be the counterpart of the proponent. Each proponent is entitled to a noncollateral, noninterest-bearing loan of ₱6,000 with a ₱30,000 annual amortization payable in five years with a grace period of one year.

Resource requirements

Budget item	Unit cost (₱)	Cost (₱)
Warehousing	1,800	26,750
Cooking vats	6	47,000
Sacks	35	36,000
Bamboo baskets		1,750
Overhead		5,575
Transportation		14,000
MOE		14,925
Miscellaneous operating expenses		
Project manager		1,500
Bookkeeper/cashier		1,000
Purchasing and marketing officer		1,000
Warehouseman		500
Total		150,000

PROJECT 4: Environmentally sound aquarium fishing.

Rationale

Like the rest of the country's aquarium fishing industry, aquarium fishing in Bolinao has been tainted by the use of sodium cyanide. But aquarium fishing can be an environmentally sound and sustainable income-generating activity if done properly. With proper incentives, fishermen can be encouraged to adopt traditional, nondestructive methods of aquarium fish collection.

Objectives

1. Revive an industry which has gained notoriety among enthusiasts for the use of cyanide to catch aquarium fish. Fishes caught this way will die soon afterward.
2. Provide jobs to 40 FA members in Bolinao, Pangasinan. The FA hopes to generate an extra income of at least ₱1,000/month/member immediately and increase this by 10% each.

Description

The project will involve the collection and marketing of marine aquarium fishes by municipal fishermen in Bolinao, Pangasinan. It will consist of 40 regular FA members, 30 of whom will be "gatherers" and 10 of whom will take charge of marketing. Their catches will be monitored to ensure that harvest rates are sustainable. Nondestructive, traditional collection methods will be used. The catch will be kept at least a week to acclimatize the fishes for marketing. Necessary materials, such as AC-DC portable aerators, glass aquaria and feeds will be provided to allow beneficiaries to maintain good quality aquarium fishes. Shipping materials and supplies, including marketing needs will be counted as operating costs. The catch will be offered and sold to legitimate exporters. The project can later be replicated in other parts of Pangasinan (e.g., Anda or Alaminos).

The project sites are Barangays Pilar, Dewey and Lucero on Santiago Island, Bolinao, Pangasinan. The project will operate at least five years without membership expansion, after which supervision will cease.

Activities

Forty FA members will be project beneficiaries to keep the number manageable. Thirty will be designated as "collectors" (aquarium fish gatherers), while 10 will be involved in marketing activities. To qualify, a member must first have been or be presently directly involved in the aquarium fish industry. They will be trained in the necessary skills to qualify for permits/licences. Project materials will be supplied in kind and operating expenses deposited in the bank nearest the project site. Withdrawals will be made pursuant to guidelines yet to be established. Project management will rest with FA officers and members with help from the Department of Trade and Industry (DTI) and DA. Representatives of these offices will oversee and give technical advice to the project officers and members. Necessary resources like operating costs, loaded aquarium, AC-DC portable aerators, styrofoam boxes, aquarium fish-formulated feed and delivery van will be provided. All assistance will be in kind except for the operating costs which will be deposited in the bank.

The lead agency for this project will be DA, which will organize and train beneficiaries with the help of a DTI marketing specialist. The municipal government will assist in organizing the fish collectors and enforcing the sodium cyanide ban. A DA inspection officer will regularly monitor the activities to ensure fish quality. Regular monitoring by DA, DTI and municipal government will also be conducted. A DA cooperative specialist will advise FA; a fishery specialist will help in the collection, acclimation and handling of aquarium fishes; and a DTI trade specialist will help FA exploit various trade opportunities. They will also assist FAs secure national and international market outlets.

Resource requirements

Investment cost (materials)

Quantity	Description	Unit cost (₱)	Total (₱)
90	AC-DC portable aerator	200	18,000
30	loaded aquarium 2' x 1.5' x 1.25'	300	9,000
60	net gear	100	6,000
30 kg	formulated aquarium fish feed	100	3,000
1	secondhand pickup	100,000	100,000
1	submersible electric pump (portable)	3,000	3,000
2	concrete tank 5' x 3' x 3.5'	2,500	5,000
10	styrofoam boxes 40-l capacity	200	2,000
1	storing shed	10,000	10,000
30	float (styrofoam)	20	600
30	cage	100	3,000
756	plastic bag (14-in diameter)	200	151,200
3	raft	700	2,100
Subtotal			312,900
Monthly oil, fuel, maintenance of delivery van (₱6,000/month)			72,000
Grand total			384,900

Depreciation of materials

Quantity	Description	Total cost (₱)	Life span (year)	Annual depreciation (₱)
90	AC-DC portable aerator	18,000	5	3,600
30	loaded aquarium	9,000	5	1,800
60	net gear	6,000	1	6,000
1	secondhand pickup	100,000	10	10,000
1	submersible electric pump	3,000	3	1,000
2	concrete tank	5,000	5	1,000
10	styrofoam box	2,000	2	1,000
1	storing shed	10,000	3	3,333
100	plastic bag	151,200	1	151,200
				178,933

Annual yield (₱) = Gross sales - (depreciation + operating cost)
= 504,000 - (178,933 + 72,000)
= 253,067

AQUACULTURE DEVELOPMENT

The aquaculture development program will focus on improving the water supply system of brackishwater fishponds and promoting mariculture. These projects will help the gulf's aquaculture sector to achieve its production potentials within environmentally sustainable limits and will provide alternative livelihood.

PROJECT 1: Feasibility study for a saltwater canal system for fishponds in Binmaley, Pangasinan.

Rationale

The aquaculture development program will focus on improving the water supply system of brackishwater fishponds and promoting mariculture.

The lack of good water supply for a large percentage of the Sector II fishponds is a major reason for the low average production of the gulf's aquaculture. Fishponds are now built right on river waterways and tributaries, impeding water circulation to other fishponds. A two- to three-fold increase in aquaculture production can be expected from improved water management. The majority of potential beneficiaries would be low- to middle-income owners of small fishponds (1-2 ha). The canal system could revive abandoned fishponds and allow the recovery of investments. The increased fish supply could partially offset any initial decrease resulting from measures to conserve the gulf's capture fisheries resources.

Improving the canal system in the gulf's aquaculture areas would require a multimillion dollar-civil engineering project, which could probably be financed only by securing a loan. Under present financial conditions, such a huge public expenditure would be justifiable only if a thorough feasibility study indicated a large cost-benefit ratio. The feasibility study itself is inexpensive.

Objective

Prepare a feasibility study involving a preliminary design of a canal system in Binmaley, and a cost-benefit analysis of the proposed system.

Description

The study would be contracted out to a firm with expertise in civil engineering and aquaculture. The firm will coordinate with the Department of Public Works and Highways, the National Irrigation Administration and other concerned government agencies. The study would involve preliminary design of a canal system and a cost-benefit analysis of the proposed system. If the results indicate a large cost-benefit ratio, this feasibility study could be used to secure a grant or a loan from funding agencies. It should be emphasized to the firm and all parties concerned, that the feasibility study is not intended to justify a previously decided outcome, i.e., the decision to apply for a loan.

Resource requirements

This study will cost approximately ₱350,000.

PROJECT 2: Seaweed culture.

The natural dependence of coastal inhabitants on the sea for food and livelihood is best exemplified among the rural communities in the Philippines. The utilization of marine resources has largely been limited to finfishes, crustaceans and shellfishes. Seaweeds are among those which have not been fully developed except for a few species traditionally recognized as food. This may be attributed to the unfamiliarity of most Filipinos of the importance and potential of seaweed resources as food and raw material for the manufacture of commercial products. There is also a lack of appreciation of their role in maintaining the productivity of shallow coastal areas. Fortunately, a greater awareness of this resource has increased in the last few years due to rising foreign and local demand for seaweeds and seaweed products.

Objectives

1. Provide livelihood opportunities and increase the income of fishermen and coastal residents.
2. Increase seaweed production for export to generate foreign exchange.
3. Encourage residents to acquire seaweed farming technology and realize its importance and potentials.

Description

The project will primarily produce seaweed of the genus *Eucheuma* locally known as *gozo*. This species is preferred over other species because of its tolerance to ecological changes and its higher yield. The scheme is to develop a half-hectare area suitable for seaweed farming. A lease to use this area in the group's name will be obtained from the DA Regional Office and subdivided among the members of the association for farming. The project will be managed by the proponent with the help of a BFAR technician. After beneficiaries have been identified, they will be organized into an association and train with ICLARM.

Activities

	Schedule (man days)
Preproject training	6
Site identification	2
Release of funds/procurement of supplies and materials	5
Site preparation	10
Construction and planting	12
Farm care and maintenance	35-45
Harvesting	4-6
Drying	15-30
Marketing	10
Replanting	10-15

Resource requirements

Budget item	Cost (₱)
Fixed cost	28,470
Capital	7,300
Contingencies	1,650
Subtotal	37,420
Training	25,586
Total	63,006

PROJECT 3: Seafarming in cages.

Rationale

This project will help provide alternative livelihood for fishermen and their families. It will also discourage the production of *bagoong* or *patis* (fish sauce) from the fry of siganids and other species, which is a wasteful use of valuable resources.

Objectives

1. Develop an awareness of the economic potential of culturing finfishes in cages.
2. Pilot test the applicability of a finfish culture technology under local conditions.
3. Demonstrate the applicability of CPM using cage culture projects as entry points for individual and group participation in managing allocated coastal areas.
4. Help raise the protein supply of coastal inhabitants.
5. Ensure the continued economic yield of the coastal waters by encouraging the fishermen to engage in cage culture of commercially important finfishes.

Description

The three-year project will pilot test the culture of commercially and nutritionally important finfishes in floating cages in protected bays or coves. These fish species are siganids, groupers and tilapia. The primary project sites will be in the Hundred Islands in Alaminos and in Baguioen Bay in Sual, Pangasinan. The cage culture demonstration projects will last three years. The implementing agencies are PSU College of Fisheries and DMMMSU (Sto. Tomas).

Activities

Cage construction
Nursery work
Cage culture
Harvesting and marketing
Production brochures on culture technology
Training

Resource requirements

Budget item	One-year cost (₱)
Personnel services	198,000
1 project coordinator	
2 project leaders	
4 pilot study leaders	
MOE	302,710
Total cost	500,710

PROJECT 4: Oyster culture.

Rationale

Extensive fishing in Lingayen Gulf has led to a depletion of aquatic life. More effort is needed to maintain the same income. To reduce the pressure on the environment and provide income, suitable inland areas can be developed into profitable oyster farming projects.

Present oyster production cannot meet the needs of local markets and the demand for oyster shells in lime and feed supplement production. The establishment of depuration plants for oysters will open new markets abroad that would raise production, provide employment opportunities and increase the income of the fishing families.

Objectives

1. Promote an alternative income source.
2. Balance the supply-and-demand ratio of marine fishes.
3. Reduce the unemployment rate by using human resources efficiently.
4. Increase oyster production to meet local and export demand.

Description

The project will engage primarily in the production of oyster of the genus *Crassostrea* (locally known as *talaba* or *tirem*). The *C. iredalei, malabonensis* and *palmipes* are preferred species because of their adaptability to ecological changes and higher yield. The scheme is to develop a 0.25-ha suitable area for oyster farming per family for an association of fishing families.

The kind of material and method of culture are dependent on the availability of cheap raw materials in a given locality, current-velocity and nature of the bottom soil. The culture methods being practiced in Pangasinan are:

1. Stake method - staking of whole or split bamboo trunks or tree trunks on the intertidal and sublittoral zone at a regular 0.5- to 1-m interval.
2. Simple hanging method - horizontal bamboo suspended on posts (bamboo plots) hung with wire or plastic strings with empty oyster shells at 4-6 in intervals or rubber strips of used tires for collecting spots.

The preparation of oyster clutches by spot collectors should be done at least one month prior to the spawning season which occurs from April to June and September to October. The oyster clutches are hung on bamboo plots at 30.5-cm regular intervals, 1-2 weeks before the expected spawning period of the mother oysters.

Oyster harvesting, which occurs once a year, starts after 4-6 months of culture. By then, the bivalves have reached 3-4 in in length. They may then be pulled from the bamboo frame. The bamboo may be knocked by a rod to detach the oyster. If wire, plastic or rubber strips are used, then the strips may be untied and loaded into a banca.

Oysters are usually marketed "in their shells or as shucked oyster meat," or by the gallon/liter, respectively. Binmaley and Dagupan oysters are sold at ₱30-45/l at their public markets.

Activities

Preproject training
Site identification
Release of funds/procurement of supplies and materials
Spot collector preparation
Construction of caretaker/farm hut and oyster plots
Installation of spot collectors
Farm maintenance and management
Harvesting
Marketing

Resource requirements

These are the major financial assumptions. The annual volume of sales will be ₱34,590 at the average selling price of ₱30/l.

The funding requirement of this project is ₱25,750, which will be used to purchase supplies and materials necessary for the establishment of a 0.25-ha oyster farm. Labor shall be the equity participation of the proponents.

Fixed cost

Quantity	Description	Cost/farm (₱)
1	farmhouse/hut	5,000
1	dugout/banca	1,500
2	bolo	200
2	hammer	180
4	bamboo baskets	200
	municipal permit	250

Operating cost

Quantity	Description	Unit cost (₱)	Project cost (₱)
50	full-length bamboo	40	2,000
250	bamboo trunks	15	3,750
5 kg	assorted nails	8	40
10 kg	tie wire/plastic	8	80
10,000	rubber strips	0.70	7,000
	Harvesting/handling		3,000
	Contingencies		2,800
	Subtotal		18,670
	Total		25,750

Sales of 1,153 l of oyster at ₱30.00/l	34,590
Less production cost of ₱18,670 and annual 18% amortization of ₱4,635	23,305
Net income	11,285

INSTITUTIONAL DEVELOPMENT

Rationale

The institutional development program will train resource managers in project management, coordination and development, project M&E, rapid rural appraisal and implementation management.

Management planning is important in project coordination and development, particularly where implementation responsibilities and functions are dispersed among a number of agencies, various tiers of government (national, provincial and municipal) and several private organizations. The implementation of the management plan requires strong skills and mechanisms for coordinating the activities of the various parties involved; it requires a common understanding of the plan.

The LGCAMP calls for the NRO Technical Secretariat to act as the interim PMO for the interim period of Years 1-2. Because the bulk of NRO work will involve interagency activities, this training will serve as an orientation and skills development seminar-workshop. Phase I (Orientation) will acquaint the participants with the program. Phase II (Skills Development) will include topics on project development, implementation, M&E, rapid rural appraisal, etc.

Objectives

1. Orient participants to LGCAMP.
2. Improve the knowledge and basic skills of NRO and provincial coordinating committees (PCCs) staff in managing programs and projects.
3. Facilitate coordination between NRO and PCCs.

Description and activities

This is an intensive, one-month training program with a total of 60 participants, 7 of whom will come from NRO, 5 each from the two PCCs, 18 from the municipal task forces and 5 from NGOs. The training program will have two modules. The orientation module will provide in-depth understanding of the plan. The second module covers project management, coordination and development, project M&E, rapid rural appraisal and implementation management. This module will consist of lectures, discussion and actual field applications.

Resource requirements

Budget item	Cost (₱)
Salaries/honoraria	200,000
Travel/communication	30,000
Training kits/handouts	30,000
Contingencies	23,000
Board/lodging/facilities	200,000
Total	483,000

CHAPTER 3

PLAN IMPLEMENTATION

PHASES

The proposed programs will be implemented in two phases: an interim period (Phase I) of 2 years and Phase II of 3-5 years in which full implementation will take place. All the preparations to launch large-scale projects will be completed in Phase I. In that period, NRO will submit proposals for Phase II projects to funding sources. Selected demonstration projects of an urgent nature will then be implemented. The major projects of Phase II will culminate in the establishment of a gulfwide CPM system.

THE REGIONAL DEVELOPMENT CONTEXT

All its proposed programs are designed to be *conceptually consistent* with RPFP 1990-2020. The RPFP already wants "immediate relief especially to the degraded marine resources in Lingayen Gulf to ensure sustained development," recognizing that:

> ...this approach becomes feasible only if coupled with the provision of viable alternative livelihood to those affected, especially subsistence fishermen. [Desirable] environmental measures include [the] restoration of marine habitats adversely impacted by man's activities, enforcement of applicable laws and zoning measures, provision of protection measures from beach erosion and encroachment, and water quality improvement and monitoring. Economic measures involve [pursuing] alternative or additional livelihood in services, small industry, agriculture and tourism (RDC 1991).

The proposed programs will be implemented in two phases: an interim period (Phase I) of 2 years and Phase II of 3-5 years in which full implementation will take place.

The proposed implementation mechanism will be *administratively consistent* with RPFP's integrated area development (IAD) approach. It may be recalled that RPFP divided Region I into three zones based on resource homogeneity: upland, lowland and coastal subregions. As a multisectoral and regional activity, the rehabilitation of the gulf will be coordinated with the IAD structure (RDC 1991).

La Union and Pangasinan have been designated separate IADs. La Union has two sub-IADs and Pangasinan, six. Each sub-IAD is organized around a

growth center and managed as a unit. Lingayen Gulf and its coastal municipalities, however, have been declared a special planning area or coastal zone sub-IAD because of the serious problems they present. Though it will overlap with existing sub-IAD boundaries, the Lingayen Gulf planning mechanism will not take any powers and functions from established sub-IADs. Rather, it will pursue projects that will complement ongoing projects. Coordination could be effected through RDC. The mechanism is described below.

THE ADMINISTRATIVE FRAMEWORK

Technical Secretariat

In Phase I, NRO will form a Technical Secretariat to implement selected projects of an urgent nature and to make preparations to launch large-scale projects.

The NRO Technical Secretariat shall oversee the overall implementation of LGCAMP in the first two years. The NRO shall perform these duties and responsibilities:

1. serve as a coordinating center for interagency planning and management of Lingayen Gulf projects;
2. commission the preparation of feasibility studies for identified projects in the gulf and other technical studies which will be the basis for drawing up guidelines for the enforcement of rules meant to protect coastal resources;
3. coordinate with the various line agencies, LGUs and the other parties concerned regarding the implementation in the interim phase of demonstration projects such as livelihood and rehabilitation;
4. monitor and evaluate the progress and effects of plan implementation. Information gathering and monitoring may involve academic institutions in the region;
5. extend technical assistance to LGUs particularly in the preparation of ordinances concerned with the preservation of coastal resources and effective gulf management;
6. coordinate community organizing activities;
7. encourage private business and government agencies to plan, develop and implement projects for the accelerated development of Lingayen Gulf;
8. initiate the application for, receipt and acceptance of grants, donations and other forms of development assistance from all internal and foreign sources;
9. call on the appropriate departments, bureaus, offices or agencies for assistance in the discharge of its duties; and
10. perform any other function which may be assigned to it by RDC.

The NRO Technical Secretariat will be headed by the NEDA Region I director. It will report directly to LGCC which will be created within RDC Region

I (Fig. 3.1). The LGCC shall review all plans, assess development activities and provide planning and management policy guidance for the day-to-day operations of the NRO Technical Secretariat for Lingayen Gulf. The LGCC shall be chaired by a governor of La Union or Pangasinan, who may rotate the chair among themselves.

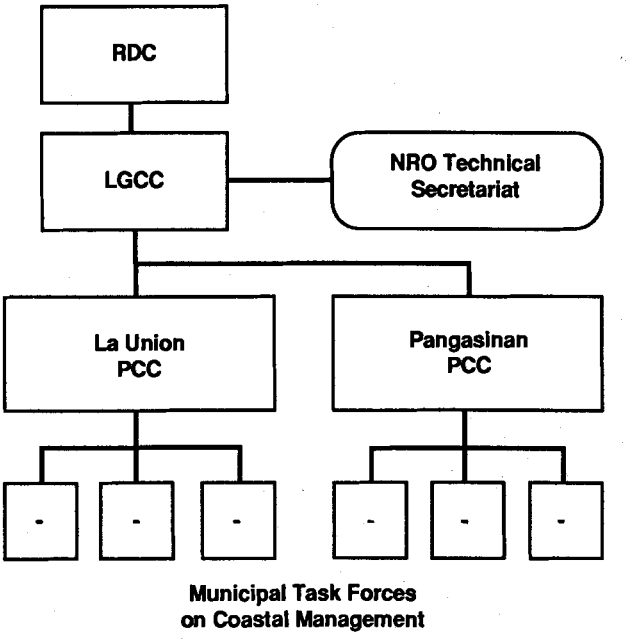

Fig. 3.1. Interim (Phase I) organizational structure.

The LGCC shall include all line agency regional directors concerned with the gulf (DA, BFAR, DENR, Department of Social Work and Development, Department of Local Government, Department of Tourism [DOT]), the NEDA regional director, the Housing and Land Use Regulatory Board (HLURB) regional representative, representatives from the provincial and city development councils (Pangasinan, La Union and Dagupan City), the presidents of the federations of people's organizations, the private business sector, representatives from NGOs operating in the gulf, the youth, the educational and religious sectors and such others whose representation the LGCC chairman may deem important.

Below LGCC, PCCs will be formed for Pangasinan and La Union. These will:

1. coordinate program operations in the whole province;
2. coordinate activities and policy implementation with all the municipal task forces on coastal management;
3. make policy recommendations to LGCC regarding management problems affecting any or all municipalities within its provincial jurisdiction;

4. work closely with LGCC and NRO Technical Secretariat to ensure that all activities are consistently in the best interest of the gulf as a single resource and ecological unit; and
5. resolve all conflicts in coastal resource use.

The governor will chair PCC. It will consist of the president of the Federation of Fishermen's Association as co-chairman and the Provincial Planning and Development coordinator as secretary. The committee will include all provincial line agency representatives, representatives from the private business sector, the Fish Dealers' Association, Association of Fishpond Operators, Tourism Operators' Association and others from the provincial government.

Municipal task forces on coastal management will be organized under PCCs. These task forces will plan the management of the municipal coastal areas; recommend policies to the Sangguniang Bayan (SB, i.e., municipal council) for enactment into ordinances; implement the municipal coastal management plan and monitor the progress of the implementation. They will assist law enforcement in checking violations of municipal ordinances governing the proper coastal resource use and call the attention of PCCs to any intermunicipal conflict in carrying out the policies of LGCC. The mayor will chair the municipal task force. An SB member will be Fisheries/Coastal Ecology vice-chairman; the Municipal Planning and Development coordinator will be secretary. The other members of the task force will be all coastal barangay captains, all presidents of barangay FAs, presidents of Fishpond Operators' Association, the municipal agricultural officer, the municipal pollution officer, the zoning administrator, the station commander of the Philippine National Police and representatives of other government agencies operating at the municipal level. Fig. 3.1 shows the interim machinery that will support LGCAMP.

Project Management Office

In Phase II, RDC will create PMO to replace the Technical Secretariat.

In Year 3 of plan implementation, it is suggested that RDC create PMO by administrative order to take over the functions of the NRO Technical Secretariat for Lingayen Gulf. It will implement urgent demonstration projects, conduct feasibility studies and secure funding for the implementation of the remaining aspects of the plan. The PMO departments should be operational by Year 3. The PMO will report to LGCC and RDC (Fig. 3.2).

The PMO shall be headed by a full-time project director appointed by the RDC chairman. The PMO will have three divisions: Program Planning, Program Management and Administration. Program Planning will take charge of research, project planning and development, and M&E. Program Management will handle coordination functions as well as information and education. Administration will be concerned with finance, legal matters, personnel and general services. These three divisions will be staffed with full-time officers. The PMO will not perform law enforcement, which will be the duty of LGUs and agencies like the Philippine Coast Guard and Philippine Navy.

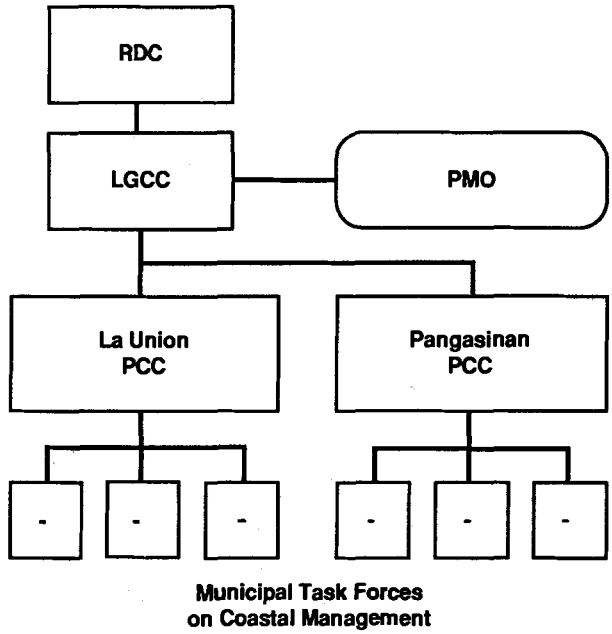

Fig. 3.2. Final (Phase II) organizational structure.

These proposals conform with national policy which gives towns and provinces an expanded role in protecting and managing natural resources. Adequate legal basis for the creation and funding of the suggested mechanisms is provided by RA 7061. (See Appendix A for provisions.)

To facilitate the task of project evaluation, an M&E framework has been provided in Appendix B.

CHAPTER 4

COMMON PROPERTY MANAGEMENT

A common property management system will be established to replace open access to the gulf's fisheries with arrangements which grant exclusive use rights to fishermen's organizations.

Lingayen Gulf represents a classic example of overexploitation through open access. Right now, anyone with a boat can fish in the gulf. Access is possible through a 160-km long shoreline or from the open sea as in the case of commercial trawlers. Access to marine fisheries, corals, etc. is a function of the possession of fishing vessels and gear (Silvestre et al. 1991). The municipal fishermen and trawlers have come in conflict over the dwindling fisheries. A CPM system will be established to replace open access to the gulf's fisheries with arrangements which grant exclusive use rights to fishermen's organizations. These exclusive rights will be granted under existing law, and defined by local ordinances and contracts (See Appendix A). Fishermen's organizations will be obliged to find ways to prevent nonmembers from entering the fisheries and establish procedures to divide the benefits and costs among members. Under CPM, access to the municipal fisheries is restricted to a definite user-group governed by rules for sharing of benefits and costs. The user-group, in turn, takes responsibility for protecting it, since it has a stake in the resources. In exchange for this privilege, the municipal fishermen's organizations must bear the necessary management costs. This combination of rewards and duties will reduce long-run costs and maximize benefits. The organization must discipline individual members who damage the resources.

To avoid confusion and conform with the IAD principle, a single CPM area will be established for the gulf. The unequal distribution of fishermen within the municipalities means it is not feasible to limit fishermen to coastal waters immediately fronting their town. Any prospective CPM must include the whole gulf. Before establishing a CPM it will be necessary to gradually close the gulf to commercial trawling and organize municipal fishermen comprehensively into associations. Several years are needed to prepare local organizations to take responsibility for managing Lingayen Gulf's fisheries.

ORGANIZING FISHERMEN

Since only 3,782 of the estimated 12,500 fishermen in the gulf were listed as belonging to fishermen's organizations and cooperatives, extensive preparatory work is needed to establish CPM. Funds must be sourced to organize all gulf fishermen, obtain acceptance for the CPM and prepare the implementing structure. Gulf fishermen must be able to defend against illegal encroachment, not only from without, but also from within their ranks. Since

the fishermen will have effective control over the resources, their management must provide the means to share net benefits and assure their equitable distribution. It must be impossible for one or two members to monopolize benefits.

TRAWLER PHASEOUT

In 1988, the trawl fleet of Lingayen Gulf employed only 220 people but took 20-25% of the total catch. The number of trawlers in Lingayen Gulf has increased since 1990 from 49 to 82. This has exacerbated overfishing and led to conflict between trawlers and the municipal fishermen. This can only be solved by regulating or banning trawlers (including baby trawlers, i.e., vessels less than 3 GT, but which approximate trawlers in their mode of operation) throughout the gulf. There should be adequate support for a request for an administrative order to ban trawlers from the gulf. Also, provision must be made for gulf-based trawlers to seek business elsewhere. Attempts to impose controls will probably engender opposition from politicians representing vessel owners, shipyards, etc., but there is no alternative. Particular attention should be given to preventing the conversion of vessels to circumvent license limits.

The BFAR can close the gulf to trawling if all coastal villages and municipalities can pass resolutions calling for a trawl ban.

PREPARING FOR THE ESTABLISHMENT OF COMMON PROPERTY MANAGEMENT

The establishment of CPM implies the exclusion of unauthorized municipal fishermen. To soften the blow, licenses could be provided to all current fishermen with the proviso that only the Lingayen Gulf PMO may replace vacancies. Then attrition, offset only by limited replacement and other resource management measures that FAs are expected to put in place, will gradually reduce fishing to sustainable levels. Part-time fishermen can be eliminated in case not every full-time fisherman can be accommodated. Some of the criteria that may be used to select licensees are: years as a fisherman; percent dependence on fishing; and number of years of residence.

A schedule of preparatory activities is given in Table 4.1.

Table 4.1. Schedule for establishing CPM in Lingayen Gulf.

Activity	Year								
	1992	1993	1994	1995	1996	1997	1998	1999	2000
Establish monitoring system for fisheries management									
Source funds for organizing campaign									
Mobilize for the removal of trawlers									
Public hearing for trawler removal									
Phaseout period for trawlers									
Organize all fishermen in the gulf									
Encourage acceptance of CPM concept									
Confederate all fishermen's organizations in the gulf									
Prepare implementation procedures for CPM									
Test run CPM									

Procedures include the enactment of ordinances relevant to CPM implementation and arrangements with academic institutions to monitor fish stocks, i.e., update MSY calculations, determine how many fishermen should be allowed access and determine close season scientifically.

These extensive preparatory activities may exceed the capability of PMO, which should undertake what it can and tap NGOs for the remainder.

CHAPTER 5

ZONATION GUIDELINES FOR THE LINGAYEN GULF COASTAL AREA AND VICINITY

These zonation guidelines call for the establishment of aquaculture and mangrove rehabilitation zones; coral reef reserves; exclusive fishing and general use marine zones. Existing land uses shall be respected unless seriously inconsistent with the goal of sustainable development.

A zonation scheme is necessary to ensure that all resource use activities are compatible with each other and the environment. This section is a guide to formulating a zonation scheme for Lingayen Gulf and its vicinity. Additional information is being gathered by a two-year GIS Coastal Area Management and Planning Project funded by the International Development Research Centre of Canada so that guidelines can be made operational.

BROAD POLICY GUIDELINES

1. The coastal area shall be divided into zones in accordance with the goal of sustainable resources management with which LGUs enacting ordinances should be consistent.
2. The coastal zone plans and implementing regulations shall be in accordance with or should form part of municipal development plans.
3. The broad policy guidelines provided herein shall be translated into specific rules and regulations using the town planning process prescribed by HLURB to the extent applicable.

RECOMMENDED ZONES

Land Use Component

Existing land uses shall be respected unless seriously inconsistent with the goal of sustainable development. The land use areas that may be broadly provided for are: residential, agricultural, forest land, timberland, industrial and tourism. Authorities shall indicate no-access, limited-access and open-access zones.

Aquaculture Zone

Rationale

The benefits of limiting aquaculture activities to suitable sites are many. Siting farms away from dense human settlements and commercial areas may

prevent contamination by wastewater and sewage, thus, minimizing public health risks. Away from critical habitats (e.g., coral reefs), the negative environmental impact of aquaculture may be minimized. Potential conflicts between aquaculture and other economic activities can be avoided if aquaculture is discouraged in rich fishing grounds or vice versa. Successful aquaculture ventures can be assured in part by proper siting, thereby decreasing the chances of pond abandonment and preventing the waste of habitat and economic resources.

Criteria for delineating the aquaculture zone

The aquaculture zone shall include both existing and potential aquaculture sites. It will cover brackish aquaculture (pond culture of fish and shrimps) and mariculture (culture of oysters and other mollusks, fishcage culture, seaweed culture and ocean ranching). The existing brackishwater or mariculture farm should meet the following criteria for inclusion in the aquaculture zone:

1. It must be commercially viable.
2. It must not seriously affect water quality and circulation in the area.
3. It should not obstruct navigation.
4. It must not be located too close to critical habitats or landscapes with scenic value.
5. It must not be located within flood-prone areas, along fault lines or near other areas with natural hazards.
6. Mariculture farms should not be sited in breeding, feeding and nursery grounds of crustaceans and finfishes.

Moreover, productive agricultural lands shall not be considered potential aquaculture sites. Conversion of productive agricultural lands into fishponds should be discouraged. Unproductive lands should be given priority for conversion to aquaculture farms.

Zone regulations

These are the considerations in preparing the regulations to be enforced in the aquaculture zone:

1. Aquaculture farms should be allowed only inside the aquaculture zone and not in any other zone.
2. Environmental laws must be enforced strictly in the aquaculture zone and its vicinity. This should be emphasized in traditional oyster-growing areas near dense human settlements and commercial areas.
3. Carrying capacity must be considered in determining the size and number of farms that may be allowed in suitable areas.
4. Ponds should not be sited within 100 m from the riverbanks, according to the National Mangrove Committee (NMC).
5. In the absence of legal setback lines along coasts, ponds should be 40-100 m from the mean high waterline, according to NMC. The buffer zone may be increased in eroding areas.

Mangrove Rehabilitation Zones

Rationale

Mangrove protect the coastline from erosion and promote accretion. Where harvested at sustainable rates, mangroves can provide a continuing supply of wood for charcoal, furniture, resins and other products. Most of the mangroves in Lingayen Gulf were converted into fishponds in the 1950s-1960s. The benefits provided by thriving mangrove communities can be regained only after their sufficient rehabilitation.

Criteria for delineating mangrove rehabilitation zones

These factors shall be considered in establishing Mangrove Rehabilitation Zones (see Chapter 2):

1. The few remaining mangrove swamps in Lingayen Gulf should be preserved and made part of the mangrove rehabilitation zone.
2. Areas previously covered with mangroves (e.g., abandoned fishponds) shall be made candidates for reforestation.
3. Mangrove afforestation (planting in an area not previously covered with forest) will have second priority to reforestation. It may be attempted in areas that possess the following characteristics.

    - Rehabilitation zones should be located in intertidal areas that are underwater for several hours each day. These areas should not be exposed to strong currents or wave action. Shore conditions should favor accretion.
    - The soil type should be sandy and/or muddy.
    - The salinity of the water should have a range of 18.46-36 ppt.
    - Water temperature should be between 17-30°C.
    - Rehabilitation zones should be accessible but not located too close to human settlements.

Zone regulations

1. Entry into the mangrove rehabilitation zones and their buffer zones should be allowed only for the purpose of monitoring, conduct of scientific research and supervised educational visits.
2. Mangrove rehabilitation zones that have recovered sufficiently as determined by DENR may be opened to sustainable harvesting of wood by organized coastal communities.

Coral Reef Reserves

Rationale

The coral reefs of Lingayen Gulf provide finfish, aquarium fish, seaweeds and various invertebrates such as shellfish and sea cucumbers. The reefs and their neighboring habitats also serve as tourist attractions. The deterioration of the gulf's coral reefs therefore represents an enormous and irrecoverable loss for the coastal communities.

The rehabilitation of coral reefs can be facilitated by a well-designed, multiple-use coral reef reserve. The reserve will contain zones in which different regulations apply, depending on their intended function. The most important zone is the core zone, a reef area that has good coral cover and contains a high number of species. It will serve as a source of coral larvae which can recolonize damaged reefs. The other zones that may be defined within the reserve may include a fisheries management zone, where particular fish stocks are monitored and catch levels are controlled, and a scientific zone, where ecologically sound research is allowed.

Designing coral reef reserves

Reserves should be established in Sector I which coastal communities will manage following the successful examples in the Visayas (White 1988). Extensive community work and public education will be conducted to prepare communities for their role as stewards and main beneficiaries of the reserves. In time, the increased fish yields and possibly revenues from tourism will become incentives for the fishing communities to maintain the reserves. These guidelines deal mainly with the physical aspects of establishing coral reef reserves (Salm and Clark 1984) and do not include community organizing which is discussed in Chapter 2.

The core zone must be delineated in the reserve. It should contain 95% of the species in the area and include not just the coral reef but portions of its neighboring habitats such as reef flats, seagrass communities, algae beds and sand flats.

Potential core zones are coral reefs off Barangay Malinap in Santiago Island and Cangaluyan Island in Anda (UPMSI 1988b). Reef areas with 40-49% coral cover should also be considered. These are found off Barangays Trinchera, Lucero and Guyoden in Bolinao, and Barangays Cabungan, Sablig, Macaleeng and Batiarao.

A buffer zone shall be defined to serve as a transition between the core zone and the area outside the reserve. Less strict regulations are applied in the buffer zone. It includes the rest of the neighboring habitats. It may also include areas which influence the core zone but are not necessarily adjacent to it. Beaches, dunes, watersheds, agricultural lands and urban and industrial areas may be included in the buffer zone if there are potentially damaging or hazardous activities in these areas (e.g., mining) or if there are identifiable physical processes (e.g., water currents) which link them to the core zone.

Other zones may be defined within the buffer zone such as a traditional fishing zone. It might be necessary, for instance, to delineate a fisheries management zone for siganids in Bolinao. In general, however, the zonation of the reserves should be kept simple. Additional zones should be introduced at later stages after the simple schemes gain acceptance, and only if absolutely necessary.

Reserve regulations

1. Within the core zone, fishing and harvesting of resources shall not be allowed. Boats shall not be allowed to drop anchor in this zone but may be secured to mooring buoys specially installed for this purpose. Nonextractive activities such as scientific research and controlled tourism may be permitted.
2. Entrance fees may be collected from tourists (e.g., snorkelers and scuba divers) to raise funds for the maintenance of the reserves. Sites near tourist areas where this might be possible include Trinchera, Sablig, Macaleeng and Batiarao.
3. Within the buffer zone, fisheries laws should be strictly enforced. All destructive methods (e.g., muro-ami and the use of fine-meshed nets) will be disallowed and correspondingly penalized. Traditional fishing within the buffer zone using simple gear such as traps, hook and line and spear fishing (without scuba) may be allowed. More efficient municipal gear such as the bag net shall be excluded from this zone.
4. A special siganid fishery may be set up in Bolinao. This zone may be closed during the spawning run. Fish corrals which impede the migration of juvenile siganids may be ordered to relocate to more suitable places.

Exclusive Fishing Zones

Separating competing fishing gear categories is one way of reducing the intense competition among fishermen. It is also a fair and reasonable means of allocating resources in favor of the more disadvantaged fishing communities. The proposed amendments to the existing Fisheries Code (PD 704), which limit the area in which commercial fisheries may operate, propose the separation of certain municipal gear. The proposals call for the separation of passive and active fishing gear. A passive fishing gear is an instrument or device used to capture aquatic animals in a manner where gear movements of sweeping the waters or motorized pursuit are absent, such as hook and line, fish pots, traps and gill net set across the path of fish. An active fishing gear effects capture by lifting, towing or driving fish into an impoundment such as trawl, purse seine, ring net, encircling gill nets, Danish seine and bag net. The Fisheries Code appears likely to allow the establishment of communal fisheries areas within the zone reserved for passive gear. Communal fisheries areas will be allocated for the exclusive use of selected families or fishing communities. When the Code becomes law, authorities may divide the CPM area into active or passive zones as the situation dictates. Such efforts, however, should be planned carefully and should not conflict with the larger objective of establishing a single CPM for the gulf.

General Use Marine Zone

The waters of Lingayen Gulf that are not included in the above zones should be designated as a general use marine zone. No special regulations are necessary for this zone. Still, existing environmental laws that apply to this zone should be strictly enforced by the authorities concerned.

ZONATION SCHEME IMPLEMENTATION

These overall coastal guidelines are expected to be adopted by the two provinces which are mandated to adopt adequate measures to safeguard and conserve land, mineral, marine, forest and other resources in coordination with the mayors of component cities and municipalities (See Appendix A for relevant legal provisions.) The provincial legislative body is also authorized to adopt measures and safeguards against pollution and to preserve the natural ecosystem in the provinces in consonance with approved standards

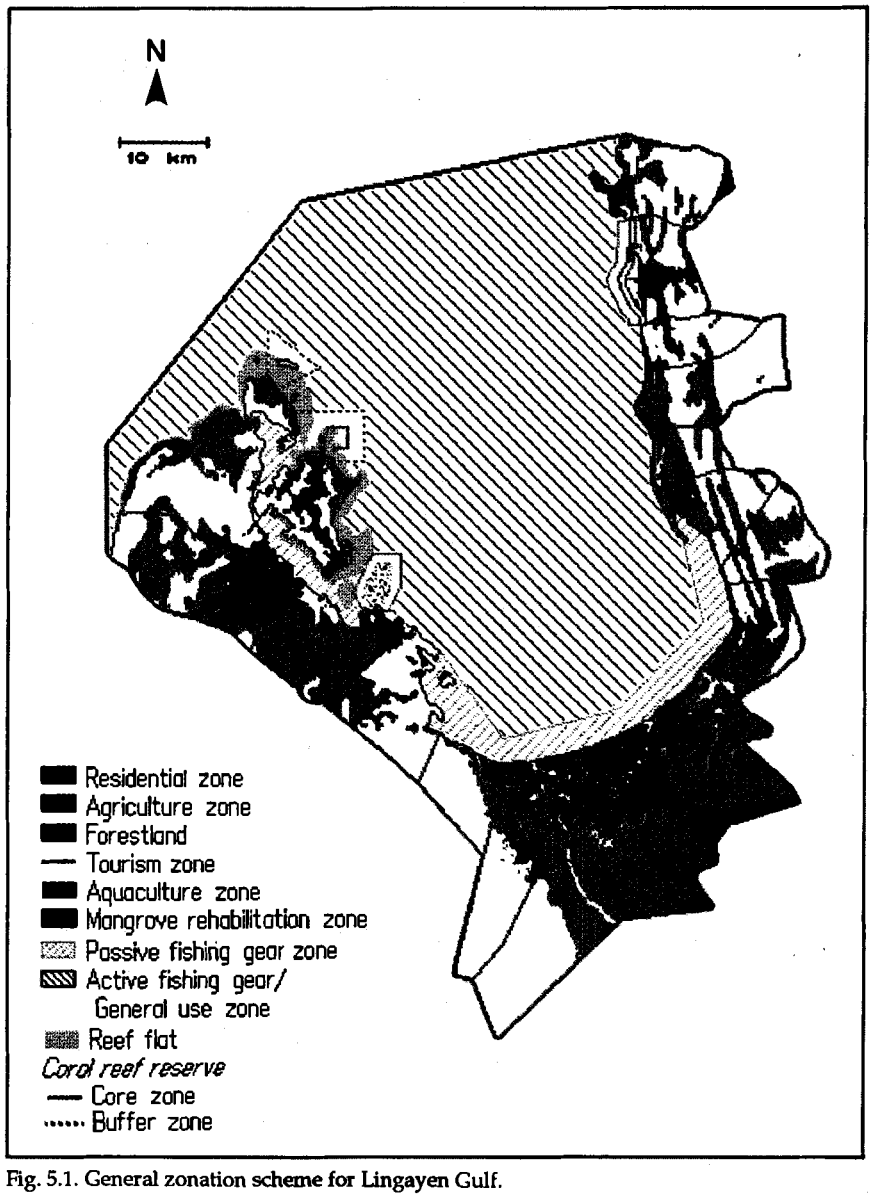

Fig. 5.1. General zonation scheme for Lingayen Gulf.

on human settlements and environmental sanitation. Under the broad mandate of the Sangguniang Panlalawigan (SL, i.e., provincial council) to enact ordinances, approve resolutions and appropriate funds for the general welfare of the province and its inhabitants, the legislative body of the two provinces shall enact this zonation policy scheme in the form of a resolution which shall be binding on and shall guide the formulation by the component cities and municipalities of their respective ordinances and resolutions affecting planning, land use allocation and zonation. Compliance with these policies by the LGUs concerned may be monitored by the provinces through its review power over all the ordinances approved by the Sanggunian of the component cities and municipalities and the executive order issued by the mayors of these LGUs. Compliance with this zonation policy scheme can likewise be ensured through SL's review of the comprehensive land use plans and zoning ordinances of component cities and municipalities.

A general zonation scheme is presented in Fig. 5.1.

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APPENDIX A

SELECTED LEGAL PROVISIONS RELEVANT TO COMMON PROPERTY MANAGEMENT

The new LGC signed into law on 10 October 1991 provides strong support for many LGCAMP programs and projects. It strengthens LGUs in general through the devolution of more powers to them and amends certain provisions of special laws which include the Fisheries Code (PD 704) and other related legislation. These provisions provide strong legal basis for the LGCAMP implementation scheme.

GRANT OF SPECIFIC AUTHORITY TO PROVIDE FOR THE APPROPRIATE PLANNING OR IMPLEMENTING STRUCTURE FOR COMMON PROPERTY MANAGEMENT ACTIVITIES

The LGC reiterates the broad constitutional provision authorizing LGUs to group themselves together, consolidate or coordinate their efforts or services and resources for purposes commonly beneficial to them. Complementing it is that which allows LGUs the power to establish an organization that shall be responsible for the efficient and effective implementation of their development plans, program objectives and priorities (Sec. 18). Realizing that for this purpose, LGUs will continue to need the help of national government agencies, LGC mandates the coordination of national government policies and programs, and extension of technical and material assistance to less developed and deserving LGUs (Sec. 3 [k]). Furthermore, it encourages the participation of the private sector in local governance, particularly in the delivery of basic services (Sec. 3 [l]).

These provisions support the LGUs' power to institutionalize an administrative mechanism to assist it in implementing a Lingayen Gulf plan, including the grouping of all the municipalities concerned. Sec. 33 provides that LGUs may, for their benefit through appropriate ordinances, group themselves, consolidate or coordinate their efforts, services and resources. Upon approval by the *sanggunian (council) concerned*, after a public hearing conducted for the purpose, they may even contribute funds, real estate, equipment and other kinds of property, and appoint or assign personnel under such terms and conditions as may be agreed upon by the participating local units through Memoranda of Agreement (Sec. 33). Without this more explicit authorization, LGUs face problems (from accounting and auditing

perspectives) in allowing the use of their funds or other assets for activities which also benefited other LGUs.

Further, in clear deviation from the existing provisions of the Fisheries Code, LGC vests municipalities and cities with the exclusive authority to grant fishery privileges in the municipal waters and city waters, respectively, imposing the corresponding rentals, fees or charges thereof. Thus, power shall be exercised through SB and Sangguniang Panlungsod (SP, i.e., city council) which shall enact the required ordinance and prosecute any violations of the provisions of applicable fishery laws. In the Fisheries Code, these ordinances are subject to the approval of the DENR Secretary.

The specific activities covered by this exclusive authority are:

1. grant fishery privileges to erect fish corrals; oyster, mussel or other aquatic beds; or milkfish (*bangus*) fry areas within a definite zone of the municipal or city waters;
2. give preferential rights to such privileges to duly registered organizations and cooperatives of marginal fishermen;
3. require public bidding in conformity with and pursuant to an ordinance for the grant of such privileges;
4. grant the privilege to gather, take or catch *bangus* fry, prawn fry or fry of other species and fish from the municipal and city waters by nets, traps or other fishing gear to marginal fishermen, free of any rental, fee, charge or any other imposition whatsoever;
5. issue licenses for the operation of fishing vessels of three GT or less for which purpose, the Sanggunian shall promulgate rules and regulations regarding the issuance of such licenses to qualified applicants under existing laws (Sec. 149, Sec. 447 [2][xi] and Sec. 458 [2][xi]).

The provincial, city and municipal agriculturists shall undertake these activities:

1. ensure that maximum assistance and access to resources in the production, processing and marketing of aquaculture and marine products are extended to farmers, fishermen and local entrepreneurs;
2. enforce rules and regulations relating to aquaculture; and
3. recommend to the Sanggunian and advise the governor or mayor on all matters related to agriculture and aquaculture which will improve the livelihood and living conditions of the inhabitants (Sec. 482 [b][3i/iv] and [5]).

The environment and natural resources officer shall:

1. develop plans and strategies and upon approval by the governor or mayor implement those which have to do with environment and natural resources programs and projects which the governor or mayor is empowered to implement and which the Sanggunian is empowered to provide;
2. coordinate with government agencies and NGOs in the implementation of measures to prevent and control land, air and water pollution with the assistance of DENR;
3. be in the frontline of the delivery of services concerning the environment and natural resources, particularly in the renewal and rehabilitation of the environment during and in the aftermath of man-made and natural disasters and calamities; and
4. recommend to the Sanggunian and advise the governor or the mayor on all matters relative to the protection, conservation, maximum utilization, appreciation of appropriate technology and other matters related to the environment and natural resources (Sec. 484 [a], [b], [3vi] and [4-5]).

POWERS WITH RESPECT TO IMPLEMENTING NATIONAL PROJECTS

National government agencies with project implementation functions must coordinate with one another and with the LGUs concerned. They must ensure the LGUs' participation both in the planning and implementation of national projects (Sec. 25[b]). Moreover, it shall be the duty of every agency or government-owned or controlled corporation authorizing or involved in the planning and implementation of any project or program that may cause pollution, depletion of nonrenewable resources and extinction of plant species to consult with the LGUs, NGOs and other sectors concerned and explain the measures that will be undertaken to prevent or minimize the adverse effects thereof (Sec. 26). An even stronger provision provides that no project or program shall be implemented by government authorities unless prior consultations are held in local governments and the approval of the Sanggunian concerned has been obtained (Sec. 27). This is a major shift from the situation prevailing before 1991 where local government was generally not consulted on the proposed projects to be located in their territorial jurisdiction. They were usually informed "after the fact," i.e., after the major decisions had already been made.

SHARING OF RESPONSIBILITIES FOR ENVIRONMENTAL MANAGEMENT

The LGUs are empowered to share with the national government the responsibility for the management and maintenance of ecological balance within their territorial jurisdiction, subject to the provision of LGC and national policies. (Sec. 3 [i]). Further, the General Welfare clause authorizes LGUs to exercise the powers granted to them, those necessarily implied therefrom as well as powers necessary, appropriate or incidental for its efficient and effective governance which are essential to the promotion of the

general welfare. More specifically, within their respective territorial jurisdiction, LGUs shall ensure and support the right of the people to a balanced ecology and support the development of appropriate and self-reliant scientific and technological capabilities (Sec. 16).

To improve the capabilities of local governments to undertake development projects, LGC mandates the provision of opportunities for them to participate actively in the implementation of national programs and projects (Sec. 3 [g]). This shall further be enhanced through improved coordination of national government policies and programs and the extension of adequate technical and material assistance to less developed and deserving LGUs (Sec. 3 [k]).

Substantial environmental management activities have been devolved to various LGUs: some reiterate existing laws while others are new provisions dealing with these activities for the first time. A summary of the allocation of pollution control activities follows:

1. The *punong barangay* (village head) shall enforce laws and regulations relating to pollution control and protection of the environment (Sec. 289 [b] [9]).
2. The municipal mayor, city mayor and the provincial governor shall adopt adequate measures to safeguard and conserve land, mineral, marine, forest and other resources of their respective areas (Sec. 444 [3] [vii], Sec. 455 [3] [vii] and Sec. 465 [3] [v]).
3. The SB, SP and SL shall impose appropriate penalties for acts which endanger the environment such as dynamite fishing and such other activities which result in pollution, acceleration of the eutrophication of rivers and lakes or of ecological imbalance (Sec. 447 [1] [vi], Sec. 458 [1] [vi] and Sec. 468 [1] [vi]).
4. The SL shall adopt measures and safeguards against pollution and for the preservation of the natural ecosystem in the province, in consonance with approved standards on human settlements and environmental sanitation (Sec. 468 [4] [i]).

REVIEW AND RECOMMENDATIONS

The overall effect of the amendments introduced by LGC is to increase the powers of LGUs significantly. These added powers do not strengthen the LGUs and improve their contribution to planning, project development and implementation automatically. These will depend on the technical, administrative and financial capability of LGUs to discharge their newly acquired powers. The basic issue that arises from this devolution of powers is whether LGUs have the capability to perform these functions efficiently and effectively or, technical and financial assistance need to be continued by national agencies in initial years. The establishment of a PMO is recommended because it will provide the LGU with the technical, administrative and financial kernel to carry out the Lingayen Gulf plan.

The LGC itself provides that it will take effect on 1 January 1992, after its complete publication in at least one newspaper of general circulation (Sec. 536). It, however, also provides that the national agencies or offices concerned shall devolve to LGUs the responsibility for the provision of basic services and facilities enumerated in Sec. 17 within six months after the LGC's effectivity. This will span the period from January to June 1992.

Furthermore, regional offices of national agencies or offices whose functions are devolved to LGUs as provided, shall be phased out within one year from the approval of LGC. These national agencies and offices, however, may establish such field units as may be necessary for monitoring purposes and provide technical assistance to them. The properties, equipment and other assets of these regional offices shall be distributed to LGUs in the region in accordance with the rules and regulations issued by the Oversight Committee created by LGC (Sec. 17 [b] [4e/h]). The devolution shall include the transfer to LGUs of records, equipment, other assets and personnel of national agencies and offices corresponding to the devolved powers, functions and responsibilities. The personnel of said national agencies or offices shall be absorbed by the LGUs to which they belong or in whose areas they are assigned to the extent that this is administratively viable as determined by the Oversight Committee (Sec. 17 [b] [4i]). Within one month from the approval of LGC, the President of the Philippines is supposed to convene an Oversight Committee to formulate and issue the appropriate rules and regulations necessary for the efficient and effective implementation of the provisions. The committee shall submit its report and recommendations to the President within two months after its organization.

APPENDIX B

MONITORING AND EVALUATION SYSTEM

OBJECTIVES

1. Improve the performance of plan implementation by providing information to the LGCC and RDC as well as to line agencies/implementing units in a timely manner. Such information consists of inputs and outputs, achievement of targets within time specified and level of resources allocated. It also involves identification and analysis of problems encountered during implementation and suggesting possible solutions for action by LGCC and/or RDC.
2. Evaluate the results of plan implementation and improve future planning for CRM through measurements of effects and impacts, analysis of key factors affecting success or failure of sectoral plans, projects and activities and the evaluation of the relevance of the concepts, models or assumptions used in the light of actual performance and conditions prevailing during implementation.

ORGANIZATION AND RESPONSIBILITIES

The M&E will be lodged with the PMO's Program Planning Division. Its functions are to develop specific measurable performance indicators in consultation with concerned units; formulate reporting formats and frequency; analyze and evaluate monitoring reports submitted by implementing units; conduct field validation; identify problems affecting plan implementation and recommend solutions for appropriate decision/guidance by LGCC; and design a system for the conduct of periodic evaluations, e.g., install Project Benefit Monitoring and Evaluation systems for each major project.

PROCESS

The M&E process takes off from the benchmark surveys and studies conducted during the 1986-1988 preplanning period. Important information such as the state of the gulf's coastal resources, patterns of utilization, areas of underutilized potential as well as the socioeconomic and institutional environment prevailing are available.

The next phase involves monitoring the outputs of plan components of desired frequency. The third phase is report management, which involves the preparation and submission of plan component and plan implementation

reports. A feedback mechanism would ensure the transmission of information from implementing units to LGCC/PMO and vice versa. The implementing units can then relay the problems/issues which need to be addressed and LGCC/PMO can inform them of their decisions. This mechanism will assist in correcting deviations from the plan's goals and expected benefits.

Monitoring Levels

The plan activities will be monitored through a four-level reporting system. This framework is consistent with the organizational arrangements for the implementation of specific projects and plan components. Details of the types of reports, data sources, target users, frequencies and schedules of preparation and submission of reports shall be developed by PMO's Program Planning Division. Logical framework analysis (LogFrame) could serve as the basis for the refinement of such system.

Plan Evaluation

It is envisaged that there will be three major evaluations to be conducted, the initial one being at the end of the interim period, the second during Year 5 of implementation and the final one at the end of the seven-year planning period. The primary purpose of the initial evaluation would be to determine the following:

1. the extent to which financing or financial commitments for other components of the plan are available;
2. whether the initial results of urgent and necessary projects implemented by PMO justify their full scale implementation, and if not, suggest possible changes in the design or approach;
3. the extent and effectiveness of institutional and local organizational preparations made for eventual implementation as well as their adequacy, and possible changes or improvements, if warranted.
4. the number, results and relevance of feasibility studies undertaken.

The second evaluation will be designed to examine the initial impact of urgent and other projects implemented; determine the degree to which the plan outputs, objectives and goal have been achieved; and to the extent possible, assess the relevance and validity of the assumptions, models and concepts used in the planning process in light of actual conditions and initial lessons learned from implementation. The foregoing analyses are expected to generate recommendations so that deviations may be identified and corrective measures installed for the succeeding years of plan implementation.

The final evaluation will assess whether the planned goals, objectives and outputs have been achieved and the desired impacts generated. The assessment will be designed to determine primarily the following:

1. overall impact of the plan in terms of promoting the sustainable development of the gulf's coastal resources;
2. achievement of the plan components and respective projects in terms of reducing the pressure on the coastal resources, rehabilitation of damaged ecosystems/areas, improvement of environmental quality, effective utilization of aquaculture potential, reduced incidence of user conflicts, violations and illegal activities and the extent to which the alternative livelihood program has attracted municipal fishermen away from fishing;
3. the capacity, strength and preparedness of local organizations (government agencies, LGUs, NGOs, people's organizations, etc.) to plan, manage and protect the coastal resources in order to ensure the sustainability of efforts initiated under the plan;
4. the validity of the assumptions, theories and concepts (more specifically the CPM concept as an approach to sustainable coastal area management) used in the planning process; and
5. the important lessons learned from plan implementation to serve as guide for future work on CAM.

APPENDIX C

TOURISM DEVELOPMENT STANDARDS AND GUIDELINES

The following sections contain planning standards and guidelines for tourist development prepared under the DOT *Tourism Master Planning Project* (1991). Only sections which directly bear on the coastal zone are reproduced herein.

SITE PLANNING

Siting

The detailed Site Development Plans for each of the report areas and other proposed land uses or areas in the Framework Plan must be submitted for review, evaluation and approval by the Estate Management. Minimum setbacks between buildings must be observed. It is best that public facilities such as swimming pools, restaurants and the like are sited or located closer to the beach (observing minimum or desired setbacks) and facing it. On the other hand, accommodation facilities may be located in promontories or hills which may be some distance from the beach, but which would have panoramic views. Service facilities such as parking areas, spaces for loading and unloading goods, utility areas, staff housing and similar uses should be situated in convenient locations, but must be as unobtrusive as possible. They should be hidden from public view, and must not block the scenery of the beach and the sea.

Grading and Clearing (Site and Beaches)

Careful grading and clearing of the site must be done, making sure that special features such as hills, promontories, steep banks, cliffs, rock formations and similar landforms are not graded down, removed or flattened but rather preserved and even enhanced. The clearing of the site must also be properly supervised so that coconut and other large trees, fruit-bearing trees, flowering plants, vegetation cover and other landscape elements are not removed or even disturbed (see Landscaping and Protection of Trees below).

Beach Improvements

The beach area should be cleared of debris, seaweeds, litter and other garbage. A swimming area may be provided by clearing the identified site of rocks, dead corals, seaweeds and other unsightly or dangerous obstructions. The rest of the beach area should be left in their natural state as much as possible.

SETBACKS AND BUFFER ZONES

Buffer Zones

There shall be a minimum of 10-m buffer zone along the entire perimeter of each of the clusters or tourism zones, and around the proposed golf course site. These buffer zones shall be landscaped, provided with mounds and planted to shade trees and bushy and flowering plants, enough to serve as a visual screen of the development inside.

Setbacks

Any development along and adjacent to coastlines must respect the beach's natural function as an energy dissipation system which provides a dynamic equilibrium and thus protects the inland against storm surge, particularly during periods of rough weather. No change of the natural beach dissipation zone which can impair its protective function should be allowed.

Any regulation or change of the natural coastal environment such as construction of piers, groin and breakwaters, must be designed on the basis of a comprehensive study of the currents, flood/ebb and coral reef structure.

Designs and specifications must justify that the construction will have no negative impact on the environment. An environmental impact assessment (EIA) by an authorized body must be carried out before a construction permit can be issued. A mandatory beach front easement along all coastal areas shall be defined at 30 m from the edge of the beach zone inland perpendicular to the coastline. No permanent or temporary structures are allowed within this easement. The area shall be properly landscaped in order to prevent erosion and to serve as a buffer zone between the sea and the developments. In coastal environments where the ecosystem can tolerate such, constructions can be allowed closer to the coastline and in the transitory zone between sea and land. Construction in these areas shall require an EIA before approval.

Distances Between Structures

- For single storey units, the minimum setback should be 10 m along walls with openings; and at least 7 m along walls without openings.
- For multistorey units, the minimum setback along walls with openings should not be less than twice the height of the building measured from the ground floor line to the apex or tip of the roof; and at least 15 m along walls without openings.

Landscaping and Protection of Trees

A landscaping plan shall be prepared for the site and shall be approved by the Estate Management Group. Preference shall be given to the planting of:

- large shade trees (such as *narra, acacia, dap-dap,* etc.) along roads and footpaths, and within the buffer zone;
- coconut and other palm trees along the beach front, and either scattered or clustered within the entire site; and
- flowering bushes and plants along corridors, balconies, walkways, and scattered or clustered within the entire site to provide accents.

"Color planting" may be achieved by scheduling the flowering of trees and shrubs such that there are flowers blooming throughout the entire year. Plants and other landscaping elements may be used not only to beautify and enhance the natural character of the resort, but also to provide privacy, screen noise or serve as wind barriers. They may also be used to screen service areas, serve as boundaries or demarcation lines and provide shade along pedestrian lanes and roads. Part of the landscaping plan should be a thorough site analysis, identifying existing trees, shrubs, plants and other landscape elements that must be preserved and protected. Existing valuable vegetation should also be preserved.

Density Requirements

For ease in determining the number of rooms allowed, the concept of gross density may be followed. This would refer to the total number of rooms (double rooms) that will be allowed to be built within a given resort zone or area. The following standards may be used in arriving at the maximum number of rooms allowed in any one resort zone:

Density	Rooms/ha
High	60-80
Medium	30-45
Low	10-15

Parking

In the design of parking spaces, regular rectangular lines of parking should be avoided; landscaped cluster is preferable, with vegetation, banks and variations in level to provide shelter and screening around the park. Shade trees must be planted along the islands between parking spaces; and wheel stops must be provided for each parking space. A minimum dimension of 2.5-5 m may be observed for each parking space. Parking areas shall preferably be of concrete, gravel, and in less intensively used areas, turf is preferred over dark bituminous surfacing. One-way access should be used and parking outside the parking spaces should be made physically impossible. Parking should be located within 200-300 m (maximum of 500 m) from the tourist facilities.

Proper maintenance of facilities, grounds, beach areas and other zones must be done on a regular basis. Cleanliness and sanitation in a beach resort cannot be overemphasized.

ENVIRONMENTAL PROTECTION

Marine Habitat Protection

The coral reefs, seagrass beds and mangroves should be assessed for the purpose of delineating them into zones and uses appropriate to their character. The coral reefs, seagrass beds and mangroves in the three islands have already sustained extensive damage. There may, however, be isolated spots that are as yet damaged. These must be identified and strictly protected. Establishment owners, local associations and residents should be recruited to help guard these habitats against destructive activities (e.g., dynamite, grass raking for shells, tree cutting). The commercial selling of corals and shells and the cutting of mangrove trunks shall be prohibited. Decorations made from corals, shells and other marine products (i.e., marine turtle shells) shall likewise be prohibited.

The disposal of garbage at sea shall be prohibited. Boats, yachts, ships, seaplanes, helicopters or other seagoing crafts shall be prohibited from throwing garbage, refuse, chemicals, oil or oil slicks into the coastal waters of the island. The seagrass and mangrove community along the coast of the island shall also be protected. While the presence of seagrass and mangroves may subtract from the quality of the beaches in some areas because of rotting leaves washed ashore and the protruding roots which limit visitor movements, these plants are ecologically important as they are sources of detritus needed by certain marine organisms. They also provide protection to juvenile and small marine organisms during storms. Seagrasses and mangroves lessen the turbulence caused by storms by covering the sand with a mat of vegetation. There shall be regular monitoring of the coastal waters for pollution and contamination.

Utilities

Solid waste disposal

Solid waste shall be sorted. Biodegradable waste shall be deposited into sanitary landfill areas in the utility zone, provided this is covered by soil immediately after disposal. Nondegradable wastes shall be brought to a selected site inland and incinerated.

1. No garbage or trash shall be permitted on any lot except in closed receptacles screened from view of any adjoining lots and common areas

by a completely opaque screen which is compatible in design, color and materials with the main structures of the site. Containers must be durable, water- and rodent- proof, regularly inspected and emptied.

2. Construction of compost pits for the disposal of organic waste shall be encouraged. For this purpose, there shall be reserved 2.0 m^2 (for single units and duplexes) and 130 m^2 (for large units) of open space/ha.
3. For inorganic garbage, there shall be organized a centralized garbage disposal system. A modified landfill disposal system can be adopted. After the garbage is dumped and compacted, it should be covered immediately with a layer of soil, not less than 0.6 m in thickness.
4. The site for an inorganic garbage dump should meet the following criteria: there are no excessive winds in the area; it is well drained; slope is flat to gently rolling; soil is nonerodible; runoff does not drain into the site itself and the site is well above the water table.
5. Burning of inorganic waste in the dump should be regulated and in small amounts. Furthermore, it should be resorted to only when the wind is blowing towards a harmless direction and if the dump is very far from the populated area.
6. Sanitary landfill areas shall be at least 250 m away from any habitation.

Sewage treatment

1. The elevation of the sewage disposal system should be lower than those of shallow and deep wells.
2. The design should be based on a thorough assessment of the site for percolation rate, depth of water table, drainage and flooding characteristics.

Water supply

1. Water supply shall be designed separately for domestic use and drinking purposes.
2. The quality of water for drinking and domestic use shall strictly adhere to the requirements of sampling, testing and treatment of the Water Code of the Philippines.
3. Water pumping tests shall be conducted regularly and in accordance with proper procedures to avoid overextraction.
4. Digging of water wells shall be regulated and allowed only in accordance with the Water Code of the Philippines.

Drainage

1. Drainage for dirty water and storm water shall be provided.
2. Storm water may be drained directly into the sea. But, dirty water from laundry, dishwashing and other domestic uses shall be filtered before draining directly into the sea.

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