UNITED NATIONS ENVIRONMENT PROGRAMME

EAST ASIAN SEAS REGIONAL COORDINATING UNIT

UNEP

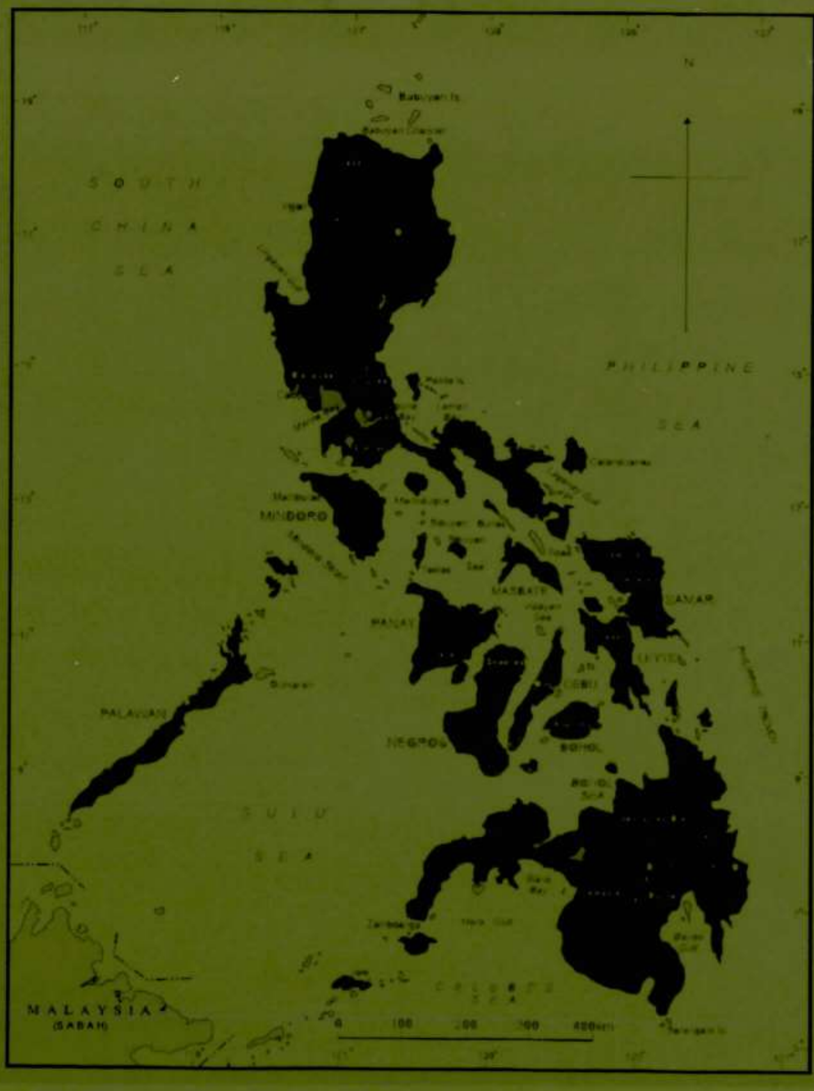
UNEP/GEF

Project Coordinating Unit

NATIONAL REPORT OF THE PHILIPPINES

on the

Formulation of a Transboundary Diagnostic Analysis and Preliminary Framework of a Strategic Action Programme for the South China Sea



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1.0 INTRODUCTION

1.1 AIM OF THE NATIONAL REPORT

This report provides a synoptic review of the state of water-related issues and problems. It seeks to characterize water-related problems in terms of the environmental stresses which accrue from pollution, freshwater shortage, over-exploitation of the aquatic resources and habitat modification. The evaluation of these problems is based on insights from the emergent spatio-temporal patterns and the processes that may have brought them about. It aims to assess the social and economic costs and the root causes of the issues and problems as the bases for deriving possible solutions in the formulation of a framework for action. The framework for action proposes changes in the perspective "that what is good business sense without sustainable development require shifts in the business as usual attitude" (for example, coming up with a functional zonation system and capacity-building for the transboundary water concerns of the country). The programmes also suggest some areas of reform especially in some of the processes in the joint participation by government and stakeholders in the identification of site specific problems and solutions. This effort is primarily an inter-agency governmental initiative of some of the national government organizations under the coordination of the Department of Environment and Natural Resources - Environmental Management Bureau (DENR-EMB).

Although the inputs are primarily written by individuals from these agencies, the importance of identifying institutional ownership and responsibilities for the proposed actions in order to deal with water-related issues and problems needs to be re-emphasized and further processed. The Philippine contribution to the transboundary diagnostic study of the East Asian Seas (EAS) region under the United Nations Environment Programme (UNEP) is part of the project development phase to establish a joint transboundary programme for possible funding by the World Bank Global Environmental Facility (WB-GEF). The report not only provides the stimulus for a joint regional undertaking but the synopsis can serve as a checklist or a sort of report card system for evaluating these water-related issues both nationally and in relation to regional and global partners. Despite the constraints in undertaking all the proposed actions, if the feedback cycle of monitoring, evaluation and adaptive action were enhanced by this study then this effort would already be a positive step forward.

1.2 MAJOR WATER-RELATED ENVIRONMENT PROBLEMS

The Philippines as a country that aspires to the status of a newly industrializing economy (NIE) by the year 2000, has to contend with the development option of how to find the proper harmony in sustaining economic growth with enhanced social development in a setting of long-term environmental health and viability. To date, this seems to be an elusive goal since most of the issues of pollution, freshwater shortage, over-exploitation of aquatic resources and habitat modification have worsened in many areas of the country (Aliño 1997, unpublished). In addition, the question can be addressed as to how environmental resources can be allocated to provide sufficient benefits and responsibilities to the local people and the nation so that a realistic response to the regional and global community can be envisioned.

The root causes of the issues and problems related to the water environment can be both systemic (for example, common property rights and zoning) and issue specific (such as environmental impact assessments (EIA) and the water code as it relates to pollution). Thus, the options for their appropriate solutions require an integrated approach which facilitates coordinated action rather than overemphasizes sectoral concerns. At the same time, the appropriateness of these actions recognizes the specificity of both the local and national concerns together with the general and specific relevance to the issues at hand. This means that clearly defined roles and responsibilities should be established so that improved coordination is facilitated.

Water-related issues pertaining to impacts on the environment and its resources are primarily under the mandate of the Department of Environment and Natural Resources (DENR) and the Department of Agriculture (DA) especially the DA-Bureau of Fisheries and Aquatic Resources (DA-BFAR). Unfortunately, there is a considerable chasm in coordinating the efforts of both institutions. In addition, concerns on freshwater utilization are in most respects under the National Water Regulatory Board (NWRB) under the Department of Public Works and Highways (DPWH) which is often quite inadequate to deal with issues related to the environment such as watershed management and resource extraction. Nevertheless, the constraints exhibited within national government organizations have been more than overcome by the laudable initiatives of local governments (for example, Palawan) and non-governmental organizations (NGOs).

Some crucial information is derived from sources: (a) Deocadiz (1997) for issues relating to pollution; (b) Jacinto and Gervacio (1997) review of ongoing projects and programmes on the coastal and marine environment; (c) JICA study (1997) on ground and surface water sources; (d) DENR marine affairs and policy; and (e) PCSD (1997) Action Plan for Philippine Agenda 21 for sustainable development.

1.3 COUNTRY BACKGROUND

The Philippines is considered part of the centre of marine biodiversity found in the Indo-West Pacific region. Around two thirds of its population of around 70 million Filipinos live within the coastal zone (Chua 1997). An annual population growth rate of around 2.3 per cent which is largely dependent on fish as the main protein source suggests that fish production requirements would reach 2.7 million metric tons by the year 2010 (Bernaesck 1996). These estimates indicate that increased pressures on the path of upstream sources and downstream receptors of water-related environmental concerns will need urgent proactive action. Nevertheless, a considerable increase has been gained to date in the enlightenment of Filipinos, resulting from the seminal inflow of environmental consciousness in the early 1980s. This provides an opportunity not only for a paradigm shift in the views towards improved environmental management in general but also a positive movement especially in the integrated coastal zone management (ICZM) arena (see also Chua 1977). Aside from the wealth of expertise on matters of ICZM in the Philippines, its experience in community based coastal resources management (CBCRM) has been exemplary (OECF 1997). Based on the identification of the strengths and weaknesses found in the history of the Philippine environmental movement and the government policies for environmental management, there is cause for optimism.

This optimism holds despite the dire condition projected for the Philippines against the odds for the coming year as a consequence of the financial crisis starting in 1997. The Philippine situation should be taken as a lesson to be more conservative in making unsustainable economic projections and that "sound economic fundamentals" require sound environmental fundamentals (Montes 1994). This principle of wise use to be sustained for the longer term and the equitable allocation of the resources can be considered as inherent aspects in the evaluation of the water-related issues/problems, their causes and options for enhanced management. Much of the country's development is the result of the processes the country has taken in response to the socio-economic and biophysical forces of its history.

The country exhibits a north-south and east-west gradient, both as a result of the north-east and south-west monsoons and the influence of the Spanish and American colonial experience. Historically, the country developed in the northern main island of Luzon where the national capital was established in the Spanish period. The past resistance of the Muslim communities in the southern island of Mindanao to the predominantly catholic national government has often marginalized this region. In the central region of the Visayan islands, the maritime and fishing industries have developed owing to its strategic position as a trading centre and the traditional fishing affinity of island communities. The influence of typhoons has also affected the social development of various regions, as seen in the northern Batanes and eastern parts of the country such as the Isabela, Aurora, Bicol and Samar areas which have been less accessible to past national development pushes.

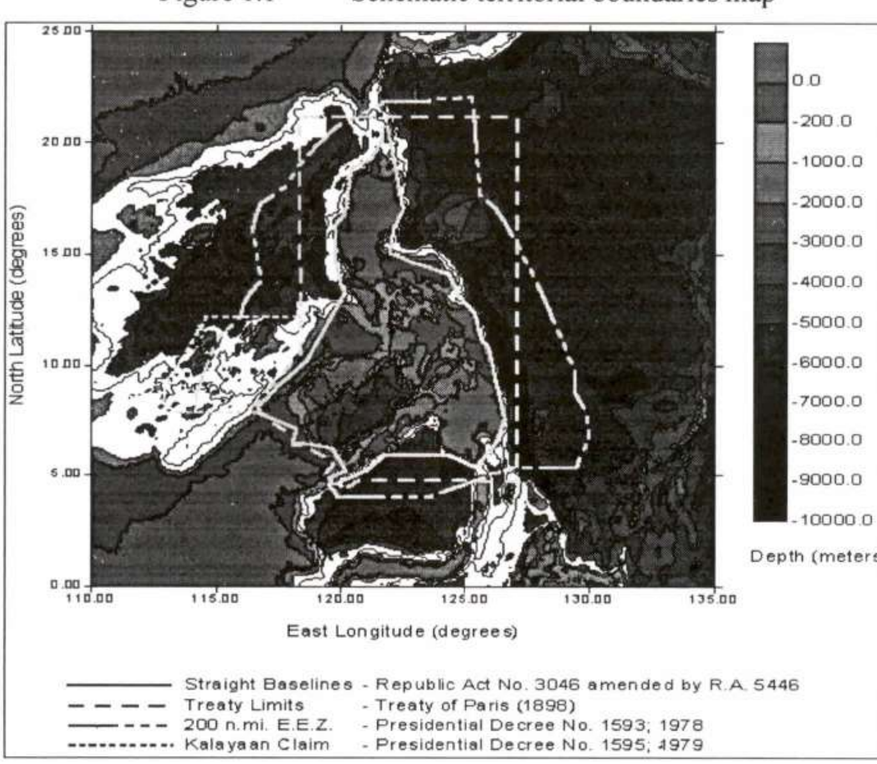
The geological development of the archipelago has resulted in both distinct biotic distributions, economic and socio-cultural development. The archipelago's position in the north-eastern flank of the South China Sea not only serves as a buffer to the typhoons and the influences of the Kuroshio currents but it is critical in the consideration of its national and transboundary context in coping with pollution and biodiversity issues.

1.4 GEOGRAPHIC DIVISIONS USED IN THE ANALYSIS

The archipelago, composed of over 7,000 islands, is bounded by the Batanes region in the north and the Palawan region in the south-west area (figure 1.1). Two main categories for classifying geographic divisions are used in this study: one based on the political jurisdictions (15 regions) of the national government agencies and the other based on a biogeographic perspective (six to seven zones identified by Aliño and Gomez 1994 and Hayden and others 1984). Merging the two geographic classification schemes is pragmatic in order to provide the functional context, taking into consideration the processes involved in the interactions of human society and its biophysical environment.

In practice, it involves moving the government polity together with the community in the institutionalization and implementation of actions in a biophysical setting which is dynamic in its ecological and evolutionary nature. Some of the issues are: (a) the relevance of the programmatic environment impact assessments (EIA) to the regional industrial centres (RIC); (b) the problems of coping with the territorial jurisdictions of municipal and commercial fisheries; (c) the matching of the scales of management regimes for marine ecosystems such as in the large marine ecosystem concept utilized in the establishment of the Sulu and the Celebes Sea Commission; (d) the transboundary treaty with Malaysia and the Philippines for the joint marine protected area management of the Turtle Islands; and (e) the establishment of an area of peace and prosperity in the dangerous grounds area of the South China Sea.

Figure 1.1 Schematic territorial boundaries map



2.0 DETAILED ANALYSIS OF MAJOR WATER-RELATED CONCERNS AND PRINCIPAL ISSUES

The archipelagic nature of the Philippines provides some general features in its land and sea interaction. Its effect in the South China Sea is predominantly the landward influences to the sea coming from the western sections of the country. Specifically these areas would be from the north and south-western sectors of Luzon and western Palawan. Aside from its buffering effect on the influence of the Pacific north equatorial current, the circulation of the inland waters has a great influence on the fisheries productivity and movement of the straddling and shared stocks of the country. Interrelated concerns are inherent in the fluid nature of the water medium aside from the highly mobile attributes of its associated resources. For example, pollution in a water body not only affects the biota of the ecosystem but can also modify the carrying capacity in the fisheries exploitation levels and effect habitat changes or modification (for example, eutrophication from impoundment and reclamation in bays).

2.1 POLLUTION

2.1.1 Sources of pollution

2.1.1.1 Rivers

The status of the various river basins according to their classification shows that they do not exceed acceptable criteria, but it is well known that the Pasig River basin is well beyond acceptable limits. The river basin area that drains into the Lingayen Gulf and Batangas Bay as of the moment may still be within acceptable levels but it is expected to experience greater vulnerability in the future.

2.1.1.2 Coastal cities and coastal populations

As noted by Deocadiz (1997), 70 per cent of the country's population is found in coastal cities (figure 2.1). An ongoing collaborative study by the World Resources Institute (WRI) with the International Centre for Living Aquatic Resource Management (ICLARM) and others uses the geographic information system (GIS) analytical tools together with expert validation of decision rules to highlight areas where reefs are at risk from coastal development (including pollution and maritime transport), siltation and overfishing. Some of the criteria set for decision rules propose a potential area of impact depending on the area of influence as related to proximity to population centres. The synoptic map is utilized to obtain some first approximations of the general priority areas considered relevant to the South China Sea and the country report. The primary pollution concerns relevant to coastal populations is sewage and solid waste disposal. Sewage affects BOD levels and reduces system carrying capacity. Around 34,307 tons of solid wastes are produced daily of which 62 per cent are collected (table 2.1). Around 72 per cent of what is collected is being dumped in open dumpsites while the rest is either recycled by scavengers or dumped in waterways. Deocadiz (1997) estimates that the main contributors for solid wastes are from residential areas (50 per cent), street sweepings (19 per cent) and markets (11 per cent).

Figure 2.1 Coastal populations and regional industrial centres (RIC)

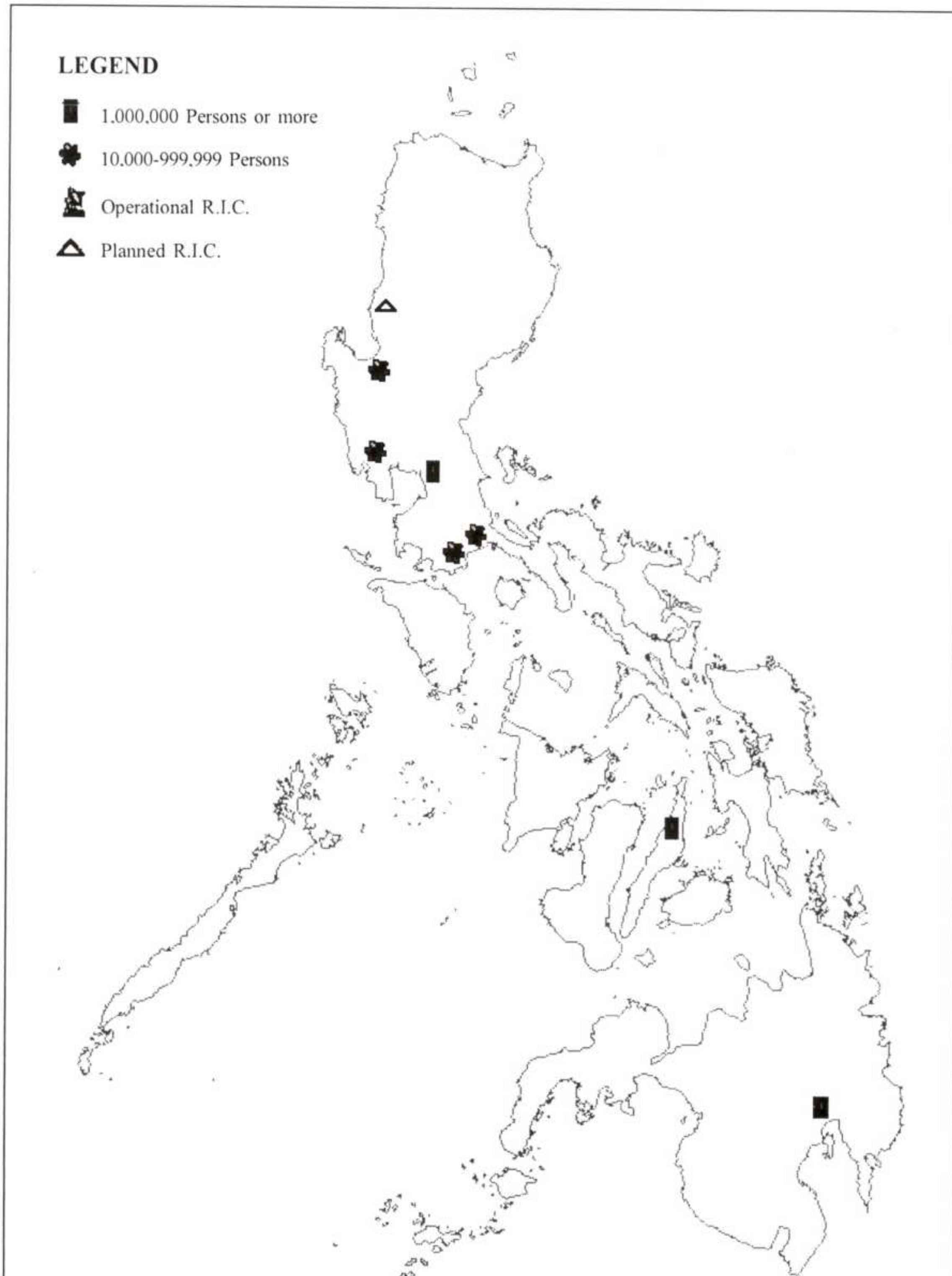


Table 2.1 Estimated daily solid waste generation in the Philippines

1989	
Per capita daily rate	0.46 kg
Population, millions	64.90
Daily quantity, tonnes	29,854
Daily quantity in coastal areas, tonnes	20,898
1995	
Per capita daily rate	0.50 kg
Population, millions	68.6
Daily quantity, tonnes	34,307
Daily quantity in coastal areas, tonnes	24,015
2000	
Per capita daily rate	0.60 kg
Population, millions	85.50
Daily quantity, tonnes	51,300
Daily quantity in coastal areas, tonnes	35,910

Source: Deocadiz 1997.

Table 2.2 Average composition of solid waste in the Philippines

Component	% By weight
Yard and field waste	33.5
Fines and inerts	12.9
Wood	11.5
Food waste	11.0
Paper and cardboard	10.2
Plastic and petroleum Prod.	9.8
Textiles	4.1
Metals	3.3
Glass	1.9
Leather and rubber	1.8
Total	100

Source: Adopted from Deocadiz 1997 citation of Consoer and others (1988).

Table 2.3 Income levels and the physical character of waste (percentage by weight)

	Residential	Area income	Level
Waste component	Low (%)	Medium (%)	High (%)
Paper	6.26	9.04	7.56
Cardboard	2.67	3.82	2.77
Food and kitchen waste	8.35	11.38	10.16
Plastic	13.50	8.86	5.60
Textiles	8.39	3.12	2.85
Rubber and leather	3.13	1.88	1.06
Petroleum products	0.01	0.01	3.73
Yard and field wastes	24.42	29.37	37.50
Wood	7.66	11.74	13.12
Fines	13.43	9.87	7.61
Metals	3.64	4.73	2.51
Glass	2.58	2.55	1.84
Inerts	5.97	3.86	3.22
Total	100.01	100.23	99.53

Source: Adopted from Deocadiz 1997 citation of Consoer and others (1988)

2.1.1.3 Industrial pollution from coastal installations

Decocadiz (1997) reports that of the 11,005 manufacturing establishments in the country more than half are found in Metro Manila. Of the 10,466 establishments which employ more than 10 people, around 47 per cent are found in Metro Manila manufacturing food (24 per cent), wearing apparel except footwear (16 per cent), publishing industries and allied industries (6 per cent), textiles (5 per cent) and fabricated metals (5 per cent).

2.1.1.4 Discharge from upland and lowland based activities, by sector

Table 2.4 Estimated THW arising by industry sector in Metro Manila, Region 3 and 4

PSIC CODE	Sector	THW (Te/y)	Arisings (%)
12	Agriculture	4	0
21	Mining	327	0
31	Food and Drink	40829	17
32	Textile	40143	17
33	Wood	1968	1
34	Paper	3816	2
35	Chemicals	48929	21
36	Non-Metallics	15629	7
37	Basic Metals	11809	5
38	Engineering	17642	8
39	Other Manufacturing	5862	3
40	Power Generation	10130	4
60	Distribution	78	0
70	Transport	24	0
973	-	411	0
	Healthcare	18000	8
	Construction	5000	2
	Municipal sludges	5000	2
	Municipal solids	6000	3
	Total	**231601**	**100**

Source: Deocadiz 1997; data were adopted from Entec Europe Ltd and others 1996.

2.1.1.5 Ports, harbours and maritime transport

One of the ways to evaluate the potential risks from port and harbour activities utilized by the project of the World Resources Institute was to set up a risk criteria classification for reefs based on high or medium risk as follows:

(a) High risk areas are those within 20 km of a port and within 20 km of an oil rig;

(b) Medium risk areas are those within 20-100 km of a port and in congested shipping areas based on the known shipping routes and narrowness of the passage.

This exercise (WRI and others 1998 ongoing) can serve as an initial indicator for this study since reefs are among one of the most sensitive and valuable habitats in the marine environment. Nevertheless other sites without reefs and with less relevance to the South China Sea transboundary site are important but are not considered for this report. The highest risk areas considered are located in: Manila Bay, Subic Bay, Batangas Bay and Puerto Galera Bay whereas the medium risk areas are the areas in Bacuit Bay and the Malampaya Shell - Oxy exploration site. Note should be taken of the internal waters in the Mindoro Strait area which are considered at medium risk and similar narrow passage ways in the central and eastern Visayas.

Despite the low risk from maritime and harbour activities for the Spratlys (known as the Kalayaan Island Group [KIG]) in the Phippines), one may consider this a sensitive area considering the high level of shipping activity and the potential conflicts which may arise from the conflicting claims to the area.

2.1.1.6 Seabed exploration

In the Philippines, the only area with a potential offshore seabed development at the moment is located around 50 kilometres from the north-west Palawan area. Initial environmental impact studies on the development of an underwater gas pipeline from the Palawan offshore site crossing towards the Mindoro Straits into Batangas Bay and Bataan suggests some possible areas of concern. A possible oil blow-out in these areas may threaten the environmentally critical areas of north-west Palawan within five days of a major oil spill in the area. On the other hand these prospects may be remote and the development activities at the moment concentrate on gas development.

2.1.1.7 Marine dumping

As mentioned in the previous accounts, Manila Bay has the highest impacts experienced from marine dumping. Large fishkills and red tide occurrences have been attributed to toxic waste dumping, domestic sewage and pollution from the factories around the bay. Relevant to the South China Sea are the areas of Batangas Bay and Puerto Galera which are moving towards a medium to high risk condition. Frequent anecdotal accounts of garbage being dumped in these routes are cause for concern. The fishing and maritime trade activities in these areas have also a considerable link to shipping activity in the dangerous ground areas of the South China Sea.

In addition, Subic Bay, Zambales which has accelerated its shipping activity and link to Manila Bay is the next most important area for land-based influences in the marine environment.

2.1.1.8 Atmospheric inputs to the aquatic environment

Atmospheric inputs to the aquatic environment have often been attributed to some industries and natural catastrophic events. Only the Calaca coalfired plant in Batangas might be considered to have affected the South China Sea through atmospheric inputs (attributed to human activity).

The Mt. Pinatubo eruption in June 1992 shows that the world's atmospheric condition has been affected, aside from direct ashfall coming from the eruption itself. Initial estimates of annual fisheries losses for that period are around $0.5 million (Ochavillo and others 1992).

2.1.2 Pollution hot spots

Pollution hot spots derived from areas considered to be regional growth centres and where there have been incidences of red tide suggest that the pollution hot spots which have primary importance to the South China Sea are the following: (a) Manila Bay and the Calabarzon area; (b) the Zambales area where the Subic Bay free port is located; and (c) the Mindoro Straits where Batangas Bay and Puerto Galera Bay interact (figure 2.2). Important protection buffers should be considered between the Lubang areas, Mindoro and the Balayan Bay and Batangas areas (i.e., the Verde Island Passage areas).

In addition, the inputs from mining activities in the Agno and Viñas river basins into Lingayen Gulf have primarily localized effects. Initial indications of interaction among their highly migratory fish species with the South China Sea is seen in some genetic affinities of the gulf and those from Zambales coast and northward in the Curimao area (Ochavillo personal communication).

2.1.3 Sensitive and high risk areas

Areas with red tide occurrences are considered high-risk areas (figure 2.3). The highest occurrence of red tide is in Manila Bay with only occasional and localized records in the Masinloc, Zambales area. Other areas are more eastward and found in constricted passages in the Visayas region. Although only in the initial stages, oil and gas development is ongoing in the Malampaya and Camago field areas off north-west Palawan. Potential conflicts in the South China Sea, especially in the Spratlys, could create a high-risk situation owing to the presence of a considerable number of military installations from the claimant countries.

Sensitive areas have high fisheries and ecological values and functions. These priority areas in relation to the South China Sea are: the North-western Palawan areas especially Bacuit Bay and the Mindoro Straits (including Apo reef) since they are known passage ways and spawning areas of endangered species and important fisheries stocks (for example, tuna and groupers or "lapu-lapu"). In addition proposals for marine protection for nesting areas of marine turtles and seabirds have been proposed in the Spratlys Islands and the Batanes Islands biogeographic zone.

Radioactive waste dumping areas have not been documented for the area although proposals for consideration have been made to the Philippine Government.

2.2 FRESHWATER SHORTAGE AND THE DEGRADATION OF ITS QUALITY

2.2.1 Surface water

2.2.1.1 Sources of surface water and current status

Table 2.5 shows the classification of the main freshwater bodies in the Philippines, according to the standards of DENR. In general the JICA (1997) study suggests that even with half of the areas still having an AA or A classification, areas around Metro Manila show considerable problems from contamination of domestic, industrial and agricultural effluents. The rivers, which were vigorously monitored, were the Pasig River, Marikina River, and the Tullahan-Tenejeros River. Aside from the pollution related problems, soil erosion and deforestation are considered the most important concerns in sustaining surface water supply and its quality.

Figure 2.2 Pollution hot spots, sensitive and vulnerable areas

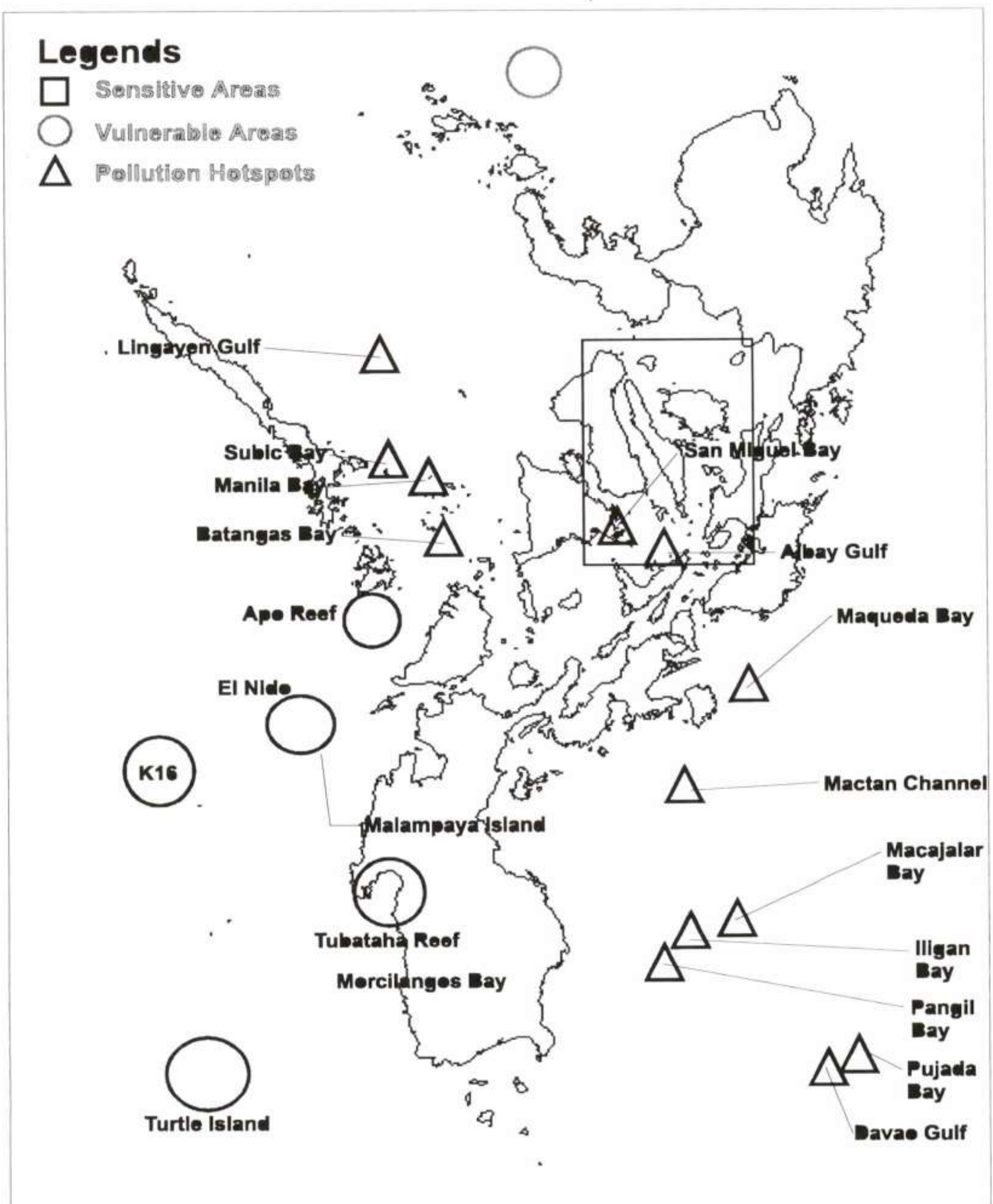


Figure 2.3 Pollution high risk areas

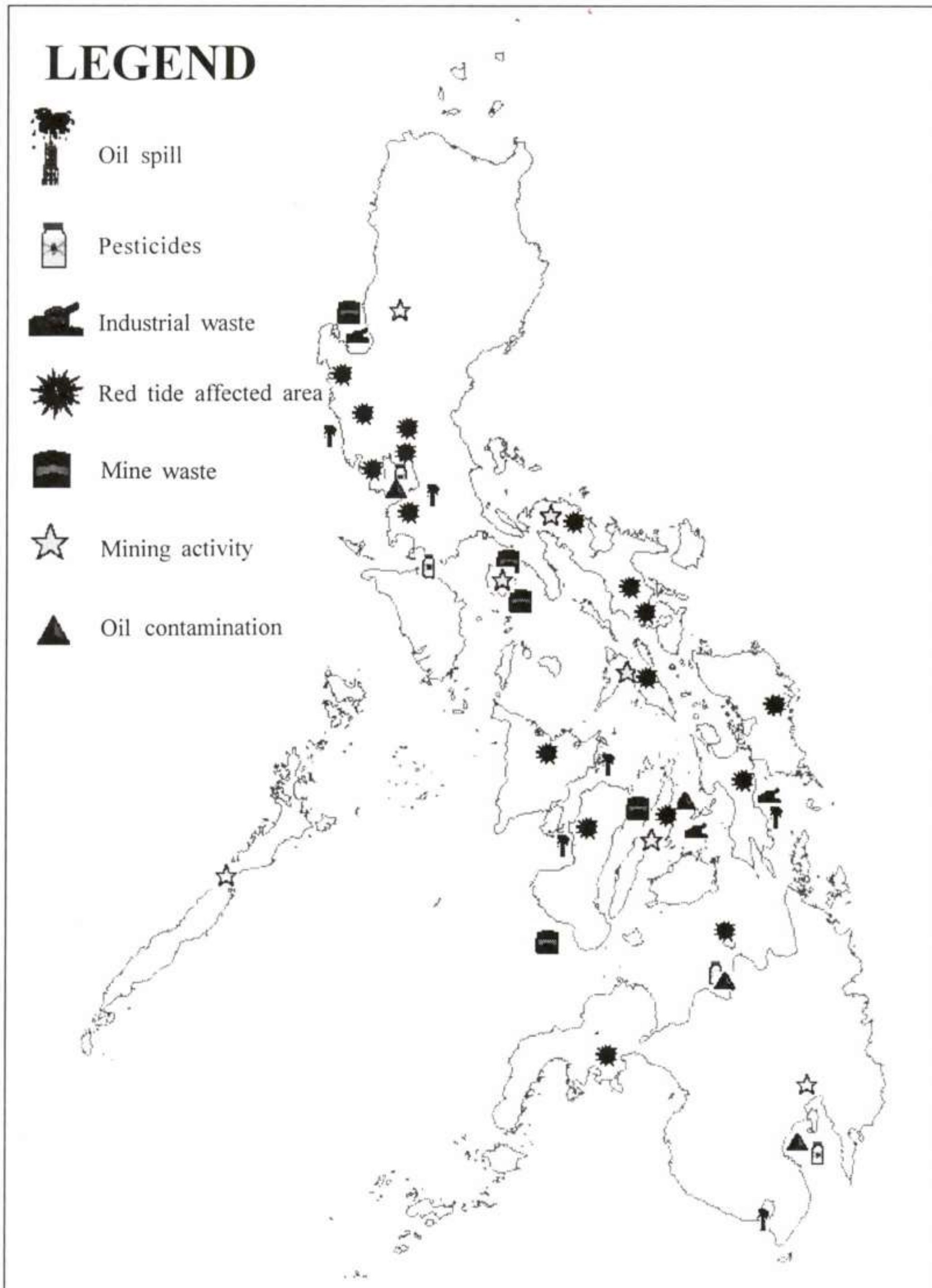


Table 2.5 Classification and use criteria of fresh surface waters

Classification	Beneficial use
Class AA	**Public Water Supply Class I**. Waters having watersheds which are uninhabited and otherwise protected and which require only approved disinfection in order to meet the National Standards for Drinking Waters (NSDW) of the Philippines.
Class A	**Public Water Supply II**. Sources of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the NSDW.
Class B	**Recreational Water Class I**. Waters for primary contact recreation such as bathing, swimming, skin diving etc. particularly those designated for tourism purposes.
Class C	1. **Fishery Water** for the propagation and growth of fish and other aquatic resources. 2. **Recreational Water Class II** (Boating etc.) 3. **Industrial Water Supply Class I** (for manufacturingprocesses after treatment)
Class D	1. For agriculture, irrigation, livestock watering etc. 2. **Industrial Water Supply Class II** (e.g. cooling) 3. Other inland waters, by their quality, belong to this classification

Source: Department of Environment and Natural Resources.

Table 2.6 Classification and use criteria of coastal and marine waters by the Department of Environment and Natural Resources (DENR)

Classification	Beneficial use
Class SA	1) Waters suitable for the propagation, survival and harvesting of shell fish for commercial purposes. 2) Tourist zones and national marine parks and reserves established under Presidential Proclamation No. **1801** existing laws and/or declared as such by the appropriate government agency. 3) Coral reef parks and reserves designed by law and concerned authorities.
Class SB	1) **Recreational Water Class I** (Areas regularly used by the public for bathing, swimming, skindiving etc.) 2) **Fishery Water Class I** (Spawning areas for Chanos chanos or Bangus and similar species)
Class SC	1) **Recreational Water Class II** (e.g. boating) 2) **Fishery Water Class II** (Commercial and sustenance fishing) 3) Marshy and/or mangrove areas declared as fish and wildlife sanctuaries.
Class SD	1) **Industrial Water Supply Class II** (e.g. cooling) 2) Other coastal and marine waters, by their quality, belong to this classification.

Source: Department of Environment and Natural Resources.

In addition, Laguna Lake, which is presently under the jurisdiction of the Laguna Lake Development Authority, has been considered a possible water source for the Calabarzon area. Some considerable drawbacks have been pointed out for Laguna Lake mainly: (a) the problem of eutrophication and pollution, and (b) costs in pumping water to Metro Manila might not be feasible since the level of the intake is low. As a result of the alarming rate of deforestation (2 per cent a year from 1990 to 1994), and despite considerable conservation efforts, an additional nine (from the original 99) watershed areas were established in 1994. Around 1.4 million hectares were proclaimed watershed forest reserves. A list of the reserves of from the Parks and Wildlife Bureau of the Department of Environment and Natural Resources (PAWB-DENR),which includes some noteworthy species, is available in the JICA (1997) report.

2.2.1.2 Water demand by sector

The total municipal and industrial water demand for Metro Manila, which is supplied from surface water, is estimated to reach 72 m^3 per sec in 2025. Around 25 m^3 per sec in the vicinity of Metro Manila is needed. This may come after the completion of the Umiray Angat trans-basin project. The following are alternative surface water sources which are being considered for further development: (a) Marikina river basin (Wawa dam); (b) Kaliwa river basin (Laiban dam); (c) Kanan river basin (Kanan dam); (d) Umiray river basin (under construction); and (e) Pampanga river basin (Ring Dike around the Candaba swamp).

2.2.1.3 Impact areas for shortage or low quality surface water

An assessment of the water resources potential in each water resources region (WRR) using a water balance study (JICA 1997, sec. H) was undertaken, the total water resources potential being derived from the sum of the groundwater and surface water.

This study suggests that the discharges of 80 per cent firmness in river basins of Luzon island are small compared with those of Mindanao. Mindanao seems to have sufficient supply owing to its more favourable climatic conditions. Surface waters in Luzon might also be affected by irrigation diversion in the upstream areas. Agricultural water will still be dominant in 2025 in most of the WWR except in Metro Manila where a large part of the supply will be utilized by the municipal and industrial demand. As mentioned earlier, it is suggested that Metro Manila will have a severe water deficit by the year 2025 unless additional water sources are tapped.

2.2.1.4 Causes of issues and problems including sectoral demands and market failures

The unabated extraction of groundwater resources and the pollution of surface water seem to continue and are aggravated by the disequilibrium in investment in the sector and the rapid growth of the population (JICA 1997).

There exists a very fragmented approach by the regulatory government agencies. Private sector participation needs stimulating. In addition, there is a need to clarify ownership of water districts and to define where the proceeds of privatization will accrue once a water district is privatized.

2.2.1.5 Impacts and global changes

As seen in the El Niño vulnerability maps, the western sector of the country is most susceptible to drought conditions.

2.2.1.6 Proposed interventions and sustainable rates of extraction

Most of the proposed interventions in the surface water use are geared to:

(a) Improving policies, laws and institutional arrangements such as the establishment of a super body to upgrade the National Water Regulatory Board;
(b) Establishing and implementing a master plan to integrate the various uses such as irrigation, watershed management, inland fishery, flood control, power generation and domestic water supply;
(c) Establishing and implementing the Small Water Impounding Management (SWIM) project;
(d) Coordinating watershed management programmes for water resources development;
(e) Rationalizing the privatization process especially water pricing and water rights allocation.

2.2.2 Groundwater

Freshwater resources have been classified as surface water and groundwater resources. Present conditions suggest that groundwater resources grants occupy around 3.4 per cent of freshwater use. Of these water resources grants, around 92 per cent is consumed by the irrigation sector while the municipal (3.5 per cent), industrial (3.1 per cent) and others (1.5 per cent) occupy a small percentage (JICA 1997).

2.2.2.1 Groundwater aquifers and current status

Figure 2.4 shows a map of the groundwater aquifers and their status as of 1997. In Luzon, groundwater is utilized in a greater proportion than surface water while in the Visayas and Mindanao surface water is mainly utilized (JICA 1997).

2.2.2.2 Demand for its use (by sector)

(a) For level III (water districts supply system), 85.9 per cent use groundwater. Most of this production comes from wells rather than from springs. Around 560 Mecum/yr is produced from groundwater for domestic use (Level III) (JICA 1997).

(b) Level I (areas outside level III with parts from rural and urban areas) groundwater production is around 159.3 Mecum/yr with Central Luzon (42.4 Mecum/yr) and Metro Manila (31.2 Mecum/yr) as the highest consumers of domestic water (level I) (JICA 1977).

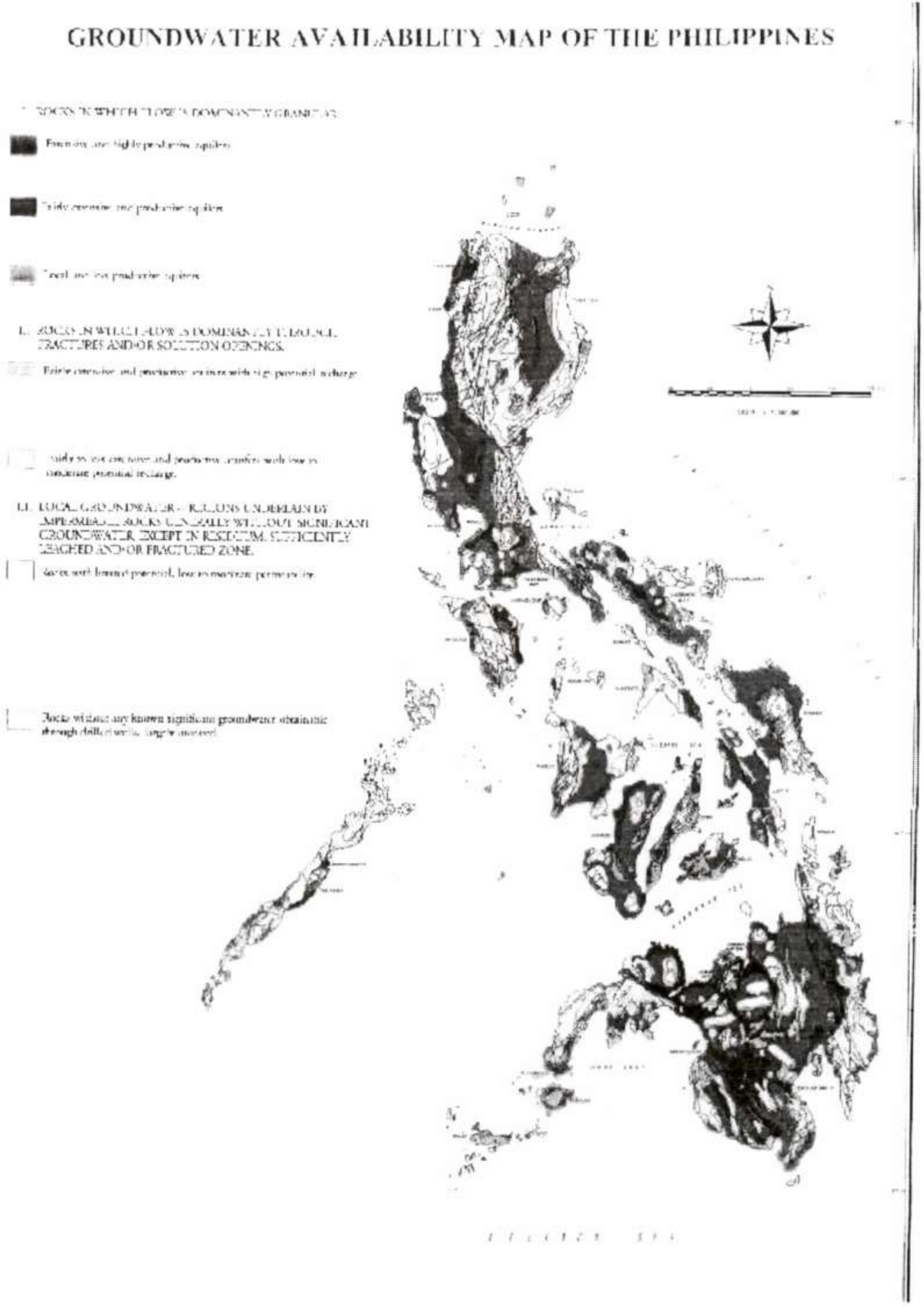
(c) Level II water supply systems (communal faucet systems, barangay level water supply) produce a total of groundwater production of 57.4 Mecum/yr with Metro Manila (11.3 Mecum/yr) and Central Luzon (7.0 Mecum/yr) as the highest consumers (JICA 1977).

2.2.2.3 Impact areas of groundwater shortage and low quality groundwater

The groundwater potentials of the WRR have been calculated based on their relative surface area, hydrogeology and the amount of precipitation they receive.

Based on the land-use patterns in these areas and a recharge rate based on around 5 per cent of their annual precipitation volume, the impacts of water shortage have been estimated for the WRR/provinces. This is tabulated in table C5 - C7 of the JICA (1997) report. It was also pointed out that urban development reduces groundwater recharge because of the reduction in the porosity of surface areas owing to covering by concrete, asphalt and other non-porous material.

Figure 2.4 Groundwater map of the Philippines



According to the Metropolitan Waterworks and Sewerage System (MWSS) as of 1995 out of the 265 wells they owned 156 (58.9 per cent) were abandoned because of saline water intrusion, lowered water levels or deterioration of the facilities (JICA 1997).

In the JICA report, table G7 shows that the projected water shortages and saline water intrusion are related to the projected economic growth scenarios. The coastal areas of Metro Manila have an estimated 1086 per cent demand/recharge ratio and Batangas 226 per cent. The projected shortage of level III supply systems and saline water intrusion are expected by the year 2025 for Metro Manila, Zambales, Oriental Mindoro and Palawan (JICA 1997).

2.2.2.4 Causes of issues and problems including sectoral demands and market failures

Similar to the surface water situation, the causes of the issues and problems are primarily socially induced, such as the following:

(a) No comprehensive water resources management plan;
(b) Ineffective coordination of water resources management;
(c) No clear basis for appropriating water grant amounts;
(d) Inadequate measures and capacity to regulate users of water facilities;
(e) Groundwater pollution and saline intrusion has been attributed to over-exploitation of groundwater because of the above constraints.

2.2.2.5 Impacts of global change

Please see the El Niño vulnerability map (figure 2.5) to gauge how global changes affect the Philippines.

2.2.2.6 Proposed interventions for sustainable rates of extraction

(a) Establish a Groundwater Resources Development Plan (GRDP)

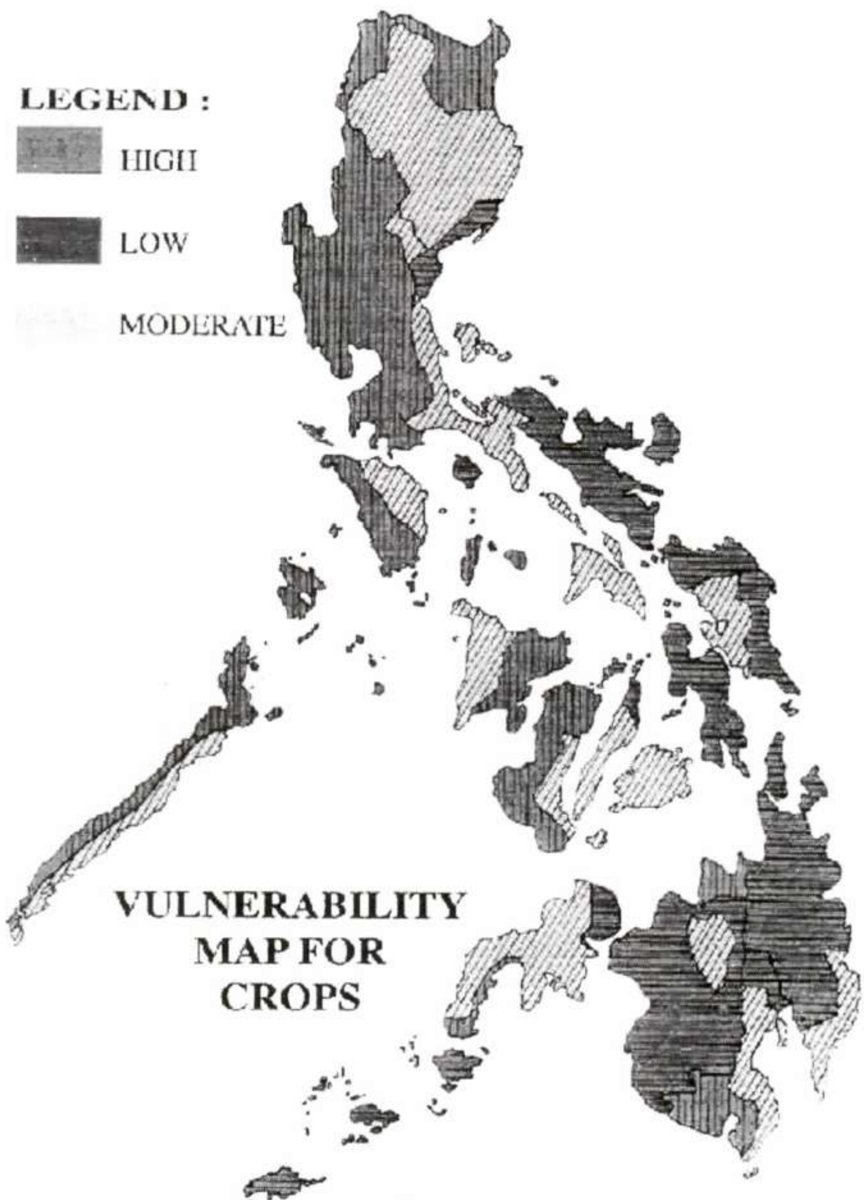
(b) Prioritize projects according to needs: (i) Metro Manila and outskirts, (ii) Central Luzon plain area, and (iii) provincial cities water supply (water districts)

(c) More detailed groundwater balance study to be undertaken in the groundwater shortage areas (JICA 1997).

In general, it is reiterated that:

(a) The creation of a "super" regulatory body be established;
(b) The National Water Regulatory Board be strengthened as an interim measure;
(c) An independent regulatory body be established especially in the arbitration of water rights;
(d) Incentives for private sector participation to develop water resources with adequate safety nets to safeguard the public and the water resources be provided.

Figure 2.5 El Niño vulnerability map for the Philippines



2.3 EXPLOITATION OF LIVING AQUATIC RESOURCES

2.3.1 Living freshwater resources

2.3.1.1 Status: productivity, catch levels, fishing pressure

Municipal inland production contributes only around 7 per cent (186,760 tons in 1996) of the total fisheries production in the country (JICA 1997). Most of the evaluation of the exploitation of freshwater resources was based on the medium term fisheries management and development programme for the period 1993 - 1998. It mainly concentrates on aquaculture productivity targets to be set at around 156,910 hectares for fishpond areas. The projected fishpond area of 340,300 hectares was estimated based on socio-economic projection targets.

The estimated water demand for aquaculture has doubled in recent years. This is nearly half the quantity for what would be needed for irrigation and a little over five times what is needed for poultry and livestock for same period (2025).

The introduction of six species of tilapia and nine hybrid tilapia needs to be monitored and evaluated. Through the Genetically Improved Female Tilapia (GIFT) - the production of YY tilapias may improve fish yields in inland fishponds and cages and provide a cheap source of protein.

2.3.1.2 Endangered/transboundary/migratory species

Of the 21 fish species reported by Conlu (1986) at least three endemic species have been noted: Harengula tawilis in Taal Lake, Mistichthys luzonensis, a goby which has been considered the smallest fish in the world and is found only in Lake Bato, Lake Buhi and Manapao, and Camarines and Pandaca pygmaea found only in the Navotas and Malabon Rivers (McManus 1997).

2.3.1.3 Major problems/issues

(a) Introduced species may outcompete endemic and native species;
(b) Groundwater extraction and other competing uses may affect the viability of fishpond production;
(c) Pollution of aquifers and saline water intrusion needs to be addressed especially in coastal areas.

2.3.1.4 Economic losses because of over-exploitation

Undetermined but anecdotal accounts of fishkills and localized loss of native species have been reported for some areas.

2.3.1.5 Causes including sectoral demands and failures and internal and external market demands

The causes of the increase in freshwater loadings including sectoral demands (internal and external market demands) and failures are the following:

(a) Increased demand in aquaculture for higher value fish products;
(b) Increased population and human settlements that have resulted in greater demand for water-use and associated resources;
(c) Aquaculture exports.

2.3.1.6 Impacts of global change

Although no unequivocal evidence has been shown in terms of the effects of global change in the productivity of marine fisheries resources, some anecdotal accounts of lowered production levels may be surmised from the 1997 El Niño year. In Bolinao, Pangasinan where the University of the Philippines Marine Sciences Institute (UPMSI) has been doing some fisheries catch monitoring in the area, a considerable decrease has been observed (at least three to four times lower in 1997 than in the early 1990s) in reef fisheries and milkfish fry caught in the estuarine area. This decrease may not be fully attributed to effects of overfishing alone since the possible increase in fishing effort may not be able to account for this drastically reduced catch. The low estimates may also be the cause for the low estimates (i.e., based on an underwater fish visual census) seen in the Spratly Islands as compared with those of past cursory records in the area. Yap and Gomez (1989) have suggested that the higher mortality and bleaching of some corals being monitored in 1982-83 may be attributed to the elevated sea water temperatures in the Bolinao reef flats. Perhaps, with longer time series monitoring and retrospective analyses of standard fish catch per unit effort and non-fishery dependent aquatic resources estimates, the effects of human induced reduction of aquatic resources vis-à-vis global impacts will be clearer.

2.3.1.7 Proposed interventions

(a) Expand water classification from criteria based only on beneficial human use to include ecosystem functional use;

(b) Implement integrated strategic action plan for freshwater ecosystem management and fisheries management;

(c) Prioritize proposed researches into indigenous species and find mechanisms for their enhancement and conservation.

2.3.2 Living marine resources

Living marine resources include all living plants and animals found in the marine waters, which extend from the coastal to the offshore areas of the archipelago. The major ecosystems bordering the coastline represented by the highly productive mangrove swamps/forest, seagrass beds and coral reefs are examples of thriving communities which serve as breeding areas and habitat of fishes and other vertebrates, invertebrates and marine plants. These ecosystems also support endangered and threatened marine life such as marine turtles, dugongs/sea cows and dolphins. The offshore waters support an array of both small and big pelagic species, i.e., tuna and tuna-like species, seerfishes and marine mammals such as whales and dolphins.

With the adoption of the United Nations Convention on the Law of the Sea (UNCLOS) and the extension of the maritime zone of coastal states to the additional 200-mile exclusive economic zone, the Philippine territorial waters now approximately measure 2,200,000 square kilometres with a coastal regime of 226,000 square kilometres and an oceanic regime of 1,934,000 square kilometres. The shelf area which extends to a depth of 200 metres and represents 184,620 square kilometres is where the highly productive ecosystems are found and where the bulk of fishing activities are conducted.

Noteworthy features of the coastal areas are the fringing reefs covering some 27,000-44,000 square kilometres (depending on the depth contour used, which is between 10-40 fathoms) which border the country's 18,417 kilometre coastline. Coral reefs are concentrated in the following areas: Palawan group of islands (37.86 per cent), Sulu archipelago (27.31 per cent), Visayas group (21.7 per cent), Northern Luzon (7.63 per cent), central and southern Mindanao (3.21 per cent), and the Turtle Islands

Group (1.74 per cent). Philippine reefs serve as a habitat to 488 species of corals under 78 genera, 971 species of benthic algae and some 2,000 species of fish. Regrettably, almost 70 per cent of the country's coral reefs are in the fair to poor condition and only about 5 per cent are in excellent condition (see also the section on habitat modification for causes of damage).

In conjunction with coral reefs are the mangrove forests which serve as nursery grounds for fishes and invertebrates. Of the estimated 500,000 hectares of mangrove cover in 1918, only about 139,725 hectares now remain. Apparently, around a third of the seagrass beds, which add to the stability of much of our shoreline and which also serve as critical habitat for many invertebrates and fish as well as endangered/threatened marine life, are estimated to have been damaged.

2.3.2.1 Status of productivity/ catch levels/fishing pressure

2.3.2.1.1 Productivity

Productive coastal ecosystems are significant sources of food, marine products and livelihood in the Philippines. The ASEAN-Australia Coastal Living Resources Project (CLRP) in the Philippines showed a considerable number of fish species in mangroves, seagrass beds and coral reefs. There are indications that certain species are common among these ecosystems. Those in mangroves and seagrass beds are mostly juveniles supporting further the nursery functions of these habitats. Some pelagic species (for example, barracudas) and demersal (for example, mangrove jack, snapper) spend their juvenile stages in mangroves and go to deeper waters as adults. These observations indicate the interconnection of these coastal ecosystems. The exportation of particulate matter by mangroves and seagrass beds contributes substantially to the energy requirements of the nearshore benthos. Efforts on the conservation and management of these ecosystems are principal concerns since our nearshore fisheries are highly dependent on them.

Coral reefs

In general, coral reefs, which are essentially distributed in warm tropical waters, have a primary productivity in the order of 1500-3500 gCm-2. Valuable reef resources are fishes, invertebrates and seaweeds. In the Philippines, fisheries (reef fish and invertebrates) yield is 1-2 tons/ km-2/yr-1 for damaged reefs to 37 tons km-2 yr-1 for pristine or healthy reefs (Alcala and Gomez 1985). However, these estimates had reached about 50 -70 tons km-2 yr-1 for pristine reef areas, such as the Spratly Islands (Aliño and others 1997). Groupers, snappers, carangids and caesionids are among the commercially sought fish harvested from reef areas along with the various species for the tropical aquarium fish industry. Of the macroinvertebrates, lobsters, crabs, prawns and cephalopods are highly priced catches. Other than these, some 160 species of macro invertebrates are commercially exploited on the reef flat in Bolinao (McManus and others 1992). As for Philippine seaweeds, 350 recorded species have economic significance. Technology for commercial exploitation is available for some species (Llana 1990).

Mangroves

Mean production measured from Philippine mangrove sites ranges from 10.72 to 23.98 kgC10-4m-2d-1. Production rates are directly proportional to interstitial salinity, temperature and canopy cover and inversely proportional to soil erosion and light penetration through the canopy (Fortes 1991). Mangroves are significant as nursery and feeding grounds of a variety of marine organisms. Primary production in mangroves supports not only the organisms they harbour but also those in the adjacent areas through nutrient enrichment. Organic matter contained in ebb-tide waters of undisturbed mangrove areas is found to be 2,947.6 gm. (PNMC 1986). About 54 species of crustaceans, 63 species of mollusks and 110 species of fish have been reported in Philippine mangroves (PNMC 1987 in PCAMRRD 1991;

de la Paz and Aragones 1985 in Dolar and others 1991), a number of which are commercially important (Camacho and Bagarinao 1986).

Mangroves are important sources of fishery products (for example, fish, shrimps, mollusks, crabs, fry) and forest products such as timber/wood and non-timber. They are also sites of aquaculture, salt production and human settlement.

Seagrasses

Seagrass beds are likewise highly productive ecosystems. Tropical seagrass beds have an average gross primary productivity of 4.650 gCm-2yr-1 on an average of 12.9 gCm-2day-1 (Philipps and Meñez 1988). A study in the Philippines recorded a production value of 0.9 gCm-2day-1 (Fortes 1995). Fish yield from seagrass beds indicates more than 10 mtkm-2yr-1 of fish alone with a production potential of 20 mtkm-2yr-1 in biomass of fish, invertebrates and seaweeds (McManus and others 1992). Siganids are the most abundant fish and occur in seagrass beds as adults and juveniles; others are mostly represented by juveniles. Seagrasses support the siganid fry industry. The estimated annual catch of siganid fry from one sampling area in north-western Philippines is 2.6 million pcs. in 1986 and 12.2 million pcs. in 1987 (Ungson 1990). In Bolinao, northern Philippines, a dominant species of siganid, Siganus fuscescens, registered an estimate mean biomass of 2 t km-2 and a frequency catch of 4 t km-2 yr-1 in seagraa beds (del Norte and Pauly 1990).

Of the invertebrates, shrimps, prawns and crabs are of commercial significance. Other economically important products with mariculture potential are sea urchins and sea cucumbers.

In contrast to the high productivity of our coastal ecosystems, productivity of the Philippine offshore waters is low. Data taken from the larger oceanographical expeditions such as the Dama Albatrosss and the Galathea described the surface layers of South-East Asian waters as extremely poor in nutrients (Wyrtki 1961). Megia (1952) described the surface waters in and around the Philippines as nutrient poor. A small organic production of less than 0.5 gCm-2day-1 was reported from the China Sea, Philippine waters and the Celebes Sea (Nielsen and Jensen 1952; Doty 1958) without considering the vertical distribution of productivity and depth of the phytoplankton layer. In contrast, production is high over the Sunda Shelf (i.e., the Gulf of Thailand, Malacca Strait, Java Sea and the waters between Sumatra and Borneo) where a value of 1.0 gCm-2day-1 is often exceeded. There is also high production of 1.2-1.8 gCm-2day-1 in the Banda Sea, which is ascribed to upwelling in the area during the period of May to September. This situation supported the suggestion that the interplay between wind and current systems acts to promote mixing through gyres and upwelling which may enhance the productivity of the region (Munro 1986). An overview of the Philippine offshore environment is provided by Villanoy and Jacinto (1993).

2.3.2.1.2 Production/catch levels

Philippine fisheries are known for their high diversity of the faunal assemblages on which the sector relies. Seventy-one species/groups of fishes (out of the 2,400 recorded species in Philippine waters) and 29 kinds of molluscs, crustaceans, reptiles and aquatic plants are listed in the BFAR catch statistics. Because of the multispecies nature of the fisheries, fishing gears and techniques used vary from 12 to 21 kinds of commercial and municipal fishing gear, respectively. To date, municipal fishing gear are classified as those using boats up to 3 gross tons. Commercial fishing utilizes boats greater than 3 gross tons.

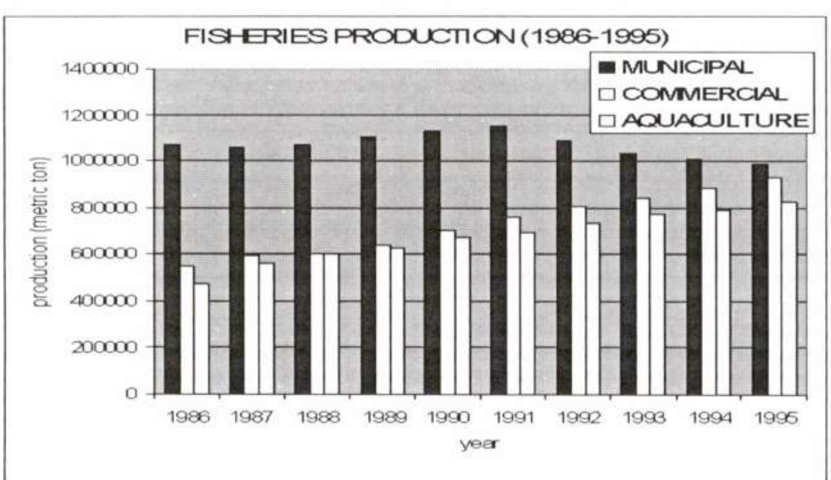
A review of the marine capture fisheries comprising production contribution from both municipal and commercial fisheries by Silvestre (1989) showed trends of production from the 1946 to 1984 level. In 1984, total landings by the marine sector totalled 1,303,000 mt. of fish and invertebrates valued at P16.8 billion. This represents a 15-fold increase from the 1946 level of about 80,000 mt. The trend of landings showed three marked periods: (a) slow increment from 1946-62; (b) a rapid phase of increase from 1962-75; and (c) a levelling of catches from 1975 to 1984 with some signs of increase in the early 1980s because of increased municipal catches. The municipal sector contributed the bulk of landings except in the period 1962-65 when the commercial sector contributed the most (figure 2.6).

A current review of production level is incorporated in the 1996 Phase 1 Report of the Fisheries Sector Development Project of the Government of the Philippines financed by the Asian Development Bank (ADB) and cited below:

In 1993, the total fisheries production of the country was estimated at 2.65 million tons valued at over P71 billion. In 1994, the total volume of production went up by only 1.5 per cent but its value increased by 14.3 per cent to over P81 billion. From 1985-1994, total production increased steadily from 2.0 million to 2.69 million tons, representing a 31 per cent increase for the period. Although the output of municipal fisheries declined, commercial fisheries and aquaculture registered significant production gains. The growth rate of the value of the sector output outpaced the growth rate of the volume of fisheries production, with municipal and commercial capture fisheries showing an increase in nominal value of 103 per cent against a combined production volume increase of only 22 per cent for the period under review. Aquaculture production increased by 61 per cent during the same period, although its nominal value increased by 306 per cent.

The total production from commercial fisheries in 1993 accounted for 0.845 million tons, representing an incremental growth of 0.332 million tons or 65 per cent since 1984. From 1984-1988, marine production was almost static, with only a 0.067 million ton changes. The increase in production occurred between 1988-1993, with production going up from 1.670 million ton in 1988 to 1.875 million ton in 1993. While municipal production remained at around one million tons, the commercial catch jumped by 347,000 tons during this period. The share of municipal fisheries had an imperceptible movement between 1984 - 1993, with production ending at a lower level in 1993 than 1984. The landings of fish from the municipal subsector slowly increased from 1985 to 1990, but by 1993 decreased to the 1985 level. In 1985, the catch was 1.045 million tons; this increased to 1.131 million tons in 1991 and to 1.03 million tons in 1993. Although the tonnage remained fairly static, there was an increase of about 75 per cent in the nominal value of the catches between 1985-1994.

Figure 2.6 Philippine fish production



From the 1977-1993, commercial fisheries gradually absorbed the share of municipal fisheries which used to be twice that of the commercial subsector. The increase in commercial landings could be due to the increase in the number of fishing days available to relatively the same number of catcher vessels as a result of the introduction of fish carriers and other support vessels, the operation of a few fleets in the waters of neighbouring countries, and the opening of relatively new fishing grounds such as Western Palawan, the Sulu Sea, and the Moro Gulf in the mid-1980s.

Aquaculture resources in the Philippines consist of freshwater and brackishwater earthen ponds, lakes, rivers and water impoundments. Of the total aquaculture area of 487,831 hectares only about 53 per cent, or 260,000 hectares, were actually farmed in 1990. In terms of farmed area, the most extensive, as of 1990, were the brackishwater fishponds covering an area of 223,000 hectares (ADB 1993). Some 14,531 hectares of freshwater farms were under cultivation that same year and only 21,040 hectares were effectively utilized out of the extensive lake, river and coastal mariculture areas.

BAS statistics showed that overall production from aquaculture has consistently increased over the past ten years, from 494,742 tons in 1985 to 791,444 tons in 1994. Its contribution to the total national fish production rose from less than 10 per cent in 1975 to almost 30 per cent in 1994, and although it represents only 29 per cent of the total fisheries production, which makes it the smallest contributor to total fish production, it has the highest share in terms of the total value of production, with 43 per cent in 1994.

In fact, the total value of aquaculture output increased by 305 per cent from P8.7 billion in 1985 to P35.3 billion in 1994. With the exception of seaweeds, the largest output came from brackishwater aquaculture, with milkfish accounting for 62.8 per cent of all foodfish production and prawns about 15.57 per cent. On the other hand, the value of aquaculture products rose by 157 per cent from 1985-1990; in particular, the output from brackishwater milkfish farming was valued at P6.6 billion in 1990.

In 1993, the Philippine seaweed industry generated US$73 million in revenue. Ranking as the country's third fishery-based industry, its 18.8 per cent growth in the export industry is expected to increase in the coming years (Trono 1995).

2.3.2.1.2 Fishing pressure

Marine capture fisheries consistently remained the most important sector of the country's fisheries. It is described as predominantly municipal (artisanal/small-scale) but with a considerable extent of commercial (large-scale) fishing activities. Based on available statistical data, the country's fisheries suffer from biological overfishing owing to excessive fishing effort, including the capture of young/juvenile fish.

Estimates of maximum sustainable yield (MSY) range from 1.2-2 mt.: 500,000 to 1,000,000 mt. for coastal pelagics; 200,000-300,000 mt. for oceanic pelagics; and 500,000-700,000 mt. for demersal species. A conservative estimate of the 1996 Fisheries Sector Development Project report indicates that the 1993 marine production of 1.7 million mt. nearly reaches the higher estimates of the country's maximum sustainable yield (Christensen and Pauly 1994). Based on various studies and observations, fisheries scientists obtain a general perception that current harvests of small pelagics and demersal species, as well as invertebrates in most nearshore areas, have already exceeded their sustainable levels. The following are examples to support this perception:

1. The Bolinao sea urchin industry collapsed in early 1990s because of over-exploitation. During the 1980s, sea urchin, Tripneustes gratilla, was commercially collected in Bolinao for its roe. The monthly harvest was registered at 1.7 tons in 1989 and declined to only 0/0003 tons in 1992. Natural densities of the species declined from 0.11-2.14 individuals /m2 in 1987 to 0.0-7 ind/m2 in 1992 in a major collection site. Before the collapse, the sea urchin industry contributed a monthly income of P2, 700 (US $25.30) per fisher family (Juinio-Menez and others 1995).

2. Preliminary analysis of the results of the tuna tagging experiment, a component of the Philippine Tuna Research Project (PTRP) from 1992 to 1993, elicited concerns about the fishing pressure exerted on the tuna resource. Natural mortality rates estimated for the species of skipjack, yellowfin and bigeyes are very high compared with values estimated for tropical Pacific waters. Estimated fishing mortality rates are also high for the Celebes Sea, Sulu Sea and the Philippine Sea compared with estimates for adjacent areas in the western Pacific (Hampton 1993). In the Celebes Sea, fishing mortality rates are estimated at 0.40 for skipjack, 0.44 for yellowfin, and 0.53 for bigeye tuna, all of which indicate heavy exploitation. The Sulu Sea is less heavily exploited (0.30 for skipjack, 0.17 for yellowfin, and 0.17 for bigeye tuna) while the Philippine Sea values are 0.56 for skipjack, 0.44 for yellowfin and 0.14 for bigeye tuna. From these estimates, it can be gleaned that the exploitation rates for the Celebes Sea and the Philippine Sea (with the exception of the bigeye in the latter area) represent a considerable risk of recruitment overfishing. An exploitation rate of 0.4 should be considered a long-term maximum, while an exploitation rate of 0.5 poses a substantial risk of recruitment overfishing. The analyses of tagging data indicate that these exploitation rates are among the highest in the world for tropical tunas.

Although the exploited nearshore areas and traditional fishing grounds are overfished, considerable potential for expansion still exists. Offshore hard/coral grounds west of Palawan in the Spratly Islands and the Pacific coast have the potential for demersal fisheries. Offshore areas in the Pacific Ocean and the South China Sea are potential expansion areas for the oceanic pelagic fisheries (Aliño and others 1997). Although these are potential expansion sites for capture fisheries, prerequisites for expansion activities are availability of reliable resource assessment data and development of appropriate capture technology for the sustainable development of these areas.

2.3.2.2 Endangered species/transboundary/migratory species

2.3.2.2.1 Endangered species

Giant clams

Giant clams, which are valued for their meat and adductor muscles, are heavily fished in the Philippines and the entire South-East Asian region. Three species, Tridacna gigas, T. derasa and Hippopus porcellanus, occurring in Philippine waters are all endangered.

Marine turtles

Marine turtles are exposed to high predation during their life cycle. Man and other animals take their eggs from nesting grounds. The young are subjected to predation and to harsh natural conditions. In the sea, marine turtles are hunted and are caught by commercial fishing gear such as entangling nets, drift-nets, harpoons, big longlines for tuna fishing, grapnels and hooks. Some are taken as by-catch in shrimp trawls, set nets, gill nets and beach seines.

In the Philippines, the Ministry of Natural Resources (MNR) Administrative Order 12, 1979 provided for the conservation of marine turtles. Collection, gathering, utilization, possession, transport and disposal of marine turtles and turtle eggs have been banned. An inter-agency task force on Pawikan was then formed. Currently, the conservation of marine turtles is the function of the DENR-PAWB. A major breakthrough was the establishment of a Turtle Island Heritage Protected Area in Region 9 through a Memorandum of Agreement inked between Malaysia and the Philippines on 31 May 1996.
The five species of marine turtles recorded in the Philippines are:

1. Caretta caretta (loggerhead). Usually confused with the olive ridley turtle in South-East Asia but its occurrence in the Philippines is confirmed by Japan-tagged individuals retrieved from the waters of Basilan and Albay.

2. Chelonia mydas (green sea turtle). Recorded in the islands of Mindoro, Antique, Samar, Romblon and Palawan. Nesting sites are in the Sulu Sea, primarily on San Miguel Islands and the Turtle Islands with some nesting reported at Tubbataha. Nesting occurs from July to August. Seagrass beds are utilized as feeding areas. Man and other animals take their eggs either from nesting grounds or from butchered turtles. They are caught by commercial fishing gear such as entangling nets. The species is widely distributed in neighbouring countries such as Indonesia, Malaysia and Thailand. A number of recovered individuals from the Turtle Islands bear Malaysian tags and some of those recovered from the Sabah Turtle Islands have Philippine tags. Although not recently observed, green sea turtles were also noted in Cambodia way back in 1941. Green sea turtles are favoured for their meat and oil. Although commercial trading is banned, capture for food and local consumption is allowed in some parts of South-East Asia.

3. Eretmochelys imbricata (hawksbill sea turtle). The species has been observed in Mindoro Occidental, Sorsogon, Negros and Antique; in certain parts of Davao, Basilan, Cotabato, Lanao del Norte, Zamboanga der Sur and Surigao, and in Cuyo Islands, Turtle Islands and the Sulu Archipelago. They are widespread in South-East Asia, in Indonesia, Malaysia and Thailand, with early (1941) records in Viet Nam and Cambodia. It is believed that migration along the islands of the Philippines, Indonesia, Java, peninsular Malaysia and Sarawak is performed by solitary or small groups of turtles. Low level nesting is recorded in the Philippines, in southern Negros and Sumilon Island, Cuyo Islands, Turtle Islands and possibly in some parts of Palawan and the Sulu Archipelago during the period May-August. These turtles are captured for their eggs, meat and shell which is used for jewellery. Juveniles are caught for stuffing and are sold as souvenir items. Large exporters of these materials in South-East Asia, such as the Philippines, Indonesia and Singapore, were already parties of the Converntion on International Trade in Endangered Species of Wild Founa and Flora (CITES) even before 1990. Thus the trade has been significantly lowered in the region.

4. Lepidochelys olivacea (olive ridley turtle). This is generally rare in South-East Asia but has been sighted in the Philippines. It is known to migrate along continental shelves to feed in shallow waters.

5. Dermochelys coriacea (leatherback turtles). Recorded in the Cuyo Group of Islands, Diit and Maniguin Islands. A leatherback retrieved from Cebu bore an Irian Jaya tag. Other than natural predation and capture, leatherback mortality is also caused by swallowed plastic wastes which they mistake for jellyfish, a main part of their diet.

Marine mammals

Marine mammals are protected in the Philippines by Fisheries Administrative Order (FAO) 185, 1992 which prohibits the taking, catching, sale, purchase, possession, transport and export of whales and porpoises. An amendment, FAO 185-1, 1997 was issued to cover dolphins as well. Jurisdiction of these types of marine mammals falls under the DA-BFAR. Early on, DENR Administrative Order 55, 1991 was issued to protect and conserve the sea cow, dugong, under the jurisdiction of the DENR-PAWB. Twenty-two species of marine mammals have been confirmed in Philippine waters.

2.3.2.2.2 Transboundary straddling stocks/species

These are marine life distributed in areas crossed by a common boundary between the exclusive fishing zones of two adjacent countries (Naamin 1992). A good example in the region is the Spratlys where the living resources are shared by coastal states because of overlapping boundaries. The Spratlys is an ideal "resource savings bank" as it is not over-exploited and it replenishes heavily exploited areas around it by supplying these areas with larvae of commercially important fish and invertebrates (McManus and others 1992).

2.3.2.2.3 Migratory straddling stocks/species

This includes species that migrate beyond the border of one economic exclusion zone (EEZ) and are grouped into two: (a) stocks that are restricted to sea areas which are closely within the limit of two or more adjacent EEZs; and (b) stocks which occur in one or more EEZs and also extend to the open sea/high seas beyond (i.e., large tunas, skipjacks, billfishes and seerfishes).

The country's migratory species of fish are mostly determined from catches of fishing gear for tuna. These are: (a) tunas and tuna-like - Thunnus albacares, T. obesus, T. tonggol, T. alalunga and Katsuwonus pelamis; (b) seerfishes - Scomberomorus commerson, Gymnosarda unicolor and Grammatorcynus bicarinatus; (c) billfishes - Makaira mazara and M. indica; and (d) dolphinfish - Coryphaena hippurus.

The Philippine Tuna Research Project (1991-1993) conducted by PRIMEX and the South Pacific Commission established the movement of tuna within Philippine waters and between the Philippines and adjacent areas. Local movement is significant from the Celebes Sea to the Sulu Sea. Movement to adjacent areas suggests the mixing of stocks between the Philippines and eastern Indonesia and the large purse seine fishing grounds to the east. The PTRP Phase I Final Report, December 1993 includes illustrations of movement of tuna within the Philippine waters and movement to and from adjacent areas.

2.3.2.3 Major problems/issues

Major problem: OVER-EXPLOITATION OF MARINE LIVING RESOURCES

Issues:

(a) Reduced fishing stock/low biomass
(b) Reduced coastal productivity
(c) Reduced biodiversity
(d) Loss of protection of the terrestrial zone
(e) Loss of commercial value
(f) Low catch rates and income levels
(g) Increased poverty
(h) Increased conflict among resource users
(i) Increased competition between municipal and commercial fishermen
(j) Degradation of habitat

Transboundary consequences:

(a) Lower productivity and carrying capacity affects shared and straddling stocks;
(b) Excessive by-catch (i.e., marine mammals such as the dugong and other endangered species such as marine turtles);
(c) Recruitment;
(d) Spawn-stocking biomass collapse.

2.3.2.4 Economic losses because of over-exploitation

The Philippines is an important fish producer in the world, ranking twelfth among the top 80 fish-producing countries in 1993. It is the second biggest tuna and tuna-like producer in the Indian Ocean and in the Association of Southeast Asian Nations(ASEAN) region. Its total fish production in 1993 reached about 2.65 million mt. valued at approximately P71 billion or US$2.73 billion (BFAR

1995). Fishery is an important sector, its contribution to the gross national product (GNP) in 1994 was 3.9 and 4.3 per cent respectively in current and constant prices. Its net foreign exchange earnings amounted to P12.52 billion, with the value of export (P15.65 billion) exceeding the value of imports (P2.92billion) by almost five times. However, during the first quarter of 1996, an apparent increase was observed in the importation of frozen fish for domestic consumption, being retailed in the wet markets at prices significantly lower than domestically caught fresh fish.

The fisheries sector also provides direct and indirect employment to over one million people representing about 5 per cent of the natural labour force. This can be broken down to 65 per cent in municipal fishing, 25 per cent in aquaculture, 5 per cent in commercial fisheries, and 5 per cent in ancillary activities (i.e., post-harvest handling, processing, transport, marketing, boat-building and repair, and manufacturing or distribution of fish-related activities.

If we are to seriously consider the above attributes of the fisheries sector, a tremendous debacle on the country's economy will ensue if the major problem of over-exploitation is not dealt with.

Preliminary estimates of consequent rent dissipation because of over-exploitation amount to as high as US$400 million annually for the demersal and pelagic fisheries alone (Silvestre 1989).

Another factor that contributes to economic losses in the fisheries sector is illegal fishing (for example, poaching in offshore areas, smuggling, use of prohibited gear). In comparison to the landed value of Philippine fisheries of about US$2 billion a year, harvests by illegal fishing activities have been valued at more than US$1.5 billion or P40 billion a year.

2.3.2.5 Causes including sectoral demands and failures and internal and external market demands

Population growth

Population growth causes an increased demand for fish for domestic human consumption, Filipinos being among the highest fish consumers in the world. Of the total fishery production of 2.93 million tons in 1994, 1.95 million tons (67 per cent) are allocated for domestic consumption. Between 1994 and 2010, the population is expected to increase by about 23.5 million people. This will require an additional fishery production of 719,000 tons in order to maintain the present level of per capita fish supply of 28.5 kg/yr. Based on trends in supply and demand parameters, two scenarios are possible by the year 2010 (Bernacsek 1996):

1. A sustainable scenario would be a rise in domestic food fish production to 3.2 million tons by 2010 and an import quantity of 97,000 million tons to maintain the per capita food fish supply of 24.7 kg/yr. This is assuming that all positive interventions in the fisheries sector are successful;

2. A pessimistic or unsustainable scenario assumes that no positive interventions are instituted in the fisheries sector. This will mean a food fish production of as low as 940,000 million tons by 2010 and a per capita foodfish supply of 10.5 kg/yr. In order to meet the deficit of 18.7 kg/person/yr import quantity should be 1.8 million tons of foodfish.

Alarmingly, the country's maximum sustainable yield of 1.2-2 million tons for capture fisheries has been nearly reached based on the 1993 marine production of 1.7 million tons. Moreover, nearshore catches have already exceeded sustainable levels.

Employment needs

In view of the free and open access to fisheries, marginalized labourers and migrants that have no access to land-based resources turn to the sea for a livelihood. This uncontrolled increase in the number of fishers results in the over-utilization of marine resources. Despite declining yields, the number of fishermen continues to increase as the sea is regarded as the "employer of last resort" in many coastal areas.

Growth and recruitment overfishing in municipal waters

This is due to the increase in the number of fishers, the use of efficient gear and the lack of and non-implementation of control measures.

Overcapitalization of the fishing industry

There is an increased world demand for seafood products, either for direct human consumption or indirectly for feeds for livestock and poultry.

International demand

There is an increased world demand for seafood products, either for direct human consumption or for feeds for livestock and poultry. The principal species exported by the Philippines are shrimps and prawns, tuna and seaweeds. The Fisheries Sector Development Project 1996 report reveals that the unit terms of international trade of the Philippine fisheries sector are very favourable as foodfish exports have exceeded imports by a factor of 1.75 in volume and 23 in value. This is because the Philippine exports high-value products (prawns and fresh-chilled tuna) while it imports lower-value frozen fish (canning-grade sardines and mackerel). It should be noted, though, that the country is still highly depended on the Japanese market for prawn exports. While the country imports significant quantities of fishmeal, which are the principal ingredients in livestock feed production, it remains the world's largest producer and exporter of dried seaweed used as raw material for the manufacture of carageenan.

In general, it is considered that fisheries resources around the world are being exploited at, or very close to, the maximum sustainable yield levels of production. Commercial catches in the world have remained almost stagnant since 1989 at a level of 100.1 million tons as against the steady increase from 3.3 million tons in 1958 to the 1989 level. For the period 1989 to 1993, Japan, the United States of America and the European Union (EU) all reported increases in their imports, which account for over 75 per cent of the value of fish imports. The value of world imports increased by 24 per cent in this period. It is expected that per capita fish consumption will further increase in developed countries as rising health consciousness appears to be causing a shift in food preference from red meat to fish and other marine products. The increase in world demand for seafood will require an increase in fish production in the face of resource depletion in major fishing grounds.

2.3.2.6 Impacts of global change

(See the previous discussion on El Niño and reduced fisheries production, section 2.3.1.6).

2.3.2.7 Proposed interventions

(a) Evaluation of current resource uses (rates of exploitation, carrying capacity of resources, users' conflicts, socio-economic aspects, political environment, existing legal and institutional framework);

(b) Alleviation of pressure on heavily exploited resources through the introduction of alternative environment-friendly livelihoods that are socially acceptable and feasible;
(c) Encouragement of lightly-exploited areas including the EEZ (this calls for resource assessment, development of capability to explore offshore waters, formulation of appropriate fishery and related policies, establishment of means of policing offshore waters);
(d) Development of capability for resource management at the community, municipal and regional levels through training and public education programmes;
(e) Establishment of marine reserves and provision of means for management by local communities;
(f) Policy revision and formulation to suit present resource conditions and uses;
(g) Improved enforcement of fishery laws and regulations.

2.4 MODIFICATIONS OF AQUATIC HABITATS

2.4.1 Freshwater

2.4.1.1 Freshwater and coastal wetlands

At present there has been no sufficient appreciation of the effects of changes in freshwater and coastal wetlands. In the water resources master plan some suggested criteria for evaluating the effects have been proposed (JICA 1997) but no documentation has been made on a comparative evaluation of overall effects on these habitats. Anecdotal accounts have shown that the reduction of water and impoundments of water bodies have affected the flora and fauna of areas such as the Candaba swamp and those in the Angat Dam. In addition, the location of industries around Laguna Lake and the establishment of fishpens have lowered the water quality and have modified the integrity of the lake habitat.

2.4.2 Marine habitats and resources

The major marine habitats are functionally linked and interconnected from the breeding and nursery grounds of the mangroves and seagrasses to the diverse coral reefs surrounded with soft bottom areas distributed onwards to the oceanic region. Based on the present review, the marine resources and habitats in the country have generally been over-exploited and drastically degraded. There are many factors that interplay and impact on the marine environment. Pauly and Lightfoot (1992) described a hypothetical coastal cross-section illustrating biomass and cash flows between a community of small-scale fishers, processors/intermediaries and the nearby city. Coastal conversion is one of the main concerns affecting the marine environment especially in the context of renewability and rehabilitation. The ecological importance of these coastal ecosystems as buffers which protect the land from the erosional effects of waves and the sea from the destructive activities from the land is well known. The destructive effects of upland activities, such as deforestation and dredging, result in the degradation of the marine habitats through increased sedimentation run-off. The loss of the natural protective buffers will exacerbate man-induced destructive practices especially in combination with natural stresses such as storms and floods. The destruction of the habitats will likewise effect a decline of the marine resources dependent on these habitats. Further, the high poverty rate in coastal communities forces marginalized fishermen into fishery putting additional heavy pressure and burden on the resources (Malthusian overfishing from Pauly and others 1989). The open-access nature of the marine environment has led to heavy exploitation and abuse of the resources.

Another important factor that undoubtedly influenced the rate of utilization of these resources is the Government's economic policies that have inadvertently increased the pressure and burdens on the marine environment. De los Angeles and Padilla (1992) attributed the accelerated rate of degradation of coastal resources to economic policies such as subsidies, incentives, tax exemptions and lower tariff rates that resulted in increased fishing intensity, encouraged coastal conversion and decreased wild stock resources. This redounds on the economic viability of coastal industries (mariculture, tourism, fishing, and fish processing and other related industrial/agricultural ventures) and the importance of the marine environment. The case study in Bacuit Bay, Palawan by Hodgson and Dixon (1988) is the only example in the country that examined the economic benefits of logging versus tourism and marine fisheries. The study showed a reduction in gross revenue of $40 million over a 10-year period with continued logging compared with the revenue generated if a logging ban had been implemented.

2.4.2.1 Estuaries and embayments

(See Mangrove habitats and FSP bays)

2.4.2.2 Coral reefs

The Philippines holds the distinction of being the first country in the world to conduct a nationwide assessment of coral reefs (Gomez and others 1994). Coral reefs in the Philippines are the most extensively surveyed in the South-East Asian region (Aliño and others 1995). Estimates on the areal extent of these coral reefs range from 25,000 square kilometres (Gomez and others 1994) to 33,500 square kilometres (Carpenter 1977) depending on the varying assumptions of the maximum depth limits of where corals can be found.

The most recent countrywide status reviews for coral reefs in the Philippines have been undertaken by Gomez and co-workers in collaboration with the group of Alcala (Alcala and others 1987; Gomez and Alcala 1979; Gomez and Yap 1985a; Gomez and others 1981, 1994a-b; UPMSI 1979, 1980, 1982). The health of the reefs was calculated on the arbitrary percentage quartile classification of live coral cover (i.e., 0.1-24.9 per cent = poor; 25-49.9 per cent = fair; 50-74.9 per cent = good; and 75-100 per cent = excellent. The overall condition of the reefs in the country has been evaluated based on samplings gleaned from over 700 transects sampled in over 14 provinces.

These nationwide surveys made in the 1970s showed 5 per cent of the reefs to be in excellent condition, 25 per cent good, 39 per cent fair and 30 per cent poor (Gomez andAlcala 1979). Further studies in the 1980s (see table 2.7) showed 70 per cent of our reefs in poor to fair condition, with less than 50 per cent living coral. Despite the ongoing debate on how to come up with a better indicator of the condition of reefs (for example, the quadrat method and percentage live cover; belt transect and coral mortality index) it is generally accepted that there is an urgent need to turn the tide against the unabated destruction of coral reefs in the country (Gomez and others 1994a; Alino and others in press).

Table 2.7 Status of Philippine coral reefs based on surveys by three projects

Source	**No. of transects (stations)**	**Excellent (75-100%)**		**Good (50-74%)**		**Fair (25-49%)**		**Poor (0-2.4.9%)**	
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Yap and Gomez (1985)	632	35	5.5	153	24.2	242	38.3	202	32.0
ASEAN-Australia MSP LCR	103	4	3.9	32	31.1	46	44.7	21	20.4
ASEAN-US CRMP	40	0	0.0	18	45.0	17	42.5	5	12.5

There are various natural and man-induced impacts, degradations and problems that have resulted in the decline of live coral reefs in the country. Coral reefs are natural buffers against the erosive action of waves and typhoons, yet in some areas these reefs were destroyed by strong typhoons, for example, Mactan, Cebu (Gomez 1988). In some localized areas, natural events, such as the infestations of Acanthaster planci in the Visayas and the gastropod Drupella rugosa in Mactan, destroyed the reefs (Alcala 1976; Aliño and others 1981; Gomez 1988).

The most common problems are sewage and fertilizer pollution. Impacts from nearshore development, dredging, mining and industrial pollution follow. Many other factors contributing to the loss of this natural buffer are the collection of corals (for building material), pollution and mine tailings. Tourism-derived impacts compete between recreational benefits versus unregulated shore development, such as dredging and sewage pollution resulting in coastal degradation.

There are three factors that are most common and influential in affecting coral reefs in the country, namely, sedimentation, overfishing and destructive fishing (Aliño and Campos 1995).

Siltation is the most important factor influencing conditions in coral reefs, either by natural processes or anthropogenic events. The eruption of Mt. Pinatubo in June 1990 dramatically changed coral cover to 10-20 per cent a week after the eruption from 60-70 per cent cover before the eruption (Atrigenio and others 1992). Anthropogenic effects of siltation are mostly in reefal areas near rivers because of upland deforestations, for example, Bacuit Bay, Palawan (Aliño and Campos in press) and industrial sites, for example, Toledo City, Cebu (Aliño 1984). The sediments physically smother the corals, further reduce recruitment success owing to poor larval settlement and increase post-larval mortality (Gomez and others 1994a).

Fisheries-related destruction, such as dynamite fishing and cyanide, affects coral reefs. It takes up to five years for only half of the original cover to return. Other factors causing negative impacts may prolong the recovery period (Yap and Gomez 1985).

The prevalence of the impacts of the three most common factors affecting coral reefs was determined by Aliño and others (1995) based on the frequency distribution of reefs experiencing each intensity level for each type of impact per location, expressed as a percentage. To get a better picture of the impacts of these factors, the studied sites were grouped and zoned geographically and the percentages averaged. An estimate on the impact of each factor in a particular geographical zone was determined. From these frequencies, the three topmost sites considered as critical areas for that particular impact were determined (table 2.8).

Table 2.8 Critical coral reef areas in terms of siltation, pollution, fishing and storm impacts

IMPACT	TYPE	AREAS
Siltation	Agricultural	Palawan (PAL)
		Southern Mindanao (MDS)
		Southeast Luzon (LSE)
	Industrial	Southwest Luzon (LSW)
		Northern Mindanao (MDN)
		Visayas (VIS)
Pollution	Agricultural	Northwest Luzon (LNW)
		Southeast Luzon (LSE)
		Southwest Luzon (LSW)
	Industrial	Southern Mindanao (MDS)
		Northern Mindanao (MDN)
		Central Visayas (VSC)
Fishing	Overfishing	Palawan = Northern Mindanao
		Central Visayas = NE & SE Luzon
	Destructive	Southern Mindanao
		Southwest and Northeast Luzon

Palawan is the critical area for siltation damage brought about by high and medium intensity agricultural activities, followed by southern Mindanao, and south-east Luzon. The priority areas for demonstrating the effects of siltation from industrial activities are in northern Mindanao, followed by central Visayas and lastly in south-west Luzon especially in Zambales province. These areas are where most of the industrial plants in the country are located.

Interestingly, the effect of pollution from agriculture was concentrated in Luzon where agricultural activities dominate. The frequency is high in the north-west, followed by the south-east and lastly, the south-west.

Pollution from industries was found to have had a considerable effect in Mindanao and Visayas where most of the industrial zones are located. The impact is highest in Mindanao, particularly in the south and then in the north, and lastly, in the Visayas.

The effect of overfishing has been observed to be high in Luzon, both south-east and north-east, followed by northern Mindanao, and lastly, by south-west Luzon. Palawan, north-west Luzon and southern Mindanao are overfished areas, albeit of medium intensity only. Destructive fishing is very rampant in south-east Luzon, followed by central Visayas, and lastly, north-east Luzon.

Tropical storms that frequent the country were felt at high intensities in northern Mindanao specifically in the Siargao group of islands. Unlike in Mindanao, most of the reefal areas in north-west Luzon are strongly influenced by medium and high storm intensities. The eastern portion of Luzon followed by the north and the south showed impacts of both intensities.

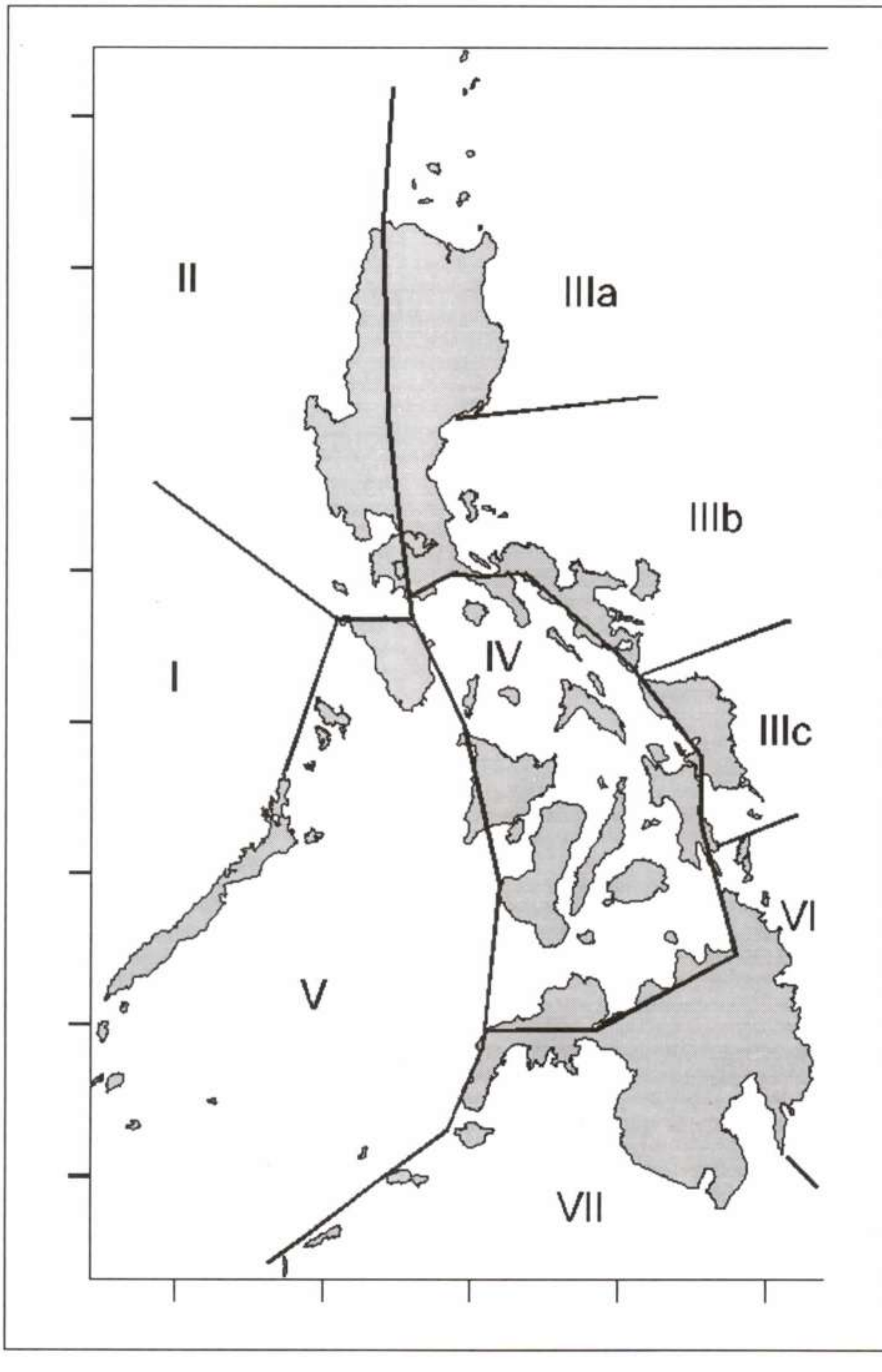
The importance of coral reefs to the fisheries, the ecological well-being of the coastal habitats, recreation and tourism has been well documented in the country. Coral reefs are natural buffers against the erosive action of the waves and typhoons (Gomez 1988) and this is especially significant in the Philippines where there are on the average 20 typhoons a year (Gomez and others 1994b).

About 4,000 species of fish are associated with coral reefs in the Indo-Pacific, more than a thousand species are found in the Philippines (Nañola and others in press). Coral reefs contribute significantly to the country's fisheries, 8-15 per cent of the finfish catches aside from other seaweeds and invertebrates collected in the reefs (Gomez 1988) provide subsistence livelihood to coastal dwellers.

The cottage industry heavily relies on shells and other invertebrates collected from the reefs for the curio trade (Gomez 1988). A significant part in the tourism industry benefits from the numerous diving spots that attract both local and foreign tourists which support numerous resorts and other related establishments (Gomez 1988).

In the Philippines, biogeographic zones have been proposed by the University of the Philippines Marine Science Institute to help the Government with the management of the coral reef resources, for example, representative sites for the National Integrated Protected Areas System (NIPAS) (Aliño and Gomez 1990) (Figure 2.7).

Figure 2.7 Philippine biogeographic subdivisions based on coral reef affinities



Recommendations for priority national programmes on coral reef conservation and management have been proposed (Gomez 1988, Gomez and others 1994a and b). The priority government concerns in coral reef management in the Philippines were highlighted in the Subic workshop (see Aliño and others in press). Intergovernmental commitments for reef management have been proposed in the International Coral Reef Initiative Workshop held in Dumaguete City (1997). Various regional workshops have also been organized to come up with an action plan for the East Asian Seas region (UNEP/COBSEA (1996) in Bali, Indonesia; UNEP COBSEA in Okinawa Japan). PhilReefs, a network of coral reef practitioners organized to follow up on the information exchange needs pointed out in the Subic Workshop (1995), have also proposed over 30 recommendations that need to be addressed.

2.4.2.3 Mangroves

Among the different habitats in the marine environment, the mangroves are the most easily perceived coastal habitat perhaps because of its more conspicuous nature in being above the water. Estimates of its coverage by different studies started in the early part of the century and continue up to the present (table 2.9).

Table 2.9 Mangrove forests in the Philippines from 1920 to 1994 (x 1000 hectares) including the geographical distribution in Luzon, Visayas, Mindanao and Palawan

YEAR	TOTAL	LUZON	VISAYAS	MINDANAO	PALAWAN
1920	450				
1968	448	47	228	125	47
1969	295	43	77	128	48
1970	288	42	78	124	44
1971	287	42	77	123	44
1972	284	41	77	122	44
1973	270	36	72	119	43
1974	256	30	67	117	42
1975	254	28	67	117	42
1976	252	27	67	116	41
1977	249	26	67	116	41
1978	247	25	66	116	40
1979	245	24	66	115	40
1980	242	23	66	115	39
1981	240	21	66	114	39
1982	211	17	55	107	32
1983	211	17	55	107	32
1984	236	17	65	112	37
1988	228				
1994	200				

Source: 1920-1984 (BFD Statistics); 1988 (Ronquillo 1988); 1994 (Calumpong 1994)

In the early part of the century, mangrove coverage in the country was estimated around 400,000-500,000 hectares (Brown and Fischer 1918). In 1984, only 230.000 hectares (51 per cent) of the mangrove forest remained (BFD 1984). Table 2.9 shows the rate of exploitation in the mid-1980s in the different regions in the country. The highest was in the Visayas at 72 per cent and Luzon at 64 per cent. Mangroves were intensively utilized in these regions compared with Mindanao (10 per cent) and Palawan (21 per cent) where the old growth stands in the country are still found (PNMC 1986). In the mid-1990s, mangrove forests were estimated to be only 200,000 hectares which indicates a loss of 60 per cent from the 1920 estimate. Although these estimates should be treated with caution since there is a high variability in the various sources of data, the data still indicate a rapid decline of the mangrove forests.

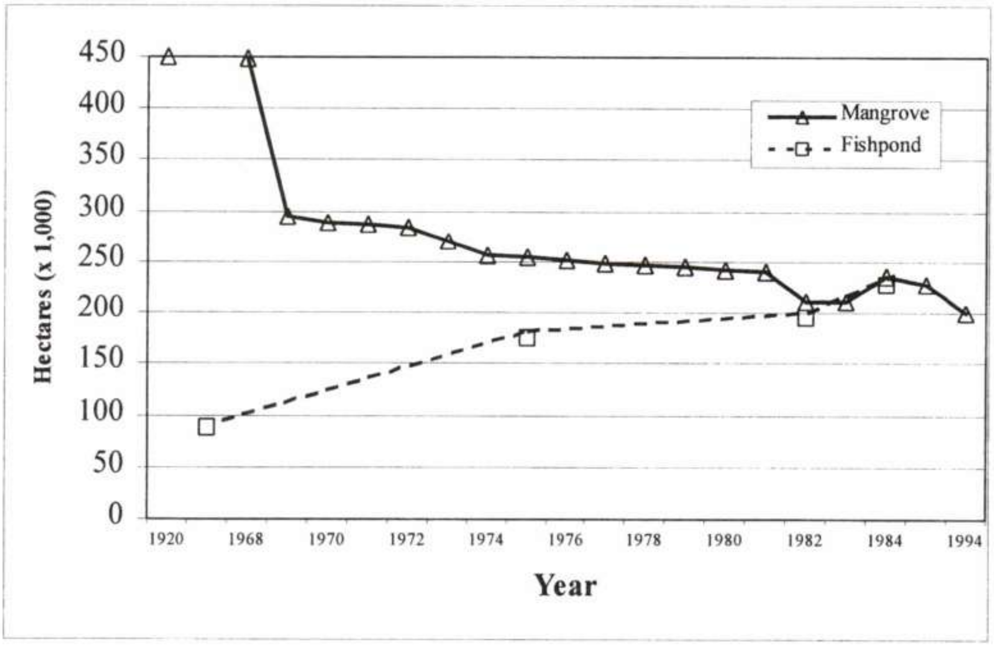
Based on the time estimates (1920-1994), it can be surmised that around 60 per cent of the mangrove habitat has been lost. The exploitation of mangroves for their forest products by the local populace is one of the significant causes for the decline in the area and volume of mangrove forests in the country (PNMC 1986; Evangelista 1992). The mangroves are economically important as sources of timber, firewood, charcoal, tannin, tanbark, nipa sap and shingles. The economic importance of mangroves has been well recognized in the Philippines and well documented, but there is as yet no quantitative estimate from these losses. Perhaps, the major cause of the reduction of mangrove forest in the country is its conversion into fishponds. As seen in figure 2.8, the increase in fishpond development over time corresponds to the decline in the coverage of the mangrove forest.

Mangrove fishpond conversion increased more than 100 per cent from 1952-1975 from 88,000 hectares to176,000 hectares. The conversion was mainly for the cultures of bangus (Chanos chanos) and sugpo (Penaeus monodon) (Datingaling 1977; NMC 1986). In 1982, brackishwater fishponds increased further to more than195,000 hectares (Gomez and others 1990). In 1988, mangrove areas converted to fishponds totalled 224,000 almost equal to the remaining mangrove swamplands of 228,000 hectares (Ronquillo 1988; Primavera 1993) (see figure 2.8).

Based on the 1920 estimate of 500,000 hectares, around 45 per cent (224,000 hectares) of these have been converted to fishponds and the rest for other purposes. Most of the fishponds in the country are located in sites where mangroves abound. Conversion to industrial and human settlements, at present, is mostly localized and minor compared with the extent of fishpond areas in the country (PNMC 1986).

The loss of mangrove swamps into fishponds corresponds to a loss of coastal productivity affecting coastal fisheries (Primavera 1993; Camacho and Bagarinao 1986; Silvestre 1989). Fishponds bring about pollution through the use of organic/inorganic fertilizers, chemical toxins, antibiotics etc. that reduce the quality of the mangrove swamps (NMC 1986; Primavera 1991). This correspondingly affects the coastal dwellers dependent on the mangrove swamps compared with the minority working in the aquaculture farms (Primavera 1991). The loss of mangrove habitats is the loss of its commercial value as an important fertile breeding, nursery and feeding grounds of economically important fish (mullet, milkfish, tilapia, eel, kitang) and invertebrates (shrimp, prawns, molluscs and sea cucumber) (see Zamora 1981; de la Paz and Aragones 1985; Alcala 1982; Calumpong 1994 and NMC Country Report 1986 for detailed listings). The fry gathered in the mangrove areas, especially of milkfish (Chanos chanos), shrimps (Penaeus monodon), and prawn (Penaeus merguiensis), contributed greatly to the country's fry gathering industry and have become important species in aquaculture (Gonzales 1977).

Figure 2.8 Mangrove cover and fishpond construction from 1920 to 1994



The salinization of the water aquifer of the adjacent lands from the drawing of sea water for fishponds is creating stress in some areas of the country, for example in central Visayas (Borjal 1989). Heavy extraction of water lowers the water table resulting in the contamination of the water aquifer with sea water (Singh 1987). The impact of salinization from shrimp ponds is still localized in the Philippines, compared with other countries where rice production has decreased owing to the loss of soil fertility (Primavera 1993).

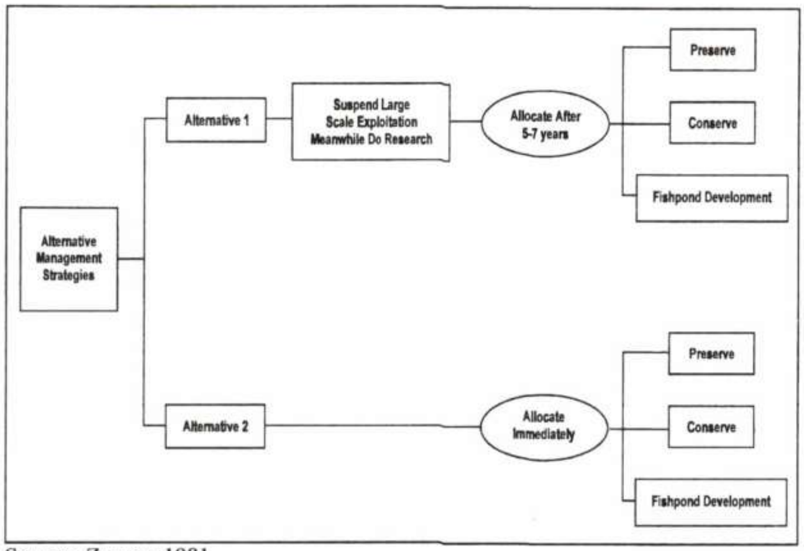
The mangrove resources in the country are threatened by the loss of the renewability of the resource brought about by coastal conversions especially fishponds (Hamilton and Snedaker 1981). This creates social inequity between the marginalized fishermen and the few fishpond entrepreneurs (Primavera 1993). A large percentage of the coastal populace depend on coastal fisheries for subsistence and income compared with the seasonal and undependable employment in aquaculture farms (Primavera 1991). However, the increasing contribution of aquaculture to the total fishery income in the country indicates the economic viability of this venture (BFAR Statistics; Camacho and Bagariano 1986). Hence, fishpond development has been the recipient of government support, such as loans, incentives, tax privileges, since its inception (Primavera 1993).

Yet, the most important but least appreciated value of mangroves is its role as a coastal buffer. Mangrove forests serve as a buffer to coastal erosion, protecting the terrestrial zone from the erosion effects of waves and preventing accelerated sedimentation and siltation of offshore and nearby ecosystems (Zamora 1981; Hamilton and others 1989; Singh 1987). Perhaps its importance has now been recognized and felt in the loss of property and lives in some coastal areas significantly influenced by the loss of mangrove strips as storm buffers along the coastline: in 1976, approximately 3,000 deaths in Zamboanga; 1,000 in northern Panay in 1984; and 7,000 in Ormoc and Leyte in 1991 (Primavera 1993).

The valuation of mangroves, especially the true costs of mangrove loss, is very important especially in cases where mangroves are converted for national and industrial development. Before the Government used the Fishpond Lease Agreement (FLA) set to as low as PhP 50/ha/yr which encouraged conversion. Recent studies by Evangelista (1992) put the pricing as high as PhP 3,296/ha/yr. This was based on the economic or resource rent that puts value on access to a valuable resource in limited supply. Nevertheless, the true value of the mangrove ecosystem requires comprehensive economic studies since it involves an accounting of the marketable (for example, forest products) and non-marketed value (for example, storm buffer), and on-site (for example, poles) and off-site (for example, nearshore fisheries) values (Dixon 1989; Hamilton and others 1989; ENRAP 1994).

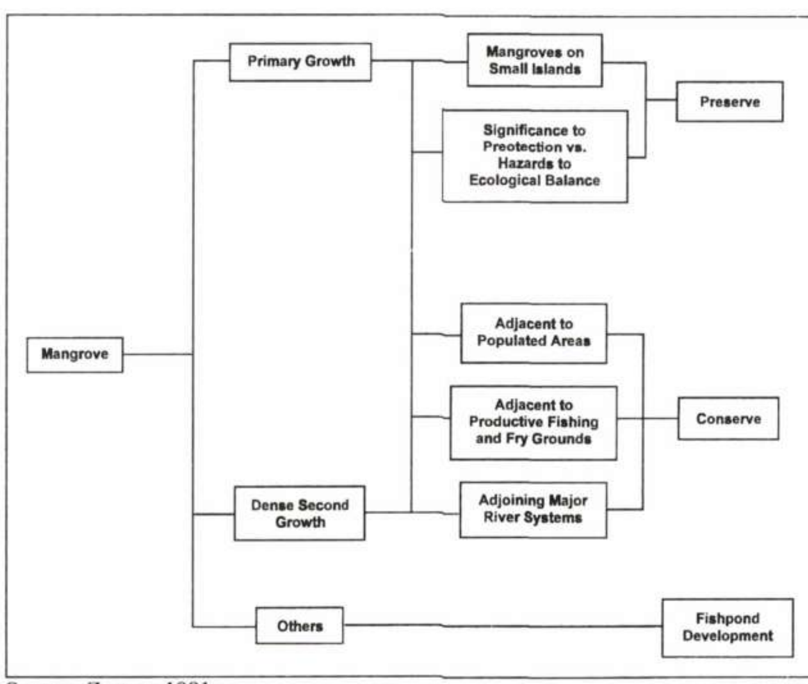
Mangrove scientists, resource conservationists and aquaculturists agree that immediate measures are needed to offset the almost irreversible trend of destruction. Previous policy recommendations for the management of mangroves have been outlined by Zamora (1981) but as yet no comprehensive nationwide monitoring and evaluation has been made on these proposals. Presented below are the summary guidelines for policy considerations (see figures 2.9 and 2.10). Strategic and tactical action programmes need to be formulated and undertaken for each of these priority management options. A schedule for realistic targets to be achieved needs to be pursued consistently. Primavera (1995) has also updated the management issues to be considered in relation to the interaction of mangroves and mariculture activities. Camacho and Bagarinao (1986)presented strategies, which in brief indicates that the government should implement rules to rehabilitate and conserve the existing mangrove areas and prevent further expansions and conversion into other uses.

Figure 2.9 Alternative strategies for existing Philippine mangrove resources



Source: Zamora 1981.

Figure 2.10 Guidelines for the selection of mangrove areas for preservation, conservation and fishpond development



Source: Zamora 1981.

2.4.2.4 Seagrass beds

No comprehensive evaluation on the extent of seagrass habitats in the country has been undertaken. Probably this is due to the extensive depth range of seagrass communities in the intertidal and subtidal (at around 1-30 m) region. Studies conducted in the country, although more extensive compared with other Association of Southeast Asian Nations (ASEAN) members, were mainly in conjunction with environmental impact assessments (EIAs) of industries along the coast, for example, for a power plant, in ecological assessments in degraded fishing grounds and in coastal management issues. The integrity of seagrasses communities as significant ecosystems on their own has only been recently appreciated (Fortes 1994 and 1995).

The only estimate of seagrass coverage in the country was done in connection with the ASEAN-Living Coastal Resources Project on seven sites in the country using remote sensing techniques (see table 2.10) (Fortes 1995). Most of the sites have fair to good seagrass beds except in south-east Luzon where 60-100 per cent of the seagrass beds in Pagbilao, Calauag and Calancan Bays are in poor condition.

Table 2.10 Seagrass assessment in seven sites in the Philippines

SITE	AREA (sq km)	STATUS		
		GOOD	FAIR	POOR
Cape Bolinao	25	38%	49%	13%
Calauag Bay	7.7	33%	---	67%
Pagbilao Bay	1.89	---	---	100%
Puerto	1.14	70%	---	30%
Ulugan Bay	2.97	17%	51%	32%
Banacon	7.81	73%	27%	---
Calancan	0.07	29%	---	71%

Source: Fortes 1995.

As with the other coastal resources and ecosystems, seagrass beds are also subject to over-exploitation and conversion to other land uses. In the Philippines, seaweed farms, like Eucheuma, are mostly associated with seagrass beds (Trono 1986).

Fortes (1995) made an inventory on the conversion and uses of seagrass areas in the Philippines (table 2.11). Industrial development, ports and recreation are the major use of seagrass beds. The impacts of waste disposal and boat traffic are widespread but moderate. Aquaculture farms of fish, prawns and crabs from seagrass areas are still localized, ranging from minor to major usage. Localized but major habitat modification effects on seagrass beds are in urban development and mining, followed by conversion to solar salt, and lastly, minor use for sugar cane and airports.

Seagrass beds are also subject to unsustainable practices of collection of the other economically important invertebrates that abound in this habitat. The bed is commonly raked to collect shells for the ornamental trade, trawled to harvest shrimps and prawn, and constructed with fish corrals for the collection of rabbitfishes. Sea cucumbers are easily harvested for food, sea urchins for the gonads, and sea hares for their eggs.

The effect of land clearing and deforestation in the watershed areas and from swidden agriculture or kaingin result in the sedimentation of seagrass beds. In addition coastal eutrophication from industrial, residential and commercial facilities are additional stresses on the seagrass community.

The loss and degradation of the seagrass beds will also affect the adjacent coral reef area and mangroves. Seagrasses are functionally linked to coral reefs and mangroves (Fortes 1988, 1991, 1995). The interconnectivity of coral reefs to mangroves through seagrass beds makes the latter more sensitive to changes in the environment. This makes seagrasses a good indicator of the health of the coastal ecosystem (Fortes 1995). Seagrasses are protective buffers against sedimentation, preventing the further transfer of sediments to nearby coral reef areas. Seagrasses are effective retainers of sediments because of the thick mass of their underground systems (Fortes 1995). The root systems are anchors that bind the sediments, and without these anchors sediments become loose causing erosion and sedimentation of the habitats. They also act as a buffer to the coastal zone from strong waves and surges, especially during tropical cyclones (Fortes 1988).

Table 2.11 Conversion/utilization of seagrass beds in the Philippines

ACTIVITY	USE	RANKING
Industrial development	widespread	Major use
Ports	widespread	Major use
Recreation	widespread	Major use
Waste disposal	widespread	Moderate use
Boat Traffic	widespread	Moderate use
Aquaculture-Fish	localized	Major use
Urban development	localized	Major use
Mining	Localized	Major use
Aquaculture-Prawns	Localized	Moderate use
Solar salt	Localized	Moderate use
Flood run-off	Localized	Moderate use
Aquaculture-crabs	Localized	Minor use
Sugarcane	Localized	Minor use
Airports	localized	Minor use

Source : Fortes 1995.

The over-exploitation and degradation of seagrass beds will inadvertently threaten the populations of some endangered organisms such as dugongs and marine turtles found in seagrass beds (Fortes 1995). Dugongs and turtles have been hunted for subsistence and their commercial trade in the Indo-Pacific region has endangered them. CITES actually listed these species as endangered (IUCN 1983).

Human society benefits from seagrass beds which could supply around 30 per cent of the fishes caught in nearshore areas (Fortes 1994). Seagrass meadows are also fishing grounds for juveniles and small adults of the economically important rabbitfish, Siganus. Siganids dominate the fish catch in seagrass areas, for example, reaching up to 80 per cent at Cape Bolinao, Pangasinan (Fortes 1995). The composition of organisms collected from a trawl sample in the beds comprised 28.6 per cent fish and 71.4 per cent prawns (Fortes 1995). Seven species of prawns, including commercially important species were found in seagrasses (Fortes and Flores 1994).

Recommendations for the management, conservation and sustainable use of seagrasses in the country have been made by Fortes (1995), as well as for an integrated approach towards seagrass and mangrove ecosystems, focusing on the interconnections of these habitats (Fortes 1988, 1991).

2.4.3 Critical habitats, ecosystems and species of transboundary importance

Critical to the goal of sustainable development of the marine ecosystem is the aim to protect, to sustain and to enhance these resources. Understanding the impacts on the marine environment from natural and human factors is crucial in the planning and management of these resources. Information on the differential contributions of these factors and their interactive effects are important for decision makers to adapt to the changing needs of society. The status review of the various ecosystems presented earlier can provide an objective basis for the strategic prioritization of critical marine habitats.

At present, aside from looking at the condition of various habitats and resources in the marine environment, various programmatic approaches (for example, the EIA system of the Environmental Management Bureau and the coastal environment programme) are being undertaken by various institutions to help understand and manage these resources.

Strategically, the protection of critical marine habitats and their biodiversity implies that the evaluation of their importance places a high priority on the significance of their integrated and multifunctional roles (for example, as a spawning and nursery ground and feeding area). The following criteria may be considered to identify and resolve the importance and significance of a particular area:

(a) Biodiversity values primarily refer to the degree of importance of the area based on the diversity of habitats, trophic levels, species and genetic pool. This also includes the appreciation of the significance of unique (for example, endemic) and endangered species;

(b) Ecological values refer to the evaluation of the role of the ecosystem as a geological buffer (for example, as in the prevention of coastal erosion) and its role in the interconnectivity of the resources, for example, as source and sink for both biotic and physical attributes (such as upstream and downstream features of pollutants);

(c) Fisheries values refer to the evaluation of the resources based on the potential for sustainable utilization (i.e., fisheries potential);

(d) Tourism values refer to the evaluation of the aesthetic values of the resources (for example, presence of scenic and recreational areas);

(e) Pragmatic considerations refer to social and economic attributes that interact with the biophysical attributes of the ecosystem which either enhance or attenuate the areas sustainable development.

In table 2.12, some management and policy considerations are proposed to highlight the possible options dealing with some priority areas and issues. Although the cases cited are not all encompassing, they provide useful lessons. The sectoral classification is based on the biogeographic areas of Aliño and Gomez (1994) and is useful in a strategic sense since it is a natural ecosystem framework. If one looks in the preceding sections for importance values, two (biodiversity and ecological) of the values are primarily related to the natural ecosystem features while the other three are more related to the ecosystems value to the Philippine society and its responses to it. The significance in the international and national level illustrates the high premium placed on the natural ecological heritage and its intergenerational importance. Another emergent insight is that in aspects where sustainable utilization is a prevalent objective (for example, FSP sites and regional growth centres for possible programmatic EIA) the primary role of local government becomes critical. Nevertheless, the emergence and heightened appreciation of community-based coastal resources management, with the establishment of municipal marine reserves and fish sanctuaries, are among the primary tools for management. It is only recently that the appreciation of coastal zoning and the harmonization of multiple uses through an inter-municipality or inter-provincial undertaking (for example, as in the FSP bays) makes coordinated and larger scale management units a challenge. In these situations, the need for coordination can be facilitated by the national government agencies through technical support, networking and leveraging of funds to where it is most appropriate.

How are the assessments of the various areas matched with ongoing and other programmes? The main programmes and relevant institutions which have direct bearing are the following: National Integrated Protected Areas System (NIPAS) under the PAWB, the environmental impact assessment system under the Environmental Management Bureau, the coastal environment programme, the Department of Agriculture - BFAR fisheries sector programme, and other associated programmes,for example, USAID - CRMP, UNDP- DENR-ICZM, and Monitoring, Control and Surveillance (MCS).

There is a need to evaluate the sustainable development needs of our national industrialization strategy through the integration of the regional growth centres in consideration of the programmatic EIA and the industrial environmental management programme recommendations. The usual EIA procedure is an important starting point that needs to be further integrated. The local government code appropriately provides jurisdiction for the local government units, a 15-km zone of municipal marine territorial waters. The Philippines, a signatory to UNCLOS and pursuing an archipelagic doctrine, subscribes to a 200 nautical mile exclusive economic zone. Further integration can be achieved with enhanced coordination and complementation at the various levels of government. For example, in areas of national and international significance the primary role of the national Government is crucial while more effective implementation can be achieved in the greater role of the local government units in the regional and local setting. In addition, while concerns such as the connectivities of genetic resources and transboundary issues (for example, the tuna as a straddling stock) are necessarily a national concern, on-the-ground efforts by the local communities can have an affect and these need to be coordinated.

The evaluation of these importance values should be viewed in an integrated perspective with the objective of determining how the multiple uses are harmonized to assure its sustainable development. These are also viewed according to their degree of significance in the international (for example, based on international conventions), national (for example, national heritage area) and local (regional and provincial) perspective.

If we look at table 2.12, we will notice that of all the sectors the Sulu Sea sector has two areas which are internationally significant (followed by those off the western coast of the Philippines facing the South China Sea). Can this imply a marine resource ecosystem strategic interconnectivity? This further implies that future marine affairs policy may require that these questions be addressed as a priority research gap agenda.

Perhaps one will notice that there is a north to south trend (albeit weak) superimposed with that of a north-east and south-west monsoon influence. This generalized influence of the monsoons together with the tectonic history primarily defines the objective constraints of our marine affairs. Our developmental thrust, as an archipelago should take this condition into greater consideration. It seems that despite the relatively more conducive conditions (for example, in the biophysical aspects such as high fisheries potential) for the development of the marine resources in the south and south-west sectors, relatively few government programmes have been undertaken. This highlights the great influence of the socio-economic conditions of the area (for example, the peace and order situation).

Consider also the marine resources evaluation exercise in table 2.13, which may help us qualitatively gauge the vulnerability and sensitivity of the sample cases. One can utilize the concept of the pressure-state-response model (IUCN/UNEP/WWF 1991) to elicit which areas are vulnerable or sensitive employing the importance values mentioned earlier. Going through this exercise, the vulnerable areas can be determined if one can glean which are the areas with high impacts (as in the coral reef evaluation approach of Aliño and Campos 1994; Aliño and others in press) and high importance values. Note that vulnerability here then implies that the type of human activities (i.e., use of the ecosystem) characterize the vulnerability of these areas. Sensitivity would refer to more objective criteria strictly based on the marine ecosystems ecological value (i.e., a turtle nesting area is more sensitive than a non-turtle nesting area regardless of use). For example, the areas in the Spratlys are highly sensitive areas because of the presence of endangered species and high clusters of reef assemblages. Although it is less vulnerable in its present state, it could become more vulnerable in the future depending on the social response (for example, effectiveness of programmes on these areas and increased political conflicts) of the times.

In addition, it is also apparent that no sufficient monitoring and evaluation programmes (especially on the effect of their protection, the improvement on the marine ecosystem and their allocation of benefits to the programmed beneficiaries) are in place to provide adequate inputs on how to adapt to the changing scenario and needs of these areas. The last column of table 2.12 is a summary of some general recommendations to encapsulate the general issues mentioned above. These recommendations should be considered as an initial tool (like a straw man) which can be used to help evolve a participatory overall framework for a marine affairs policy.

Lessons learned on the exploitation of marine resources

Based on the time estimates (1920-1994) already quoted, it can be surmised that around 60 per cent of the mangrove forest in the country has been lost to coastal conversion, mainly to fishpond developments. From a 1920 estimate of 500,000 hectares, only 200,000 hectares remained (as of 1994). In the mid-1980s, 45 per cent of mangrove loss has been converted to fishponds and the rest for other purposes (for example, exploitation for its forest products: timber, firewood, tannin, nipa). Recent stock assessment of coral reefs in the country showed about 70 per cent of the coral reefs have less than 50 per cent living coral cover. Siltation, overfishing and destructive fishing have been recognized as the three main factors affecting coral reefs. Although these three are equally prevalent, sedimentation is the most important factor. Seagrass beds in the country are also converted to other uses, for example, ports, industrial developments and recreation. However, no comprehensive evaluation on the seagrass cover in the country has been undertaken to date. Pelagic and demersal fisheries have been biologically and economically overfished. The soft-bottom areas and the oceanic regions are highly overfished communities. Around 80 per cent of our marine environment comprises sandy/muddy habitats and oceanic areas, yet these two are the least appreciated. For a complete tabulated listing of the status, uses and threats of these coastal ecosystems, see Fortes (1996).

Bioeconomic studies demonstrate that the combined ecological and economic studies on the coastal zone attempt to maximize economic benefit while minimizing social and environmental costs. Policies with a sound scientific basis are advocated for the reorientation of economic policies. The concept of resource or economic rent has only just been recognized and adapted by the Government. The employment of resource/economic rent imposes on the users near the true value of the resource. This is often abused in open-access exploitation. The open-access characteristics of the marine environment can be managed with community-based management for the rational use of the resources. Existing recommendations for different marine ecosystems can be initially used to provide the conceptual framework for the conservation, management and sustainable use of these marine resources.

Table 2.12 Priority issues and possible management options in the various biogeographic sectors

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
I. Western Palawan	I.1. Spratlys and the Kalayaan Islands Group (KIG) - disputed areas, political conflicts threaten critical habitats (small island coral reef ecosystem) and associated endangered species (McManus and others 1992; Aliño and others 1996)	I	I.1.a. Establish internationally recognized (e.g., protocols or conventions) marine protected areas (jointly-managed or stewardship arrangements) in these areas to enhance its importance as an Asian or world heritage site. I.1.b. Agree on stewardship arrangements (within the status quo) for the importance and establishment of strict marine conservation and protection zones w/in each base area and agree on grey zones for joint scientific and conservation efforts. I.1.c. Identify highly critical areas (e.g. seabirds and marine turtle nesting areas, marine mammal migratory corridors) as objective bases for a common heritage area.
	I.2. Calamianes Group - unique and threatened coastal habitats (e.g., Coron, Calauit)	N	I.2-I.4 a) Clarify and resolve delineation of importance for national and local jurisdiction based on its relative importance as national and local heritage zones. b) Emphasize and coordinate integrated activities to optimize sustainable and equitable benefits at all levels. c) Enhance the complementation of ecotourism and biodiversity protection and management as the preferred development goal to the sustainable utilization of fisheries.
	I.3. Bacuit Bay - unique and threatened coastal habitats (e.g., El Nido's pristine reefs and presence of Dugongs and marine turtles)	N	
	I.4. Ursula Island - endangered seabirds	R/P	
	I.5. Ulugan Bay - sustainable utilization of coastal resources	R/P	I.5-I.6 a) Estimate carrying capacity (e.g., fisheries and tourism of the bays and regulate harmonious uses accordingly (zoning and regulatory guidelines per zone) b) Establish sustainable local environment and resources councils (LERC) which are integrated at all hierarchical levels (e.g., barangay to the provincial level). c) Promulgate programmatic EIAs in these priority bays and/or sectors.
	I.6. Malampaya Sound - sustainable utilization of coastal resources (esp. mangroves)	R/P	

Significance Level: I=International; N=National; R/P=Regional and Provincial (local significance).

Table. 2.12 (continued)

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
II. North of Mindoro to NW Luzon	II.1. Scarborough Shoals - high diversity coral reef area together with presence of endangered species	I	II.1.a. Link this reef area to the more internal waters (e.g., through the validation of source and sink relationships or marine larvae and adults in the other sectors of the country). II.1.b. Establish the area as a national marine protected area (MPA) for the sustainable utilization of marine resources in the coastal areas of the country.
	II.2. Puerto Galera, Mindoro Oriental - UNESCO MAB -need to enhance ecological protection and highlight educational value	N	II.2.a. Coordinate with the UNESCO Man and the Biosphere (MAB) program, LGU and the DOT's short and long term plan and implementation for coastal management in the area. II.2.b. Establish the area as a demonstration site to highlight the education and cultural value of the area as a model for harmonious uses through tourism, ecological value appreciation and fisheries potential.
	II.3. Apo Reef, Mindoro Occidental -need to enhance ecological protection and highlight educational value	N	II.3.a. Highlight Apo Reef as a critical gateway to the Sulu Sea (SS) and the South China Sea (SCS) and is at the intersection between sectors I, II, IV and V. II.3.b. Establish research and monitoring programs as way of evaluating the pulse of the SS and SCS. II.3.c. Since this area has no resident population, it has a high probability of success to consolidate gains of the CEP.
	II.4 Batangas Bay and Balayan Bay -requires improvement in the effective management to assure sustainable use (for II.4 to II.8) II.5. Manila Bay II.6 Subic Bay II.7 Lingayen Gulf II.8. Oyon Bay	I/N N R/P N R/P	II.4-II.8 a) Consolidate gains of the area by phasing over most internationally initiated activities to locally implemented sustainable pursuits. b) Transform CEP led coordinated programs in the area to CEP technically assisted programs. c) Enhance local capabilities through international recognition, training and collaboration in order to assure sustained ICZM in the area.

Table. 2.12 (continued)

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
III.a. NE Luzon (Batanes to Casiguran Peninsula)	III.a.1. Batanes Islands (e.g. Yan-i Islands) - flyway and seaway of many important seabirds and endangered species (e.g. marine turtles, turban shells) III.a.2. Fuga Island - potential ecozone, privately owned but with significant manta ray population, high diversity and tourism value III.a.3. Palanan Wilderness Coastal Area -downstream sensor for one of the few remaining coastlines adjacent to ultrabasic primary forests	I/N N N	III.a.1-III.a.3 a) Due to the areas' susceptibility to the NE monsoon ("amihan"), these sectors' relative inaccessibility has been afforded natural protection so that no new high level development thrusts should be encouraged. b) Ecotourism can be the development thrust but sustaining these activities without upscaling the market demands requires innovative approaches; these approaches remain to be further explored. c) Increased access by land in the long term will create greater pressure on the eastern coasts (e.g., from siltation) and further infrastructure development would entail the EIAs on their socio-ecological impacts be carefully considered so as to maintain and reserve these pristine areas.
III.b. Aurora to Catanduanes	III.b.1. Pollilio and Minasawa Island -need to harmonize biodiversity protection within sustainable use (for III.b to III.c) III.b.2. FSP Bays on the Pacific side (e.g. Calauag Bay, Lagonoy Gulf, etc)	R/P R/P	III.b-III.c a) In order to facilitate the harmonious uses through protection and regulated use - the establishment and institutionalization of marine protected areas (especially in the island ecosystems as municipal marine reserves and fish sanctuaries). b) Planning and implementation of coastal zoning mechanisms to be merged with the bay management councils need to be further pursued.
III.c. Pacific Coasts of Samar & Leyte	III.c.1. Guian III.c.2. Limasawa Island	R/P R/P	

Table. 2.12 (continued)

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
IV. West & Central Visayas; West Coasts of Samar and Leyte and Northern Mindanao	IV.1. Taklong Island -enhance gains of local initiatives to integrate impacts for optimal benefits to the regional and national (for IV.1 to IV.5)	N	IV. This sector by far has the most number of local initiatives and these gains need to be consolidated so that sustainability is assured and its benefits are optimized; In order for these successes to be sustained and optimized, consolidation can be achieved by pursuing the following mechanisms: a) that highlight these successes in order to engender recognition of the lessons learned, b) that explore and pursue integrative value added activities to explore interconnectivities of island ecosystem clusters so as to cope with increased marine waters usage, c) where EIA programs, NIPAS and maritime activities will need to adapt to these developmental transport inevitably making the fluid conditions a crucial test case for strategic planning, d) where each of the local initiatives will require the appreciation of large scale processes which can affect their Territorial Use Rights Fisheries (TURF) areas
	IV.2. Olango Island and vicinity (including MEPZ)	N	
	IV.3. Pamilacan Island - marine mammals	N	
	IV.4. Apo Island	R/P	
	IV.5. FSP Bays (e.g., Ormoc, Sogod, Carigara)	R/P	

Table. 2.12 (continued)

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
V. The Coasts and Oceanic Regimes of the Sulu Sea	V.1. Tubbataha Reefs (including Basterra) -need to assure the sustained protection of these unique and threatened habitats; requires enhancement of its national and international significance -high diversity -world heritage site -National Marine Park V.2. Turtle Islands - nesting area of 80% of the marine green turtle population (*Chelonia mydas*)	I/N I/N	V.1 and V.2. The Sulu Sea can be considered as a relatively large marginal sea (embayment vis-à-vis others in the country) which is the Philippines' internal gateway of the Pacific Ocean to the South China Sea. This feature affords this sector with other unique assets whereby in its heart and bossom two significant international areas are situated (the Tubbataha Reefs and Turtle Islands). In order to assure the enhancement of the national and international heritage values of these areas, protection and preservation of these areas are the primary goals with the options to: a) Implement effectively the proposed management plans for the Turtle Islands and Tubbataha Reefs. b) Foster greater participation of local multisectoral stakeholders in the area. c) Assure that in the long term, greater responsibility is afforded the local governments involved with the national agencies defining their role in technical assistance, coordination, administration and funds leveraging.
	V.3. Sta. Cruz Island, Zamboanga -harmonize tourism and ecological value V.4. Taytay Bay (northeastern Palawan) -harmonize tourism and ecological value -marine mammals (*Dugon dugong*)	R/P N	V.3-V.4 a) Ecostourism activities should be harmonized with sustainable uses by emphasizing the areas' ecological values aside from the pure recreational assets. b) A sustained activity for *Dugong dugong* conservation program and other endangered species in this sector needs to be established.

Table. 2.12 (continued)

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
VI. Eastern Mindanao	VI.1. Siargao Island, Surigao del Norte -unique coastal habitats -marine crocodiles (extensive mangroves) VI.2. Pujada Bay, Davao Oriental -habitat for endangered marine organisms -start of Red Tide	N R/P	VI. For the two areas of Eastern Mindanao, the range of multiple uses are exhibited by a spectrum of high ecological, biodiversity, tourism and fisheries values. Considering these potential environmentally sensitive values, the following options may be pursued: a) Operationalize the Siargao and Pujada Bay management plans taking into consideration the range of harmonious multiple uses of the area within the context of the overall national strategy. b) The degree and direction for industrial development in Siargao Island (as an Island ecosystem) should be minimal and the ecotourism push be regulated according to the carrying capacity (targets) since the area's susceptibility to the northeast monsoon can accentuate high levels of human impacts. c) On the other hand, Pujada Bay being as enclosed bay in the northern mainland of Mindanao will experience a high rate of agro-industrial activity and thus critical protection zones (e.g. Pujada Is.) should be operationalized and buffer zones within the bay heads and belly be established.

Table. 2.12 (continued)

Sector	Areas and Priority Issues and Concerns	Level	Policy and Management Options
VII. Southern Mindanao and the Celebes Sea	VII.1. Davao Gulf -requires identification of more priority MPAs to harmonize sustainable use objectives (for VII.1 to VII.3)	R/P	VII. The Southern Mindanao sector is the least exposed to typhoons and has its rich fisheries potential as its most significant asset. There is a need to harmonize the likely increased utilization of on-stream programs (e.g. FSP-Phase II, IDRC-MCS and the DENR-CEP at Mabini Island) that have been initiated. Since the initiatives are relatively new and the socio-political climate are quite unique, the following options can be pursued: a) Enhance participation and capacity of LGUs and NGOs in the area with the proper mixture of co-management and CB-CRM approaches in relation to sustainable fisheries utilization and marine biodiversity protection. b) Consider inter-agency bay consultative committees and enhance the integration of NIPAS, CEP, FSP and EIS procedures into the economic zone (SPCPD) development agenda. c) Establish the interconnectivity of the genetic stocks in these three bays with its shared stocks of the Celebes Sea with Indonesia.
	VII.2. Moro Gulf	R/P	
	VII.3. Saranggani Bay	R/P	

Table 2.13 Sample exercise (not validated) to help elicit vulnerable and sensitive areas (based on biodiversity significance level and pragmatic value)

Sector		Significance Level	VALUE*			PROGRAMS				
			F	E	T	NIPAS	CEP	EIA need	FSP	Other Programs
I.1	Spratlys	5	5	5	1					X
I.2	Calamianes	3	5	3	3					X
I.3	Bacuit	3	3	5	5	X		H		
I.4	Ursula	1	5	3	3					X
I.5	Ulugan	1	5	1	1			M		X
I.6	Malampaya	1	5	1	1			M	X	
II.1	Scarborough Shoals	5	5	5	1			L		X
II.2	Puerto Galera	3	1	3	5	X	X	L		X
II.3	Apo Reef, Mindoro	3	1	5	5	X		L		
II.4	Batangas and Balayan Bay	4	1	3	5		X	H		X
II.5	Manila Bay	3	5	1	3			H	X	
II.6	Subic Bay	1	3	1	5	X		H	X	
II.7	Lingayen Gulf	3	5	3	3		X	H	X	
II.8	Oyon Bay	1	3	1	1			H		X
III.a.1	Batanes	4	4	5	3	X		M		
III.a.2	Fuga	3	1	5	4			H		X
III.a.3	Palanan	3	1	3	3	X		M		
III.b.1	Pollilio	1	5	3	1			M		X
III.b.2	FSP Bays	1	5	1	1			H	X	
III.c.1	Guian	1	3	1	1		X	L		
III.c.2	Limasawa	1	3	1	1			L		
IV.1	Taklong Island	3	3	5	3	X	X	M		
IV.2	Olango Island	3	3	5	5	X	X	H		X
IV.3	Pamilacan Island	3	3	5	5		X	M		X
IV.4	Apo Island	1	3	3	5		X	M		X
IV.5	FSP Bays	1	5	1	1		X	H	X	X
V.1	Tubbataha	5	3	5	5	X		L		
V.2	Turtle Islands	5	3	5	5	X		L		
V.3	Sta. Cruz Island	1	1	1	5		X	H		
V.4	Taytay Bay	3	1	5	5			H		X
VI.1	Siargao Island	3	3	5	1					
VI.2	Pujada Bay	1	3	3	3					
VII.1	Davao Gulf	1	5	3	3		X	H	X	
VII.2	Moro Gulf	1	5	3	3		X	M		X
VII.3	Saranggani Bay	1	5	3	3	X		H	X	

*F=Fisheries; E=Ecological; T=Tourism
*Values of 5 = High value, 3 = medium and 1 = low are based on expert evaluation of the author

3.0 NATIONAL ANALYSIS OF THE SOCIAL AND ECONOMIC COSTS OF THE IDENTIFIED WATER-RELATED PRINCIPAL ENVIRONMENTAL ISSUES

The following sections are constrained by the paucity of information available to provide quantified estimates of social and economic costs. Despite these constraints, this report attempts to explore some possible indicators (for example, utilizing descriptive accounts from many disaggregate and discrete sources) which may help one to surmise the range and extent of the costs in the water-related issues. Moreover, we also call attention to caveats on the available information to show the need to further investigate and establish an information system for decision support on these issues. This can be developed in an adaptive management approach in which interventions do not have to be delayed but with best guess or information available, measures are implemented (utilizing precautionary principles). Adequate information feedback to adapt or adjust the management mechanisms to appropriately respond to the situation should be an inherent aspect in this adaptive management approach.

Cross-sectoral relationships in freshwater and marine, upstream and downstream effects are difficult to cost but can be estimated based on some crude indicators (for example, Hodgson and Dixon study in Palawan 1988). As mentioned, the need for a more comprehensive and ongoing national and environmental resource accounting system integrated into government policy has been pointed out by many (Cruz and Repetto 1992, de los Angeles 1994, Montes 1994 and Constanza and others 1997). In order to evaluate these socio-economic costs, the cause and effect relationships in the following areas have to be well established:

(a) The variability of effects in habitat change and resource over-exploitation;
(b) The intersectoral effects of natural and environmental use changes by the stakeholders (for example, materials intensive and industry intensive industrial growth and increasing pollution);
(c) The interpersonal effects of unemployment, poverty and population pressure on marginal resources (Cruz and Repetto 1992).

The stabilization mechanisms and structural adjustment policies of the Government and how they impact on the environment and the water-related issues need to be proactively examined so as to cope with the present local and global changes. Since cause and effect indicators in environmental and resources utilization together with their effects are only starting to be incorporated into government policy and management of programmes (see Mendoza and Magpantay 1997), many of the descriptive accounts outlined below can be utilized to design and quantify forthcoming data inputs.

Biodiversity losses and habitat change in water-related concerns are not well quantified especially in terms of socio-economic values. Only indirect measures are described to give an indication of the possible socio-economic costs. For example, one can describe the decline in forests as related to effects on the watershed source of water and concomitant effect of erosion and siltation on water reservoirs.

How effective is the establishment of protected areas in reducing costs to the environment? The need sustain financial resources is also very fuzzy at the moment. It is not clear how capacity-building efforts, especially in manpower and research, have an effect in solving the problems concerned with water-related issues.

Table 3.1 Philippine nature sector accounts, 1988 (in million pesos)

INPUT	Amount	Pct to GDP
Environmental Damages		
a. Air	102	
b. Water	2,507	0.3
total	2,609	0.3
Net Environmental Benefit	24,214	3.0
NATURE SECTOR INPUT	26,823	3.3
Nature/Env'l Depreciation	(1,949)	0.2
NET NATURE SECTOR INPUT	26,874	3.1

OUTPUT	Amount	Pct to GDP
Final Demand for Nonmarketed Environmental		
Waste Disposal Services		
c. Air	5,149	0.6
d. Water	20,094	2.5
total	25,243	3.1
Direct Nature Services		
Diving	0.97	
Forest Recreation	13	
Coastal Beaches	1,566	0.2
Total	1,580	0.2
NATURE SECTOR OUTPUT	26,823	3.3
Nature/Env'l Depreciation	(1,949)	0.2
NET NATURE SECTOR INPUT	24,874	3.1

Source: Angeles, Peskin and Bennaga 1994

3.1 SOCIAL AND ECONOMIC COSTS OF POLLUTION

Estimates of the economic costs of water-related sewage are around 2.5 per cent of GDP. While it may seem low, this can be significant considering that the Philippine foreign debt servicing is around 3.6 per cent of GDP (Montes 1994). In addition since many pollution problems and habitat modification have long-term effects on ecosystem changes, annual estimates on environmental costs as a proportion of GDP should be viewed carefully. This caveat relates to the averaging of cost estimates of environmental damage which is carried over the years (giving lowered estimates) when in reality some cumulative effects may be accrued (for example, biological accumulation and entrainment of pollutants in sink areas such as lakes and embayments).

Social costs related to the loss of employment associated with poor health and reduced fish production may eventually lead to the marginalization of the poor in the coastal areas. In many of the manufacturing coastal areas, squatter colonies aggregate to provide services to the labour population in the area including the proliferation of sex workers, drug users and criminals.

Ethical and cultural costs accrue from a loss of respect for the water environment because of their sense of helplessness in not being able do something about their condition. This feeling of helplessness occurs especially in areas that are located as downstream receptors of accumulated pollutants from upstream manufacturing firms.

Health costs from diseases such as diarrhoea and gastro-enteritis from ingestion of poor quality seafood affected by pollutants have not been fully estimated. Often reports of food poisoning from seafood intake are seen in newspapers. Death from paralytic shellfish poisoning has often been an indicator that a harmful red tide bloom has occurred. Other effects from biomagnification of toxic and hazardous chemicals have not been well documented but some reports have implicated potential hazards from mercury contamination.

3.2 SOCIAL AND ECONOMIC COSTS OF WATER SHORTAGE AND DEGRADATION OF ITS QUALITY

A study funded by the Japan International Cooperation Agency (JICA) for the National Water Regulatory Board that classified the country into freshwater regions based on river basins and projected simulations of trends from 1995 to 2025 showed that the National Capital Region (NCR) had the lowest (1.8 per cent) annual average growth rate from 1995 to 2025 of the water regions classified. However, it still had the highest level of per capita income (P42,962) followed by central Luzon and southern Tagalog. Judging from the gross value added projections in all sectors (industry, agriculture and services) for these water regions, it was obvious that the regions that were projected to have the highest gross value added were found in very limited water resources regions (III, IV, VII, VIII and X) and river basins (Pasig- Laguna Bay, Mindanao and Cagayan). This suggests that a more balanced development needs to be carried out in these water resources regions or they will have to contend with water constraints.

Saline water intrusion and groundwater pollution have been identified as the two main problems pointed out by the study although it did not gauge the magnitude of these problems. Despite the identified causes of over-exploitation of groundwater and pollution from increased population activities, there is as yet no national evaluation of socio-economic costs accruing from these problems. The high incidence of anecdotal and circumstantial evidence indicates that these problems may have the highest costs in Metro Manila and Metro Cebu areas.

Environmental socio-economic costs associated with flooding on land have also not been fully evaluated but have been reported to have caused major damage to life and property and to have reduced economic productivity.

The impact of the construction of dams and related engineering facilities has been well recognized, for example, the modification of freshwater habitats and species composition changes. This area is another gap that requires further investigation.

In the environmental section of the study, it identifies soil erosion as a problem in many catchment areas but the social-economic costs have not been evaluated. Furthermore, insufficient surface water classification has led to inconsistent uses and water quality problems.

In Region VII, especially for Cebu and Bohol, the catchment area has experienced water quality problems because of the increasing population.

Since the social and economic costs have not been elucidated, one can only speculate on the possible costs. Dependent on development trends and the distortions brought about by water shortages and pollution, employment will be affected by changes in economic activity. In addition, costs to the community from poor health and disease (for example, malnutrition, hepatitis and diarrhoea) which result from lowered and inadequate water supplies have been considered but not quantified.

3.3 SOCIAL AND ECONOMIC COSTS OF OVER-EXPLOITATION OF AQUATIC RESOURCES

Around 0.1 per cent of GDP natural resource depreciation was estimated by Angeles and others (1994) as cited by Montes (1994). But Lacanilao (1997) points out that from a peak of 1.2 million tons of fish caught by municipal fishers in 1991, this catch volume dropped to 0.9 million tons in 1996. This may be indicative of possible over-exploitation since he pointed out that 1996 saw a drop in the total fisheries catch despite an increase in aquaculture and commercial fish production. If we were to estimate the total cost of this decrease it would amount to around $30 million a year, 0.01 per cent of GDP. On the other hand, Saeger (1994) provided more detailed estimates of the annual economic and financial losses and rent dissipation from the different fisheries subsectors, as follows:

1. Demersal fisheries: rent dissipation of between US$100 million and US$160 million (with an assumed average of US$130 million)
2. Small pelagics: rent dissipation of US$242 million
3. Large pelagics: rent dissipation of US$300 million
4. Brackishwater aquaculture and destroyed mangrove areas: rent dissipation of US$ 242 million
5. Collection of aquarium fish: rent dissipation of US$242 million
6. Spoilage from improper post-harvest handling: losses of US$390 million

Based on these conservative estimates, the combined annual rent dissipation and losses in the fisheries sector total at least US$1.23 billion. To be added to this figure are the losses of fish harvests because of poaching by foreign fishing vessels, worth about P50 billion since 1989, equivalent to annual losses of approximately US$57 million. These harvest losses may be classified as lost fishing opportunities and the activities certainly contributed to the current problem of overfishing. If these losses are added to the estimates above, then the aggregate deficit will total US$1.8 billion or P50.4 billion annually.

The social and economic costs to more than 90 per cent of the total fishing population in reduced incomes and loss of possible livelihood is mind-boggling. Approximately 20 per cent of fishing may need to be reduced to restore sustainable levels.

3.4 SOCIAL AND ECONOMIC COSTS OF HABITAT CHANGES

As mentioned in the earlier sections it is difficult to evaluate the socio-economic costs of habitat changes since no nationwide study has been completed to draw these estimates. We utilize examples from two (the coral reef and the mangrove habitat) of the most highly productive areas in the country to show the possible magnitude of these losses. It is in these two habitats that areal cover estimates of these ecosystems have been made.

For the coral reef, areal cover estimates range from 25,000 - 33,500 square kilometres. Gomez and others 1994 estimated that only around 5 per cent are in excellent condition whereas around 20 per cent are in poor condition. Based this information, I speculate that the shift from excellent to poor may be initially equivalent to a loss of around 5 per cent of its total productive area (range: 1,250 - 1,670 square kilometres). If one utilizes an initial benchmark estimate of Constanza and others (1997) at $6,075 per hectare the loss would already be around $0.7 - 1billion. Note though, that it is difficult to gauge the loss on an annual basis and efforts to look at the recovery rates of reefs might be the approach towards resolving this concern.

On the other hand, consider the loss of mangroves of around 260,000 hectares (1994) from an original area of around 400,000 to 500,000 hectares in the early 1900s. Again utilizing a median value of around $10,000 per hectare from Constanza and others (for coral reefs at $6,075 to estuarine areas of $16,000 per hectare) we have an estimate of $2.6 billion. Again, there is a problem of how to evaluate this loss on an annual basis.

As mentioned in the introductory part of this section, the social costs may be even more difficult to evaluate.

4.0 ANALYSES OF THE ROOT CAUSES OF THE IDENTIFIED WATER-RELATED ISSUES

Aside from the specific issues, there are some cross-cutting causes which may be considered systemic in nature. De los Angeles and Padilla (1992) have diagrammatically presented some of these concerns in relation to a cross-transect approach starting from the watershed down to the offshore areas. The demographic shifts into the coastal zone, which create increasing pressures in the main population centres, may be traced to disproportionate levels of development in the urban and rural areas. Fettered by a semi-feudal history, the large chasm between the landlord and tenant farmers who have access to natural resources has created a pull towards the sea where an open access situation prevails. In addition, this is exacerbated by inadequate coastal (marine) and land use zoning in most of the municipalities of the Philippines.

The lack of coordination and integration of administrative and jurisdictional mechanisms in order to solve water-related issues may be rooted in the insufficient legal and institutional conditions in the country. It has often been said that many of the laws on environment and natural resources are in place, and that what is needed is the political will to enforce them. Although there is some truth to this, there are macroeconomic and political conditions which may need to be addressed. The appropriate mix between central controls and private access arrangements especially in areas of common property should be well thought out.

One of the root causes may also be related to the effects of the increasing rate of globalization on the economy of the Philippines and the world in general. For example, production for exports and import substitution and enticements for increased investment into the country require caution. Instead of putting environmental controls and safety nets aside to be globally competitive, innovative taxation measures can be explored and other mechanisms for value added products can be undertaken (for example, improved processing and marketing and eco-labelling).

Some of these systemic root causes will be considered initially as constraints (see section 6) although it has to be emphasized that there exists a consistent lack of capacity in many of these areas (for example, economic, financial, scientific information and administrative organization).

4.1 ROOT CAUSES OF POLLUTION

4.1.1 Domestic and solid wastes

Only Metro Manila is served by a sewerage system (the Metropolitan Waterworks and Sewerage System, MWSS) which caters to around 1.2 million people of the estimated 9.45 million in the metropolis. According to Deocadiz (1997), the households of middle income families (about 4.8 million people) often have septic tanks which are adequately serviced while others utilize an "unconventional sewage system".