REGIONAL COORDINATING UNIT
EAST ASIAN SEAS ACTION PLAN

UNEP UNITED NATIONS ENVIRONMENT PROGRAMME

EAST ASIAN SEAS REGIONAL REPORT ON THE ISSUES AND ACTIVITIES ASSOCIATED WITH CORAL REEFS AND RELATED ECOSYSTEMS

RCU/EAS TECHNICAL REPORTS SERIES NO. 11

Prepared for the International Coral Reef Initiative (ICRI)
Regional Workshop for the East Asian Seas
Bali, Indonesia, 18 - 22 March 1996

UNEP
Bangkok, 1996

REGIONAL COORDINATING UNIT
EAST ASIAN SEAS ACTION PLAN

UNEP UNITED NATIONS ENVIRONMENT PROGRAMME

EAST ASIAN SEAS REGIONAL REPORT ON THE ISSUES AND ACTIVITIES ASSOCIATED WITH CORAL REEFS AND RELATED ECOSYSTEMS

RCU/EAS TECHNICAL REPORTS SERIES NO. 11

Prepared for the International Coral Reef Initiative (ICRI)
Regional Workshop for the East Asian Seas
Bali, Indonesia, 18 - 22 March 1996

UNEP
Bangkok, 1996

PREFACE

The first draft of this document was originally prepared and presented by the Environment Agency of Japan in cooperation with Marine Parks Centre of Japan, as a contribution to the International Coral Reef Initiative (ICRI) Workshop (Dumaguete City, 29 May - 2 June 1995).

The Dumaguete meeting requested United Nations Environment Programme's (UNEP) Regional Coordinating Unit for the East Asian Seas Action Plan (EAS/RCU) to arrange for the preparation of a revised version to be submitted for the review of the International Coral Reef Initiative Regional Workshop for the East Asian Seas (Bali, 18-22 March 1996).

The revised draft report incorporating country reports was completed by Kim-Looi Ch'ng of the EAS/RCU with inputs from Reza Amini, A. Cabanban, S. Arquit and V. Holmgren and presented for review at the ICRI Regional Workshop for the East Asian Seas. Much of the information, specially those with respect to oceanographic characteristics and species diversity, was drawn from the GBRMPA/World Bank/IUCN publication "A Global Representation System of Marine Protected Areas, Vol III" : the result of reports complied by scientists and resource manager of the region and edited by kelleter et al (1995). This report is the final edited version incorporating the recommendations emerging from the review by member States of COBSEA.

The East Asian Seas Regional Report on the Issues and Activities Associated with Coral Reefs and Related Ecosystems is divided into two sections: a main section and an Annex. The main body provides an overview of the status, issues and priority areas for action concerning coral reefs and related ecosystems. The Annex contains information with respect to the issues, existing programmes and priorities in each country which is gleaned from the original country reports sent to the RCU/EAS and reformatted with inputs from other sources.

This document is prepared as a background technical document for the International Coral Reef Initiative Regional Workshop for the East Asian Seas (Bali, 18-22 March 1996), in order to facilitate the deliberations of Workshop. **The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of UNEP concerning the legal status of any State, Territory, city or area, or its authorities, or concerning the delineation of its frontiers or boundaries.**

TABLE OF CONTENTS

PREFACE	iii
TABLE OF CONTENTS	v
INTRODUCTION	1
REGIONAL OVERVIEW	2
SOUTHEAST ASIA	2
Oceanographic Characteristics	2
Species Diversity	3
Coral Reefs and Associated Ecosystems: their Status and Factors Attributed to their Degradation	3
EAST ASIA	11
Oceanographic Characteristics	11
Species Diversity	11
Coral Reefs and Associated Ecosystems: their Status and Factors Attributed to their Degradation	11
AUSTRALIA	13
Oceanographic Characteristics	13
Species Diversity	13
Coral Reefs and Associated Ecosystems: their Status and Factors Attributed to their Degradation	14
INTERNATIONAL AND REGIONAL INITIATIVES RELATING TO THE CONSERVATION OF CORAL REEFS AND RELATED ECOSYSTEMS	15
KEY ISSUES AND PRIORITIES RELEVANT TO THE CONSERVATION AND SUSTAINABLE USE OF CORAL REEFS AND RELATED ECOSYSTEMS	17
Management	17
Capacity Building	20
Research and Monitoring	21
REFERENCES	23
ANNEX I COUNTRY REPORTS	27

1. INTRODUCTION

The area covered by the "East Asian Seas" region and the countries therein, depending on the purpose and the context in question, have been described variously.

The Action Plan for the Protection and Sustainable Development of the Coastal and Marine Areas of the East Asian Seas Region, covers the coastal and marine areas of Australia, Kingdom of Cambodia, People's Republic of China, Indonesia, Republic of Korea, Malaysia, Philippines, Singapore, Thailand and Socialist Republic of Vietnam.

For the purposes of the *World Conservation Union's (IUCN) Commission on National and Protected Areas (CNPPA)*, the East Asian Seas Region includes the following countries: Brunei Darussalam, the Kingdom of Cambodia, Indonesia, Malaysia, the Philippines, Singapore, Thailand and the Socialist Republic of Vietnam.

In this report in addition to all the countries covered by the above, included are Japan and Myanmar. However, within the framework of the ICRI, excluded is Papau New Guinea which is adequately covered by the ICRI Pacific Regional Report prepared by the South Pacific Regional Environment Programme (SPREP).

Therefore, with reference to the classification of IUCN, based on biogeographic criteria, this report covers three "sub-areas":

(i) Southeast Asia (East Asian Seas)
(ii) East Asia (Northwest Pacific); and
(iii) Australia

Coral reef ecosystems are very diversified, having the greatest number of species of any marine ecosystem[1]. They thrive in clear, warm tropical waters not deeper than 100 meters which contain low levels of nutrients, and which are of "oceanic salinity" and highly saturated with calcium carbonate minerals[2]. They also occur near to the sea-land interface; changes in conditions in adjacent land areas may therefore have significant impacts on the reef ecosystems[3].

Recent studies indicate that mainly due to the anthropogenic causes many of the world's coral reefs and related mangrove and seagrass ecosystems have been seriously damaged or destroyed. Coral reefs and associated ecosystems are being threatened by well documented causes such as over-exploitation, overfishing and inappropriate fishing techniques, human-induced environmental changes such as increased sedimentation and nutrient loading from urban, agricultural and aquacultural activities, and other land-based activities and pollution.

Compounding the problem are pollution hot spots due to the effluent discharges of the large and mega cities of the region, where untreated sewage has significant impact on the coral and associated communities.

Some coral reef communities have disappeared in the face of severe and long-term stress, to be replaced by more competitive and less valuable communities dominated by algae. In addition, coral reefs also face threats from climatic change in terms of rising temperatures and potential rising sea level, increased frequency of storm events, and altered ocean acidity due to absorption of carbon dioxide.

---

[1] Grassle et al. 1990

[2] Wilkinson & Buddemeier 1994

[3] Smith & Buddemeier 1992

It has been estimated that about 10% of the world's reefs have been "degraded beyond recovery", and that 30% are in danger of being so in the next 10 to 20 years[4]. Mangroves and seagrass beds are also facing similar problems of severe degradation.

Coral reefs and mangroves are valuable economic resources for many coastal communities in the East Asian Seas region: providing food, building materials and income (including foreign exchange from tourism and exports). However, due to increasing coastal population the exploitation of coral reefs and related ecosystems is growing significantly, seriously threatening their survival.

Globally, the vulnerable areas are those in Southeast Asia, East Asia, South Asia, East Africa and the Caribbean where there is high dependency on the reefs by coastal communities and the tourism industry.

The most immediate action needed to preserve coral reefs and related ecosystems is to establish protection and management measures, particularly for the reefs areas which have yet to be protected. This need to be combined with improvement of conservation and management measures in cases where such measures have been established but are found to be ineffective due to enforcement problems. In view of the indirect impacts of many land-based and marine-based sources of pollution on the reefs and related ecosystems, conservation measures must be addressed within the broader concept of integrated management of watersheds, coastal and nearshore marine areas, within the framework of large marine ecosystems (LME).

In addition to national measures, success will also be dependent on comprehensive and concerted regional and global cooperative efforts. The International Coral Reef Initiative provides the framework for such global cooperation.

2. REGIONAL OVERVIEW

2.1. SOUTHEAST ASIA

2.1.1. Oceanographic Characteristics[5]

The waters of the Southeast Asian region comprise the Andaman Sea, Straits of Malacca, Straits of Singapore, South China Sea, Java Sea, Flores Sea, Banda Sea, Arafura Sea, Timor Sea, Celebes Sea, Sulu Sea, and the Philippine Sea. The sea bed is highly variable and comprises shallow continental shelves, deep sea basins, troughs, trenches, continental slopes and volcanic and coral islands. The large number of islands divides the waters into several seas which are connected by many channels and straits. Climatically the region is dominated by monsoons.

The water mass of the Southeast Asian has its origin in the Pacific Ocean, though its tides are influenced by currents from both the Indian and Pacific Oceans. High temperatures, and low salinity and density prevail in the surface waters, with temperature ranging from 26°C to 30 °C. The salinity varies greatly due to the effects of high rainfall, the run-off from many large rivers and poor circulation prevailing in bays and channels. Heavy rainfall compensates for the high evaporation rate and results in an average salinity of less than 34 °/°° in most parts of the Southeast Asian regional seas.

---

[4] Wilkinson 1993a

[5] From Kelleher et al, 1995; Gomez et al, 1990; and Soegiarto, 1985

Factors such as silt, plankton and other particulate matter affect the water transparency. The water transparency is low in depths of less than 10 meters, especially around river mouths and in the coastal seas around Sumatra, Borneo and the Gulf of Thailand. In general, the transparency is high in the deep and open waters.

2.1.2. Species Diversity

The Southeast Asian marine environment supports unparalleled diversity of corals and associated fauna and flora[6]. The waters of the Philippines, the Malay-Indonesian archipelago and Papua New Guinea are believed to be the centers from which other regions of the world have recruited most of their marine fauna and flora.

Various landmasses and seas of the region exert their influence on the Southeast Asian marine environment. Currents from the Pacific and Indian Oceans bring in oceanic waters reducing the impacts of the land masses, providing optimum conditions for coral growth[7] and the associated seagrass ecosystems.

2.1.3. Coral Reefs and Associated Ecosystems: their Status and Factors Attributed to their Degradation

Coral Reefs

The Southeast Asian region is recognized to be the global center of biodiversity for coral reefs[8]. More than 30% of the world's coral reefs are found in the region[9]. Over 70 hard coral genera have been recorded in the waters around eastern Indonesia, the Philippines and the Spratley Islands, while 50 have been recorded for the other parts of Southeast Asia[10]. The reefs are mainly fringing types found around small to medium-size islands. The most extensive, diversified and spectacular reefs are found within the waters stretching from west Indonesia to the Philippines. Well-developed reefs are also found along the southern coasts of Myanmar and Thailand, the offshore islands of Vietnam, the eastern coasts of Peninsular Malaysia, and the coasts of East Malaysia (Sabah)[11]. One of the most spectacular diving sites in the world is found near the oceanic atoll of Pulau Sipadan off the coast of Sabah, where a very rich array of coral and marine life abounds. The atoll and the surrounding waters are major breeding and mating grounds for marine turtles. However, its proposed protection still remains on paper only due to its disputed status[12].

The reefs of Southeast Asia provide nursery and breeding grounds for many important commercial species of marine life, such as sea cucumbers, coral reef fishes, giant clams, sea anemones, etc. Reef fisheries form an important part of the region's catches and in some countries, such as East Malaysia, the percentage of reef fishes in the total catch can rise as high as 40% in the monsoon season when fishermen cannot go far out to sea.[13] Coral reefs

---

[6] Veron 1986; Leis 1991

[7] Wilkinson & Buddemeier 1994

[8] Kelleher et al. 1995

[9] Smith 1978

[10] Veron 1986

[11] UNEP/IUCN 1988

[12] Ch'ng personal comm. 1996

[13] Ch'ng personal comm. 1996

in the region, therefore, directly and indirectly provide the basis for a significant social, economic and ecological life support system. The reefs form is an increasingly popular tourist attraction. They are therefore important sources of food, income, and foreign exchange for many of the coastal communities.

The quality, extent and variety of the reefs, together with the degree of their exploitation, varies greatly within the waters of each country of the region. Generally, it can be said that already majority of the reefs in the region are degraded to various extent and in the absence of concerted sustainable management efforts most are threatened by further degradation.

The coastal population, particularly in the less developed areas, have always relied on the reefs as sources of food, construction materials, and income (i.e., trade of corals, shells, aquarium fish, etc.). With often unchecked growth of the population in general and coastal population in particular and lack of enforcement of conservation and sustainable management measures,the pressure on the reefs and associated ecosystems in many areas is rapidly reaching or has passed the natural regeneration and renewal capacities. The overall results is that the rich coastal waters of Southeast Asia are being over-exploited by both local inhabitants as well as fishermen from other parts. This over-exploitation has drastically reduced the population of many reef community species, and in some cases extinction of certain species has occurred[14]. The situation is made worse in many countries of the region by the use of destructive fishing methods, for instance, the use of poisons such as cyanide, the use of explosives, and the practice of "muro-ami" fishing[15].

The degradation of shallow-water ecosystems, such as coral reefs, can be considered one of the most serious problems confronting the marine environment of Southeast Asian countries[16].

The negative impact on the reefs and associated ecosystems are not confined to the nearshore activities. Many of the problems arise due to the anthropogenic land-based sources. Though it is difficult to quantify their severity, environmental impacts from land-based sources cause stress to the ecosystems leading to destruction or limiting their recruitment and growth in many areas. Inappropriate management of land and unsustainable development, coupled with the heavy seasonal rainfall in the region, has resulted in excess freshwater run-off causing (i) wide fluctuation in the optimum salinity ranges; (ii) excess sediment discharges; and (iii) heavy nutrient loading into coastal waters.

In certain areas where freshwater runoff is excessive such as the Gulf of Thailand,[17] the west coast of Peninsular Malaysia and the coast of Sarawak, East Malaysia[18], the reef growth has been limited. Eutrophication of seawater, through excess discharge of nutrient rich run-off, has been observed to decrease the water clarity and reduce the amount of sunlight necessary for coral health and growth. Furthermore, eutrophication, stimulating algal growth, often results in changes of community species toward a predominance of the less desirable benthic community species which in turn can accelerate the bioerosion of the reef system, leading to imbalance or the collapse of the reef structure[19].

---

[14] Wilkinson & Buddemeier 1994

[15] "Muro-ami" fishing makes use of tethered stones weighing approximately 2 kgs which are used to pound the reef structure with the intent of frightening fish into drive-in nets.

[16] Gomez 1988; Yap 1992

[17] Wilkinson and Buddemeir. 1994

[18] Ch'ng personal comm. 1996

[19] Report of the Workshop on Integrated Management of Watersheds in Relation to the Management and Conservation of Coastal and Marine (Nearshore) Areas in the East Asian Seas Region. UNEP/EAS, 1995 (unpublished).

Natural causes of reef damage are generally minimal. Apart from the central and northern Philippines, the region does not suffer from cyclones. Storm waves, therefore, have quite limited impact on the reefs of the region.

The reefs of Southeast Asia are also vulnerable to organic and non-organic pollution from other land-based sources. Organic pollution stems primarily from untreated urban sewage discharges, including tourist resorts, as well as runoff from agriculture and aquaculture. Heavy and often over-reliance on chemical fertilizers for agriculture is one of the main contributors.

Tourism development in the coastal areas and on the islands of the region has been increasing at an alarming pace over the past decade. These resorts are usually located in the near vicinity of reefs as an added attraction. Paradoxically, there are very few examples of proper management and safeguards to protect the reefs and tourism development on the coasts often result in a negative impact on the reef ecosystems. The impacts, in addition to organic pollution from untreated sewage discharges, are also as the result of physical damage. Destructive activities associated with recreation and tourism include coral trade, excessive reef visits and damage due to trampling, souvenir collecting, fishing (including spear fishing), anchor damage by boats and dredging of reefs to create channels and marinas. This is very evident in Malaysia, where tourism development on the nearshore islands of Johore and Terengganu in Peninsular Malaysia have adversely affected the islands' fringing reefs. An example is the archipelagic islands of Pulau Redang, off the east coast of Peninsular Malaysia, where a massive tourist resort development has severely degraded the only stand of mangroves on the main island. The damage to the mangroves has resulted in severe sedimentation in the adjacent waters which in turn has affected the only single-species stand of coral *(Millipora sp.)* in the Peninsular Malaysian waters[20].

Unchecked mining activities in coastal areas can also lead to major damage to coral reefs and the associated ecosystems. On Phuket island, Thailand, past tin mining in coastal areas has destroyed a significant part of the adjacent reef ecosystems.

The combined effects of all land-based and nearshore activities could result in almost irreversible damage. In Jakarta Bay, chronological data has shown a significant increase in the extent of sedimentation, pollution, and eutrophication between 1929 and 1993. As a result the average coral cover has diminished from 30% in 1985 to 5 % in 1995. A concomitant decrease in the number of species of corals from 96 to 16 for the period between 1929 and 1993 was also observed at one site. Benthic communities which have now become predominant are rapidly destroying the limestone reef matrix. A similar reduction in the numbers of fish species in the area has also been observed[21].

Most of the Philippine reefs are similarly afflicted. Studies have shown that only about 5% of the reefs are in good condition, with about 70% being seriously degraded[22]. The situation is comparable in Indonesia where 5% of the reefs are considered to be in good condition and about 60% degraded[23].

---

[20] A-Rahim and Ch'ng personal comm. 1996

[21] Kelleher et al. 1995

[22] ASEAN-Australian Marine Science Project 1992; Yap and Gomez 1985

[23] Sukarno et al. 1986

The Spratley Islands, situated in the South China Sea and subject to territorial disputes between the countries of the region, have some 600 coral reefs and associated ecosystems extending for more than 300 miles north of Sabah (East Malaysia) and southern Palawan (the Philippines). The database of the marine and coastal living resources of the Spratley Islands is relatively poor. Malaysia has established a tourist resort on one of the islands (Pulau Layang) and has undertaken a systematic survey of the adjacent reefs. The objective is to develop a manaģement plan for the protection of the marine resources as a marine park[24] However, some damage to the reefs has already been caused by the development of the facilities on this island.

The Spratley islands are located far from any land mass and, therefore, from most of the major land-based sources of pollution. Compared to the condition of reefs located close to land masses, those of the Spratleys are relatively pristine. However, there are recent reports of reef disturbances due to fishing with explosives and from damage inflicted by troops stationed there.

Land-based oil discharges into coastal waters causes problems for reefs and associated ecosystems. However, in the case of the Spratleys, a potential problem is oil exploration, production and transportation in the region. Over 200 ships pass through the area daily and oil rigs are located nearby, off western Palawan, Sabah, Sarawak, Brunei and the Natuna Islands of Indonesia. There is also the potential for oil exploration on the islands themselves. Presently the Spratleys have not to any large extent been subject to development owing to overlapping claims and political sensitivity over the islands. However, with any political settlement or agreement unplanned development could do untold damage to the reefs and the associated ecosystems in the area.

The Spratleys lie within the realm of the highest marine biodiversity of Southeast Asia and may support around 70 species of scleractinian coral genera. Marine turtles nest on the islands and there are significant seabird populations. The islands are, therefore, one of the last good remaining sources of viable broodstocks of larval coral, fish (important commercial species such as tuna) and other reef organisms which could be used to re-populate coral reefs in degraded areas[25]. The Spratley Islands are, therefore, of both regional and global significance for marine biodiversity conservation and consideration should be given to ensure their protection as a world heritage site[26].

Over the past few years efforts have been made by scientists and managers from several Southeast Asian countries and China to meet annually on an *ad hoc* and informal basis to discuss cooperation for the conservation of the area. However, due to the ad hoc and informal nature of the discussions, it is doubtful whether they will lead to any concrete results. [27].

---

[24] A-Rahim and Ch'ng personal comm. 1996

[25] McManus 1992

[26] Wilkinson & Buddemeier 1994

[27] Rahim and Ch'ng personal comm. 1996

Table 1: Major Coastal Activities and their Impacts on Coral Reef Ecosystems in Southeast Asia

	Activity		Impact
(a)	coastal urban development	*	sedimentation due to run-off
(b)	mining of corals	*	destruction of the reefs
(c)	destructive fishing methods, such as the use of muro-ami, use of poison (cyanide), and the use of explosives.	*	destruction of the reefs
(d)	land reclamation, dredging of waterways and estuaries, and construction	*	sedimentation due to run-off
(e)	anchoring on the reefs	*	physical damage to the reefs
(f)	removal of mangrove belts	*	sedimentation due to coastal erosion and excess freshwater run-off
(g)	uncontrolled aquaculture practices	*	pollution due to excess nutrient run-off
(h)	untreated domestic sewage run-offs	*	pollution due to excess nutrient run-off
(i)	industrial wastes run-off	*	pollution due to untreated industrial run-off
(j)	watershed/ catchment areas modification	*	sedimentation due to excessive run-off
(k)	Agriculture development	*	excess nutrient and fertilizer run-off and sedimentation from inappropriate agricultural development
(l)	Crown-of-thorns infestation	*	feeds on coral polyps and kills the reefs
(m)	Tourist resort development	*	sedimentation, untreated sewage discharge, and physical damage

The total coastline of the Southeast Asian countries is more than 100,000 km. Over 60% of the region's population lives in coastal areas. Even the remote offshore islands support populations of fishermen, and in recent years many of these islands have experienced an increasing influx of diving enthusiasts and general tourists[28]. With the exception of Singapore, the Southeast Asian region is experiencing rapid population growth. The region's population is predicted to increase from 475 million in 1993 to 726 million by the year

[28] Rahim and Ch'ng personal comm. 1996

2025[29]. At the same time, the region is experiencing one of the highest rates of economic growth in the world. If current trends continue, the already visible adverse impacts on the nearshore environment of coral reefs, mangroves and seagrass beds will be exacerbated by the growth of the population and the economy.

At present it is predicted that 48% of the Southeast Asian reefs will be depleted in the next 10 to 20 years and the rest in 20 to 40 years if the nations of the region do not take effective measures to ensure sustainable use of the coral reef resources and their associated ecosystems[30].

Mangroves

Mangroves represent the dominant coastal vegetation of Southeast Asia. About 35% of the world's mangroves occur in Malaysia, Thailand, Indonesia, Singapore, Cambodia and Vietnam. These form the world's most complex and diverse mangrove wetlands, with the world's highest species diversity of plants and animals. However, in the absence of management plans and conservation measure it is estimated that up to now approximately 30-40% of the region's mangroves have now been lost[31].

Indonesia's mangroves cover an area of 4.25 million hectares[32], with 2.9 million hectares in Irian Jaya. The mangroves in the western part of Indonesia have been badly degraded by human activities such as illegal cutting, pollution and conversion to other uses such as mariculture[33]. There are, furthermore, indications of degradation in the eastern part of the country, for example on the islands of Ambon and Halmahera[34].

About 642,000 hectares of mangroves occur in Malaysia. Mangroves and peat swamps cover 81% of the coastal areas in Peninsular Malaysia. Thailand and Vietnam each have about 200,000 hectares. The mangrove cover in Thailand decreased by 25% from 1979 to 1987, and 46% of the remaining stands have since been converted to other uses. The 100,000 hectares in the Philippines is estimated to be only about 20% of that of the 1920s, and about half of this remaining forest is composed of secondary forest. About 7,000 hectares are found in Brunei Darussalam and 10,000 hectares in Cambodia[35]. With the political settlement in Cambodia, there have been reports of extensive cutting of mangroves for aquaculture and development projects.

The main causes of mangrove depletion and degradation in the region are the following:

(a) reclamation and conversion of mangroves into industrial and housing developments, aquaculture and agricultural development, tourist resort development, and beach improvement;

(b) uncontrolled and unsustainable cutting of mangroves for poles, construction materials, firewood, and charcoal;

---

[29] World Resources Institute 1992

[30] Wilkinson 1993b

[31] Report of the Workshop on Integrated Management of Watersheds in Relation to the Management and Conservation of Coastal and Marine (Nearshore) Areas in the East Asian Seas Region. UNEP EAS/RCU, 1995 (unpublished).

[32] WCMC 1992

[33] ASEAN-Australian Marine Science Project 1992

[34] Kelleher et al. 1995

[35] WCMC 1992; ASEAN-Australian Marine Science Project 1992

(c) loss of diversity through the establishment of mangrove monoculture to support local construction and charcoal industries;

(d) oil pollution, including discharges from ships (both accidental and operational) and from coastal refineries as well as other land-based discharges;

(e) upstream watershed development (land-based activities) such as deforestation, agriculture, industry, housing expansion, mining, damming and irrigation development which substantially increase sediment, nutrient and pollutant loads downstream;

(f) reduction of water volume available to mangroves due to uncontrolled and/or excessive upstream damming and irrigation activities; and

(g) increased runoff of pesticides and herbicides associated with intensive agricultural activities.

Although mangroves have been found to be resilient to increased sediment, nutrient and pollution loads, this is only true for occurrences of short periods, and only for mature stands. The recruitment rate of mangroves is probably negatively affected by heavy sediment loads[36].

Mangroves are an important basis for the economy of the coastal communities in Southeast Asia. Mangroves support a rich ecosystem, crucial to commercial marine species by providing important breeding, feeding, and nursery grounds for valuable types of shrimps and other commercially or environmentally significant organisms. Mangrove forests also support numerous seabirds and are roosting and feeding grounds for migratory birds.

In addition, mangroves play a major role in the coastal ecosystem as a stabilizer. They assist in reducing the effects of land-based discharges on associated ecosystems such as reefs and seagrasses due to their capacity to function as filters. Mangroves probably act as a "sink" for industrial chemicals, although the long-term effects are poorly known and understood. They also function as a buffer to the effects of storm waves and their removal often results in severe coastal erosion, entailing high costs of mitigative measures to the nations concerned.

Seagrass[37]

As with corals and mangroves, the twenty species and seven genera of seagrass in the Southeast Asian region are among the most highly diversified in the world: 12 species are found in the waters of Indonesia[38], 16 in the Philippines[39], 10 in Malaysia[40], and 12 in Thailand[41].

It is only over the past decade or so that seagrass beds have been recognized as significant ecosystems which are of economic and ecological importance. Seagrasses perform several

---

[36] Report of the Workshop on Integrated Management of Watersheds in Relation to the Management and Conservation of Coastal and Marine (Nearshore) Areas in the East Asian Seas Region. UNEP EAS/RCU, 1995 (unpublished).

[37] Taken from Kelleher et al. 1995 and the unpublished report of the Workshop on Integrated Management of watersheds in Relation to the Management and Conservation of Coastal and Marine (Nearshore) Areas in the East Asian Seas Region 1995 (UNEP EAS/RCU)

[38] Den Hartog, 1970; Soegiarto and Polunin, 1981; Kiswara and Hutomo, 1985)

[39] Fortes. 1989

[40] Japar. 1994

[41] Lewmanomont and Ogawa. 1995

physical and biological functions. They serve as feeding areas, nursery grounds[42] and habitats for fish, many invertebrates, turtles and dugong. They also act as filters and help stabilize sediments.

Seagrass habitats are "hotspots", a term for areas rich in total numbers of species or of a particular species, especially those that are endangered or endemic. An example is the sea cow, *Dugong dugon* which is totally sea-grass dependent. It is the only remaining representative of the mammalian family dungongidae, and is an endangered species throughout its distribution. Sea turtles, which are similarly endangered, are found in seagrass areas and have been also observed to feed on seagrasses.

Among the Southeast Asian countries, only Indonesia and the Philippines have a relatively good knowledge of their seagrass habitats and associated resources. Even so, scientifically documented information of their response to environmental impacts is still lacking. Information is needed especially on the impacts of sedimentation, eutrophication and other types of pollution, in order to allow the application of appropriate management measures. The ignorance of the importance of seagrass beds as a marine life support system, ecologically and economically, has caused neglect in instituting protective measures for these valuable resources.

Threats to the seagrass beds of the region are both anthropogenic and natural. The latter includes cyclones, volcanic dusts, floods, sedimentation, storm waves, freshwater run-off and tidal exposures. Of the two, natural causes are responsible for seagrass loss over a wider area, however, recovery from losses due to natural causes is quicker. The most common anthropogenic impacts in the region are sedimentation (and its associated effects), nutrient-loading, and other types of pollution.

The sedimentation that adversely affects the seagrasses in the region has its origin in the river-runoff, carrying sediments resulting from extensive shrimp pond development, logging of forests, diminished mangrove cover, land reclamation, dredging and coastal development in general. There are increasing evidence that extensive land reclamation, agricultural development and mining activities have led to high water turbidity and the burying of seagrass beds[43].

As before, land-based activities lead to industrial and domestic sources of pollution such as chemical wastes (particularly heavy metals), various other toxic substances, oils and petrogenic hydrocarbons. Added to this is the ever present of pesticides and fertilizers, stemming from intensive agriculture and aquaculture practices. The most notable effect of pollution stress in the seagrass communities is the reduction in population and distribution to levels that are below naturally recoverable.

Plankton and algae flourish in eutrophic waters reducing the availability of light and thereby causing the declining health of the seagrass. In this respect, eutrophication poses one of the major threats to seagrass beds in the region. Eutrophication is especially prevalent in enclosed bays with insufficient tidal flushing. The run-off of excess agricultural fertilizers is not the only cause of eutrophication. Among the causes are wastewater from industrial and urban establishments; untreated sewage; boat discharges of human and fish wastes; and storm drain run-off carrying additional organic wastes and fertilizers.

---

[42] Hutomo and Peristiwady. 1996.

[43] Fortes 1989

2.2. EAST ASIA

2.2.1. Oceanographic Characteristics[44]

The East Asian Region covers an extensive area, from the arctic circle, to the south at the Hainan Islands and the southern territories of China. Consequently, a varied range of ecosystem types are found in this region: from those of the arctic to those of the tropics.

The major current systems influencing the region are the Kuroshio (warm) and the Oyashio (cold). The fronts of these two currents converge north of Japan, inducing very productive waters.

The archipelagic arch formed by the Philippines, Taiwan Okinawa, Japan, Kuryl, Kamtchatka and the Aleution Islands divides the region into an outer area and an inner area. The latter includes the South China Sea, East China Sea, Yellow Sea, Bohai Sea, Sea of Japan, Okhotsk Sea and Bering Sea. The local currents in these seas are influenced by the Kuroshio-Oyashio system, the large rivers that flow into them and the monsoon cycle.

Surface water temperatures range from arctic to tropical. In the southern areas in the South China Sea off Hainan temperatures vary between 20°C in winter and 29°C in summer. Temperatures range from 8°C and 26°C in the East China Sea and between 3°C and 24°C in the Bohai Sea. South of Kyushu, in the Pacific, the temperatures vary between 20°C and 28°C. Liaodong Bay in the far north China is frozen for more than 100 days a year.

Water temperatures range from 25°C in winter to 30°C in summer at a depth of 10 meters in the south and from 0°C in winter to 5°C in summer in the north.

Salinity is usually between 32 and $34^{0/00}$, except in areas where it is influenced by river run-off in which case it can be as low as $28^{0/00}$.

2.2.2. Species Diversity[45]

Since the East Asian Seas region ranges from arctic to tropical waters, it includes a great variety of coastal and marine ecosystems. The region's marine waters are some of the most productive in the world: over 1,000 species are caught by commercial fisheries alone. The region has very high biodiversity, with China having more than 20,000 marine species. The southernmost region of China and the Ryukyu are characterized by a great diversity of coral reefs, marine fish and invertebrates.

2.2.3. Coral Reefs and Associated Ecosystems: their Status and Factors Attributed to their Degradation

Coral Reefs[46]

Japan is the northernmost area in the region where coral reefs are found: along the Pacific coast of Honshu, Shikoku and Kyushu and along the Amami Archipelago, Ryukyu Archipelago including Okinawa Island, Yaeyama Archipelago, the Izu Archipelago to the south of Tokyo, and in the Ogasawara Archipelago.

Further south, in the island of Taiwan the main coral reefs are found at the southern point of the island, around Kenting. There are also smaller reefs in several other areas, especially in the

---

[44] Kelleher et al. 1995

[45] Taken from Kelleher et al. 1995

[46] Taken from Kelleher et al. 1995

Penghu Archipelago. The northernmost reefs in the Peoples' Republic of China are found in Fujian province, around Pingtan Island. Small reefs also occur all around the coast and off Hong Kong. Large coral reefs exist south of Hainan and in the archipelagos of the South China Sea.

The region has quite a high number of coral species: more than 400 species of corals have been identified in Japan[47] and about 325 species in the Peoples' Republic of China[48]. About 300 species are reported along the coast of Taiwan.

Japanese reefs are unique as they are the northernmost reefs in the world. Around 30% of the Japanese coral species are not common anywhere throughout their range and are, therefore, in the absence of conservation measures they are considered to be at risk of extinction. Another 28% are classified as rare or are restricted to Yaeyama Island. Five to eight of the known endemic species are found only in species specific areas.

The reefs in East Asia show the same pattern of degradation and depletion from land-based sources of pollution as observed in the Southeast Asian region. In China, many of the reefs have been significantly depleted[49]. On the southern coast around Hainan, pressures from the large human population has resulted in extensive degradation of the reefs[50]. China is experiencing very rapid economic growth, especially in the coastal cities of the south. This growth will exert a greater pressure in the near future on the coastal and marine living resources and the associated ecosystems by creating a higher demand for food coupled with an increasing detrimental effect due to the land-based sources of pollution and activities.

The main threats to the coastal living resources are essentially the same as in any other region, with possibly different emphasis on the severity of certain causes. These threats can be summarized as:

- untreated urban sewage and industrial discharges;
- reclamation of nearshore areas for development;
- run-off from agricultural and aquacultural development;
- crown-of-thorns starfish;
- industrial discharges; and
- tourism development.

In case of the island of Taiwan in addition to these causes, further degradation is also the result of sedimentation from dredging and construction, the use of destructive fishing methods, thermal pollution[51], coral collection and overfishing.

Mangroves[52]

Most of the mangroves in the region are concentrated in the coastal areas of P.R. of China and measure up to approximately 67,000 hectares[53]. Japan has only 400 hectares.

---

[47] Veron 1992

[48] Liang 1985

[49] UNEP/IUCN 1988

[50] Wilkinson & Buddemeier 1994

[51] UNEP/IUCN 1988

[52] From Kelleher et al. 1995

[53] WCMC 1992

In the P.R.of China, the northernmost mangroves are found near Fuding in Fujian province. Significant areas of mangroves are found around Hainan and in the Beibu Gulf near Quinzhou and Beihai. China has a total of 36 mangrove species, which is about 43% of the total number of species of the world[54].

The mangroves in the East Asian Seas region, like those in the Southeast Asian region, are facing continued threats from land-based sources of pollution, mainly from agriculture, aquaculture, domestic sewage, and industrial discharge. Integrated coastal zone management, combined with conservation and rehabilitation measures, are essential to counteract the ever-increasing pressures from a growing population and its concomitant threats to coastal areas and mangroves of the P.R. of China.

Seagrass

Seagrass beds are located throughout the East Asian Seas region, with the most extensive areas around Japan. Of the 12 genera of seagrasses in the world, 8 are located in the region[55]. The more important seagrass beds are those of *Zosters sp. and Halophila sp.* found in the northern part of Honshu and around Hokkaido.

The seagrass beds in the East Asian region suffer from the same problems as those of Southeast Asia: excess nutrient loads from domestic sewage discharge, agriculture and aquaculture development, excess sedimentation and freshwater run-off due to inappropriate development activities in the watersheds and hinterlands and pollution from industrial development.

2.3. AUSTRALIA

2.3.1. Oceanographic Characteristics[56]

The marine waters of Australia range over three ocean temperature zones: tropical, with a temperature range of 25-31^{0}C; subtropical, ranging between 15-27^{0}C; and temperate, ranging between 10-25^{0}C. The tropical zone is the only one characterized by coral reefs and mangroves. The northern tropical waters have temperatures reaching 32^{0}C in the shallow waters in the summer months. In the tropical waters of the Indian and eastern Pacific Oceans, surface temperatures may sometimes exceed 28^{0}C. Surface temperatures in the deep oceans areas seldom show marked seasonal changes. Pools of warm waters such as the Leeuwin Current are produced by surface temperatures over the continental shelf in the summer months.

The oceanic waters around Australia are generally low in nutrients and consequently show low biological and fisheries productivity.

2.3.2. Species Diversity[57]

The greatest species diversity in Australia's marine environment occurs in northern tropical waters/ However, endemic species are uncommon, and most of Australia's tropical marine species are widely distributed in the tropical Indo-Pacific. By contrast, in Australia's temperate seas, overall species diversity is lower, but a higher proportion of endemic species occur. Recent research indicates that the waters of the southwest, Bass Strait, and the southeast are

---

[54] SOA 1993

[55] Den Hartog 1970

[56] Taken from Kelleher et al. 1995

[57] Taken from Kelleher et al. 1995

particularly important centres for marine endemism. For example, 20 new species of algae have recently been described in the Solitary Islands Marine Reserve, New South Wales. Some algal and ascidian communities in South Australian waters are among the richest and most diverse in the world (ANPWS, 1992).

2.3.3. Coral Reefs and Associated Ecosystems: their Status and Factors Attributed to their Degradation

Coral Reefs[58]

Australia has the largest area of coral reefs of any country. The Great Barrier Reef forms the largest reef complex in the world extending for 2,000 km from the low-latitude tropics to temperate zones, whilst Ningaloo Reef is the world's largest fringing reef. Other major reef areas occur in the Torres Strait, the Coral Sea Territories, and central and northern Western Australia. The Great Barrier Reef is most diverse in reef types (fringing, platform, barriers and atolls), habitats and environmental regimes. South of this reef complex, reef building corals occur as far as Sydney and Nabucca Heads. Although the best developed reefs are found in the northeastern tropical areas and northwestern coasts and shelves, Australia's temperate reefs of the Tasman Sea (Elizabeth and Middleton Reefs and Lord Howe Island) are found in the highest latitude of any coral reefs globally. In the Tasman Sea there is an influx of warm waters from the East Australian and Leeuwin Currents allowing the reefs to thrive at latitudes that are marginal for coral growth.

The reefs in western Australian extend north for over 3,000 km from the southernmost reef development around the Houtman Abrolhos. A wide variety of coral types are found here; oceanic atolls, fringing and veneer reefs and platform reefs of varying degrees of development.

Australia's coral reefs are relatively unaffected by human activities due to their remoteness and because of low to moderate levels of use. However, increasing levels of nutrients and sediments from inland soil erosion pose a threat in the non-arid areas.

Australia's reefs occur within the area of the world's highest coral diversity, namely the central Indo-Pacific region. The Australian reefs are, therefore, critical to coral reef conservation as few other countries in the region have such low coastal population pressure or the capacity to control the anthropogenic impacts on their reefs. Australian reefs, besides being an ecological asset, support very rich fisheries and a thriving tourist industry. The annual revenue from fisheries and tourism in the Great Barrier Reef alone is over 1 billion Australian dollars. The reefs are also valuable for scientific research on natural products of biopharmaceutical potential.

Mangroves[59]

Australia has the third largest area of mangroves, with some of the most diverse communities. Mangroves extend from the southern tip of Western Australia, through the Northern Territory, Queensland, New South Wales and Victoria around to the eastern side of the Great Australian Bight in South Australia.

Australia has 39 mangrove species (belonging to 21 genera and 19 families), of which only the *Avicenia integra* is endemic, whilst the rest are also found in Southeast Asia, Papua New Guinea and Irian Jaya. The most diverse communities are found in the tropical areas (35 species in the estuaries of Cape York) and the least diverse in the subtropical and temperate areas.

---

[58] From the Australian State of the Marine Environment Report (SOMER); the Commonwealth's Coastal Policy: Living on the Coast; and Graeme et al. 1995

[59] Taken from Kelleher et al. 1995

As in Southeast Asia and East Asia, mangroves are ecologically and economically important to Australia. Mangroves provide important habitats for fish and crustaceans and some of Australia's valuable commercial fisheries of single species are either directly or indirectly linked to mangroves. Approximately 197 species of fish have been documented from northern Australian mangroves, 64 from those around Brisbane and 46 from those in the vicinity of Sydney. The Australian mangroves provide bird sanctuaries and play important roles in stabilizing the coastline by mitigating the effects of cyclones and storm waves. Mangroves also have a crucial function in trapping and stabilizing sediments from river catchments, and act as effective barriers to nutrient carried by run-off from land to sea, protecting the coral reef communities from excessive sedimentation and nutrient loading.

Seagrass

Australia has the most extensive area of seagrass and the highest number of seagrass species (over 30 species) in the world. Their ecological and economic importance to commercial and recreational fisheries are well documented. The seagrass beds also enhance substrate stabilization. They are important in the supply and fixation of biogenic calcium carbonate, detrital food chains, and nutrient cycling. They serve as substrate for epibiota and are critical habitats (hotspots) for many species of marine animals.

Australia has fairly good database and knowledge of her seagrass habitats but much has still to be learned with regards to the responses of seagrass habitats to environmental changes so that mitigating measures of adverse impacts can be put in place. This is particularly true of the impacts of sedimentation, nutrient-loading and other types of pollution. Australia's seagrasses face such threats as sedimentation from large river run-offs, floods (the impacts of floods on seagrass beds are only documented in Australia), mining and chemical discharges from industrial and domestic sources.

Studies carried out in the Gulf of St.Vincent, South Australia[60], Toorbul Point in Moreton Bay in Queensland[61] and in Burum and Mary Rivers[62] have shown that smothering of seagrass by sedimentation have caused the reduction of seagrass beds. The decrease of seagrass beds in Botany Bay, Australia has been found to coincide with the period of industrial and residential development in the watershed areas between 1930-1987[63].

3. INTERNATIONAL AND REGIONAL INITIATIVES RELATING TO THE CONSERVATION OF CORAL REEFS AND RELATED ECOSYSTEMS

Several international and regional initiatives and programmes are currently involved in promoting sustainable development and conservation of coral reefs and associated ecosystems in the region[64]. Among these are:

(a) UNESCO's Man and the Biosphere Programme

---

[60] Shepherd et al. 1989

[61] Kirkman 1978

[62] Preen et al. 1993

[63] Larkum & West 1990

[64] Ch'ng Personal comm. 1996

(b) Programmes with regards to the 1971 RAMSAR Conventions on Wetlands of International Importance Especially as Waterfowl Habitats (being administered by UNESCO)

(c) Programmes with regards to the 1972 Convention Concerning the Protection of the World Cultural and Natural Heritage.

(d) Programmes of the ASEAN Subcommittee on Marine Science (ASCMS) and the ASEAN Senior Officials on Environment (ASOEN) both of which coordinate marine science programmes with Australia (ASEAN-Australian Marine Science Programme), Canada (ASEAN-Canadian Marine Pollution Programme), the U.S.A. (ASEAN-US AID Coastal Resources Management Programme), Japan, the Republic of Korea, and the European Community, etc.

(e) The international Maritime Organization (IMO) sponsors programmes in the region in relation to the London Dumping (LDC) Convention and the International Convention for the Prevention of Pollution from Ships (MARPOL 1973/1978/1992).

(f) UNEP Regional Seas Programme: The East Asian Seas Action Plan promotes sustainable management and development of marine and coastal areas in the region.

(g) UNDP/IMO/GEF Project on Management of Marine Pollution in the East Asian Seas.

(h) Programmes of the International Center for Living Aquatic Resources Management (ICLARM)

(i) Tropical Marine Ecosystem Project (TROMES), introduced by the Government of Australia to train trainers in the Commonwealth countries in the region on the principles of marine ecosystems management.

(j) Danish Programme on Environment and Development (DANCED) which focuses its programme in Malaysia and Thailand. Among the environment programmes being promoted is one on "Integrated Coastal Zone Management".

(k) Programmes with respect to the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

(l) Programmes of the World Conservation Union (IUCN) such as the initiative to establish a global representative system of marine protected areas.

(m) Global Environment Facility (GEF) funds are available for incremental costs of environmental projects of countries in the region and several environmental programmes in the region are presently supported by it.

(n) FAO has initiated regional and country programmes with respect to the implementation of the United Nations Convention on the Law of the Sea (UNCLOS)

There is a need to coordinate the implementation of these programmes in the region to ensure the optimal use of scarce resources and to prevent duplication of efforts.

4. KEY ISSUES AND PRIORITIES RELEVANT TO THE CONSERVATION AND SUSTAINABLE USE OF CORAL REEFS AND RELATED ECOSYSTEMS

4.1. Management[65]

The conservation and sustainable use of coral reefs and related ecosystems in the East Asian Seas, East Asia and Australia sub-region is of indisputable social, economic and ecological significance. In addition to all the other important values, for the following reasons these ecosystems in the three sub-regions are of global significance for the conservation of marine biodiversity:

(a) the region is the global center of biodiversity for many marine species;

(b) the region has the highest number of coral, mangrove and seagrass species in the world;

(c) the region's diversity and productivity support commercial as well as local (subsistence) fisheries and related activities; and

(d) these inter-related ecosystems provide spawning and spawning ground for many marine species as well as recruitment of certain species for other regions.

However, the marine habitats of the sub-regions are increasingly under the pressure of land-based activities and sources of pollution which together with over-exploitation and physical damage are causing the degradation of coral reefs and related ecosystems. The social, economic and ecological consequences of this, especially for developing countries of the region, will be extremely severe.

Therefore, to prevent further degradation and irreversible damage, there is an urgent need for the management of the marine and coastal areas in general, coupled with sustainable use, conservation and rehabilitation of the coral reefs and associated ecosystems. Management plans need to be developed within national, regional and global perspectives. First and foremost this will require national commitment to, and policies for integrated coastal zone management, followed by concerted actions to implement ICZM principles. Regional and global efforts should build upon the successful ongoing regional and global initiatives.

National policies should ensure that projects undertaken upstream and in coastal areas have minimal detrimental impacts in terms of sediment, nutrient and pollutant loads. In addition to appropriate environmental impact assessment, proper natural resource accounting methodologies should also be applied. Economic evaluation of projects in terms of direct costs and benefits should be compared with the indirect costs incurred in for example erosion control, loss in fisheries resources and diminished tourism revenue.

Certain remedial costs such as provision of sewage and effluent treatment facilities will undoubtedly prove to be quite substantial and often prohibitive. However, these costs should not be a hinderance to overall planning. Innovative means of raising the necessary finance or devising practical solutions, within the framework of actual long-term cost and benefit analysis, need to be considered. An important consideration which could help the planners and decision-makers in assessing the costs associated with the treatment and reduction of the effluent and sewage discharges will be reliance on scientific data. Depending on the severity of pollution load, environmental considerations of the recipient body of the water, location, etc., not all the effluent discharges need to be treated to the maximum possible level, necessitating excessive

---

[65] From Kelleher et al 1995; the Australian Country Report for the International Coral Reef Initiative (ICRI) Regional Workshop; and the unpublished report of the Workshop on Integrated Management of Watersheds in Relation to the Management and Conservation of Coastal and Marine (Nearshore) Areas in the East Asian Seas Region, UNEP EAS/RCU, 1995, Ch'ng personal comm. 1996/

costs. Considerable reduction in costs can be achieved on a case by case approach. The scientific community could provide the necessary information, whereby, the minimum extent of treatment required to alleviate degradation to a maximum level or allowing recovery, could be determined. For example where primary treatment is sufficient there will no need to plan for tertiary treatment and the associated exponential capital and running costs.

In the past decade or so and particularly after the United Nations Conference on Environment and Development (UNCED), all the countries of the region have recognized the importance of these major management issues. As a result most have embarked on the establishment of marine protected areas (MPAs) and have developed programmes for marine biodiversity protection. In some countries MPA management plans are in place[66], while in others proposals are being studied. However, for various reasons, the majority of the MPAs have failed to achieve their management objectives. Moreover, in some countries the existing MPAs do not necessarily represent all the biogeographic areas in the region, necessitating the need for a comprehensive MPA systems in the three sub-regions.

Irrespective of comprehensive and well planned MPAs, the health of living marine resources and associated ecosystems are still threatened by factors which are often beyond the control of the resource management agency responsible for the management of MPAs. As noted from previous sections of this report, the majority of these impacts are from anthropogenic land-based activities. Therefore, the MPAs and their successful management within their defined boundaries, may not lead to much unless undertaken within the framework of an overall integrated coastal zone management programme.

Two issues common to all the countries in the region which contribute to the failures in the management of coastal and marine resources and containment of the land-based impacts are identified in a recent Australian study[67]. One is a fragmented management arrangement arising from a sectoral governance structure. In several of the countries this is further complicated by the existence of several tiers of government, each having its own sphere of jurisdiction (sometimes overlapping) in coastal and marine areas[68]. The second is that the influences of many small and insignificant decisions over time accumulate and interact to result with significant impact on the coastal and marine areas.

A possible third issue that seems prevalent in many of the countries of the region is that environmental management is a new subject matter for decision-makers and planners who have traditionally been graduates from the liberal arts or engineering fields[69]. Therefore, apart from financial implications, often the environmental criteria are considered as essential or major attributes of the national and/or regional development plans.

The management of coral reef, mangroves and seagrass beds and associated ecosystems within the integrated coastal zone management, including land-based and marine-based activities, involves legislation, multiple agencies and several tiers of government. Therefore, initially there is a need to develop a national policy and strategy with, most importantly, common goals and guidelines regarding the conservation of critical marine and coastal habitats within the region. Secondly, there is a need to establish a focal point and formal mechanisms for coordination of efforts to address these strategies and goals. Finally, it is essential to

---

[66] A-Rahim. 1993

[67] Australian Country Report for the ICRI Regional Workshop for the East Asian Seas Region. 1996.

[68] A-Rahim and M-Pauzi. 1996. Ch'ng personal comm. 1996

[69] A-Rahim and M-Pauzi. 1996

integrate the policies, strategies and goals into the national and local development plans[70].

To address these priority needs, countries in the region should consider to undertake the following:

(a) development and management of resources must be planned and implemented within a multidisciplinary, holistic, and integrated approach. Integrated national river-basin (watersheds) and related coastal and marine zone management policies, strategies, programmes and activities must be established and rigorously implemented;

(b) mechanisms need to be established for coordination in planning and implementation, horizontally between sectors and vertically between the several tiers of governments (federal/national, regional/state and local); and

(c) the national watershed (river-basin) and related coastal and marine area management plans must be integrated into national economic and development plans.

Within integrated management plans for watersheds (river-basins) and related coastal and marine areas the following issues should be addressed:

(a) effects of coastal development: e.g. destruction of coastal and marine habitats resulting from increased sedimentation, excess nutrient levels, etc.;

(b) absence of non-point (diffuse) pollution controls resulting in chronic and cumulative negative effect due to constant low levels of various pollutants from multiple, non-point and often diffuse sources of discharges from catchments.

(c) impact of tourism development;

(d) poor management practices and unsustainable use of coral reefs;

(e) the unsustainable levels of extractive use of coral reef resources, especially by fisheries;

(f) the destructive methods of fishing, such as the use of explosives, muro-ami, cyanide, etc.;

(g) the incidental catch of non-target species and the effects of trawling on inter-reef communities;

(h) the threat of oil spills from refineries, off-shore exploration and exploitation and transportation as well as shipping and maritime activities;

(i) the oil pollution, organochlorides and heavy metal contamination from urban and industrial sources;

(j) the introduction of exotic species and microbial contamination through the discharge of ballast water;

(k) the outbreaks of crown-of-thorns starfish;

(l) the degradation of estuaries and coastal lakes through eutrophication, sedimentation, acid-soil run-off, coastal developments, loss of habitats and overfishing;

[70] Ch'ng personal comm. 1996

(m) the unsustainable use of associated ecosystems: i.e. mangroves and seagrass beds;

(n) the conversion of mangrove areas to other uses (shrimp farms) and the effect of catchment modifications on mangroves;

(o) the socio-economic and commercial costs due to the loss of coral reefs, seagrass beds and mangroves;

(p) the overlapping jurisdictions and administrative responsibilities for natural resources and activities in the watershed, coastal and marine areas. The need to establish clearer responsibilities for management and enforcement in these areas through administrative guidelines and legislation; and

(q) the lack of environmental criteria and objectives in laws and government administrative procedures.

4.2. Capacity Building

In most of the countries in the region environmental management is not only a new concept, but in some of the countries it also does not enjoy the high priorities accorded to development issues[71]. Part of the problem lies with the low level of required technical expertise at practically every level, including planners and decision-makers. There is a need, therefore, to introduce the principles of environmental management, the integrated management of watersheds (river-basins) and related coastal and marine area to the planning, decision-making and legislative/enforcement processes. This requires the training of the resource managers and planners.

The development of management capacity to tackle the issues identified in this Chapter should be undertaken at all levels and sectors of government, in particular within the regional and local governments which play critical roles in watershed (river-basin), coastal and marine area management. Many of these regional and local governments have limited access to financial resources, expertise, and training opportunities and find it difficult to tackle the whole range of technical skills (such as planning, engineering, environmental issues, natural resource management and economic analysis[72]) in order to deal with the multiplicity of management issues they often face.

For example, the management of MPAs is a specialized task, requiring specific skills and experience. It is again a relatively new field and in the countries of the region there is a shortage of trained individuals at all levels (top and middle managers as well as field personnel). As mentioned before, despite all the good intentions, this is one of the main factors contributing to the failure of the MPAs in the region in meeting the objectives for which they are set up.

The problem of capacity building needs to be addressed at different levels and to be effective almost simultaneously. The first aim should be the establishment of a self-sufficient training foundation on a long-term basis. Therefore, first priority should be accorded to addressing the urgent need to strengthened the "training" institutions and "trainers" in such institutions. A fundamental component of capacity building in cases such as this is awareness enhancement. Therefore, the focus of the strengthening the long-term foundations of training should be primary, secondary and tertiary level training institutions. Concurrent with the long-term approach, there has to be a series of short-term training measures, once again aimed at different groups of politicians, decision-makers, planners and the fieldstaff.

---

[71] Ch'ng personal comm. 1996

[72] Australian Country Report for the ICRI Regional Workshop for the East Asian Seas Region. 1996

By targeting the politician and decision-makers, the aim will be to ensure the national institutions responsible for integrated resource and MPA management have sufficient resources to undertake their responsibilities effectively. It is rare that top level administrators and decision-makers (especially individuals in economic planning and finance ministries) have sufficient background exposure to the necessity and benefits of effectively managed coastal and marine resources (including MPA).

Consequently, there is a need in most of the countries of the region for programmes to be established to assist governments in the effective management of coastal and marine resources and MPAs through:

(a) increasing the political awareness of the need for, and benefits of, marine and coastal resources management and marine biodiversity conservation; and, translating awareness into positive support; and

(b) development of training programmes for management staff, decision-makers and field staff;

(c) strengthening the institutions with responsibility for integrated coastal and marine resources and MPA management and establishing them as centers of excellence for the region; and

(d) increasing the number of trained field staff.

These national programmes will be strengthened significantly if within a regional context they are supported by the establishment of networks of marine scientists and managers. Such networks could lead to the promotion of regional cooperation and exchanges in marine and coastal resources management.

To make the endeavours long-lasting, the sustainable management of the coastal and marine resources and MPAs should benefit the local community, through direct and indirect benefits. However, the present understanding of sustainable management within local communities is low. Public awareness, support and participation should be increased. An aware public is a motivated public. With awareness, public support which is essential to realize the management goals, will follow.

Education in the region does not stress environmental concerns[73] and developing public awareness in marine and coastal management and conservation will require substantial effort from government. The priority should, therefore, be to increase awareness of the long-term socio-economic and ecological benefits of marine and coastal biodiversity conservation and sustainable use.

4.3. Research and Monitoring

Scientific research and data are essential in assisting planners and decision-makers on sustainable management of coral reefs and associated ecosystems.

With very few exceptions in the region, there is a paucity of scientific data on species and ecosystem dynamics, especially in the coastal and marine areas. More significantly, is the lack of information on the economic value of resources and activities in the coastal and marine areas. There are serious gaps in the data and knowledge for management of the coastal and marine areas. Although more is known about coral reefs, further research and data on associated ecosystems are needed.

---

[73] Ch'ng personal comm.1993

There are very few long-term monitoring programmes in place. The experiences from those in place could form a foundation for starting new ones where knowledge is scarce.

The research and monitoring programmes at national and regional level must be coordinated. The research programmes must, *inter alia*, provide information on the status of coral reefs and related ecosystems, stresses in communities, natural recovery responses and times and the ability to detect changes in order to determine whether uses are sustainable. As part of a broader programme in addressing environmental issues in the coastal and marine areas, long-term monitoring of coral reefs and related ecosystems, including the establishment and maintenance of baseline inventories, is also necessary.

The following may be considered as major deficiencies in coordinated research and monitoring in most of the countries of the region:

(a) general long-term research and monitoring of the environment in the region;

(b) applied scientific knowledge on the marine and coastal environment;

(c) scientific understanding of the functioning of the marine and coastal ecosystems at scales relevant to human use and management ;

(d) quantifiable techniques of evaluating coastal and marine resources and activities in economic, social and ecological context; and

(e) knowledge of the actual levels of nutrient and sediments that are injurious to the health of marine and coastal resources and related ecosystems.

Data from research and monitoring should be targeted to management needs and managers must be involved with scientists in the design of research programmes. There is also a need to coordinate and target research in priority or critical areas and to ensure that research efforts are meeting the needs of the coastal resource and marine resource managers[74].

Priority areas of research on coral reefs and related ecosystems should include the following:

(a) the effects of sediments and nutrients on coral reefs;

(b) the cause of *Acanthaster* outbreaks;

(c) the long-term effects of commercial and recreational fishing on coral reefs and related ecosystems;

(d) the inter-reef communities - in the region;

(e) the basic descriptive data on coral reefs in the region;

(f) the distribution and composition of seagrass communities and their responses to natural and anthropogenic changes; and

(g) the mangrove-dependent fauna and the effects of different types of human disturbances on mangroves.

[74] Ch'ng personal comm. 1996

REFERENCES

A-Rahim, G.Y. 1993. Planning and management of marine protected areas in Peninsular Malaysia: Case study for the Pulau Redang Marine Park. Paper presented at the UNEP-COBSEA/MOSTE/DOF EAS 25 Workshop in Case Studies for the Planning and Management of Marine Protected Areas, Penang, Malaysia, 8-12 February.

A-Rahim, G.Y. and M-Pauzi. A. 1996. Malaysia's Country Report: status of coral reefs and related issues and priorities. ICRI Regional Workshop for the East Asian Sea Region, Denpasar (Bali), Indonesia 18-22 March. Unpl.

Association of Southeast Asian Nations (ASEAN) and Australia Marine Science Project. 1992. The status of living coastal resources in ASEAN countries. In. S. English (ed.) ASEAN *Marine Science*, No. 19, ASEAN-Australian *Marine Science Project: Living Coastal* Resources 1992, Australian Institute of Marine Science, Townsville, pp. 6-17.

Association of Southeast Asian Nations (ASEAN) and Australia Marine Science Project. 1994. In: C. R. Wilkinson (ed.). Living Coastal Resources of Southeast Asia: Status and Management. Report of the Consultative Forum, Third ASEAN-Australia Symposium on Living Coastal Resources, Chulalongkorn University, Bangkok, Thailand, May 1994. pp. 37-41.

Brown, B.E. 1986. Human induced damage to coral reefs. UNESCO Reports in Marine Science No. 40, p. 179.

Ch'ng, K. L. 1990. *National Marine Parks Malaysia: Policy and Concepts. Department of* Fisheries, Malaysia Bulletin Publication No. 40

Ch'ng, K.L. 1993. A marine protected area system for the Asia-Pacific region. Paper presented to the Second Asia-Pacific Regional Consultative Meeting on Biodiversity Conservation, Bangkok, Thailand, February.

Chou, L. M. and C. Wilkinson. 1994. Existing reef management systems in ASEAN. pp. 33-36. In: C. R. Wilkinson (ed.). Living Coastal Resources of Southeast Asia: Status and Management. Report of the Consultative Forum, Third ASEAN-Australia Symposium on Living Coastal Resources, Chulalongkorn University, Bangkok, Thailand, May 1994.

Chou, L. M., C. Wilkinson, E. Gomez, and S. Sudara. 1994. *Status of the coral reefs in the* ASEAN region. pp. 8-12. In: C. R. Wilkinson (ed.). Living Coastal Resources of Southeast Asia: Status and Management. Report of the Consultative Forum, Third ASEAN-Australia Symposium on Living Coastal Resources, Chulalongkorn University, Bangkok, Thailand, May 1994.

Den Hartog, C. 1970. The seagrasses of the world. Tweede Reek, Deel 59, no. 1; Amsterdam and London: North Holland Publishing Company.

Fortes, M.D. 1988. Mangroves and seagrass beds of East Asia: Habitats under stress. Ambio XVII (3).

Fortes, M.D. 1989. Seagrasses: a resource unknown in the ASEAN region. ICLARM Education Series 5, International Centre for Living Aquatic Resources Management, Manila, Philippines, 46 pp.

Gomez, E.D. 1988. Overview of environmental problems in the East Asian Seas region. Ambio 17: 166-169.

Gomez, E. 1988. Achievements of the Action Plan for the East Asian Seas. In UNEP 1988: Cooperation for environmental protection in the Pacific. UNEP Regional Seas Reports and Studies No. 97. Nairobi.

Gomez, E.D., E.Deocadiz, M. Hungspreugs, A.A. Jothy, K.J.Kuan, A. Soegiarto, and R.S.S. Wu. 1990. The state of the marine environment in the East Asian Seas Region. UNEP Regional Seas Reports and Studies No. 126. Nairobi.

Grassle, J.F., P.Laserre, A.D. McIntyre and G.C. Ray. 1990. Marine biodiversity and economic system function. Biology International 23, 19 p.

Hutomo, M. and T. Peristiwady.1996. Diversity, abundance and diet of fish in the seagrass beds of Lombok Island, Indonesia. Seagrass Biology: Proceedings of an International Workshop, Rottnest Island, Western Australia, 25-29 January 1996. pp. 205-212.

Japar, S.B. 1994. Status of seagrass resources in Malaysia. Proceedings of the ASEAN Australian Symposium on Living Coastal Resources, Vol.1. Status reviews. (eds.) C.R. Wilkinson, S. Sudara and L.M. Chou. pp. 283-289. Chulongkorn University, 16-20 May 1994, Bangkok, Thailand.

Kelleher, G., C. Bleakley, and S. Wells. (eds). 1995. A Global Representative System of Marine Protected Areas . Great Barrier Reef Marine Park Authority, The World Bank and the World Conservation Union (IUCN). Vol.111: pp.107-136, Vol. 1V: 107-130, 154-199.

Kirkman,.H. 1978. Decline of seagrass in northern areas of Moreton Bay, Queensland. Aquat.Bot. 5:63-67.

Kiswara, W. and M. Hutomo. 1985. Habitat dan sebaran geografik lamun. Oseana. 10: 21-30.

Larkum, A.W.D. and R.J. West. 1990. Long-term changes of seagrass meadows in Botany Bay, Australia. Aquat. Bot. 37: 55-70.

Leis, J.M. 1991. The pelagic stage of reef fishes: the larval biology of coral reef fishes. In. P.F. Sale (ed). The Ecology of Fishes on Coral Reefs, Academic Press, San Diego. pp. 183-230.

Lewmanomont, K. and H. Ogawa. 1995. Taxonomy and distribution of seagrass in Thailand. Proceeding of the NRCT-JSPS joint Seminar on Marine Science. (eds) A. Snidvongs, W., Utoomprukporn and M. Hungspreugs. pp. 142-148. Department of Marine Science, Chulongkorn University, 2-3 December 1993, Bangkok, Thailand.

Liang, J.F. 1985. Holocene reef corals of China. In Z.X. Zeng, ed., Coral reefs and geomorphological essays of South China. Geography Series No. 15. Guangzhou, China: Institute of Geomorphology, South China Normal University.

McManus, J.W. 1992. The Spratley Islands: A marine parks alternative. NAGA, The ICLARM Quarterly (July): 4-8.

Ong, J. E. 1994. The status of mangroves in ASEAN. pp. 52-55. In: C. R. Wilkinson (ed.). Living Coastal Resources of Southeast Asia: Status and Management. Report of the Consultative Forum, Third ASEAN-Australia Symposium on Living Coastal Resources, Chulalongkorn University, Bangkok, Thailand, May 1994.

Preen, A., W.J.Lee Long, R.G. Coles. 1993. Widespread loss of seagrasses in Hervey Bay. Interim Report to Queensland Department of Environment and Heritage, May 1993. 12.

Shepherd, S.A., A.J. McComb, B.A. Bulthuis, V. Neverauskas, D.A. Steffensen, and R. West. 1989. *Decline of seagrass*, In: A.W. Larkum, A.J. McComb, and S.A. Shepherd, (eds.) Biology of Seagrasses: a treatise on the biology of seagrasses with special reference to the Australian region. Elsevier. pp. 346-393.

Smith, S.V. 1978. Coral reef area and contributions of reefs to processes and resources of the world's oceans. Nature 273: 225-226.

Soegiarto, A. 1985. Oceanographic assessment of the East Asian Seas. UNEP Regional Seas Report and Studies No. 69. Nairobi.

Sudara, S., Soekarno, and C. Wilkinson. 1994. pp. 25-32. In: C. R. Wilkinson (ed.). Living Coastal Resources of Southeast Asia: Status and Management. Report of the Consultative Forum, Third ASEAN-Australia Symposium on Living Coastal Resources, Chulalongkorn University, Bangkok, Thailand, May 1994.

Suharsono. 1994. The status of coral reef resource systems and current research needs in Indonesia. pp. 30-32. In: J. L. Munro and P. E. Munro. The management of coral reef resource systems. ICLARM Conf. Proc. 44, 124 pp.

Sukarno N. Naamin and M. Hutomo. 1986. Proceedings of MAB-COMAR Regional Workshop on Coral Reef Ecosystems: Their Management Practices and Research/Training Needs. pp. 24-33.

Smith, S.V. and R.W. Buddemeier. 1992. Global change and coral reef ecosystems. Ann. Rev. Ecol. Syst. 23: 89-118.

State of the marine environment report (SOMER) for Australia, Technical Annex: 1. GBRMPA for the Department of the Environment Sport and Territories, Ocean Rescue 200 Program, Townsville.

_____. **State Oceanographic Administration (SOA). 1983.** Action Plan for marine biodiversity protection in China, Beijing.

United Nations Environment Programme (UNEP) and World Conservation Union (IUCN). 1988. Coral reefs of the world. Volume 2: Indian Ocean, Red Sea and Gulf. UNEP Regional Seas Directories and Bibliographies. Gland, Switzerland and Cambridge, U.K.: Nairobi: UNEP.

Veron, J.E.N. 1986. Distribution of reef-building corals. Oceanus (Summer): 29

Veron, J.E.N. 1992. Conservation of biodiversity: A critical time for the hermatypic corals of Japan. Coral Reefs 11(1992): 13-21.

Wilkinson, C.R. 1993a. Coral reefs of the world are facing widespread devastation: can we prevent this through sustainable management practices? Proc. 7th Int. Coral Reef Symp., Guam 1: 11-21.

Wilkinson, C.R. 1993b. Status of coral reefs in Southeast Asia: threats and responses. In: R.N. Ginsburg (ed.) Global Aspects of Coral Reefs: Health Hazards and History, Collected Case Histories, 7-11 June 1993, University of Miami. pp. J33-J39.

Wilkinson, C.R. (ed.). 1994. Living Coastal Resources of Southeast Asia: Status and Management. Report of the Consultative Forum, Third ASEAN-Australia Symposium on Living Coastal Resources, Chulalongkorn University, Bangkok, Thailand, May 1994.

Wilkinson, C.R. and R.W. Buddimeier. 1994. Global climate change and coral reefs: Implications for people and reefs. Report of the UNEP-IOC-ASPEI-IUCN Global Task Team on the implications of climate change on coral reefs. IUCN, Gland, Switzerland. x+124pp.

World Conservation Monitoring Centre (WCMC). 1992. Global biodiversity: Status of the earth's living resources. London: Chapman and Hall._____.1993. Protected areas with mangrove habitat. Draft. Cambridge, U.K.

World Resources Institute (WRI). 1992. World resources 1992-93: A guide to the global environment. Oxford, U.K. University Press.

Yap, H.T. and E.D. Gomez. 1985. Coral reef degradation and pollution in the East Asian Seas region. In: A.L. Dahl and J. Carew-Reid (eds.) Environment and Resources in the Pacific, UNEP Regional Seas Reports and Studies No. 69, pp.185-207.

Yap, H.T. 1992. Marine environmental problems - experiences of developing regions. Mar.Poll.Bull. 25: 37-40.

ANNEX I

AUSTRALIA
COUNTRY REPORT

Background

This paper is a summary of an information paper prepared as background for participants at the ICRI Pacific and South East Asian regional workshops. It summarises issues and priorities relevant to coral reefs and related ecosystems in Australia.

Information for this paper has been drawn from two key documents: *Living on the Coast* - the Commonwealth's Coastal Policy, and the *State of the Marine Environment Report for Australia*.

1. KEY ISSUES RELEVANT TO THE CONSERVATION AND SUSTAINABLE USE OF CORAL REEFS AND RELATED ECOSYSTEMS

1.1 Management

The responsibility for management of Australia's coastal areas, including coral reefs and related ecosystems, is shared between the Commonwealth, state and local governments. As noted in the Commonwealth Coastal Policy, inquiries into coastal management have repeatedly identified two problems that contribute significantly to the failure of the current coastal management system to effectively secure sustainable use of Australia's coastal zone:

- fragmented management arrangements based on issue or sectoral management; and
- the 'tyranny of small decisions', whereby over time a number of decisions that in themselves are not significant accumulate and interact to result in a significant impact on the coastal zone.

These issues are common to many countries. Australia, through the Commonwealth Coastal policy is taking concrete steps towards decision making that is integrated and takes a long-term or strategic approach to problems.

Specific issues highlighted by SOMER and the Commonwealth Coastal policy which must be addressed within the context of integrated management of coral reefs and related environments are identified in section 2.1.

1.2 Capacity Building

The development of management capacity at the local level is an issue given high priority in the Commonwealth Coastal Policy, SOMER and the report of the Resource Assessment Commission Coastal Zone Inquiry. A key theme is recognition that local government plays a critical role in coastal zone management in Australia; many decisions which affect coral reefs and related ecosystems are made at the local level. Many local authorities have limited access to financial resources and expertise, and therefore find it difficult to support a significant range of technical skills to deal with many of the resource management issues which arise.

Managing coastal resources has traditionally presented a challenge for local authorities because the issues involved usually span several areas of professional competence in local government, such as planning, engineering, environmental and health sciences, and finance. It often requires expertise not always available to local authorities, for example, expertise in resource management and economic analysis.

Many community groups currently provide voluntary help in managing coastal zone resources. The Resource Assessment Commission, in its Coastal Zone Inquiry, found that interest in and affection for the coast are widely shared in the community. An important issue in seeking to manage coral reefs and related environments is how to galvanise the volunteer spirit and enthusiasm in community, and to harness it to help implement management initiatives.

A large proportion of the Aboriginal and Torres Strait Islander population is found along the coast of north eastern Australia where also occur coral reefs and related ecosystems. Many Aboriginal and Torres Strait Islander communities maintain an active interest and involvement in coastal zone management; in some areas they retain ownership rights. The special needs of indigenous communities have to be considered in developing management regimes for coral reefs and related environments. A further issue is that the implications for coastal zone management of the High Court's 1992 decision recognising native title are unclear.

1.3 Research and Monitoring

Over the past 25 years Australia has developed major programs of research in coral reef and related environments. Despite this, inquiries into coastal management have repeatedly found that there are serious deficiencies in the knowledge available for management of coastal resources and in the arrangements for coastal resource managers' access to the information that does exist.

These deficiencies were highlighted in the SOMER report which found that there are major gaps in the availability of geographically comprehensive and long-term scientific information on the marine environment in general. Without this it is difficult to accurately assess its condition, to identify trends, and to design and assess management programs. Major gaps include:

- lack of long-term research and monitoring of Australia's marine environment;
- lack of applied scientific knowledge on the marine environment; and
- lack of scientific understanding of the functioning of marine ecosystem at scales relevant to human use and management.

2. PRIORITIES FOR ACTION FOR THE CONSERVATION AND SUSTAINABLE USE OF CORAL REEFS AND RELATED ECOSYSTEMS

2.1 Management

The Commonwealth Coastal Policy identifies area-based management plans involving all relevant government agencies and other interests and the establishment of a long-term strategy for the coast as a practical way of achieving integrated management of coastal and marine resources. Such an approach promotes the following:

- strategic assessment and integration of significant environmental, economic, social and cultural issues in the area concerned;
- identification of key issues and development of shared management goals;
- where necessary, joint action between authorities, agencies and spheres of government to deal with key issues;
- establishment of continuing arrangements to promote implementation;
- extensive involvement of the local and regional community, NGOs and the private sector; and
- effective corporate planning and management within governments, to focus attention and resources on broad strategic issues, outcomes and priorities and to provide the basis for involving and co-ordinating others with an interest in the area.

Widespread adoption of integrated and strategic approaches by agencies dealing with the coastal zone is critical to effective management of coral reefs and related ecosystems.

These principles are being applied in some areas. Examples of marine protected areas which include coral reefs and/or related ecosystems are: the Torres Strait Protected Zone, the Great Barrier Reef Marine Park, Kakadu National Park, Ningaloo and Shark Bay (and adjacent Hamelin Pool Marine Nature Reserve) Marine Parks, Solitary Islands Marine Reserve, Jervis Bay National Park, and Coringa-Herald, Ashmore Reef, Mermaid Reef, Lihou, and Elizabeth and Middleton National Nature Reserves.

Within the specific context of integrated management of coral reefs and related ecosystems there are a number of issues which are of priority for action:

- planning for likely increased levels of tourism use of coral reefs;
- achieving sustainable levels of extractive use of coral reef resources, particularly the development of sustainable and ecosystem-based fisheries management (as opposed to current species- and effort-based management);
- mitigating the effects of coastal development on coral reefs and related ecosystems especially the effects of increased sedimentation, elevated nutrient levels and clearing of mangroves and seagrass;
- maintaining effective measures for the control and reduction of ship-based pollution and oil spills;
- improving the safety of shipping while maintaining viable shipping lanes, particularly in the Great Barrier Reef and Torres Strait;
- improved management of urban sources of pollution and for non-point sources of pollution;
- introducing guidelines and other measures for managing ballast water;
- further developing the system of marine protected areas to protect representative examples of coral reefs and related ecosystems. In particular, the representation of mangrove and seagrass areas should be strengthened. Work to develop such systems is being carried out by state and territory governments; the Commonwealth is assisting this process through the Ocean Rescue 2000 program.

2.2 Capacity Building

All decision makers should have sufficient expertise to ensure that coastal resources are wisely used. A range of education, training and information exchange skills are required for integrated management. Among those who need these skills are local, state and Commonwealth officers, the resource development sector and community groups.

All jurisdictions have a role to play in ensuring that managers have the capacity to deal with the dynamic and cross-sectoral nature of the issues relevant to management of coral reefs and related ecosystems. Co-operation will lead to more effective use of limited resources, and in some cases cost savings.

All people who use the coastal zone, including coral reefs and related ecosystems, need to play an active role in maintaining the quality of these environments. This involvement not only extends the ability of society to physically manage the problems caused by its use of resources, but also helps to spread awareness of coastal management issues and to engender a sense of community responsibility.

Aboriginal and Torres Strait Islander peoples have a special relationship with and interest in coral reefs and related ecosystems. There needs and special interests need to be considered in developing management initiatives.

2.3 Research and Monitoring

Information on the 'state' of coral reefs and related ecosystems, and the ability to detect changes, is necessary in order to determine whether uses are sustainable. As part of wider programmes which address ecosystems across the coastal zone, long-term monitoring of coral reefs and related ecosystems, including the development and maintenance of baseline inventories, is essential.

Data from monitoring should be capable of meeting more immediate management needs. Results from monitoring should be directly relevant to managers, and for this reason managers, not just scientists, must be closely involved in their design.

Although a significant amount of research is being carried out there remains a need to co-ordinate this effort to ensure that the research is directed at priority areas and is effectively meeting the needs of those who are managing coastal resources. Some issues of priority for research and monitoring of coral reefs and related ecosystems are:

- the effects of sediments and nutrients on coral reefs;
- cause of *Acanthaster* outbreaks;
- long-term effects of commercial and recreational fishing on coral reefs;
- inter-reefal communities - these comprise more than 90% of the area of the Great Barrier Reef and are heavily trawled for fish and prawns;
- basic descriptive data on coral reefs in some areas, most notably the far northern Great Barrier Reef, and the reefs of the Northern Territory and Western Australia;
- the distribution and composition of seagrass communities and their responses to natural and human-induced changes;
- mangrove forests - apart from intensive work in a few localities and except for vegetation species lists, little is known about most mangrove forests in Australia; and
- mangrove-dependent fauna and the effects of different types of human disturbances on mangroves.

References

DEST. 1995. Living on the Coast - the Commonwealth Coastal policy. The Department of the Environment, Sport and Territories (DEST), Commonwealth of Australia.

Resources Assessment Commission. 1993. Coastal Zone Inquiry Final Report. Australian Government Publishing Service, Commonwealth of Australia.

Zann, L. (ed.) 1995. Our sea, our future: major findings of the state of the marine environment report for Australia. GBRMPA for the Department of the Environment Sport and Territories, Ocean Rescue 200 Program, Townsville.

KINGDOM OF CAMBODIA
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

Over twenty years of internal strife has stunted the development of institutions dealing with environmental converns and natural resource management. By the same token, the two decades of internal strife also dampened the extent of the exploitation of Cambodia's coastal/marine resources with the result that Cambodia posseses some of the more extensive

coastal ecosystems (coral reefs, mangroves) in the region. It is imperative to reconcile pressing economic development needs with preservation and sustainable development of coral reefs and related coastal/marine resources through the development of integrated coastal zone and watershed management. The establishment of marine parks is a key issue.

1.2 Capacity building

- Lack of local expertise, staff, and resources to conduct necessary research and monitoring.
- Enforcement capability inadequate due to small staff and lack of resources

1.3 Research and monitoring

- Presently little information is available on the extent of cover and of the status of coral reefs, seagrass beds, and mangroves.
- Monitoring programmes are not yet underway, baseline inventories of coral reefs and other coastal resources are lacking.

2. EXISITNG PROGRAMMES

2.1 Management

The Ministry of Environment with the assistance of the IUCN and other international organizations formulated the National Environmental Protection Regulations. These will greatly support the Ministry to ensure compliance with environmental regulations, including those pertaining to coastal/marine resources. In November 1993, by Royal decree, the National Environment and Wildlife Protection Programme was established and measures are now underway to establish a marine park system under the aegis of this programme.

2.2 Capacity building

Cambodia has been an active participant in the UNEP East Asian Seas Project "Enhancement of the Public Awareness and the Public Participation on Environmental Issues Related to Coastal and Marine Areas in the East Asian Seas Region".

2.3 Research and monitoring

- IUCN is supporting a project to survey the coastal ecosystems of Cambodia
- Cambodia has been an active participant in the UNEP East Asian Seas project "Integrated Management of Watersheds in Relation to the Management and Conservation of Coastal and Marine areas in East Asian Seas Region".

3. PRIORITIES FOR ACTION

3.1 Management

- The generation and management of natural resources (including coastal/marine resources) data bases.
- The synthesis, integration and analysis of information
- The formulation of appropriate national resources management policies
- The integration of policies concerning the conservation and sustainable use of coastal/marine resources into national economic and social development planning
- The development of appropriate institutional framework at all levels as a fundamental condition to the successful implementation of the above elements.

3.2 Capacity building

Great emphasis is put on capacity and awareness building regarding the conservation and sustainable management of coastal/marine resources at all levels from local to the national.

The following steps would be undertaken to achieve this objective:

- Educational and information sharing sessions to be set up at national, regional, and community levels in the forms of workshops, seminars, and round-table discussions.
- study tours as a means of sharing information, capacity building and training.

3.3 Research and monitoring

Knowledge of coral reef and related ecosystems in Cambodia is still at an embryotic stage. *Research priorities under the national strategy for the conservation of coral reefs are, inter alia:*

- survey and demarcation of coral reefs
- identification of problems afflicting reefs
- detailed studies of coral reef flora and fauna
- preparation of status report on coral reefs in Cambodia
- investigation of the impacts of pollutants on corals, terminiation of point and non point sources of pollution

PEOPLES' REPUBLIC OF CHINA
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

A major managerial constraint being faced in China is:

- the limited enforcement capabilities

1.2 Capacity building

There is a lack of qualified staff and resources preventing regular monitoring and surveillance.

1.3 Research and monitoring

There is limited data on marine resources and the impacts of exploitation on these resources.

2. EXISTING PROGRAMMES

2.1 Management

China plans to establish about 30 coastal and marine natural reserves over the next 5 years. A total of 18 Fishery Resources Protected Areas have now been established. The primary purpose of these reserves is to protect the reproductive capacity of commercially important species, these reserves would also protect the biodiversity in the marine system.

China has developed the Biodiversity Action Plan. Under this plan, the following activities are planned:

- the update of endangered species lists by determining the value and vulverability of species
- The protecction of endangered species by, inter alia:

  * identifying natural habitats that support these species
  * studying the ability or capacity of natural reserves or parks in protecting endangered species
  * protecting habitats outside of reserves
  * instituting actions in national economiic plans

Special regulations with respect to marine avnironmental management include:

- provisional regulations of Hainan province concerning utilization of marine areas

- regulation for the management of Sanya Coral Reef Nature reserve

- regulation for the management of Dazhou Island Marine Ecosystem Nature Reserve (Hainan)

- regulation for the management of Shankou Mangrove Ecosystem Nature Reserve

2.2 Capacity building

Programmes to improve public awareness on coastal and marine environmental problems are being instituted. Environmental education is being upgraded and promoted in universities throughout China.

2.3 Research and monitoring

China has embarked on:

- nation-wide comprehensive, multiplidiciplinary investigation of coastal and beach resources

- monitoring of marine environmental pollution

- study on the issues involved in the exploitation of marine resources

3. PRIORITIES FOR ACTION

3.1 Management

China recognises that coastal/marine environmental problems are due in large part to poor management. Strengthening environmental management under the official programme of Environmental Managment and Coordination is of highest priority.

China also is committed to strengthen measures to enforce environmental law at all levels.

3.2 Capacity building

Environmental education is a strategic priority to encourage the population to participate voluntarily in efforts to protect the coastal and marine environment.

3.3 Research and monitoring

Towards the general goal of protecting the coastal and marine environment, studies on the prevention of "red tides" and on managing nursery and breeding grounds of marine organisms are planned. Monitoring stations, particularly in natural parks, will be well equipped.

INDONESIA
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

There are a large number of Government and other public sector agencies involved in the planning and management of coastal and marine resources in Indonesia. These agencies reflect a wide range of sectoral activities and interests in coastal/marine resources. With so many agencies involved, managing the coastal/marine resources presents a major challenge to ensure that all parties concerned are given the opportunity to express their views within any decision making process. The widespread geographic locations of many agencies make this task even more difficult.

There is no policy coordination mechanism specifically concerned with management of marine resources. Each sector agency (ministry) is responsible for its own policy formulation and implementation. Often there are conflicting development objectives sponsored by different agencies.

There are no special management measures to conserve Indonesian coral reefs. The management of coral reefs falls under the general marine and coastal resources management and conservation programme which consist of coastal resources planning, fisheries and environmental regulation and the development of marine protected areas. Coastal zone planning and implementation, including coral reefs, involves numerous agencies at three government levels. This underscores the complexity of coastal and marine management in Indonesia.

1.2 Capacity building

In recent years the Government has placed emphasis on private sector involvement, much of the future development of marine resources will be in the hands on the private sector. Where local communities can be integrated into resource management plans they should be involved at an early stage. This would facilitate development of sustainable resource use and offer a solution to the problem of public access to marine resources. The allocation of stewardship rights creates the incentives for long term sustainable management of a natural resource.

1.3 Research and monitoring

The knowedge of the marine and coastal ecosystems of Indonesia is not well developed. It is recognised that knowledge of these ecosystems is fundamental to their effective conservation and sustainable use.

There is a need to develop standardised techniques for monitoring coral reefs to be followed by fieldstaff working in different areas of the country.

2. EXISTING PROGRAMMES

2.1 Management

Through the Research and development Centre for Oceanology, the Indonesian Institue of Sciences and several governemnt agencies are currently developing the Coral Reefs Rehabilitation and Management Programme. Two key objectives of the programme are: to provide an integrated management network to cover priority areas and to develop management measures specific to each priority area; and, to strengthen coordination among agencies/institutions involved in the management of coral reefs.

2.2 Capacity building

Several NGOs in Indonesia have facilitated the formation of cooperatives of fishermen in small or remote islands in Indonesia providing small enterprise skill and credit schemes among other things. Local NGOs also are training local fishermen in marine conservation issues and promoting environmental awareness in coastal communities.

Indonesia was an actively participating country in the UNEP East Asian Seas project "*Enhancement of Public Awareness and Public Participation on Environmental Issues Related* to the Coastal and Marine Environment".

The Asian Development Bank is supporting the Marine Science Education Project which provides support to 6 universities in the development of marine science courses in Indonesia. Support is also provided for oversesas training.

2.3 Research and monitoring

Since 1992 the Research and Development Center for Oceanology (LIPI) has conducted programmes for development and investigation of long term monitoring of coral reef *ecosystems and for the development of standardised monitoring techniques.*

3. PRIORITIES FOR ACTION

3.1 Management

- The development of integrated marine and coastal zone managment cross cutting across the various sectors, geographic zones, and different tiers of goverment.

- The coordination of decision making at policy, strategic planning, and operational levels.

- *Expansion of the total area of marine conservation areas.*

- The implementation of management plans and protection measures for marine conservation areas already gazetted.

3.2 Capacity building

Priorities in capacity building are:

- To strengthen human resources at managment and decision making levels through academic and training programmes and through on the job training.

- To improve public participation and public awareness in sustainable management of coral reefs and related coastal and marine resources through the integration of local communities into resource management and development plans.

3.3 Research and monitoring

- Expansion of the knowledge base of coastal and marine resources pertinent to the sustainable use of those resources.

- The further development and upgrading of the national database of Indonesian coastal and *marine resources.*

- The standardisation of monitoring techniques

JAPAN
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

- prevention of the impacts caused by terrestrial activities

- Strengthening of cooperation with relevant secotrs including llocal communities and private sectors in the conservation and sustainable management of coral reefs and related ecosystems.

1.2 Capacity building

- Enhancement of environmental education, in particular, public awareness of divers, tourists, local communities etc.

- Human resource development for international cooperation

1.3 Research and monitoring

- Better understanding of the status and functions of the coral reef and rlated ecosystems

- Effective monitoring of outbreaks of crown-of-thorns starfish

- Development of improved measurs for the monitoring of coral reef ecosystems

- development of methods for transplantation and restoration of coral reefs

- Better understanding of the human-induced degradation mechanisms of coral reefs and related ecosystems.

2. EXISTING PROGRAMMES

2.1 Management

- Marine protected areas containing coral and/or coral reef
  [97 marine park areas (total 2,212 ha) in 16 national and quasi-national parks under the Natural Parks Law]

  [1 marine nature conservation area under theNature Conservation Law]

- Removal of crown-of-thorns starfish
  [18 million per year for 19 areas in the marine park areas]

2.2 Capacity building

- Educational education through intrepretation, publication, etc.

- International training course on the conservtion and sustainable use of corla reefs for the technical officials of developing countries by Japan International Cooperation Agnecy(JICA)

- International support programme for improved management of marine protected areas

2.3 Research and monitoring

- National survey on the natural environment including tidal flats, seagrass beds, coral reefs, etc.
- Study on the measures for the monitoring of coral reef ecosystems
- Study on the mechanisms of the coral reef ecosystem

3. PRIORITIES FOR ACTION

3.1 Management

Strengthening of cooperation with relevant sectors including local communities and private sectors in the management of marine protected areas by national and loca governments.

3.2 Capacity building

Enhancement of international cooperation to developing countries

3.3 Research and monitoring

3.4 Others

Enhancement of regional cooperation for the conservation of coral reef and related ecosystems [Fot this purpose an East Asian workshop will be held by March 1997, subject to the approval of FY 96 budget by the National Diet]

THE REPUBLIC OF KOREA
COUNTRY REPORT

Korean waters have no stony coral formations, being situated beyond the northern limit of stony coral (zooxanchellate scleractinians) distribution. Mangroves are also absent. However, the sea around Chejudo Island and its surrounding islets, lying 141 km off the south-west coast of the Korean peninsula contains soft coral communities. These provide habitats for unique and diverse flora and fauna. Presently these little-understood ecosystems are threatened by pollution, land development, and tourism. Preservation of these soft coral ecosystems is a key issue in Korean marine research.

1. KEY ISSUES

1.1 Management

At present there is no management programme or legislation relating to the protection and management of coral reefs. In 1993 the Korean Minister of Environment supported a survey of the islets around Chejudo Island conducted by the Korean Society of Underwater Science and Technology (KOSUST). The purpose of the survey was to designate a marine reserve under the Natural Environment Preservation Law, established in 1991. The report of the survey expedition strongly recommended the establishment of a marine reserve protecting the ecosystems of the islets. However, the Minister of Environment was unable to make the islets a marine reserve due to strong opposition by fishermen and local residents.

1.2 Capacity building

No special programmes for capacity have been established as of yet.

1.3 Research and monitoring

The issue of protecting the ecosystems and biodiversity of the islets was first considered in the early 1980s. Surveys were carried out at the southern islets of Chejudo. They included:

- Ecological surveys by Cheju University (1983-1993)
- An ecological carried out by KORDI (1987-1988)
- A study on marine fauna and flora by the Ministry of Culture (1992), and
- An ecosystem survey conducted by the Korea Environmental Protection Agency and the Korean Society of Underwater Science and Technology (KOSUST)

2. EXISTING PROGRAMMES

At present no programmes concerning coral reefs and related ecosystems are underway. However, some programmes will be developed in the near future.

3. COUNTRY PRIORITIES

At present no country priorities for action for the conservation and sustainable use of coral reefs have been established. However, priorities are now being set.

MALAYSIA
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

* **Dual jurisdiction over land (and fresh water) and marine resources (and marine waters).**

  The Federal government has jurisdiction over all marine and estuarine resources, the seabed three miles from shore up to the limits of the continental shelf boundary and the superadjacent marine waters, while the State governments (11 states) have jurisdiction over all terrestrial resources, the foreshore up to three miles from shore and the superadjacent marine waters and marine turtles. In addition, the local government have their own sphere of jurisdiction, and are responsible for the by-laws with regards to building and construction requirements, safety, health and sanitation. Policy with regards to planning, development and management of land resources of the coastal zone is therefore the perogative of the state governemnt, while the local government are responsible for the day-to-day decision making, monitoring and enforcement of development activities.

* **The majority of islands have no by-laws with respect to development: building, construction, safety, health or sanitation and are governed by district offices mainly on the main land. At present the Ministry of Local Government and Housing is developing a set of policies and by-laws for all the offshore islands in Peninsular Malaysia.**

* **Sectoral planning and management**

Several federal, state and local governments agencies and powerful quasigovernment bodies (within their own sphere of jurisdiction) are involved in managing coastal resources. There is no formal mechanism to coordinate the activities of these bodies and agencies, resulting in conflict of management objectives being implemented for the use of coastal resources. Management of the resources is fragmented among the government agencies. The coastal zone is therefore subject to myriad of decisions, both small and big, but all having their impacts on the coastal and marine resources and related ecosystem. Some important agencies that have responsibilities in the coastal zone are shown in the box below:

Levels of government	**Responsibility**
Ministry / Department	
Federal Government	Development Policies
Ministry of Agriculture	
Department of Fisheries	Management of all marine resources
Department of Drainage and Irrigation	Coastal erosion control
Ministry of Transport	
Harbour Master	Marine transportation
Ministry of Science and Technology	
Department of Environment	Environment Impact Assessment on coastal development and coastal and marine pollution
Ministry of primary industry	
Department of Forestry	Planning and management of federal forest land
Ministry of Housing and Local Government	
Dept. of Town and Country Planning	Structural plan for the towns and villlages,
Ministry of Public Works	Implement public development project
State Government	
Department of Forestry	Forestry and mangrove
State Economic Planning Unit	Planning of development projects
Local Government	
Land Office	Land administration and permits for development projects
Municpal and District Offices	Sewerage and garbage disposal

* **Lack of integration of sustainable development goals into national and state policy with regards to planning and development.**

The concept of sustainable resource development is fairly new and has yet to gain acceptance among the policy makers and private sectors in Malaysia.

* **Increasing development in the coastal areas**

Malaysia is enjoying one of the highest rate of economic development in the region. The tourism industry is attracting investment both from within and outside the country and

tourist resorts are being built on a very massive scale along several coastal areas and islands. In 1990, the Malaysian government launched the first Visit Malaysia Year. With the promotion of tourism, there has been an increase in alienation of natural areas for tourism and infrastructure development projects in coastal areas and on offshore islands. Sediment load entering the coastal areas, especially during the construction stage of these tourist and development projects have caused localized problems to the nearby coral reef areas and related ecosystems. Many of these developers lack the awareness of the benefits of sustainable development and often in their development destroy the resources they depend on. Untreated sewage from hotels runoff into the surrounding sea. In addition, unprofitable fishing stakes off the coasts of some states in Malaysia have been allowed by the state government to be turned into overnight accomodation for anglers. These fishing stakes which are located near to coral reef areas also dumped their raw sewage into the surrounding marine waters.

* **Environmental criteria needs to be incorporated in the various laws which have jurisdiction over the coastal and marine areas.**

Many of the laws that prevail over the coastal and marine areas are obsolete, some having been established over several decades ago. The relevant laws and guidelines with respect to activities and usage of resources in the coastal zone do not therefore have any environmental criteria in their provisions. There is a need to amend these laws taking into account the need for sustainable management and development of the coastal and marine resources.

1.2 Capacity building

* **Awareness on environmental issues, especially on marine related issues among coastal communities, private sectors and both federal and local government is lacking in Malaysia.**

The majority of government personnel at all levels both in the federal and state government, including top decision makers have liberal arts education. Managing the coastal resources encompasses a range of issues, and would require expertise from various fields. Such expertise among policy makers and managers at all levels of government (federal, state and local) with regards to the coastal and marine resources is lacking, and awareness on environmental related issues is still low. Most of the policy formulated at state level are geared toward the economic development of the resources, and little regards is given to their sustainable development. Even those in the professional fields such as engineering have little awareness of environmental criteria for sustainable development.

The state governments and the local government are the crucial players in the development and management of the coastal zone in Malaysia. Decisions on matters in the coastal zone which will impact on the marine resources and ecosystem (including coral reefs and related ecosystem) are made at the state and local government level. All state government and local authorities in Malaysia have limited access to financial resources , expertise and training. They therefore do not possess the significant areas of technical skills (engineering, environmental and health sciences) needed to deal with many of the prevalent resource management.

With the expansion of the mandate of the National Development Council in 1993 to cover environment and national resources, the Economic Planning Unit (EPU) in the Prime Minister's Department has set up an Environmental and Natural Resource Section in 1995 to give more emphasis on the management of environmental resources. This section is now currently being strengthened both in terms of human resources and

capacity building. In this regard the Danish Government within the framework of its Danish Fund for Environment and Development Cooperation (DANCED) is helping the Malaysian Government to enhance its capacity in undertaking development on a sustainable basis.

The coastal community in Malaysia especially in the islands and areas where coral and related ecosystem are found are basically rural folks and have little awareness of the needs to conserve these resources. Their immediate need is to find an income for their daily needs. In the past these needs need not prove destructive to the coastal and marine resources, but in recent years with the event of tourism development in the area, their use of the coastal and marine resources are now more geared towards the tourism industry. Many villages now provide the required fresh seafood, coral reefs products as soveniers, simple accomodation for budget tourists etc. Their new needs put a different type of and more severe pressure on the marine and coastal resources.

* **Many NGO groups currently provide voluntary support in managing important coastal zone resources, especially corals and mangroves. An important issue in seeking to manage coral reefs and related environments is how to use this support, and to harness it to help implement management initiatives among the local community.**

* **Diving is also a new sport among the corporate sector personnels and these personnels now take a keen interest in protecting the coral reef diving spots. Since many of these corporate sectors represent banks (responsible for giving out loans) and companies with investment in the coastal areas, the new found interest of the personnel concerned should also be harnessed by the government to ensure that environmental concerns are taken into account in development plans for the coastal and marine areas.**

1.3 Research and Monitoring

Various government research institutions and universities are involved in research and monitoring of coral reefs and related ecosystem.

Constraints in coastal and marine research in Malaysia include:

* lack of long-term research and monitoring of Malaysia's marine environment: constraints in establishing long-term research and monitoring programmes include difficulties in obtaining long-term funding for research and monitoring, absence of coordinated data acquisition and storage; and the absence of standardised scientific reseach techniques.

* Lack of Applied Information on coastal and marine resources: applied scientific information on coastal zones are not readily available and not easily accessible to support the formulation of environmental policies by policy makers and to guide managers, both federal and state, in managing the marine and coastal resources. Information from research programmes are not published, and the published reports are not easily available to the resource managers at state and local government levels.

* lack of scientific understanding of the functioning of marine ecosystem at scales relevant to human use and management: there is a lack of expertise and manpower to conduct research and monitoring. Most research are conducted on *ad hoc* basis and little coordination exist between the Department of Fisheries, the authority responsible for marine resources management and the local universities with regards to long-term research of the marine and coastal resources.

2. EXISTING PROGRAMMES

2.1 Management

* **Management and institutional arrangements over coral reefs and related ecosystems**

Presently there is no integrated coastal zone policy to coordinate activies which impact on coral reefs and related ecosystems. The marine resources are managed by the federal Department of Fisheries, except for Sabah which have their own State Department of Fisheries, which implement policies set by the federal DOF as jurisdiction over marine resources is a federal perogative. Management over mangrove is under the state Forest Department and with the exception of the Matang Mangrove which are managed on a sustainable use basis, most mangrove are considered as not significant and are available for conversion to other uses, especially for shrimp culture.

* **Establishment of Marine Park**

In the early 1980s the Government of Malaysia (Department of Fisheries), intiated action for the establishment of marine protected areas, focussing on protecting areas rich with coral reef resources. A survey conducted in these early years led to the establishment of the surrounding waters around 31 islands as fisheries protected areas in the interim period, before efforts were undertaken to establish them as marine parks. Management plans have been established for all these areas and some of them have been gazetted as marine parks. A Marine Park Trust Fund was established in 1988 to finance the establishment and management of these parks. Through this trust fund, marine parks have been established and managed in the following areas of Peninsular Malaysia: Pulau Redang in the State of Terengganu, Pulau Payar in the state of Kedah, and Pulau Tioman in the state of Pahang.

Steps to establish marine parks in the waters of a group of islands in the state of Johor, Peninsular Malaysia, three groups of islands in the state of Sarawak and Federal Territory of Labuan, in east Malaysia are being undertaken.

* **Formulation of policies with respect to development on islands.**

Steps to classify islands according to their uses is being formulated by the Ministry of Local Government and Housing. Islands will be classified for: development, tourist reserves and marine protected area. This initiative will benefit islands surrounded by marine parks as stricter by-laws governing development on these islands will be applied.

* **Marine Park Advisory Committee**

To coordinate efforts with regards to the protection of marine resources in the designated marine parks, a National Marine Park Advisory Committee has been established with members coming from federal government agencies, universities, private sectors, NGOs and most importantly representatives of state governments concerned.

* **Public outreach and awareness programmes**

To increase public awareness on environmental issues, especially on marine related issues, the department has been producing brochures, phamplets, posters, and documentary videos on marine parks. Department of Fisheries also conducts regular public awareness programmes at marine park centers. These programmes were on issues of park management and sustainable use of the resources in the park.

* **Training on marine park management**

To strengthen the capacity and capability in marine park management, the Department of Fisheries conducts twice yearly training programmes for staff, officials from the state and local governments. Rangers and managers of the parks have also been sent to undergo short-term attachment training at the Australian Great Barrier Marine Park Authority (GBRMPA)

* **Monitor infestation of crown-of-thorns**

Monitoring of crown-of-thorns in marine park waters is being conducted on a collaborative basis between Department of Fisheries and a non governmental organization. The programme involves recording sightings of crown-of-thorns by the park users through the use of questionnaire.

2.2 Research and Monitoring

Present research initiatives on coral reefs were conducted by the following government agencies and local universitites:

Department of Fisheries

The department has two research institutes; Marine Fishery Resources Development and Management Department (MFRDMD) and Fisheries Research Institute (FRI) that were involved in research and monitoring of marine resources.

MFRDMD research effort is focused on living communities in marine parks waters. The institute conducts the following research and monitoring:

* Coral inventory and base line studies
* Monitoring of water quality
* Monitoring of closed area
* Coral growth study
* Giant clam larval production for restocking
* Marine turtle hatchery conservation
* Mapping of underwater dive sites in selected marine parks

Fisheries Research Institute (FRI)

The institute conducts the following research and monitoring:

* Monitoring of coral bleaching at Pulau Payar Marine Park in the state of Kedah.
* Monitoring of impact of floating tourist pontoon at Pulau Payar Marine Park in the state of Kedah.
* Seagrass community study at three sites; Pulau Sibu, in the state of Johor, Setiu Lagoon, in the state of Terengganu, and Pulau Langkawi, in the state of Kedah.
* Study mangrove ecosystem employing GIS mapping method.

Universiti Sains Malaysia (USM)

USM's research efforts are mainly conducted in the marine park waters in the field of:

* Biology, stock assessment and breeding of giant clam at Pulau Redang and Pulau Tioman Marine Parks.

* Biology and distribution of sponges and sea cucumber
* Sedimentation studies at Pulau Redang Marine Park

Universiti Malaysia Sabah (UMS)

UMS's research efforts on coral reefs is mainly confined in East Malaysia, specifically in the state of Sabah. UMS conducts research in collaboration with Sabah Parks and World Wide Funds For Nature (WWF) in East Malaysia.

Universiti Pertanian Malaysia (UPM)

UPM was involved in ASEAN-Australian Coastal Living Resources Project, in which studies of coral reefs status were conducted at various sites in Peninsular Malaysia and East Malaysia.

2.3 Capacity building

* **Training on research and monitoring**

The Fisheries Research Institute conducts training to marine park rangers on research methods, such as line intercept transect and underwater photography and video recording to increase capacity to collect data on coral reefs.

3. PRIORITIES FOR ACTION

3.1 Management

Integrated Coastal Zone Management
A national coastal zone management policy will be formulated to provide clear principles and guidelines for resolving the conflicting interest among different types of development in coastal areas and to ensure that environmental criteria is taken into account in order to ensure the sustainability of coastal resources such as mangroves and peat swamp forest. Under the policy, integrated coastal zone management plans will be drawn up to coordinate and rationalize the activities and efforts of various Federal, State and Local Authorities responsible for planning and managing resources in the coastal zone. In addition, the legal provisions that govern the management of the coastal resources and related development activities, especially with regards to aquaculture, sand mining and ground water, will be reviewed to ensure better coordination and implementation. A National Islands Development Board will be set up to establish policy guidelines on island development in order to reduce the detrimental impact of development activities on island ecosystem. Tourism and recreational activities will be included in the list of Environmental Impact Assessment (EIA) prescribed activities to minimise the impact of tourism development of the coastal and marine ecosystems.

Management of coral reefs and related ecosystems
Inorder to ensure that impacts from coastal and watershed areas are managed in an integrated fashion to ensure minimal impacts of activities in these areas on the coral reefs and related ecosystems, the following steps are priority for action:

* Development for tourism must take into account their impact on the coral reefs and related ecosystems;

* Fisheries management should include management of ecosystems and critical habitats;

* Steps should be taken to reduce sediment load and other pollutants in runoffs and rivers, through better management of watersheds and development projects in the hinterland and coastal areas, preservation of mangroves and seagrass, management of urban sources of pollution (treatment of all domestic sewage and industrial wastes to an acceptable level) and non-point sources of pollution;

* establishing effective measures for the control and reduction of ship-based pollution and oil spills through national and regional efforts: building of desludgin facilities at ports in Penang, Kuantan and Johore Bahru and establishment of emergency response mechanisms and protocols for the effective management of oil spills respectively;

* improving the safety of shipping in the Malacca Straits and the South China Sea through some international and regional mechanisms;

* establishment of management measures for ballast water of ships and fishing boats inorder to prevent pollution and introduction of exotic species of marine fauna and flora;

Marine Park Management

* Developing additional marine protected areas to protect representative examples of coral reefs and related ecosystems. In particular, the representation of mangrove and seagrass areas should be incorporated into marine park management objectives;

* Gazetting of marine park regulations;

* Establishment of management plans for all protected areas and reviewing existing management plans;

* Strenthening the coordination between federal and state efforts in the management of coral reefs and related ecosystems;

* Increase mooring points in marine parks

* Setting carrying capacity on the use of coral reefs resources

3.2 Capacity building

* All politicicans, decision makers and managers should have sufficient knowledge to ensure that coastal resources are used on a sustainable basis. A strategic programme should be undertaken by the federal government to offer a range of education and training programmes in integrated management of natural resources for all levels of government staff at the federal, state and local government level, as well as the private sectors and coastal community.

* All federal, state and local government agencies institute steps to ensure that managers have the expertise to deal with diverse and cross-sectoral nature of the issues relevant to management of coral reefs and related ecosystems. There is a need for managers of all agencies to work closely together in each specific management area. In in this context the state development agency should be trained and exposed to understand in depth the nature of such issues and the necessary action to resolve them;

* State government and the federal agencies involved in ICZM in specific areas should institute a strategic programme to educate all stakeholders especially the coastal community and developers of coastal zone projects, inorder to ensure that all people who use the coastal Zone are made awarene of coastal management issues and to establish a sense of community involvement and ownership. The fishing community and the islanders should be among the targetted groups.

* Increase public participation in marine park programmes and during formulation and revision of management plans

* *Upgrade management and research capacity and capability*

3.3 Research and monitoring

Coordinated and targetted research

* Long-term monitoring of the status of coral reefs and related ecosystems, including the establishment and maintenance of baseline inventories, are essential inorder to detect changes and to determine whether uses are sustainable in all marine park areas as well as to mitigate impacts from activities in the coastal zone;

* Managers should be involved in determining the type and form of data monitored by scientist inorder to ensure that they are targeted towards meeting the immediate management needs;

* The Ministry of Science, Technology and the Environment should co-ordinate effort in coral reef research to ensure that the research is directed at priority areas and is effectively meeting the needs of those who are managing coastal resources.

Priority areas for research and monitoring of coral reefs and related ecosystems are:

* the effects of sediments, nutrients and other pollutants on coral reefs and related ecosystems;

* mapping of infestation of crown-of-thorn outbreaks and research on the causes of their outbreaks;

* long-term effects of traditional, commercial and recreational fishing on coral reefs;

* status of all coral reef areas, seagrass and mangrove areas, mapping of these areas, biomass of the marine resources in these areas, their responses to natural and anthropogenic induced changes in the environment, evaluation in terms of dollars and cents of these ecosytems including the estimation of related fish and prawn catches in the waters further offshore of species which use these ecosytems as breeding and nursery grounds;

MYANMAR
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

Myanmar is at a nascent stage of development in its management of coastal and marine resources. The Ministry of Forestry and the Ministry of Livestock and Fisheries are jointly responsible for managing and protecting coastal/marine resources. In general there is a lack of appropriate national policies, legislation, infrastructure and capability to manage the protection and sustainable use of costal/marine resources. A Mechanism to integrate the often conflicting agendas of conservation and development is lacking. Departments responsible for management are compartmentalized and an integraeted multi-disciplinary approach is absent. Use of land and marine resources are often disjointed and in conflict due to the lack of a proper national land-use policy and plan. Funds and facilities are insufficient for effective implementation of adopted policies, laws and management plans. A further hindrance to the development of effective management of marine/coastal resources is the difficulty of access to remote areas where many of the important coastal/marine resources exists.

1.2 Capacity building

Generally, awareness of the need and importance of conservation and sustainable use of coastal/marine ecosystems is undeveloped.

1.3 Research and monitoring

Research on coral reefs and related ecosystems is being conducted by the Ministry of Livestock and Fisheries and relevant universities. Research efforts and applications are largely disjointed and, consequently, of limited effectiveness. Limiting factors are inadequate funding, facilities, and incentives.

2. EXISTING PROGRAMMES

2.1 Management

The following management steps are being undertaken by the government:

- The Forest Law and wildlife and protected areas legislation were promulgated in 1992 and 1994 respectively. Emphasis is on conservation and sustainable use of these resources.

- The National Commission for Environmental ffairs (NCEA) under the Ministry of Foreign Affairs has adopted a comprehensive national policy to guide agencies towards an integrated approach for environmental protection and sustainable development and for appropriate land-use. The Ministry of Forestry is adopting a new forest policy emphasising conservation and sustainable use.

- The UNDP/FAO and the Myanmar Government jointly are exerting efforts to rehabilitate the degraded mangroves of the Ayeyarwady delta.

- Lampi National Marine Park will be designated in the near future. This is the first step in a plan to conserve and use sustainably in an eco-friendly manner the ecosystems of the Myanmar coastline. Surveys for additional marine protected areas are underway.

- Measures for the protection and sustainable management of Bird-nest Island Reserves are being instituted. Such measures are also be extended to cover the Moscos Islands Wildlife Santuaries, important breeding and feeding habitats of bird-nest swiftlets and other avifauna, marine turtles, corals and other marine life.

2.2 Capacity building

- The Ministry of Forest Development has taken steps to strengthen the capacity and capability of its staff for the past several years. These efforts are still be instituted.

- Awareness campaigns on sustainable development of natural resources are being carried out through various media targeting the public as well as policy makers. However, impact at the grassroots level is still rather limited.

2.3 Research and monitoring

- The Forest Department is now engaged in an assessment of the present status of coastal and marine resources.

- A number of joint research programs are being conducted by the Forest Department and relevant universities.

3. PRIORITIES FOR ACTION

3.1 Management

The Ministry of Forestry and the Ministry of Livestock and Fisheries are responsible for formulating policies and plans for effective conservation and sustainable use of coastal and marine resources. Priorities to this end are:

- to improve existing legislation for the effective protection and sustainable use of coastal and marine ecosystems.

- to establish marine protected areas within the shortest possible time.

- to integrate conservation and development through effective management of the natural coastal/marine ecosystems by means of:

  * laying down effective guidelines for eco-tourism development
  * adopting appropriate arrangements to meet the needs of local inhabitants without impairing the natural resources.
  * taking steps to meet the committments of international agreements such as the Convention on Biodiversity Conservation to which Myanmar is a signatory.

3.2 Capacity building

- The following actions are necessary to achieve the goals of sustainable development and perpetuation of coastal and marine resources:

  * to develop institutional structure in a multi-disciplinary approach to cope with day-to-day issues of protection and sustainable management.
  * to train staff through science and technology transfer programmes.
  * to educate the public and seek sustained support from policy and decision makers

- Capacity building at both the institutional and individual levels will depend on infrastructure improvement, proper man-power planning, consideration for attractive incentives to work in remote areas and sustained financial and moral support.

- To gain public confidence and support, local people must be guaranteed the right to use, on a sustainable basis, the natural resources on which they have depended since time immemorial.

3.3 Research and monitoring

The coastal and marine ecosystems of Myanmar are still largely unexplored scientifically. It is considered of utmost importance to encourage scientists and managers to investigate these coastal and marine resources, to develop long-term monitoring programmes, to the relevant databases, and to share information with international conservation communities.

THE PHILIPPINES
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

Under the Philippine Local Government Code, local governemnts are now empowered to establish sectoral development plans under the guidance of the national government. This will allow local communities to have more direct access to the benefits of coastal and marine conservation and sustainable development. The challenge will be to retain a coherent and unified national policy for protection of coral reefs and related ecosystems.

Enforcement of existing laws and regulations designed to protect coastal and marine resources is largely ineffective. Destructive fishing practices and destructive coral reef exploitation of coral reefs have not been effectively regulated. Conversion of coastal wetlands, especially mangroves, has not been regulated. In terms of conserving endangered marine species, both the management and adherence to CITES is moderate.

1.2 Capacity building

A lack of trained personnel in coastal zone management is identified as a key issue to be addressed.

Public awareness and concern for the coastal and marine evvironment is growing. However, the lack of awareness among local fishing communities continues to hinder sustainable development of coastal and marine resources in the Philippines.

1.3 Research and monitoring

There is a need for research to demonstrate economic values of coastal and marine conservation and sustainable management.

2. EXISTING PROGRAMMES

2.1 Managment

Many activities and projects are underway or being planned to deal with the manifold problems of the management of coral reefs and associated marine systems. Among these are:

- the ASEAN-US Coastal Resources Management Project,

- the Department of Agriculture's Fisheries Sector Programme dealing with coastal zone management,

- the Department of Environment and Natureal Resources's Coastal Environment Programme concerning coastal zone management.

- the UNEP East Asian Seas "Intergrated Watershed Management" project

2.2 Capacity building

There are numerous programmes dealing with capacity building, among these are:

- the National Research and Development Programme under the Department of Science and Technology (providing training in applied research)

- the project for the National Integrated Protected Areas System (NIPAS), supported by the World Wildlife Fund (WWF) which provides training in management of marine protected areas.

- A project for training in coastal zone management supported by the International Development Research Centre (Canada) and the University of Phillipine's Marine Science Institute

A large step in the promotion of public awareness was taken through the Philippines active participation in the project UNEP East Asian Seas "Enhancement of Public Awareness and Participation "project.

2.3 Research and monitoring

Most of the programmes mentioned above under "management" and "capacity building" categories also feature research components. The University of Philippine's Marine Science Institute and Siliman University Marine Laboratory are engaged with on-going research projects pertaining to the conservation and sustainable use of coral reefs and related coastal and marine ecosystems.

3. PRIORITIES

3.1 Management

Priorities in management include:

- the development of community based coastal and marine resources managment.

- the development of integrated coastal zone management, to provide a common goal and ensure coordination of efforts among the various sectors and tiers of government, and particularly among local governments now responsible for the development of management plans.

- improved management and protection of marine parks with participation of local communities and with emphasis on benefits accruing to the local communities.

3.2 Capacity building

Emphasis is placed on:

- capacity awareness building through the participation of local communities in projects promoting conservation and sustainable use of coastal and marine resources.

- the further development of programmes and activities involving youth groups.

3.3 Research and monitoring

Research priorities will include practical research activities conducted within the environment of local communities and addressing socio-economic constraints to effective conservation and sustainable development of coastal and marine resources.

SINGAPORE
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

Singapore as a highly urbanised island state with one of the most dynamic economies in the world has been under great pressure to convert coastal lands for industrial and urban expansion. Consequently almost all mangroves and coastal wetlands have been lost with heavy negative impact on the health of neighboring marine ecosystems. However, Singapore has made impressive strides in cleaning its once heavily polluted rivers. Today sewage effluent is treated before being released into the environment and idustry must comply with stringent discharge limits.

1.2 Capacity building

Singapore has one of the most highly educated populations in the world. Awareness of coastal and marine environmental problems is quite high.

1.3 Research and monitoring

Singapore is actively engaged in coastal and marine research and monitoring, both of water quality and of coral reef health. Singapore has a long time series of data on its coral reefs, going back to the 1960s.

2. EXISTING PROGRAMMES

2.1 Management

As part of the "Green Plan", four marine areas have been declared as protected aeas. These areas, which together occupy around 7 km^2, contain a variety of coastal and marine habitats including coral reefs. An action programme of the Green Plan calls for greater protection of coral reefs through better enforcement of controls and monitoring of the effects of development projects.

2.2 Capacity building

The Green Plan calls for widespread education and public awareness campaigns.

Singapore has been an enthusiastic participant in the UNEP East Asian Seas project "Enhancement of Public Awareness and Participation on Environmental Issues. Youth participation clubs have become active in schools and communities.

2.3 Research and monitoring

The ASEAN-Australian Marine Science Project has provided long-term, systmatic, quantitative reserach and monitoring of coral reefs since the late 1980s.

3. COUNTRY PRIORITIES

3.1 Management

Improved enforcement of environmental regulations and careful monitoring of impacts upon coral reefs from developments projects are seen as management priorities.

3.2 Capacity building

Public awareness campaigns will continue to be promoted at all levels.

3.3 Research and monitoring

Research and monitoring activities as described above will continue to be developed

THAILAND
COUNTRY REPORT

1. KEY ISSUES

1.1 Management

- Laws and regulations for protecting coastal/marine resources are unclear or incomplete. Lack of specific prohibitions, e.g.,domestic sale of coral is not specifically prohibited.
- No catch limits or seasonal limits in effect for reef fisheries.
- Generally there is a lack of enforcement of laws and regulations intended to conserve and sustain coastal and marine resources.
- Management authority for coastal/marine resources is fragmented and distributed among a host of government agencies
- overlapping and conflicting priorities between government sectoral agencies concerned with management coastal and marine resources.
- conflicts between short term development objectives and long term objectives of conservation and sustainable usage.
- conflicts between conservation and sustainable usage designation and traditional uses of coastal/marine resources.

1.2 Capacity building

- awareness and acceptance of regulations among local resource users is low.

- shortage of qualified personnel in management and decisionn making roles

- There is a lack of resources, especially trained man-power, equipment and boats to patrol the reef areas.

1.3 Research and monitoring

There is a need to monitor and evaluate progress in implementing conservation and sustainable usage initiatives.

2. EXISTING PROGRAMMES

2.1 Management

The Fisheries Act establishes regulations governing marine fisheries in coastal and offshore waters. Four types of waters are designated by the Act: Protected areas, Reserved Areas, Leased Areas, and Public Areas. All coral reefs in Thailand are classified under either Public Areas or Protected Areas. There are presently 4 reef areas designated as Protected Areas covering an area of approximately 2000 km^2. When approved by the Government Navy personnel will be authorised to enforce regulations persuant to the Fisheries Act.

Under the National Environmental Quality Act, (NEQA) EIAs are required for major developments that have the potential to significantly affect Thailand's natural environment, including the coastal/marine environment.

A community-based habitat protection programme was initiated in Puket in 1987 as part of the Thailand Coastl Resources Managment Project. Local, provincial and national officials were involved to formulate and implement a strategy for coral reef protection. Similar projects have been undertaken at Ko Samui Island as part of the Upper South Coastal Management Project.

At the regional leve Thailand has been actively participating in the UNEP East Asian Seas "Integrated watershed" project.

2.2 Capacity building

The Office of Environmental Policy and Planning (OEPP) has endeavoured to increase public awareness about the importance of coral reef ecosystems and about the human activities that are leading to the destruction of these resources. This campaign has reached most of Thailand's newspapers.

The OEPP, the Tourism Authority of Thailand, and volunteer associations of divers and tour boat operators have help educate boat pilots and guides in coral reef ecology and in ways to avoid damaging the reefs.

Thailand has participated in the UNEP East Asian Seas project "Enhancement of the Public Awareness and Participation in Coastal and Marine Ecosystems".

2.3 Research and monitoring

Cooperation among coral reef scientists in Thailand has been extensive and is essential to the national strategy formulation process. Researchers have worked together to document reef condition in Thailand through the ASEAN-Australian Marine Science Project: baseline study of coastal living resources.

3. PRIORITIES FOR ACTION

3.1 Management

In formulating a National Coral Reef Managment Strategy the following principles are recognised:

- Maintain a balance in the intensity and variety of coral reef uses.
- Consider both national economic priorities and local needs
- Rely on both regulatory measures and non-regularatory measures to achieve managment objectives.
- Create incentives for coral reef managment
- Integrated management approach
- Base management decisions on best available data on reef condition, uses, and carrying capacity.

3.2 Capacity building

- Promote the use of environmentally sound practices and technology among resource users
- Public education, including the dissemination of information materials and the conducting of community event and workshops
- Institutional strengthening such as technical training and interagency coordinations to enhance the capacity to carry out conservation and sustainable usage strategies.

3.3 Research and monitoring

- Monitoring to detect changes and trends in reef condition and use and to follow progress in implementing protection strategies
- Research to understand the ecological process underlying reef degradation and to improve the techniques for protection and restoration.

VIETNAM
COUNTRY REPORT

1. COUNTRY ISSUES

1.1 Management

Vietnam suffers the same issues that other countries faced with respect to the management of coral reefs and related ecosystems: degradation of the reefs and decline of reef living resources due to over-exploitation and dynamiting; adverse impacts from tourism related activities; high turbidity and siltation due to deforestation, river-runoffs and trawling activities; coral mining for construction materials, pollution from land-based sources of pollution (sewage and industrial wastes); and population pressure in the coastal areas.

Vietnam also faces the same problem of sectoral management and lack of coordination between the implementing agencies and the different tiers of government with respect to planning and development.

Vietnam's environmental management policies and programmes are at an early stage of development. Vietnam is now beginning to undergo rapid economic growth. The Vietnamese Governemnt must balance urgent economic development needs with long term needs for protection and sustainable development of coastal and marine environmental assets under the constraint of limited financial resources.

Enforcement of environmental rules and regulations and protection of marine parks is inadequate.

1.2 Capacity building

In general there is a lack of appropriate policy, planning, programmes, funding, man-power, facilities and equipment to support management efforts. There is a shortage of personnel with training relevant to management of coastal and marine ecosystems. Government departments concerned with environmental and coastal and marine management and law enforcement are understaffed and underequiped and lack coordination.

Generally all sectors of the community including coastal and fishing communities, private sectors, and government managers lack awareness with regards to the principles of sustainable usage of coastal and marine resources. Environmental awareness is also absent among the top decision-makers.

1.3 Research and monitoring

There is a perceived need for increased research efforts with regard to the biology, ecology, and environmetal conditions of coral reefs. There is an absent of baseline information on coral reefs and related ecosystems. Neither is there an on-going long-term monitoring programme for collecting such information since there is low investment in research.

2. PROGRAMMES

2.1 Management

Vietnam has established Environment Divisions within the Deaprtment of Science, Technology and Environments (DOSTE) in the various provinces to implement plans established by the National Environment Agency with regards to environmental management.

The Ministry of Fisheries has also established a department for protection of aquatic resources in several of the provinces to assist in the management of aquatic reosurces.

The protection of coral reef resources from over-exploitation is covered under the Environmental Law and Regulation for the Protection of Aquatic Resources.

Marine Protected areas have been proposed. During 1992-1994 surveys for potential locations of marine protected areas were conducted with support from the World Wildlife Fund, the National Science and Technology Institute of Vietnam, and the Institute of Oceanography. A programme to revegetate hillsides is underway.

2.2 Capacity building

Environmental education is being upgraded at all levels of education and several training courses on management of coastal and marine resources have been conducted through bilateral assistance in Vietnam.

2.3 Research and monitoring

In conjunction with the IUCN and with support of the WWF, surveys was conducted on the biodiversity of coastal and marine ecosystems in 7 sites during the period of 1992-1994. A

research project in preparation for the establishment of marine parks was implemented by the National Centre for Science and Technology during the period of 1994-1995.

3. PRIORITIES

3.1 Management

- establish the appropriate policy, strategies, programmes and mechanisms for the effective management of coastal and marine resources and the arrangements for coordination between sectors and the different tiers of governments.
- Establish an effective network of marine protected areas as recommended by the National Biodiversity Action Plan approved by the Government in 1995.
- Apply experiences of countries in the region on community-based management of MPAs.
- publish appropriate regulations concerning coastal and marine conservation and management.
- enhance cooperation with international and regional bodies in the management of coastal and marine resources.
- prohibit coral collection and mining
- prohibit destructive fishing methods
- address socio-economic aspects of coral reef management
- provide assistance to fishermen to obtain suitable equipment so that they are less likely to use damaging fishing techniques

3.2 Capacity building

Education of local fishermen with regard to the importance of coral reefs is considered a priority. Generally, environmental education of local communities and local managers should be emphasised.

Management agencies with responsibilities for marine national parks should be adequately staffed with trained personnel. These scientists and managers need to be equiped with the necessary technical skills and expertise.

3.3 Research and monitoring

Priorities are:

- Increase the knowledge and information base regarding Vietnam's coastal and marine resources.
- Monitor the recovery of damaged reefs.
- monitor the multi-sourced threats impinging on coral reef health.
- conduct surveys to gather information needed for establishment of management plans for MPAs.
- restore population of endangered species of rare marine population of marine flora and fauna
- establish a long-term monitoring programme with respect to coastal and marine resources and water quality, including those in the coral reefs and related ecosystems.

PUBLICATIONS OF THE RCU/EAS TECHNICAL REPORT SERIES

EAS 1 UNEP: Training Manual on assessment of the quantity and type of land-based pollutant discharges into the marine and coastal environment. RCU/EAS Technical Reports Series No. 1 UNEP, Bangkok, 1993. (65 pages) **(out of stock)**

EAS 2 L.M. Chou (ed.): Implications of expected climate changes in the East Asian Seas Region: an overview. RCU/EAS Technical Reports Series No. 2 UNEP, Bangkok, 1994. (196 pages). Also published as UNEP Regional Seas Reports and Studies No. 160. **(out of stock)**

EAS 3 UNEP: Proceedings of the UNEP Workshop on biological effects of pollutants. RCU/EAS Technical Reports Series No. 3 UNEP, Bangkok, 1994. (67 pages) **(out of stock)**

EAS 4 R. Kenchington and K.L. Ch'ng (eds.): Staff training materials for the management of marine protected areas. RCU/EAS Technical Reports Series No. 4 UNEP, Bangkok, 1994. (545 pages) **(in stock)**

EAS 5 Dr. Lawrence C.C. Koe & Dr. M.A. Aziz: Regional Programme of Action on Land-Based Activities Affecting Coastal and Marine Areas in the East Asian Seas. RCU/EAS Technical Reports Series No. 5 UNEP, Bangkok, 1995. (117 pages) **(in stock)**

EAS 6 Miguel D. Fortes: Seagrasses of East Asia: Environmental and Management Perspectives. RCU/EAS Technical Reports Series No. 6 UNEP, Bangkok, 1995. (79 pages) **(in stock)**

EAS 7 L.M. Chou: Proceedings of the Workshop on Soft-Bottom Benthic Communities as Indicators of Pollutant-Induced Changes in The Marine Environment. RCU/EAS Technical Reports Series No. 7 UNEP, Bangkok, 1995. (83 pages) **(in stock)**

EAS 8 Trevor J. Ward: Proceedings of the Workshop on Eutrophication in Tropical marine Systems - The Impacts and Management of Nutrient Pollution. RCU/EAS Technical Reports Series No. 8 UNEP, Bangkok, 1996. (137 pages) **(in stock)**

EAS 9 Report of the Training Workshop on Land-based Oil Discharges to Coastal Waters: Ecological Consequences and Management Aspects. RCU/EAS Technical Reports Series No. 9 UNEP, Bangkok, 1996. (220 pages) **(in stock)**

EAS 10 Proceedings of the Second ASEAMS Scientific Symposium (ASEAMS). RCU/EAS Technical Reports Series No. 10 UNEP, Bangkok, 1996. (120 pages) **(in stock)**

EAS 11 East Asian Seas Regional Report on the Issues and Activities Associated with Coral Reefs and Related Ecosystems. RCU/EAS Technical Reports Series No. 11. UNEP, Bangkok, 1996. (68 pages) **(in stock)**

EAS 12 Integrated Coastal Zone Management Training Manual (EAS-34). RCU/EAS Technical Reports Series No. 12. UNEP, Bangkok, 1996. (382 pages) **(in stock)**

Report of the Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia, Dumaguete, 27 - 30 June 1995. (101 pages) **(in stock)**

Report of the Workshop on the Application of Methodologies for Valuation of Environmental and Natural Resources with Particular Reference to Oceans and Coastal Areas, Denpasar, Bali, Indonesia 27 November - 1 December 1995. (112 pages) **(in stock)**

Report of the International Coral Reef Initiative (ICRI) Regional Workshop for the East Asian Seas, Denpasar, Bali, Indonesia 18 - 22 March 1996. (92 pages) **(in stock)**

Issued and printed by:

East Asian Seas Action Plan
United Nations Environment Programme

Additional copies of this and other publications issued by
the East Asian Seas Action Plan of UNEP can be obtained from:

Regional Coordinating Unit for East Asian Seas Action Plan
United Nations Environment Programme
United Nations Building, 10th Floor
Rajdamnern Avenue
Bangkok 10200
THAILAND

EAS/RCU Direct lines: Tel: (66-2) 281 2428
Facsimile: (66-2) 267 8008