This Conference Report, which synthesizes the views, experiences and approaches of the participants to the World Coast Conference 1993, is intended as a contribution to, and for consideration by, the United Nations Conference on the Sustainable Development of Small Island Developing States, the United Nations Commission on Sustainable Development, and the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change. It is also offered as supporting material for consideration by the Intergovernmental Panel on Climate Change, towards its Second Assessment Report. This Conference Report has not been subjected to the formal review processes of the IPCC, nor any of the other organizations mentioned.

The World Coast Conference 1993 was conducted under auspices of the Intergovernmental Panel on Climate Change (IPCC) and sponsored by the international and regional organizations: the International Geosphere-Biosphere Programme (IGBP), the International Union of Geological Sciences (IUGS), the Intergovernmental Oceanographic Commission (IOC/UNESCO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Conservation Union (IUCN), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the World Bank (WB), the Commission of the European Communities (CEC), and the World Meteorological Organization (WMO).

The preparatory workshops and the organization of the World Coast Conference would not have been possible without the support provided by the Governments of Australia, Japan, the Netherlands, the United Kingdom, Sweden and the United States of America.

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Preparing to meet the coastal challenges of the 21st century

CONFERENCE REPORT

World Coast Conference 1993

Noordwijk, The Netherlands

1-5 November 1993

Prologue

The possibility that emissions of greenhouse gases into the atmosphere might lead to a significant change in climate has been recogni: long time by the scientific community as a challenging issue for research. The first truly global climate model that addressed this issue developed by S. Manabe and co-workers at Geophysical Fluid Dynamics Laboratory at Princeton University, was presented just abou years ago. The change in the global mean temperature that would occur due to a doubling of the amount of carbon dioxide in the atn was then estimated to about 3 °C.

Since then the work of an increasing number of the world's best theoretical climatologists has profoundly increased our understandir global interactions that we need to consider in analyses of this kind. The most likely value for the global change in temperature, howe remained about the same throughout these 20 years, but now we understand much better the uncertainty and limitations of such mo computations. The Intergovernmental Panel on Climate Change (IPCC), in assessing the scientific literature on the subject has theref assigned a range, 1.5 - 4.5 °C.

The facts that about 160 countries signed the Framework Convention on Climate Change at the UNCED meeting in Rio in 1992, and that more than 50 countries have now ratified it, means that the climate change issue has been recognized by the world, although the with which it will occur and its more specific impacts are still not well understood. The Convention came into force 21 March 1994 a meeting of the Parties to the Convention will be held in Berlin in March/April 1995.

To implement the objectives of the Convention, "*....to achieve stabilization of greenhouse concentrations in the atmosphere at a level tha prevent dangerous anthropogenic interference with the climate system*", however, will not be easy and will certainly take time. Efforts to emissions of greenhouse gases have so far been very modest. Thorough analysis of both the impacts of climate change and ways and n adapt to some changes that may be unavoidable are required in order to reach international agreements on more far-reaching efforts.

Undoubtedly the rise of sea level that would be associated with a change of climate and its impact on the coastal zone is one of the mc important issues need our careful attention. The fact that a large part of the worlds' population lives in the vicinity of the coast adds fi justification to address this problem with some urgency.

It is important that conferences dealing with sustainable development of natural resources and impacts of climate change do not becc exclusive exercises for the scientific community. Rather, there is a need that scientists, politicians and people directly concerned with development and protection get together and learn to appreciate fully each other's knowledge and views. Only in this way can effectiv timely measures be developed.

The World Coast Conference 1993, arranged by the Government of the Netherlands, indeed was a major and very successful conferer address such objectives. There will certainly be a need for many other conferences of this kind addressing other sectors of society that threatened by the impacts of climate change. The experience gained during the World Coast Conference 1993 will then be most usefu above all, a further step towards effective coastal management has been taken, which of course also is of great importance in itself.

I wish to express my sincere thanks to the Government of the Netherlands and all individuals who made the conference into a success

Stockholm, March 1994

Bert Bolin
Chairman of the Intergovernmental Panel on Climate Change

Preface

For millennia, coastal zones of the world have been major centers of human populations. Coastal waters served as many of the primary of transportation and communication among these population centers. Despite exchanges among very different cultures over the years enormous differences still exist among coastal societies. Over the past two years, coastal Rio de Janeiro, New Orleans, Tsukuba and Noordwijk have been the settings for important advances in coastal zone management. At the 1992 Earth Summit in Rio, a major step taken toward achieving the goal of global sustainable development. International cooperation was identified clearly as an essential ingre Concerning coastal zone management, participants of the Earth Summit noted that ". ..a global conference to exchange experience in tl could be held before 1994."

And it happened! In New Orleans, Tsukuba and Noordwijk intense communications took place among representatives of over 90 coast nations. This series of meetings served to bridge the gap between the goals of UNCED and the identification of specific actions that nee taken by international and national governmental and non-governmental organizations to achieve them.The Earth Summit document trends of the continued deterioration of ecosystems and clearly identified the need for environmental protection to be considered as an integral component of economic development. Toward this end, Agenda 21 recommended the need to "...improve or restructure the decision-making process so that consideration of socio-economic and environmental issues is fully integrated and a broader range of p participation assured." These ideas were among the key issues that were addressed for coastal areas by the WCC'93. Because of its large potential impact, climate change is a particularly important issue for the management of coastal zones. Integration of the effects of clin change into the coastal management process is difficult due the large uncertainties and long time scales involved. However, proactive management to prevent problems, rather than reactive actions to correct them, is clearly the preferred approach.

During the WCC'93, the exchange of information among participating nations and organizations was recognized as simply one step in much larger process - the education and training of the relevant stakeholders in integrated coastal zone management (ICZM) world-w Therefore, training and institutional capacity-building received significant attention. Even though large differences exist among coastal nations, the development of common concepts and methodologies for ICZM could contribute significantly to building global capaciti idea is demonstrated, for example, by the continuing effort to establish a common framework to assess the vulnerability of coastal area effects of climate change.
With the goals of the Earth Summit in mind, we acknowledge the tremendous challenge to attain healthy and productive lives in harm with nature, especially for people living in densely populated coastal areas. Improvements in human settlements, particularly in shelter drinking water, and waste disposal are among the essential elements needed to meet the developmental and environmental needs of pr and future generations. The fulfillment of these needs depends on the development and implementation of integrated coastal zone management. We hope that results of the WCC'93 contribute to our continued efforts to attain these critical goals.

We acknowledge all delegations of states and organizations, governmental and non-governmental, who prepared for and participated in the of exchanging experiences and ideas. The information on coastal issues that was submitted and presented to the pre-Conference Workshops the Conference was overwhelming in number and inspiring in content. It reflects the increasing interest of all who are involved and responsib understanding and managing the coastal areas of the World. Synthesizing the information content of all these contributions objectively was Although this Conference Report is an attempt to do so, we realize that the underlying contributions embrace the wealth of information: the state of the art. The integral contributions to the Conference therefore will be made available in proceedings for all concerned.

We specially acknowledge with gratitude the support of all who have participated in the efforts of drafting the report: Martha Crawford, Fra Hoozemans, Richard Klein, Ben Mieremet, Robbert Misdorp, Robert Nicholls, Katie Ries, Julian Spradley, Marcel Stive, Leo de Vrees, Suzie Westmacott; and reviewed the report: Mohammed Ali (Maldives), Christian Auger (France), Larry Awosika (Nigeria), Fé Domingo (Philip Danny Elder (IUCN), Mohammed El-Raey (Egypt), Victor Gallardo (Chile), Lorenzo Gómez-Mórin (Mexico), Fazlul Huq (Bangladesh), F Jerez (Nicaragua), Lakshmikant Joshi (India), Chalapan Kaluwin (SPREP), Robert Kay (Australia), Robert van Lierop (Vanuatu), Leonar (Barbados), Jacub Rais (Indonesia), David Richardson (United Kingdom), Horst Sterr (Germany), Ian Stewart (New Zealand) and we sinc appreciate the support of the IPCC, the efforts of its chairman Bert Bolin and Pier Vellinga.

Washington, Ibaraki and The Hague, March 1994

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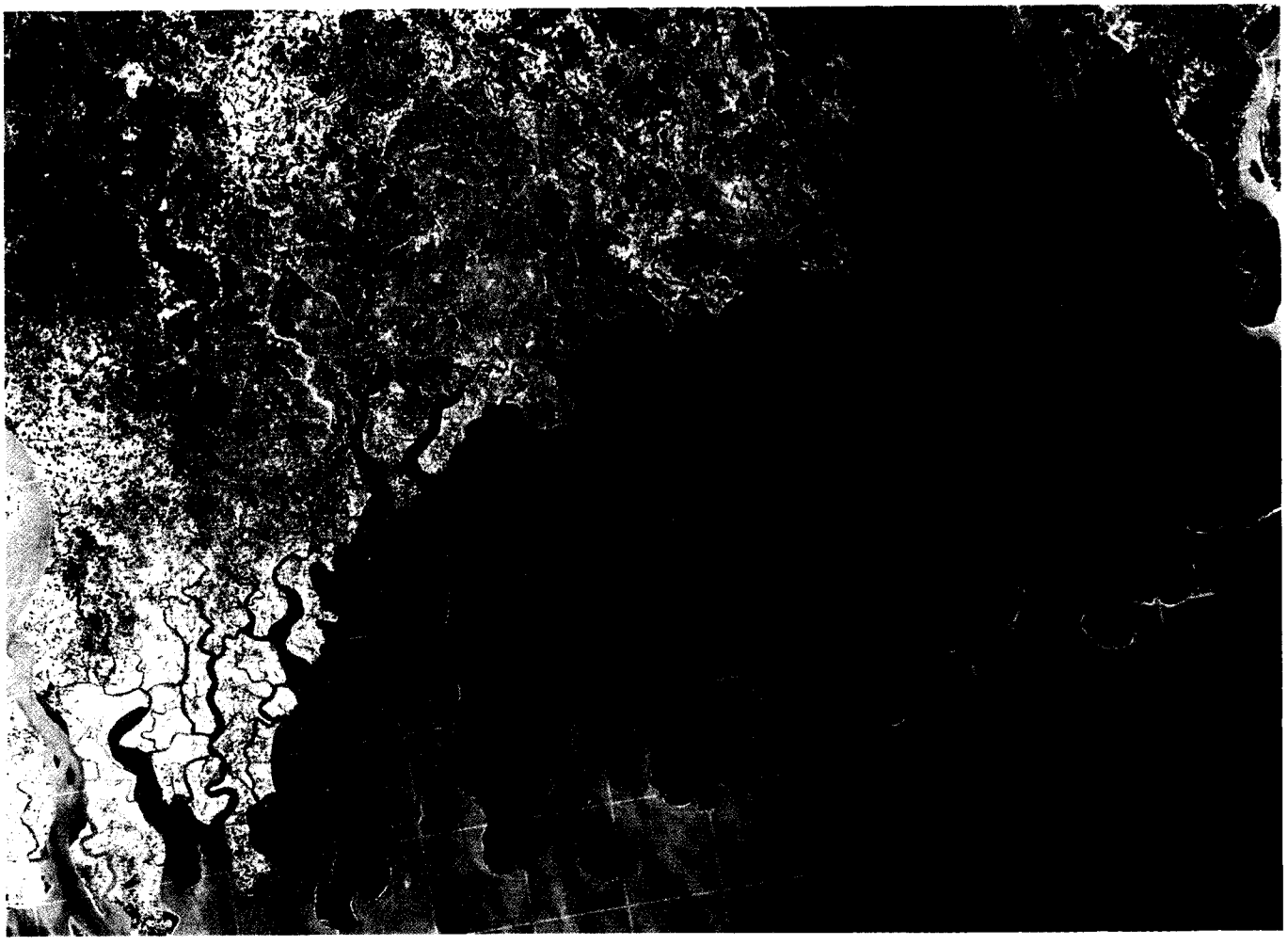

Mangroves in Bangladesh, a multiple resource and a stabilizing component for the hinterland.

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The closure of a tidal inlet by a multi purpose dam (irrigation, flood protection, communication and land reclamation) by the men power of 5000 people during one tidal cycle.

1 Introduction

1.1 Background

Two-thirds of the Earth's surface is covered by oceans, one-third is land, and the transition between them is a small strip, the coastal zone. Although the coastal zone covers less than 15% of the Earth's land surface, this is where the majority of the world's population lives and works.

Many coastal problems that are now being encountered worldwide have resulted from the unsustainable use and unrestricted development of coastal areas and resources. These problems include the accumulation of contaminants in coastal areas, erosion, and the rapidly increasing decline of habitats and natural resources. Population growth and associated economic developments place additional demands on coastal areas and resources, posing yet another threat to the sustainability of these areas. The impacts of unsustainable coastal development will ultimately result in the degradation of natural systems that provide protection against the sea, habitat for many species and food for many people, and could pose significant risks to public health.

In addition to the problems related to unsustainable coastal development, coastal zones can also be significantly affected by the impacts of human-induced climate change. One of the many anticipated effects of climate change is an accelerated rise in global mean sea level. The Intergovernmental Panel on Climate Change (IPCC) estimate that over the next century the sea level will rise by 31-110 cm by the year 2100, and that this could have severe impacts on coastal areas and their resources. Wetlands are likely to be threatened, coastal erosion will increase, and coastal resources, populations and economies will be adversely affected. Already in the shorter term, other aspects of climate change may have serious effects; these include changes in the frequency, intensity and patterns of extreme weather events such as tropical cyclones, intense precipitation, and associated storm surges and flooding. Some coastal areas, particularly those that are frequently hit by tropical cyclones and monsoons, are already now facing significant threats posed by climate variability, independent of climate change.

The world's coastal zones thus face a multifaceted challenge, which will become apparent over various time scales (figure 1.1). The IPCC's systematic assessments of the vulnerability of coastal zones to climate change and accelerated sea level rise clearly show that climate-related impacts and impacts resulting from present-day human activities in the coastal zone cannot be separated. On the contrary, *climate change and climate variability are likely to aggravate the impacts of unsustainable development of coastal areas and resources. In turn, these impacts will further exacerbate the vulnerability of coastal areas to the consequences of climate change and associated sea level rise.*

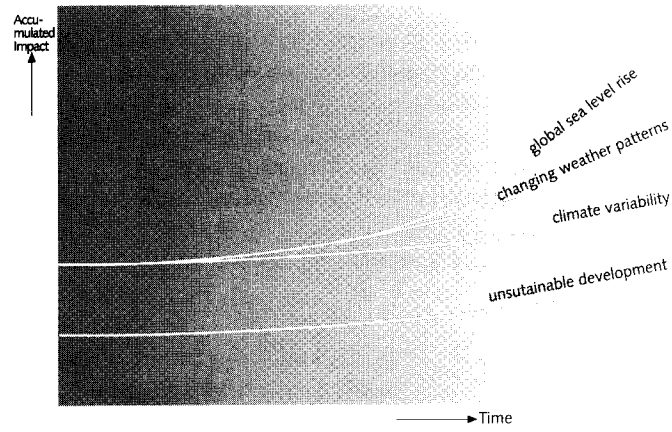


Figure 1.1 The world's coastal zones face a multifaceted challenge

1.2 The World Coast Conference

The global importance of coastal areas in terms of both ecological and socio-economic values is widely recognized. Many international organizations, including the IPCC, have called for action to implement strategies towards better planning and management of coastal areas and resources. In 1992, the Coastal Zone Management Subgroup of the IPCC concluded that:

> *In many parts of the world, the natural systems that provide protection against the sea are being degraded by development activities through mining for sand and coral, cutting mangroves, damming and confining the flows of rivers, and filling wetlands. Every year that countries postpone addressing these issues, they continue to increase their vulnerability to climate change and associated sea level rise. Moreover, environmentally sound responses have lead times of several decades and longer. Thus, even though the effects of accelerating sea level rise are still decades away, NOW is the time to take action.*

The importance of improving the management of coastal areas and resources is also explicitly mentioned in Chapter 17 of Agenda 21 of the UN Conference on Environment and Development (UNCED).

In response to the calls of UNCED and the IPCC, the World Coast Conference (WCC'93) was organized by the government of The Netherlands (Noordwijk, 1-5 November 1993), with the following objectives:

- to provide an opportunity for nations with vulnerable low-lying coastal areas and small island nations to exchange information and experiences in assessing vulnerability to climate change and in developing coastal zone management plans;
- to contribute to the development of common concepts, techniques and tools in preparing coastal zone management plans;

- to foster the participation of coastal nations that may be affected by climate change in the global research programme; and
- to stimulate discussion on more effective coordination among national, regional, international and intergovernmental organizations that are assisting and supporting nations in the development and implementation of coastal zone management programmes.

In preparation for the WCC'93, workshops for the Western hemisphere were held in the USA (New Orleans, 13-16 July 1993), and the Eastern hemisphere in Japan (Tsukuba, 3-6 August 1993). Countries were encouraged to prepare contributions on their experiences in coastal zone management to be presented at the WCC'93 or one of these workshops.
Elaborating on the findings of three earlier meetings held by the Coastal Zone Management Subgroup of the IPCC (Miami, Florida, USA, 1989; Perth, Australia, 1990; Margarita Island, Venezuela, 1992), the WCC'93 and its preparatory workshops focused specific attention on the need to integrate responses to long-term threats such as climate change and associated sea level rise with existing planning and management efforts in coastal areas. Following Chapter 17 of UNCED's Agenda 21, new approaches to marine and coastal zone management and development are required. These approaches will need to be precautionary and anticipatory by nature, and their elements will need to be fully integrated.

The WCC'93 participants included representatives of more than 90 nations, 20 international organizations and 23 non-governmental organizations (NGOs). Coastal zone experts and policy makers were able to discuss possible means and opportunities for strengthening integrated coastal zone management capabilities, in preparation for the coastal challenges of the 21st century. The WCC'93 recognized that:

> *Integrated Coastal Zone Management (ICZM) has been identified as the most appropriate process to address current and long-term coastal management issues, including habitat loss, degradation of water quality, changes in hydrological cycles, depletion of coastal resources, and adaptation to sea level rise and other impacts of global climate change.*

Thus, ICZM is an effective vehicle for addressing short-term development challenges, and also enables long-term goals to be incorporated. However, it should be noted that the WCC'93 recognized that there is no unique "recipe" for the process of ICZM; rather, it should be regarded as a range of concepts and techniques that can be adapted to different situations and circumstances.

At the WCC'93, the national and international experiences and results of coastal management programmes, and the results of studies of the vulnerability of coastal areas to sea level rise and other impacts of climate change were presented. In addition, opportunities for coastal planning and management were discussed. An analysis of the urgency of the need to develop and implement ICZM programmes now, and of the short- and long-term benefits of ICZM, combined with an improved understanding of the basic elements that comprise an ICZM programme and the obstacles that have to be overcome in implementing such a programme, formed the basis for the Conference Statement that was adopted on the last day of the WCC'93. This Statement reflects the consensus views of the participants on actions that can be taken to strengthen capabilities for progressive sustainable development and integrated coastal zone management.

Four technical documents have been issued in preparation for the WCC'93:
- *How to account for impacts of climate change in integrated coastal zone management: Concepts and tools for approach and analysis;*
- *Some considerations on the economic importance of pro-active integrated coastal zone management;*
- *Management arrangements for the development and implementation of coastal zone management programmes; and*
- *Synthesis of vulnerability analysis studies.*

Together with the contributions of the participating countries, these documents will also appear in the proceedings of the WCC'93.

To demonstrate the importance of information and communication to policy makers and coastal managers in the design or application of integrated coastal zone management plans or programmes, for the WCC'93 a "Toolbox" was prepared. The Toolbox software contains a comprehensive bibliography of coastal zone management issues, models that include demonstrations of the use of remote sensing capabilities, simmulation palnning and analyzing coastal resources, and a geographical management system.

1.3 The Conference Report

This report provides a synthesis of the information (concepts, ideas and approaches) that was assembled at the WCC'93 and the preparatory workshops. During the conference, consensus was reached that efforts to strengthen ICZM should be motivated and developed by addressing the urgency and the benefits, by identifying elements and obstacles, and by exploring the possibilities for building capabilities. Accordingly, the contents of the Conference Statement and this Conference Report are organized along these lines.

Chapter 2 deals with the urgency of the need for, and the benefits of integrated coastal zone management. The problems being faced in coastal areas are described, and the results of 46 assessments of the vulnerability of coastal areas to sea level rise are analyzed. The environmental and economic benefits of implementing ICZM are also discussed. Based on the descriptions of experiences in coastal zone

management presented at the WCC'93 and the preparatory workshops, chapter 3 describes the elements of ongoing ICZM programmes, and the obstacles that have been encountered in their design and implementation. Although the processes of ICZM described in the case studies are situation-dependent, nevertheless some commonalities between the various experiences are identified. Chapter 4 outlines the opportunities for building national and international ICZM capabilities.

Finally, the appendices to this report summarize the results of the vulnerability assessment case studies (Appendix I), coastal zone management case studies (Appendix II), and the relevant programmes of international organizations in the field of ICZM (Appendix III).

Extended tidal flats in The Netherlands, important foraging areas for migrating birds.

Exhibit 1.1 Preamble to WCC'93 Conference Statement

Integrated coastal zone management (ICZM) has been identified as the most appropriate process for addressing current and long-term coastal management issues, including habitat loss, degradation of water quality, changes in hydrological cycles, depletion of coastal resources, and adaptation to sea level rise and other impacts of global climate change. It also is a means to identify and anticipate future opportunities. Thus, ICZM is a major tool for achieving for sustainable development in coastal states, including states with boundaries on inland seas. ICZM is consistent with Principles 1-19 of the Rio Declaration, particularly Principles 2, 3, 4, 6, 9, 15 and 16 as raised during the conference. Among the international calls for ICZM:

- The UN Conference on Environment and Development (UNCED) expressed, in Chapter 17 of *Agenda 21: Programme of Action for Sustainable Development*, the urgent need for coastal states to develop capabilities for ICZM and to implement national ICZM programmes;
- The UN Framework Convention on Climate Change (FCCC) calls for coastal states to develop programmes for coastal zone management to address the impacts of global climate change;
- The First Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) recommended that coastal nations should implement comprehensive coastal zone management plans to reduce their vulnerability to global climate change;
- The Alliance of Small Island States (AOSIS) expressed its support for integrated coastal zone management in August 1993 at the Substantive Session of the Preparatory Committee of the Global Conference on the Sustainable Development of Small Island Developing States;
- The member governments of the Organization for Economic Cooperation and Development (OECD) called for ICZM at all levels of government; and
- The contracting parties to the Barcelona Convention for the Protection of the Mediterranean Sea from Pollution stressed the importance of ICZM.

ICZM is also particularly relevant to the Convention on the Conservation of Biodiversity, the Convention on Wetlands of International Importance Especially Waterfowl Habitats (RAMSAR), and other international and regional environmental agreements.

The *World Coast Conference 1993* generated materials and stimulated discussion on integrated coastal zone management. Most coastal states have indicated their interest in developing capabilities for integrated coastal zone management. To date, however, less than one-third of coastal states have developed these capabilities. A variety of regional and international organizations (including bilateral assistance organizations) have voiced their support for measures to assist coastal states in the development of national ICZM programmes.

Participants at the WCC'93 from more than 90 nations, 20 international organizations and 23 non-governmental organizations discussed actions for coastal states to undertake ICZM as they progress towards the year 2000. The Conference Statement is provided for the consideration of governments, institutions and organizations as they focus their efforts to meet the coastal challenges of the 21st century.

In particular, the Conference Statement and the Conference Report, in representing the views of the participants at the WCC'93, are intended as contributions to the work of, and for consideration by, the Preparatory Committee for the Global Conference on the Sustainable Development of Small Island Developing States (for the conference in Barbados in April 1994), the UN Commission on Sustainable Development (for the development of its programmes), the Intergovernmental Panel on Climate Change (for its Second Assessment Report), the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (for its presentation to the first session of the Conference of Parties to the Convention) and other relevant organizations and institutions.

The participants, while agreeing that coastal states are faced with a broad range of short- and long-term challenges, noted with particular concern the potentially severe impacts of global climate change, and emphasized the role of the signatories to the UN Framework Convention on Climate Change in meeting the ultimate objective of that agreement, which is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

2 The Urgency and Benefits

Challenges for Integrated Coastal Zone Management

2.1 Introduction

Coastal areas contain some of the world's most diverse and productive resources. They include extensive areas of complex and specialized ecosystems, such as mangroves, coral reefs and seagrasses, which are highly sensitive to human intervention. These ecosystems are the source of a significant proportion of global food production. Moreover, they support a variety of economic activities, including fisheries, tourism, recreation and transportation. In recent decades, many coastal areas have been heavily modified and intensively developed, significantly increasing their vulnerability to natural coastal dynamics and predicted impacts of global climate change.

The challenge facing policy makers in coastal areas today is to facilitate economic development, while limiting the impacts of such development on natural areas, and protecting human life, infrastructure and other support systems from external stresses. Policy makers then find themselves confronted with many day-to-day management questions, such as:

- "Is it safe to build here, or will erosion increase?";
- "Is it safe to swim here, or is the water too polluted?";
- "Is it safe to eat fish caught here, or do they contain too many contaminants?";
- "Will there be enough fish to eat next year, or are they being overharvested this year?";
- "Is it wise to invest in tourism development here, or will the area lose its attractiveness due to other developments?"; and
- "How to create public awareness and the involvement of local groups in resource management?."

To integrate these sectoral considerations, these questions can be rephrased as, for example:

- "What is the best way to manage coastal areas and their resources, while maintaining the resilience of coastal systems?"; and,
- "How can coastal areas and resources be best developed to provide desired products and services to meet human needs, while maintaining viable and diverse ecosystems?"

In this chapter the rationale for ICZM is discussed in the context of both short- and long-term concerns.

2.2 The Urgency

Increasing pressures on coastal areas and their resources clearly underline the urgency of the need to start the ICZM process now. These pressures include present-day population growth and economic development, resulting in competing demands for space and resources in coastal zones, and future impacts of global climate change, such as accelerated sea level rise.

Population growth

Today, the population in coastal areas is equal to the entire global population in the 1950s. As shown in table 2.1, most of the world's largest cities are located in coastal areas. Various estimates suggest that the populations of the world's coastal zones represent 50-70% of the estimated 5.3 billion people alive today. There are, however, wide variations among nations in the estimated numbers of people living and working in coastal areas. In many small island nations, such as the Maldives, virtually all the inhabitants live in coastal areas. The proportion of the total population living in the coastal zones of larger nations varies considerably. For example, only 17% of the total population of Kenya lives in the coastal zone, whereas two-thirds of the population of Norway lives within 15 km of the sea, and in the USA the average population density of coastal counties is five times greater than non-coastal counties.

The UN median projections for population growth suggest that the world's population will reach 8.5 billion by the year 2025, and that 70% of this increase will occur in 20 of the less-developed countries. Estimates of the future populations of coastal areas vary considerably. UNCED's Agenda 21, Chapter 17, suggests that up to three-quarters of the world's population could be living within 60 km of the shoreline by 2020. World Bank experts suggest that two-thirds of the population of developing countries (3.7 billion) is expected to be living along the coast by the end of this century (see also figure 2.1).

Economic development and competing demands

In addition to population growth, coastal areas are also facing unprecedented pressure on the economic development of their resources. For instance, tourism represents an important and growing activity in coastal regions. Tourism, in fact, could be called the world's largest single industry. Estimates indicate that it accounts for at least 5% of the combined Gross National Products (GNP's) of all nations. In the Caribbean, tourism helps to support the economies and is estimated to contribute about 43% of the region's combined GNP. The Galapagos Islands generate some US$ 700,000 per year from tourism and estimates suggest that this could rise to US$ 25 million. However, great care must be taken in planning for and managing tourism development, to avoid "killing the goose that lays the golden eggs". In most coastal nations there are increasing demands for coastal sites for tourism development; and policy makers are facing a major challenge in meeting demands while protecting the quality of the environment. A bitter lesson learnt by several Mediterranean and Asian coastal nations is that once the quality of the environment declines, tourism revenues decline as well. Once the reputation of an area is lost, it is extremely difficult to convince people to return.

Table 2.1 The world's largest cities, year 2000 (population in millions)

Rank	Agglomeration	Country	1970	1985	2000	1970-2000
1	Mexico City	Mexico	9.12	17.30	25.82	16.70
2	Sao Paolo	Brazil	8.22	15.88	23.97	15.75
9	Tehran	Iran	3.29	7.52	13.58	10.29
12	Delhi	India	3.64	7.40	13.24	9.60
15	Beijing	China	8.29	9.25	11.17	8.29
17	Cairo/Giza	Egypt	5.69	7.69	11.13	5.44
23	Moscow	Russia	7.07	8.97	10.40	3.33

Source: UN (1987).

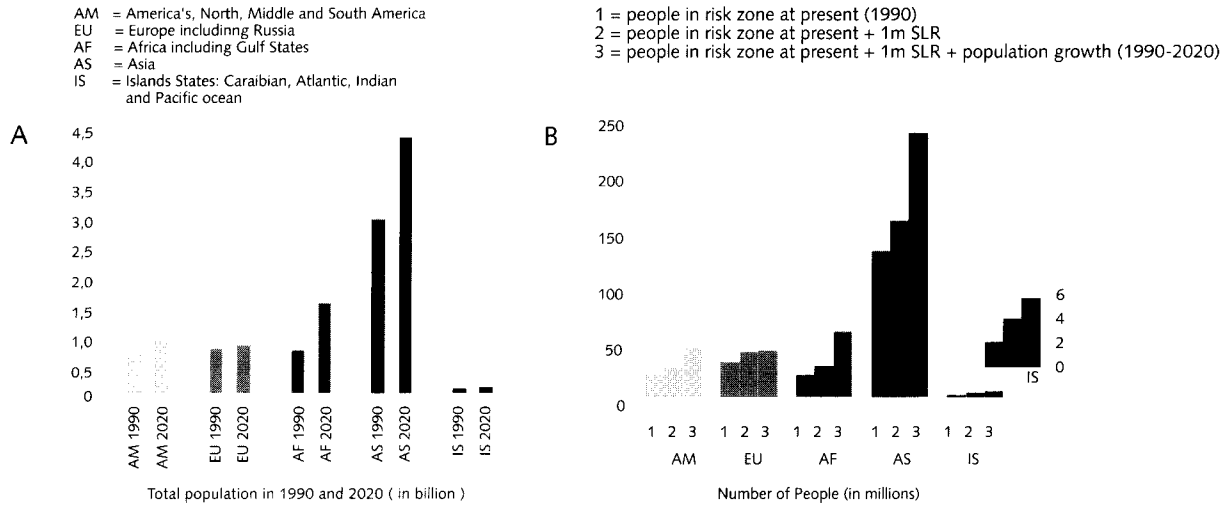


Figure 2.1 Population projections: (A) total world population; (B) people in coastal risk zones.
Source: Adapted from: Rijkswaterstaat and Delft Hydraulics (1993).

A recent study on international fisheries shows that more than 100 million people, directly or indirectly, depend on fisheries for their livelihood. Worldwide, 95% of all marine fish harvests is derived from coastal waters. The global fish catch is close to the estimated sustainable yield. Fisheries are important to the food security of nations. Fish is a major source of animal protein. Among the 40 countries that rank highest in per capita consumption of marine sources of protein, all but one are developing nations. In some cases there may be untapped capture fisheries potential. Many regional fisheries however, show signs of overharvesting. FAO data suggest that 19 fishing zones are above the lower limit of estimated sustainable yield. Coastal wetlands (mangroves, intertidal areas and coral ecosystems) are important breeding grounds for coastal fish species. These wetlands, however, are lost at an alarming rate. Decline rates of more than 1% per year are reported for many coastal wetlands, due to conversion to aquaculture, coastal erosion, pollution, land reclamation and harbour development. Conserving habitats and breeding grounds, and managing the food supply from living resources and harvesting from ecosystems is, therefore, a critical task for nations and international cooperating bodies. There is almost no resilience and any loss can disrupt local (subsistence) communities.

Oil and gas development in coastal areas, both onshore and offshore, has been well established for some 100 years. In ten years time (1978-1988), there has been a 27% increase in oil production and a 20% increase in gas production from coastal areas, and substantial proven reserves have been discovered. Associated with all forms of energy development in coastal zones there is a corresponding increase of harbour facilities, oil and gas processing, support services and related infrastructures. It is obvious that there is a growing need for environmentally sound decision making, for which environmental impact assessments are important tools.

From the above it is clear that demands for space and resources are increasingly exponential. Whenever there are conflicting interests and competing demands for the use of coastal areas and resources, trade-offs are required between conservation and development, and among various development options. For example, a proposal for the development of heavy industry in an area that has the potential to be developed as a tourist resort could create conflicts among development stakeholders that are just as intense as choices between conservation and development. In these cases, the need for cross-sectoral cooperation is obvious, and the need for integrated coastal zone management (ICZM) is the greatest. Unfortunately, there are many examples in which agencies involved in the planning and management of coastal areas have no linkage to the activities of the other sectors.

Exhibit 2.1 Examples of trade-offs in coastal management

Decision making on the use of natural resources needs making trade-offs. Many uses of natural resources are mutually exclusive. For instance, a forest cannot be cleared for logging, while at the same time being used as a nature reserve for an endangered species of bird. The opportunity of using natural resources in one way necessarily involves giving up the opportunity to use them in another way.

Some uses are not necessarily mutually exclusive, however, and with proper planning, can accommodate one another. A coral reef may support artisanal reef fisheries and eco-tourism, if both users make slight compromises. For instance, if fishing is limited to certain species, and to fish over a certain size, then the beauty of the reef can be maintained, and its value for scuba diving retained.

An environmental impact assessment can be useful to identify areas where possible trade-offs or compromise may be needed. For example, consider the case of beach mining, in an area where sand and gravel are difficult or expensive to obtain, versus the beach erosion that is caused by such mining. In many coastal areas it is common to remove beach sand and/or gravel for construction or for liming the soil (if the sand has a high calcium carbonate content). However, the removal of the sand will cause erosion. Therefore, a trade-off must be made between the short-term benefits of removing the sand from the beach, versus the long-term benefits of developing alternative sources of supply. Taken to the extreme, on islands where tourism is an important source of income, the continued removal of beach sand will eventually mean that beach nourishment will be required, using sand from other, more distant sources. However, it will not be easy to break established traditions. If laws are introduced to prevent further mining, they will need to be supported by a widespread education programme to explain the reasons behind them. Careful consideration will also be needed for the individuals who will suffer the economic consequences of such a change in practice.

Global climate change

Despite many local and national efforts, current approaches to the management of coastal zones have often proved to be insufficient to achieve sustainable development. Therefore, coastal resources are being degraded and lost in many parts of the world. Expensive sanitation, restoration and protection measures will be necessary to prevent further reduction of the viability of local communities and indigenous peoples, and to prevent further increase in the vulnerability to longer-term climate change and associated accelerated sea level rise.

In its First Assessment Report (1990), the IPCC predicted that, under its "business-as-usual" scenario, global mean sea level would rise by 3-10 cm per decade over the next century (see figure 2.2). Although in its 1992 Supplement the IPCC did not revise the sea level rise scenarios, it did revise its greenhouse gas emissions scenarios and discussed new information on atmospheric processes that may lower the estimates of changes in radiative forcing and mean global temperature. Such changes would lead to downward revisions in the sea level rise scenarios. However, current indications are that projections for sea level rise would still represent a significant, although uncertain, increase in the rate of sea level rise over that experienced during the last 100 years. Moreover, even if greenhouse gas emissions are stabilized or reduced, sea level rise can be expected to continue for decades or even centuries because of the long response time of the global ocean system (see figure 2.2).

It is important to note that any rise in sea level is not expected to be uniform over the globe, due to factors such as differences in ocean circulation patterns, although these variations cannot be accurately predicted at present. In addition, vertical land movements, whether natural or occurring as a result of human activities (such as water, gas or oil extraction), could be equal to or larger than changes in global sea level. From an ICZM perspective, it is essential that these and other non-climate-related factors are taken into account when considering responses to sea level rise and other impacts of climate change. Figure 2.3 shows the distribution of past changes in relative sea level that have occurred due to geological processes.

Sea level rise is not the only climate change issue for coastal areas and resources. For example, changes in the frequency and intensity of extreme events are expected, and weather patterns may shift, exposing some areas to significant changes in climate. In some coastal areas, climatic extremes such as cyclones in the Bay of Bengal or those produced by the El Niño/Southern Oscillation (ENSO), have already caused serious economic disruption, damage to infrastructure and loss of human life, independent of global climate change. The mechanisms that determine the frequency of occurrence of such events, as well as their patterns, are poorly understood, hindering effective responses. Exhibit 2.2 shows that for The Netherlands the financial impacts of a 10% change in the intensity of storms may be worse than those of a 60 cm rise in sea level.

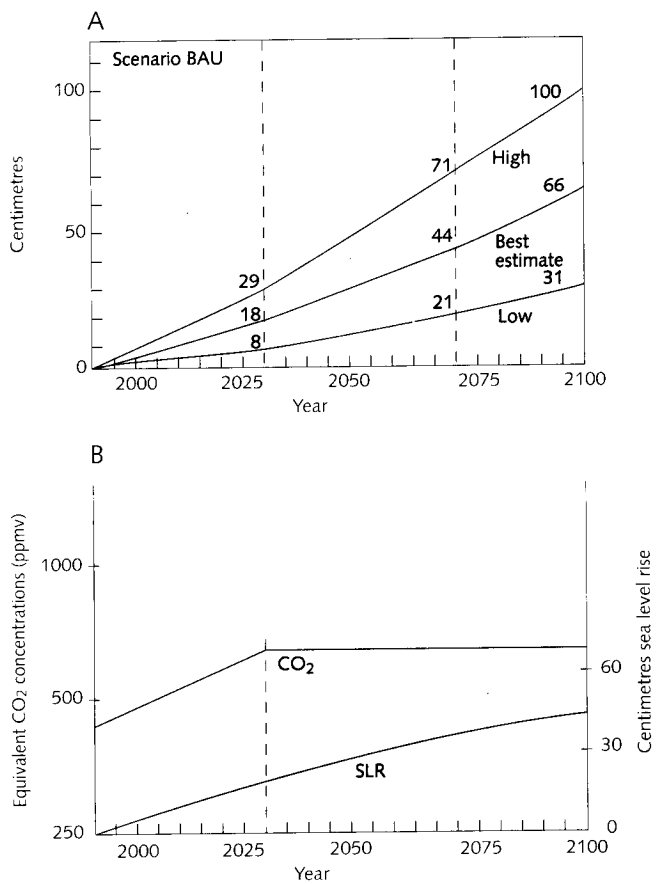


Figure 2.2 The IPCC's projections of global sea level rise. (a) Business-as-Usual scenario, with no limitation of greenhouse gas emissions. (b) Sea level rise due to Business-as-Usual (BaU) emissions to 2030, showing that the sea level would continue to rise throughout the remainder of the century even if the concentration of greenhouse gases in the atmosphere were to be stabilized by the year 2030.
Source: IPCC (1990).

2.3 Vulnerability

The assessment of a country's or region's vulnerability to sea level rise is intended as a vehicle to promote long-term thinking in developing ICZM programmes. In 1991, the IPCC developed a "Common Methodology" for assessing the vulnerability of coastal areas to sea level rise (see Appendix I). The Common Methodology specifies three scenario variables: global climate change (including accelerated sea level rise), socio-economic developments, and response options. It considers national or local development by extrapolating 30 years from the present situation. The Common Methodology strongly encourages coastal nations to consider a full range of response options, including at least the extreme options of complete retreat and total protection. In assessing vulnerability to sea level rises of 30-100 cm, the Common Methodology considers the potential impacts on population, on economic, environmental and social assets, and on agricultural production up to the year 2100. These two climate change scenarios approximate the low and high estimates of the IPCC's 1990 Scientific Assessment.

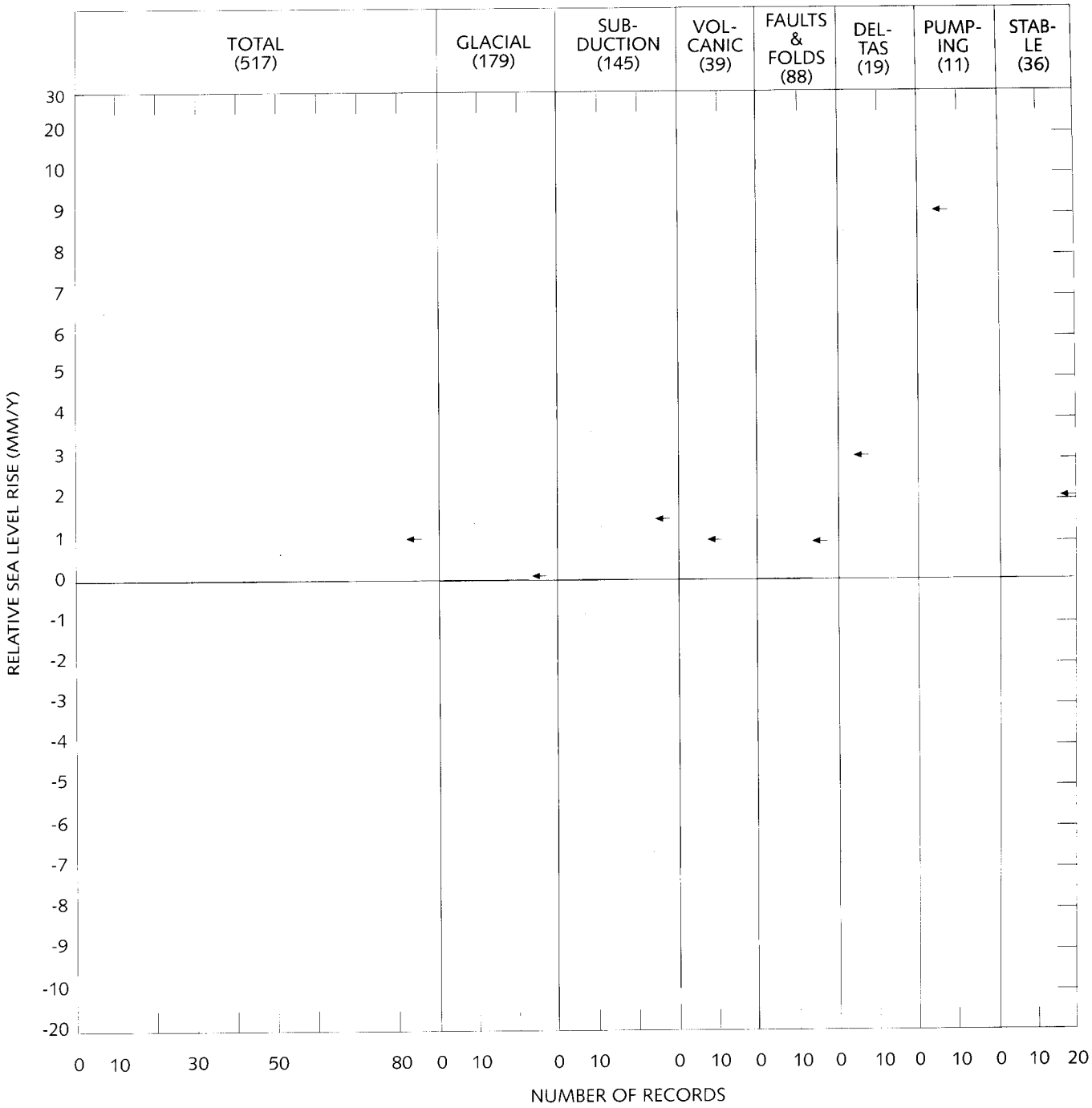


Figure 2.3 Histograms showing the rates of vertical changes in relative sea level records from 517 selected tide gauge stations grouped according to geological processes.
Source: Adapted from Emery and Aubrey (1991).

Vulnerability Assessment (VA)case studies

As of January 1994, 46 VA case studies had been completed or were in progress (Appendix I). This level of activity demonstrates the considerable interest and concern worldwide regarding the potential implications of accelerated sea level rise and other impacts of climate change for coastal areas. Aggregation of the case studies suggests that significant impacts could occur on a global scale (see table 2.2). The common scenarios assume a one metre rise in sea level in 100 years, with current patterns and levels of development. The results therefore tend to overstate the implications of sea level rise, and to understate the implications of other changes in climate, and of pressures for development due to socio-economic trends.

The VA case studies show that vulnerability to accelerated sea level rise varies widely from country to country. This depends on the physical and ecological parameters of the coastal system, the socio-economic settings and the management

Exhibit 2.2 Comparison of the impacts of changes in storm intensity and sea level rise in The Netherlands

The potential consequences of climate change for The Netherlands were investigated in the study The Impact of Sea Level Rise on Society (ISOS). Various scenarios of climate change were considered, including sea level rise, changes in river discharge and storm patterns (the latter is defined as an unfavourable change in wind direction and an increase in wind intensity of 10%). The table compares the financial implications of three scenarios in terms of the estimated extra costs over 100 years (in US$ billion).

	60 cm SLR	100 cm SLR	10% increase in storm intensity
Raising dikes	3.6	5.9	3.7
Protection of flood-prone infrastructure	0.9	1.7	2.0
Preservation of dunes	0.5	0.9	0.5
Adaptation of water management system	0.8	1.6	1.7
TOTAL	5.8	10.1	7.9

Source: Rijkswaterstaat (1991).

capabilities. Therefore, the vulnerability of a coastal zone cannot be expressed as a single index. Vulnerability is a typical multifactorial entity and could best be expressed by means of a vulnerability profile, identifying the different components of vulnerability.

The case studies also show that global sea level rise is often not the most critical issue, particularly in areas where pressures due to population growth and economic development are already creating problems and hazards. For example, in a river delta, changing patterns of rainfall and runoff in the catchment area, as well as more frequent and more intense storms and storm surges, could have significant impacts. A number of non-climate-related factors are also important, including water and sediment management, particularly where rivers cross administrative boundaries. Subsidence, a natural geological phenomenon in deltas, is frequently exacerbated by excessive groundwater abstraction. Near Tianjin in China, for example, the current rate of subsidence of 5 cm/yr will produce a relative rise in sea level of one metre in only 20 years, as opposed to the century or more expected from global changes.
The following general statements can be drawn from the VA case studies:

- Vulnerability analysis has further utility for countries and areas where none have yet been carried out, or where only preliminary studies are available. Continued VA studies would enhance efforts towards ICZM and adaptation to climate change.
- The vulnerability case studies show that the understanding of many of the concepts and principles of the vulnerability to sea level rise and other impacts of climate change could be greatly improved. This will require the continued effort of the international scientific community.
- The vulnerability case studies demonstrate the need for ICZM. In many cases, climate change could exacerbate existing problems such as beach erosion, wetland loss, storm-generated flooding and salt intrusion during the dry season. On the other hand, non-climate-related problems such as overexploitation of natural resources, may reduce the natural resilience of coastal areas to adapt to climate change. Therefore, solving today's coastal problems, while simultaneously addressing longer-term concerns within an ICZM framework, will reduce vulnerability, encourage sustainability, and maximize the options for future generations in the face of global change.

A Global Vulnerability Assessment
To complement the country and local area studies, and as supporting material to the IPCC, a Global Vulnerability Assessment (GVA) for accelerated sea level rise is conducted following the Common Methodology (see also Appendix I). The GVA is currently limited to providing estimates of the effects of a one metre rise in sea level on population and

Table 2.2 Impacts of a one metre rise in sea level, aggregated results.

Impact	No. of VA's	Total VA's	GVA (same countries)	Total GVA
People affected	24	179 million	107 million	260 million
Assets lost	16	US$ 1,100 billion	-	-
Dry land lost	26	113,000 km^2	-	-
Coastal wetlands lost	15	62,000 km^2	54,640 km^2	168,900 km^2
Protection adaption cost	17	US$ 344-506 billion	US$ 182 billion	US$ 1000 billion

VA: Vulnerability Assessment Case Studies
GVA: Global Vulnerability Assessment

Source: WCC '93 Organizing Committee (1993b) and Rijkswaterstaat, Delft Hydraulics (1993).

wetlands, rice production and of the costs of protection.

According to the GVA, an estimated 200 million people are currently living in the risk zone (below the once-per-1000-year storm surge level). A 1 metre rise in sea level will increase this number to 260 million. When projected population growth to the year 2020 is included, the number of people living in the risk zone will even increase to nearly 400 million (see also figure 2.1). Today, about 50 million people are affected by annual flooding (based on estimates of existing protection levels). If no response measures are taken to protect against a one metre rise in sea level, the number of people who will experience annual flooding increases with 25%, and when population growth to the year 2020 is included, this number increases to 100 million. To significantly reduce the number of people at risk, protection measures need to be taken. The global costs for basic protection works are estimated at US$ 1000 billion. In some regions the costs would constitute a substantial part of current GNP, especially in small island states in the Indian and Pacific Oceans.

The losses of coastal wetlands are already serious in many locations, often exceeding 1% per year. If the current trend continues, significant losses of nearly 40,000 km^2 (or 13%) of the world's 300,000 km^2 of coastal wetlands of "international importance" might be expected by 2020. The GVA estimates that up to 170,000 km^2 (or 56%) of coastal wetlands could be lost given a one metre rise in sea level. The actual losses due to accelerated sea level rise will depend on the losses of wetlands due to other causes. If likely protection due to the year 2020 is considered, the estimated losses are further increased by an additional 10,000 km^2 as a result of reduced wetland migration. Therefore, coastal wetlands are highly vulnerable both to human pressure and to sea level rise.

Approximately 85% of the world's rice is produced in South, Southeast and East Asia; about 10% of this in areas that are estimated to be vulnerable to accelerated sea level rise. Less favourable hydraulic conditions caused by a 1 metre rise in sea level would affect the food supply of more than 200 million people, if no adaptive measures are taken. The large deltas of Vietnam, Bangladesh and Myanmar (Burma) are particularly vulnerable.

In summary, the VA case studies, supported by the GVA, demonstrate that a one metre rise in sea level would have significant impacts on a global scale. Although poorly quantified, other impacts of climate change could be equally important in coastal areas. Moreover, many coastal areas are already experiencing significant non-climate-related problems, often related to human activities. Given the rapidly expanding populations of coastal areas, these non-climate-related problems are likely to increase. In the long term, climate change impacts may exacerbate many of these short-term problems. Thus, planning for climate change cannot be separated from the planning of the urgent short-term problems.

2.4 The Benefits

The goal of ICZM is not only to address current or future coastal problems, but also to enable coastal societies to benefit from the more efficient and effective way of handling coastal development. Most coastal areas are called on to provide multiple products and services. For example, the same coastal area may contain oil and gas, support fisheries and shellfish industries, and may be used for recreation, transport, waste disposal and other activities. Few coastal areas produce a single product or service. For example, areas may have been designated and are managed as marine sanctuaries or protected areas, but multiple uses are often permitted, as long as they do not conflict with the conservation objectives for the area.

The conflicting demands of society for products and services from a given coastal area create conflicts over the uses of coastal resources. As the demands on coastal resources continue to grow with increasing population and economic development, so these conflicts will become more common and apparent. A process is needed that can resolve these conflicts and implement decisions on the mix of uses that best serves the needs of society now and in the future.

Exhibit 2.3 Integrated versus sectoral coastal zone management

The economic benefits of pro-active integrated coastal zone management are illustrated in figure A (taken from IPCC CZMS 1992). It was stated that "the benefits of integrated coastal zone management are generally recognized and considered desirable as a management tool". In preparation for the WCC'93, a qualitative underpinning of these benefits based on widely accepted economic theories, was elaborated.

Figure A shows the benefits of a pro-active versus a "wait-and-see" approach, whereas figure B more clearly illustrates the benefits of integrated versus sectoral coastal zone management. The theoretical explanation in favour of pro-active management comprises economic theories regarding decision making under uncertainty (e.g. hedging and the precautionary principle) and discounting (comparing the costs and benefits at different points in time). Also the time lag between planning and implementing coastal zone management strategies is an important factor to be considered, as well as the application of discount rates.

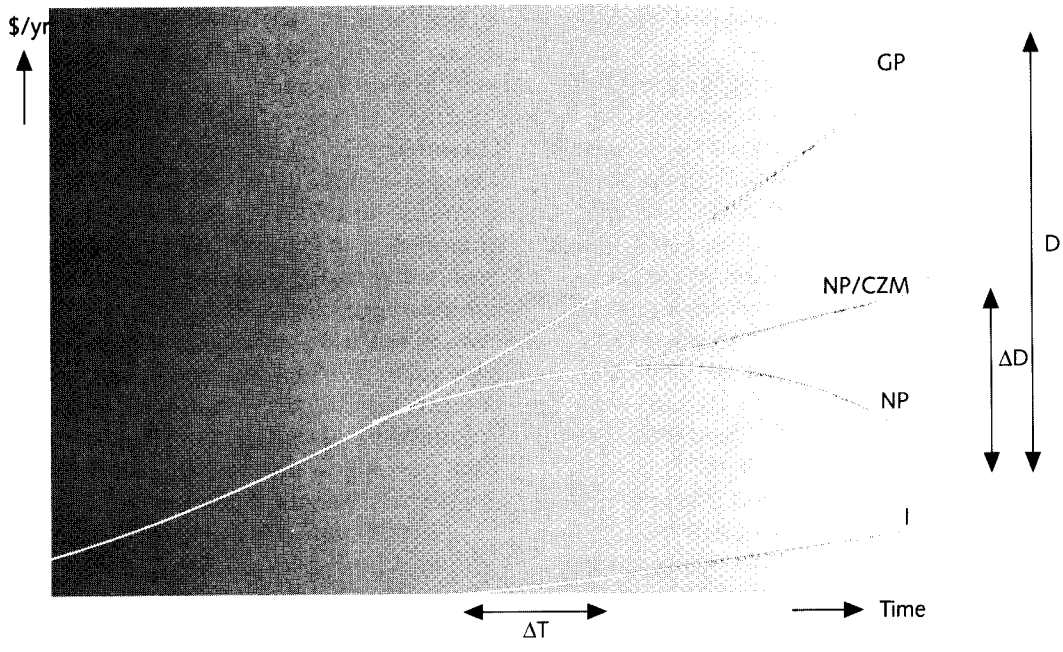


Figure A Coastal zone management for sustainable development. The upper line (GP), which represents total gross production in a particular area, country or region, increases as a result of population growth, technological progress and economic development. However, the damage (D) also increases due to accelerated sea level rise, pollution, congestion, over-exploitation of resources, etc. If no coastal zone management measures are taken, the increase in damage will be higher than the increase in total gross production, resulting in reduced net production (NP), eventually leading to a collapse. Reduction of damage (ΔD) can be achieved by pro-active investments in coastal zone management (I). Due to the long lead times required for the measures to have an effect, it will take some time before an actual reduction in damage is realized. This time lag is indicated by ΔT. During this period, no benefits will arise from the investments. Later, however, the reduction in damage enables net production (NP/CZM) to continue to increase, which can be regarded as sustainable development.
Source: Adapted from Eid and Hulsbergen (1990); IPCC CZMS (1992).

To illustrate the benefits of integrated versus sectoral coastal zone management, use is made of the presence of external effects. External effects are defined as the benefits or damages that a sector unintentionally imposes on the economic activities of another sector. If external effects are present across separate sectors in the coastal zone, policy coordination across these sectors is justified to achieve least-cost solutions.

Integrated versus sectoral coastal zone management

Figure B shows that the time lag between the start of investments in coastal management and the investments becoming effective is larger when taking an integrated than when taking a sectoral approach. This is due to the fact that ICZM involves more extensive analysis and planning. However, because of the negative external effects related to sectoral coastal zone management, the investment costs of sectoral management needed to achieve the same reduction in damage would rise faster than those of integrated management. In other words, the costs of an integrated approach will, in the longer term, be lower than the cumulative costs of separate sectoral approaches.

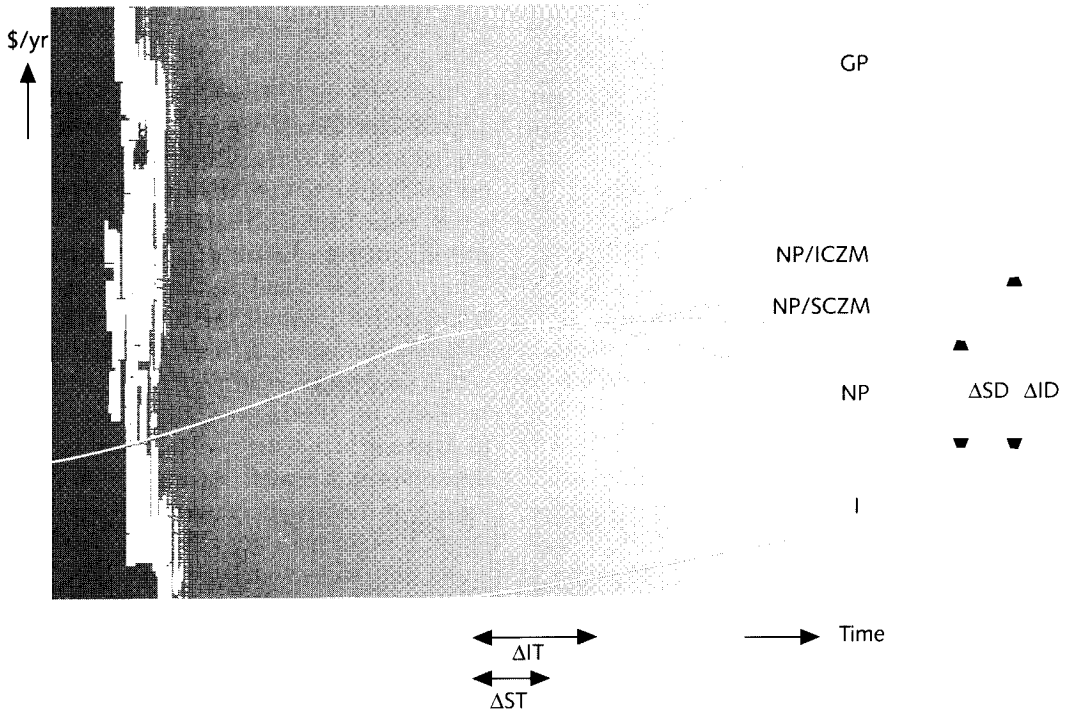


Figure B Integrated versus sectoral coastal zone management. The dashed line (GP) represents gross production, as in figure A. The lower line (NP), representing net production, results from the gross production and the damage when no measures are taken. Reduction of damage can be achieved by pro-active investments in sectoral (ΔSD) or integrated coastal zone management (ΔID). The time lag between the start of the investments is larger for integrated (ΔIT) than for sectoral (ΔST) CZM because the former involves more extensive analysis and planning. However, net production with integrated CZM (NP/ICZM) will eventually be higher than net production with sectoral CZM (NP/SCZM), again because of the external effects.
Source: WCC '93 Organizing Committee (1993a).

With regard to the benefits, in the short term, sectoral management may result in higher benefits than integrated management, due to the longer time lag related to integrated analysis and planning. However, it is apparent from figure B that the difference is hardly noticeable. As soon as integrated management strategies are implemented, again the external effects make the difference. This can be illustrated using as an example the positive impacts of nature conservation on the quality of groundwater. When this groundwater is used for drinking water purposes, unnecessary high purification costs would be incurred if the positive external effects stemming from nature conservation are not taken into account. In contrast, a negative external effect may be imposed on the drinking water supply companies if no account is taken of the interest of nature conservation when designing and constructing protection works to accommodate sea level rise.

For coastal areas, the most appropriate process for addressing these challenges is integrated coastal zone management:

- ICZM can provide for coastal societies an opportunity to move towards sustainable development. Integrated management of conflicting uses and activities is essential for this goal.
- ICZM enables current and future interests in coastal areas and resources to be taken into account. Through the consideration of short-, medium and long-term interests, ICZM can stimulate economic development of coastal areas and resources, while reducing the degradation of their natural systems. Given the inherent uncertainty of the future, including rates of climate change, ICZM can provide a framework within which flexible responses to deal with this uncertainty can be developed.
- ICZM can provide coastal states with a process to enhance economic development and improve the quality of life.

In 1990, the IPCC recommended that coastal nations implement comprehensive coastal zone management plans to address the impacts of global climate change. These plans are intended to reduce the impacts on social and economic systems while maintaining the integrity and intrinsic value of important coastal ecosystems. In 1992, the IPCC again stressed the importance of integrating the needs of various sectors into a coastal zone management programme, noting that *"the benefits of integrated coastal zone planning and management are generally recognized and considered desirable as a management tool to address complex coastal resource use issues"*.

Integration in coastal zone management is most appropriate in preventing the degradation of coastal ecosystems, which would reduce their economic value and increase their vulnerability to global climate change. Although integrated management requires more extensive analysis and planning than sectoral management, its overall costs will ultimately be lower than those of sectoral management. In other words, the total costs of an integrated approach will, in the longer term, be lower than the cumulative costs of separate sectoral approaches (see exhibit 2.3). In addition, strengthening ICZM at an early stage will be financially advantageous in the long run. Due to the long lead times that are often needed for the implementation of response measures, taking a pro-active, or precautionary, approach to ICZM (that is acting before irreversible damage is realized), is to be preferred not only from an environmental, but also from an economic perspective, because this way the eventual total damage can be minimized and benefits can be maximized.

It is common practice in economics to use a discount rate when trading off future costs and benefits against present ones. The discount rate reflects the assumption that a cost or benefit is lower when it occurs further in the future. Using a discount rate r, an amount A after t years is valued as $A/(1+r)^t$ in present value (in real terms, i.e. corrected for inflation). If, for instance, a discount rate of 10% is used (r=0.1), this means that the value of an amount A to be received/paid after eight years will be only half of that amount if it were to be received/paid now. The importance of future costs and benefits dwindles the higher the discount rate and the longer the time horizon.

Economists often argue about what discount rate should be applied by goverments to decisions with long-term implictions. The debate has gained importance since the concept of sustainable development has been officially accepted as a policy target by many governments. The concept of sustainable development (defined by the World Commission on Environment and Development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs") is, by definition, incompatible with the use of a high discount rate, and could therefore better not be mixed with economic and financial cost/benefit criteria which provide measures for the profitability of investments.

It can even be argued that when taking decisions to serve general interests of a country, a discount rate should not be applied at all. Sustainable development is considered to be of general interest to both the present population and future generations. Such considerations on general interests are to provide additional criteria on the implications of long term changes for short- and medium term planning decisions. ICZM decisions should therefore compare alternative planning options by: (i) the discounted costs and benefits within the common short- and medium term planning horizons, and (ii) the possible impacts of the options on the longer-term vulnerability or potential for sustainable development of coastal systems. For the comparison of costs and benefits referred to under (i) discounting may be applied when relevant. It is often difficult, however, to value natural ecosystems and resources that may perform essential environmental and societal functions. For the effects referred to under (ii) comparison between alternative options is possible without discounting.

Apart from the economic benefits of a pro-active, or precautionary, approach to ICZM, ICZM also follows the philosophy of the UN Conference on Environment and Development (UNCED). In fact, a number of the principles adopted by UNCED are relevant to the long-term management of coastal areas and resources. In particular, ICZM is consistent with Principles 2-4, 6, 9, 15 and 16 of the Rio Declaration. For example, with regard to Principle 15, ICZM provides a precautionary process to reduce or avoid serious or irreversible environmental damage to coastal areas and resources arising from economic development and population growth, and to reduce the impacts of global climate change.

Adaptation to climate change cannot be separated from the management and planning efforts to address present-day problems in many coastal areas. Planning and management decisions aiming at the sustainable use of natural resources can be accomplished through carefully harmonizing the

different sectoral development options and needs (the integration component of coastal management). ICZM should, therefore, be seen as an evolutionary process, which is consistent with sustainable development. Sustainable development has, by definition, an extended time horizon. Long-term thinking is therefore a key component of ICZM. Considering response options to adapt to climate change is one of the important vehicles to stimulate such long-term thinking. Solving immediate coastal problems in an integrated manner will make coastal systems more resilient in the longer term, when climate change and associated sea level rise may become important issues.

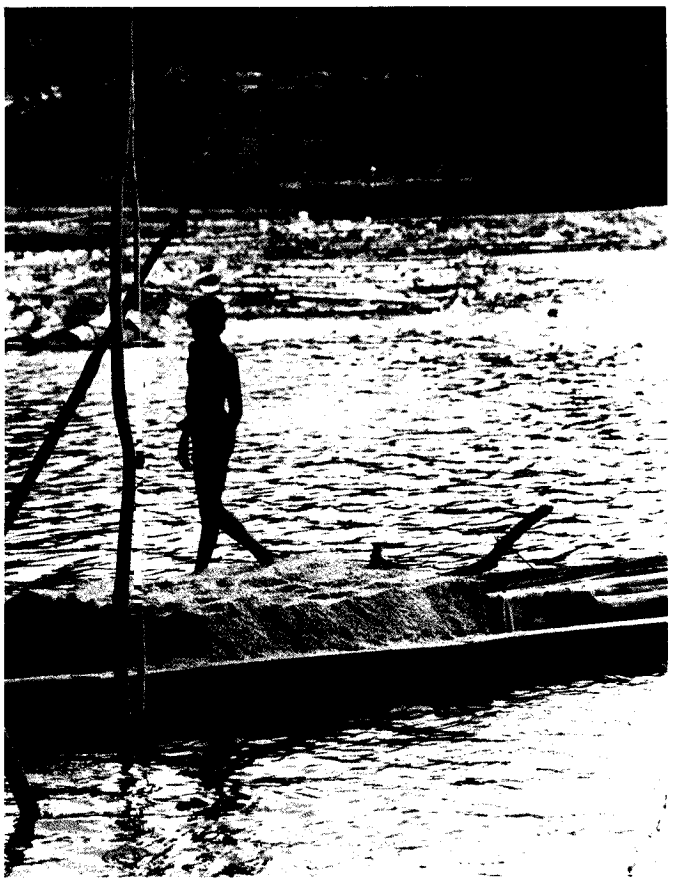
2.5 Conclusions

Based on the VA case studies and analysis presented, the WCC'93 concluded that:

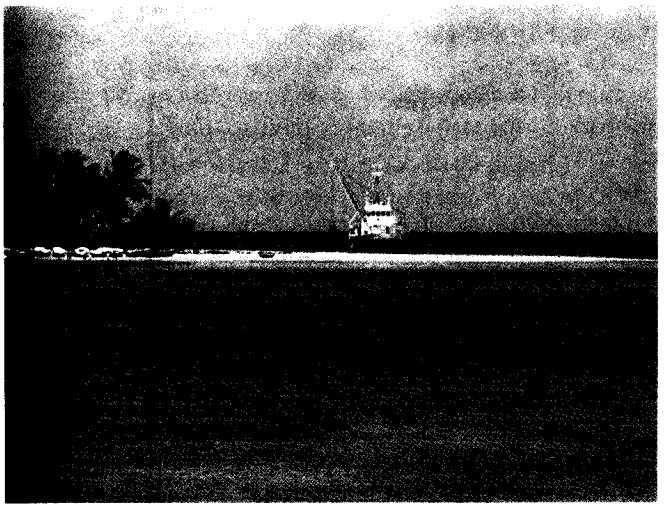
> *There is an urgent need for coastal states to strengthen their capabilities for integrated coastal zone management, working towards the development of appropriate strategies and programmes by the year 2000.*

Recognizing the multisectoral character of coastal problems and the need to consider both present and future concerns, the Conference concluded that:

> *Integrated coastal zone management is a most appropriate process to anticipate and respond to long-term concerns and needs while addressing present-day challenges and opportunities.*



A growing economy in Sri Lanka demands building material, stimulating small scale sand extraction.



A growing infrastructure in Sri Lanka demands building material, stimulating large scale sand mining.

Large scale sand mining can result in long term coastal erosion, threatening coastal communities, leading to short term emergency measures but will it sustain?.

Exhibit 2.4 WCC'93 Conference Statement on Urgency and Benefits

Urgency
There is an urgent need for coastal states to strengthen their capabilities for integrated coastal zone management, working towards the development of appropriate strategies and programmes by the year 2000.

The need for coastal states to accelerate the development of capabilities for integrated coastal zone management arises because:

- current trends of increasing poverty in coastal communities are resulting in the degradation of coastal zones and deterioration of the quality of life;
- current pressures from development and population are increasing land-based sources of marine pollution and human intervention with river basins, adversely affecting coastal processes. These pressures include:
  - the accelerating decline of habitat and natural resources, including beaches, mangroves, wetlands, corals and seagrasses, as well as fisheries and other coastal and marine resources; and,
  - the increasing vulnerability to pollution, beach loss, habitat loss, natural hazards and long-term impacts of global climate change.

The changes may, in turn, limit options for future development in a number of ways:

- many degraded and threatened coastal resources and ecosystems are in need of rehabilitation and restoration;
- efforts to develop capabilities for integrated coastal zone management and implement national programmes may take ten years or more; and,
- implementing strategies for adapting to and mitigating the impacts of global climate change may require lead times of several decades and longer even if immediate measures are taken to reduce greenhouse gas emissions.

Consequently, now is the time to initiate or strengthen efforts on integrated coastal zone management.

Benefits
Integrated coastal zone management is the most appropriate process to anticipate and respond to long-term concerns and needs while addressing present day challenges and opportunities.

The implementation of ICZM can stimulate and guide the sustainable development of coastal areas; it can minimize the degradation of natural systems, provide a framework for the management of multisectoral activities, and maintain options for future uses of resources.

As coastal states develop the capabilities for and implement integrated management of their coastal resources, they provide local and national benefits, including enhancing economic development and improving the quality of life. These benefits are achieved through the protection of the environment (e.g. water quality, biodiversity, and adaptation to climate change). Thus, ICZM will contribute to the protection and sustainable use of the Earth's coastal resources.

3 The elements and obstacles

A survey of Integrated Coastal Zone Management experiences

3.1 Introduction

Coastal problems that stem from human activities are almost always rooted in resource use conflicts. Since the majority of the world's population lives in coastal areas, such conflicts can only be expected to increase. As population growth continues, the pressure to develop coastal areas for housing, industry, tourism, aquaculture, fisheries, and other uses, will intensify these conflicts. Furthermore, these developments take place in a dynamic natural coastal environment where the hazardous conditions caused by climate variability and climate change will impose additional stresses.

The main objective of any government policy is, basically, to encourage changes in human behaviour in order to achieve desired goals. In this process, the main purpose of management is to provide the conditions that will facilitate development and stimulate progress. In general, the goals are specified targets related to the desired mix of goods, services and values to be produced, consumed, or conserved. ICZM is such a management process, which can anticipate and respond to the needs of the coastal society. Public participation in the planning and implementation of ICZM is there-fore essential.

The management procedure generally comprises a set of related tasks, all of which must be carried out to achieve a desired set of objectives. The basic steps involved in the management cycle are: problem recognition, analysis and planning, implementation of measures, operation and maintenance, and monitoring and evaluation of the effectiveness of the measures in relation to the stated objectives. The way in which this process is executed will depend to a large extent on cultural, political, economic and historical conditions, and its success will therefore depend on the degree of public endorsement achieved.

3.2 The Elements

There are many definitions of ICZM. The WCC'93 Conference Statement defines the frame of ICZM as follows:

> *Integrated coastal zone management involves the comprehensive assessment, setting of objectives, planning and management of coastal systems and resources, taking into account traditional, cultural and historical perspectives and conflicting interests and uses; it is a continuous and evolutionary process for achieving sustainable development.*

During the WCC'93 many elements of ICZM have been identified. A comprehensive list of elements is presented in the conference statement as given in Exhibit 3.7. Some of these elements are discussed here in more detail.

A national ICZM programme should facilitate integrated decision making through a continuous and evolutionary process for cooperation and coordination among sectors. Sectoral-based approaches have proven unable to meet the management challenges posed by resource use conflicts because from the perspective of one sector it is difficult to make efficient trade-offs that best utilize coastal resources. In such cases, the question of how best to utilize coastal resources sometimes reduces to one of how best to resolve an inter-agency power struggle. Consequently, decisions are often made to settle immediate, politically motivated conflicts, rather than how to address long-term, socio-economically based conflicts.

Integration in coastal zone management is basically cooperation between all responsible actors. The incentives for cooperation are the common needs to achieve objectives related to the coastal zone, resulting in "win-win" situations. In this context ICZM involves the integration of:

- the responsibilities of agencies at different levels of government ("vertical integration");
- the responsibilities of different government sectors ("horizontal integration");
- the responsibilities of government and local groups;
- policies across sectors of the economy; and
- economic, technical/scientific, and legal approaches to coastal problems.

ICZM is performed in a dynamic context which often features changes in: (i) demographic and socio-economic conditions, including social preferences and the changing demands on the coastal resources; (ii) natural coastal systems such as morphological processes and periodic climate variability, such as the El Niño/Southern Oscillation (ENSO); and (iii) long-term conditions, such as global climate change. Consequently, ICZM involves decision making under uncertainty, where uncertainty includes economic, ecological, physical and technological conditions. Consequently ICZM is a cyclic process. Through evaluation and feedback the goals can be adjusted and the management arrangements changed.

Because of the time lag involved, it will be necessary to expand the planning horizon from the typical five-year plan to include longer time horizons. As discussed in Chapter 2, it is possible to harmonize both long- and short-term goals, so that in implementing a short-term plan, long-term goals are also approached. ICZM may provide the necessary link between the two time scales. The implementation of ICZM is economically justified in the short term. In addition to enhancing the sustainable use of coastal resources, the implementation of ICZM also reduces vulnerability to sea level rise and other expected impacts of climate change. It may thus provide an effective framework for long-term strategies that would not normally be justified, given current discount rates.

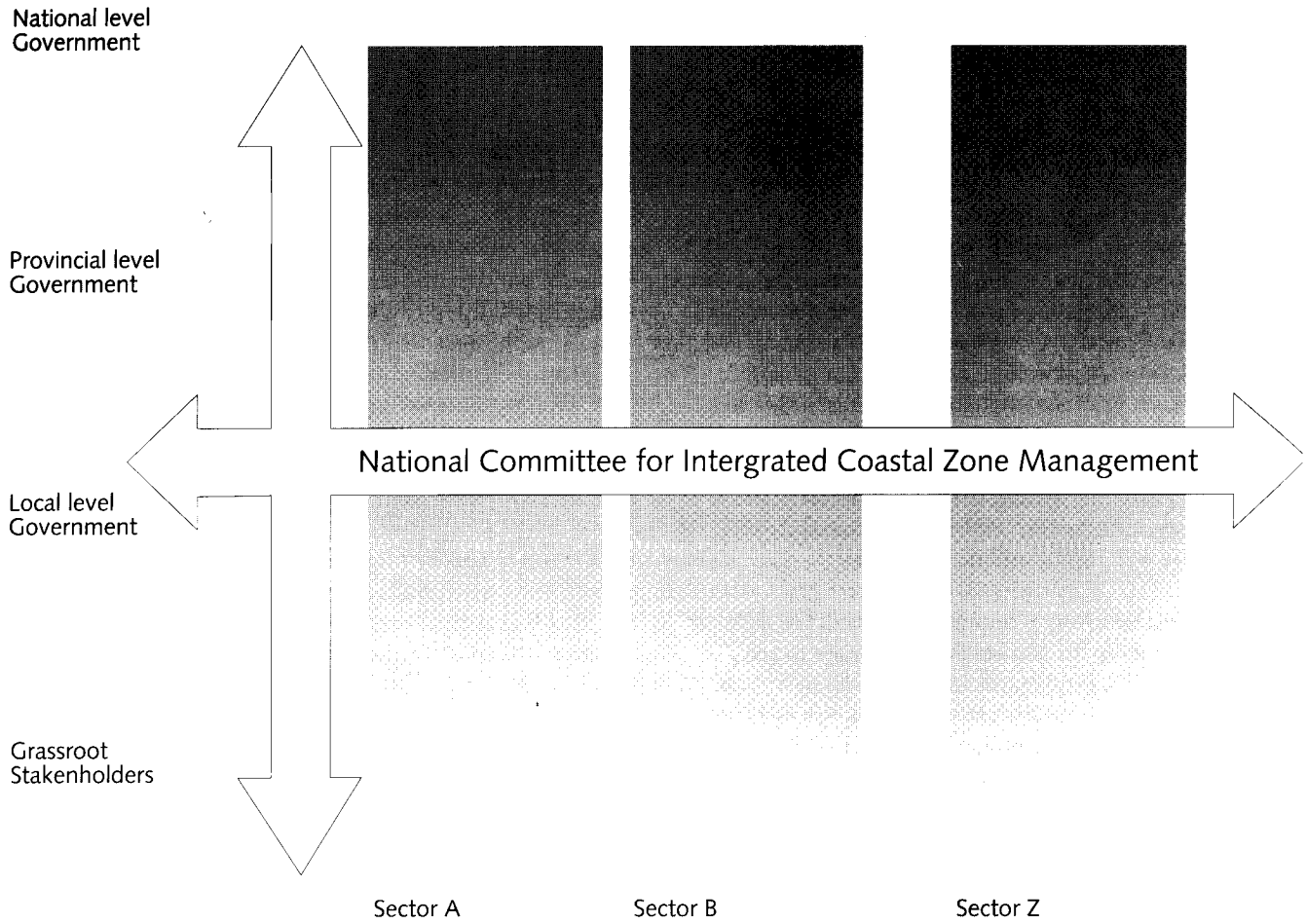


Figure 3.1 Horizontal and vertical institutional integration. Both are necessary for the coordination and implementation of ICZM.

A basic element of an ICZM programme is the arrangement of management responsibilities. Management arrangements comprise institutional arrangements and management instruments. Institutional arrangements provide the framework within which the management tasks are carried out and the management instruments applied. This framework encompasses:

- the structure of government and non-governmental organizations, including mechanisms for linking responsible agencies and organizations;
- the set of laws, conventions, decrees and standards for environmental quality; and
- the set of traditions and social norms such as customary laws.

Each of the responsible agencies has a set of management instruments in the form of structural, regulatory and incentive-based measures. These instruments need to be supported by legislation or other types of authorization. Examples of structural measures are beach nourishment, protection infrastructure, and land use plans; examples of regulatory measures are licences and fines; and examples of incentive-based measures are tradable permits, taxes and subsidies.

Decision making under uncertainty can be facilitated by formal and consistent evaluations, incorporating cost-benefit analyses, resource and land use and environmental impact analyses. Such a framework of analysis, encompassing the agents of change, can assist decision makers to choose rationally and objectively among alternative courses of action It is important that the development of such a framework is tailored to the variety of different situations (social, economic, cultural) and to the differences between natural conditions.

3.3 Experiences

In preparation for the WCC'93, each country was requested to prepare a document on the status of ICZM in their particular situation, focusing on the management arrangements applied and the bottlenecks encountered during implementation. The observations in this section are based on a survey of the 23 ICZM case studies described in Appendix II. As "snapshots" in time, the case studies depict ICZM efforts initiated by various nations, in various stages of implementation. Although limited in number and scope, the case studies can offer useful insights. For instance, if a nation with no ICZM programme is interested in initiating one, the

Exhibit 3.1 Steps in the ICZM process

The planning process for ICZM typically involves:

- identifying issues and problems, and establishing corresponding objectives and criteria;
- delimiting the spatial, temporal and substantive scope of the planning effort;
- identifying stakeholders, and ensuring their participation in the management process;
- analyzing existing planning programmes, institutional arrangements and management instruments to determine whether they may be useful in addressing the issues;
- formulating a set of actions that systematically relate the set of objectives to the current state of the coastal system;
- collecting and analyzing existing data and evaluating the need for further research and information;
- establishing monitoring systems and integrated databases; and,
- supplying information for programme evaluation to policy makers.

The implementation process of ICZM typically involves:

- ensuring concordance between the plan structure and its implementation;
- designing, constructing, operating and maintaining physical structures;
- applying and modifying regulatory measures such as physical planning;
- applying and modifying standards relating to, for example, water quality;
- enforcing strategies, regulations and standards through a formal legal process or through persuasion, education and traditional community controls;
- providing for participation of private entities and the public;
- identifying and contracting sources of funding for the implementation process;
- conducting ongoing measurements and monitoring of coastal processes and their interaction with human actions; and
- monitoring and evaluating the level of output of the ICZM plan.

Source: WCC '93 Organizing Committee (1993c)

analysis here may help to elucidate what type of programme is most appropriate. Also, the information gleaned from such analyses can help to pinpoint ways to improve existing ICZM programmes. Further evaluation will be possible in the future, as the practice of ICZM spreads to more nations, and the larger number of available case studies will facilitate more rigorous and complete analysis.

At the WCC'93 it was concluded that the quest for a unique "recipe" for ICZM was misguided, and that efforts to define one should be reoriented. As soon as it was suggested that a "top-down," central government-driven approach was most effective, national experiences to the contrary were held up. As soon as certain technologies were proposed as the most useful, experiences favouring other technologies were cited. Gradually, it became evident that the most important lessons to be learned about ICZM arise from the differences between successful approaches. It was noted that the most fruitful use of available resources would be to understand the underlying factors that may have led to the differences, rather than try to homogenize national experiences to distil a unique "recipe" (which at best would only apply in certain circumstances). In this way, certain circumstances might be recognized as "indicators" which flag the possible success of a given approach.

Although the literature on the design and practice of coastal zone management is diverse, some essential prerequisites can be identified. The first of these is the need for *initial leadership* for the planning process. For effective ICZM, institutional responsibility must be distributed intersectorally and hierarchically, both within the government, and between government and local groups. Thus, the second necessary element of ICZM is the provision of *institutional arrangements.* This may involve creating new institutions, but will more commonly involve improving horizontal and vertical linkages between existing ones. Third, *technical capacity* (both technological and human capacities) is necessary for compiling inventories in the planning phase, during the implementation of the programme, and for monitoring the changes. This may include simple methods for crop rotation, field surveying, or resource conservation. At the other end of the spectrum, sophisticated technologies such as remote sensing, computerized databases, and model

Exhibit 3.2 Framework for analysis for ICZM

The changes imposed on a coastal system may result from three types of agents of change:

- demand-driven changes;
- natural processes;
- climate change factors.

A key issue in ICZM is the determination of the relative importance of the agents of change in relation to the vulnerability and sustainable development of the coastal system. The sustainable use of the coastal system is defined as "the maintenance of a desired mix of outputs from a coastal system generated through the use of natural resources over time, subject to maintaining a prescribed environmental quality". The combination of uncertainty and the possibility of irreversible decisions emphasizes the importance of risk-averse behaviour if a goal of society is to achieve sustainable development. This leads to the recommendation that a precautionary approach for environmental management should be adopted, and that *long-term* changes should be properly accounted for, including a special focus on the impacts of climate change.

Analysis for ICZM

There are a number of more or less common approaches for the analysis for ICZM. The steps which are regarded as "common" to the analysis for ICZM apply to time horizons of the order of 10-25 years, and are referred to as the short-term analysis for ICZM:

(1) specification of the conditions and execution of the analysis;
(2) assessment of present, past and future situations within the coastal system;
(3) analysis of the coastal system;
(4) formulation and analysis of integrated coastal zone management (ICZM) strategies;
(5) evaluation of coastal zone management strategies;
(6) presentation of results to the decision process.

The first three steps comprise the preparatory phase of analysis, including the specification of the contents of the analysis and operationalization of the tools and data. The last three steps pertain to the actual execution of the analysis. The first step, i.e. the specification of analysis conditions and analysis execution, requires detailed knowledge of the relevant problems and characteristics of the coastal system. Therefore, the usual procedure is to have a first round of analysis, involving the rough execution of analysis steps 2 and 3. This will enable the detailed formulation of step 1, thereby ensuring a realistic specification of the tasks and resources required.

In addition to the above steps, specific attention should be paid to broadening short-term analyses to include the long-term impacts of climate change. In principle, the short-term analysis steps are quite adequate for dealing with the impacts of climate change; the question is which climate change factors to include. The addition of such factors will broaden the scope of the analysis, in that other mechanisms will need to be considered, other relationships will need to be specified, and other data will need to be collected. Consequently, additional tools and techniques may be needed.

Preferences for coastal zone management plans may differ in view of the possible long-term impacts of climate change in terms of vulnerability and sustainability. In order to account for the latter impacts, a *long-term* analysis step is added to the procedure, which will produce a number of additional indicators expressing the relative vulnerability of alternative ICZM strategies based on a rough assessment of the impacts of long-term climate changes. In specifying the scope of the analysis, a crucial question is which agents of change need to be considered. The answer to this question depends on the relative importance of the various agents of change, particularly climate change factors. The *relative importance* should be evaluated from the perspectives of both short- and long-term developments and decisions. The outcome of this evaluation will determine which agents of change are to be included in the short- or long-term analysis, or in both.

Source: WCC '93 Organizing Committee (1993d)

simulations may be used. The final necessary element of ICZM is *management instruments*. These include tools ranging from command-and-control to incentive-based, all with the aim of encouraging stakeholders to comply with the ICZM plan.

Although it is possible to identify several prerequisites for ICZM, as discussed above, it is important to recognize that each element has a range of implementation possibilities. For instance, by identifying leadership as an essential element of ICZM, no attempt is made to prescribe which approach is most suitable. In practice, the leadership initiative for ICZM may consist primarily of a central government-led, "top-down" approach, or a non-governmental, "bottom-up" approach, or something in between. Similarly, the other ICZM elements (institutional coordination, technical capacity, and management instruments) also show ranges of possibilities. Institutional structures range from being horizontally integrated to vertically integrated. Technologies range from the highly sophisticated to the rudimentary. Management in-struments range from command-and-control to incentive-based.

The discussion below represents a preliminary analysis of the available case studies, focusing on how the underlying conditions (geographic, demographic, cultural, economic and political) relate to the prerequisites for ICZM (initial leadership, institutional arrangements, technical capacity and management instruments). A few of the case studies of Appendix II are highlighted in Exhibits 3.3-3.6 in order to demonstrate the wide range of possible ICZM approaches.

Initial leadership

The extent of the involvement of government and local groups in providing the initial leadership for ICZM differs widely among nations. In the 23 cases examined, the majority were initiated by a top-down approach. This was true for both urban and rural settings, and for areas characterized by both traditional and modern cultural practices. All of the areas with market economies featured top-down approaches. Of the areas with subsistence economies, both top-down approaches bottom-up approaches can be found. This suggests that local groups are most willing to act, as they do in subsistence economies, when they perceive themselves to be direct stakeholders. A key to involving local groups in ICZM planning and implementation thus appears to be to enhance their awareness of the benefits of cooperation.

In general, the degree of government involvement in initiating ICZM appears to depend on the extent to which the resources being managed are viewed as public goods. Access to fresh water, for example, is often viewed as a personal right by farmers and city dwellers alike, and thus tends to elicit more personal involvement from citizens. This was demonstrated in Egypt and in Chile. Access to fisheries tends to be seen as a collective right, and thus appears more naturally to involve central government leadership. This was demonstrated in the Philippines and Indonesia. An example in which the roles of government agencies and private parties were relatively balanced is the USA. Interestingly, pollution control, which necessarily requires the involvement of both public and private sectors, served as the catalyst for ICZM in this case. As suggested by the case of The Netherlands, programmes with long histories tend to show an increasing balance between government and local leadership as they evolve, regardless of how they are initiated.

Applying the same reasoning, Bangladesh, where special interest groups can be easily identified in the river basins of concern, a grassroots-driven programme would seem warranted. But this has not been the case. A central government-led approach to flood control, largely financed by international donors, has resulted in the construction of dikes, at great expense. In some cases, these dikes have been destroyed by farmers who were not consulted prior to construction, illustrating the lack of support of local people for the programme. This, and other cases, suggests that outside funding of national programmes may encourage approaches that fail to adequately involve local groups.

The geographic setting also seemed to have some relationship to whether initiation was top-down or bottom-up. All of the island nations examined in the case studies featured a top-down approach, although the first initiative could have been provided by local groups. In Barbados, for example, the local initiative, inspired by concerns about beach erosion and coral reef degradation, was taken over by the central government who initiated formal ICZM efforts. The government borrowed from an international development bank to finance the development and implementation of ICZM in the interest of preserving future economic development options. It is interesting to note that in such cases, where the national population is very small, the government may be approached by local advocate groups.

Of the continental shore cases and in the deltaic countries, a majority followed the same top-down pattern. This may be partially attributed to the pressure from international agencies to initiate ICZM efforts, since these pressures are usually applied to central governments. For example, in Indonesia and Bangladesh, major ICZM projects undertaken over the last two years have been partially funded by international donors and have principally been driven by the national governments, with citizen participation solicited after the programme was initiated.

In general, the distribution of coastal resources appears to play a role in determining the level of government involvement. Issues involving local resources are more commonly taken on by local groups, who perceive greater direct benefits than they do for resources that benefit society at large. Resources that are widely and evenly distributed tend to elicit a central government-driven management approach. In Indonesia, a country having a wide natural resource base that is distributed throughout the country, has employed a top-down, central government approach.

Exhibit 3.3 Bangladesh: towards a participatory approach

Bangladesh is situated in the dynamic delta of the rivers Ganges, Brahmaputra and Meghna. Most of Bangladesh consists of floodplain, and is located within a few metres of mean sea level. The country is frequently hit by floods from both the rivers and the sea, heavy monsoonal rains, and by cyclonic storms from the Bay of Bengal. The occurrence of droughts stresses agricultural systems, and is influenced by upstream withdrawal of water.

Bangladesh, with a total area of approximately 144,000 km^2, has a population of more than 110 million, which is projected to grow to 140-158 million by the year 2010. The delta is one of the most densely populated areas in the world, which makes it especially vulnerable to sea level rise and other impacts of climate change on ecosystems and socio-economic activities. A quantitative vulnerability assessment has been conducted, based on the IPCC's Common Methodology. Two climate change (ASLR, temperature, precipitation) scenarios and two sets of national and regional developments with a time horizon to the year 2010, show the strong influence of the combination of future droughts, inundation and salt intrusion. The populations affected and at risk are strongly related to regional water sharing scenarios, and climate change will worsen the situation even further (see also the relational matrix).

Designated as a "least-developed nation" by the UN, Bangladesh is struggling to develop economically, but is constrained by limited natural resources and a large and young population. Accordingly, government planning priorities relate directly to making the best use of the scarce natural resources. Planning is conducted through five-year plans, the fourth of which was initiated in 1990. Development goals and objectives are formulated by the Planning Commission for approval approved by the National Economic Council, composed of the head of government and members of some 35 ministries.

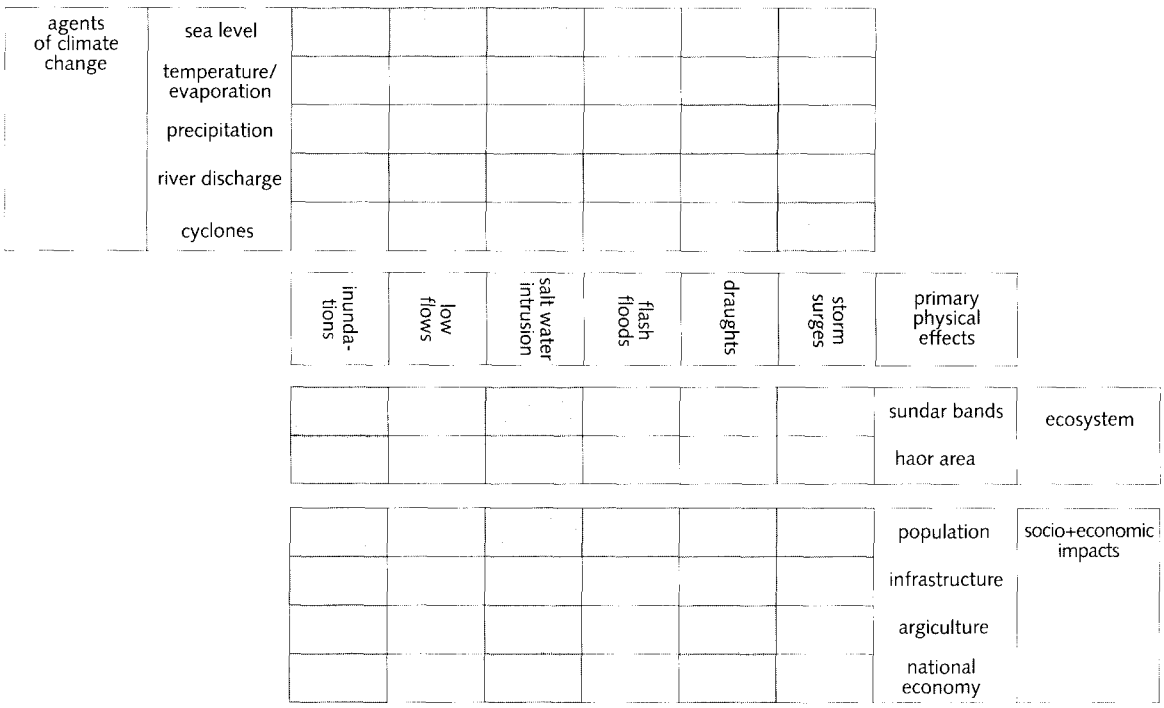
The broad international recognition of and concern for the special needs of Bangladesh, has led to considerable international aid over the past 20 years. Extensive engineering projects have been undertaken to try to stem the flow of water from the most vulnerable areas, and to increase storm readiness. Much technical assistance has been supplied for these projects, with international consultants working in tandem with government agencies.

Despite increases in international funding and technical assistance in recent years, coastal management problems are still severe. In many cases, the actions of local groups have run counter to central flood control or water management plans. For example, the dikes constructed at great expense as part of a centralized flood control programme, are often cut open by farmers to allow water to reach their crops during the dry season. During the monsoon season, the same holes in the dike lead to flooding. This highlights the need for increased public consultation and involvement during the planning process.

The concerns for coastal zone management relate to various water-related issues, including: (i) flood control and disaster management; (ii) irrigation and drainage; (iii) land reclamation and coastal protection; (IV groundwater management; and (v) water quality management. The complexity of the issues, and of the government structure, have created special challenges for ICZM in Bangladesh. The Ministry of Relief, which is primarily responsible for disaster management, must coordinate with 19 other ministries and many more related institutions and agencies. In responding to an emergency, the Ministry of Relief is required to follow an elaborate protocol involving numerous other agencies.

Developments in Bangladesh depend heavily on donor assisted projects in the water resources sector. In the past, planning and implementation of these projects were almost exclusively organized on a central government level. In many projects, however, the involvement of non-governmental organizations (NGOs) becomes more and more important. Trough these NGOs a participatory approach is introduced and recognition is growing that such an approach is needed to enhance a more effective and efficient use of the rapidly decreasing natural resources.

Bangladesh: towards a participatory approach



Relational matrices of agents of climate change, primary physical effects and socio-economic and ecological impacts.

In this case, since no one portion of the population can expect to gain substantially more than the rest by promoting conservation, and since extensive actions were required, government leadership initiated ICZM.

Institutional arrangements

Certain sectoral issues appear to have good potential to catalyze intersectoral cooperation and thus evolve into ICZM. Among these are tourism, fisheries and water management. As examined in the previous section, the specific catalyst for ICZM has much to do with which agency or group provides the initial leadership. Before planning, implementation and evaluation efforts are under way, however, institutional coordination is required. ICZM requires horizontally and vertically integration of the responsibilities of institutions. The discussion below is perhaps most applicable to large, extensive governments with numerous sectoral ministries and agencies. But it should be noted that although the need for integration may be greater in very extensive governments, it also exists in small governments.

Horizontal integration means that several agencies at the same government level work together. Horizontally integrated efforts are often referred to as "intersectoral". Vertical integration means that agencies at different levels of govern-ment coordinate their programmes. An ICZM effort that begins with an intersectoral task force making a national ICZM plan, and culminates in the implementation of permitting and monitoring programmes by specific government agencies, would be said to be first horizontally and then vertically integrated. This situation is depicted in figure 3.2. If an NGO directly implements some aspect of the ICZM plan (e.g. coordinating data collection or training activities with overseeing government agencies), its involvement would be considered an example of vertical integration with the private sector. It is important to note that ICZM institutions are often cyclical in nature, at times being predominantly horizontally integrated, and at others predominantly vertically integrated.

The degree of horizontal versus vertical integration necessary may change over time, as the ICZM effort evolves from planning to implementation. An effort that begins with a high-level, horizontally integrated planning effort, may evolve into a predominantly vertically integrated implementation programme. In the interests of efficient implementation, it may be critical to clearly define sectoral responsibilities for issuing permits, monitoring, and education. The opposite may also be true; a programme that begins as a vertically integrated approach may evolve to include more horizontal integration. This was the case in the USA, where provisions for public involvement were extended throughout the planning and implementation processes.

The degree of horizontal versus integration of a ICZM programme should be adjusted in time, to insure that all

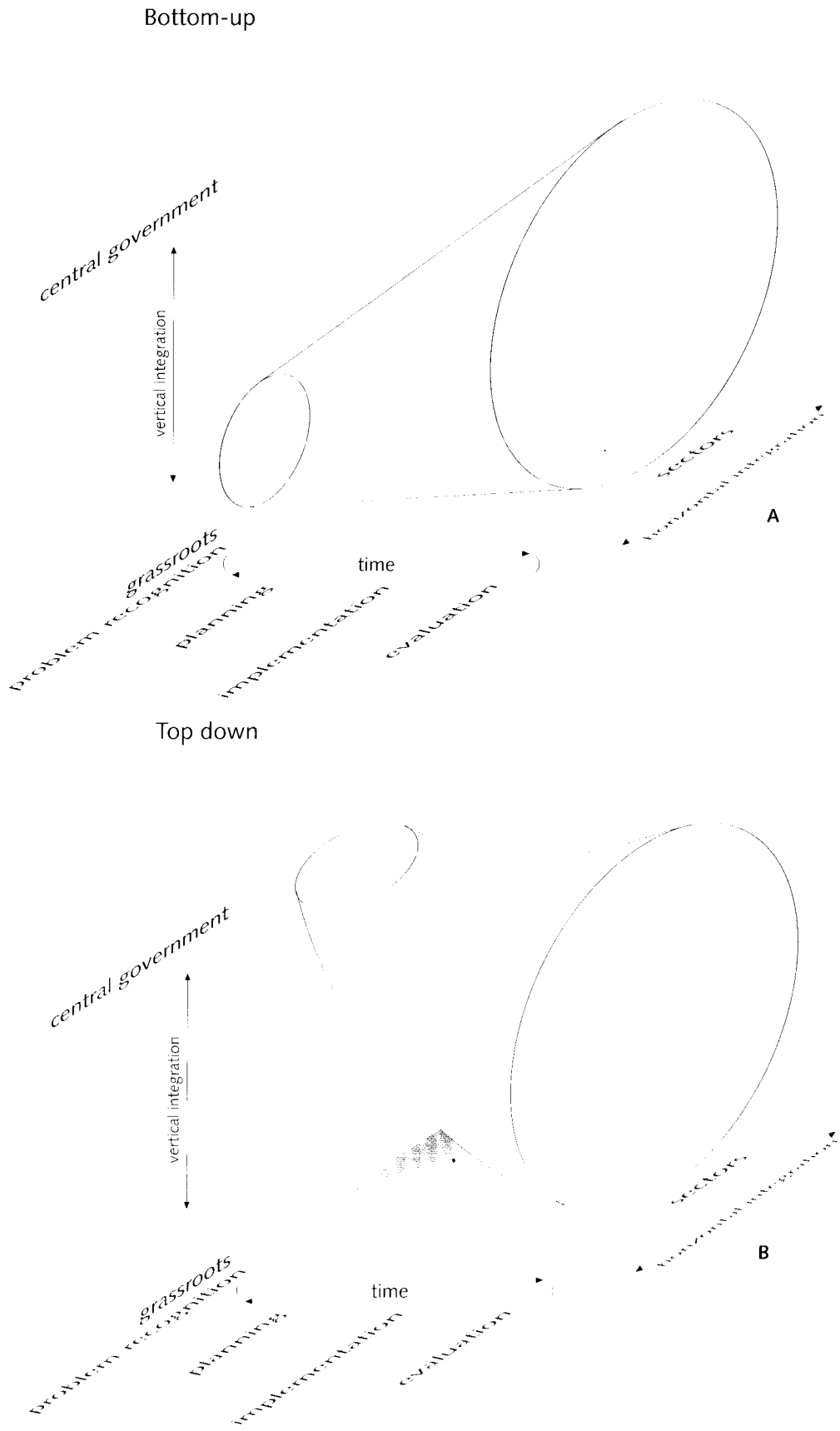


Figure 3.2 The cyclic nature of ICZM. Whether initiated by central government or local groups, subsequent steps generally broaden to include other sectors and other levels of authority. The cyclical nature of ICZM policy is depicted by the spiralling arrows.

concerned groups are consulted at each particular phase from planning to implementation. In cases where major groups are likely to be impacted by ICZM, the planning process should be integrated in a way which encourages and facilitates the involvement of local groups, taking into account their cultural and behaviour norms.

The extent of the participation of "major groups", as defined in Agenda 21, varies widely among the case studies. In Mexico, indigenous peoples and local groups (such as fishermen's, farmers' and women's groups) led the planning and implementation of ICZM. In Chile, the efforts that directly involved local people were most successful.

It is difficult to relate the actual structure of ICZM institutions to the underlying conditions. The cases examined showed virtually no preference for vertical versus horizontal integration. The only exception is that three out of four of the cases with traditional cultural practices favoured vertically integrated institutions. In general, the strongest conclusion that can be drawn from the survey is that existing ICZM approaches rely on neither horizontal nor vertical integration more than the other. Both forms of integration appear to be equally important overall, although their relative importance may vary in time, as an ICZM programme evolves from planning to implementation.

Technical capacity

"Technical capacity" encompasses hardware, practices and human skills. The most widely used technologies in the cases studied were related to resource inventories, analysis, and monitoring. Almost every case a database of some sort was used, and many also used a Geographical Information System (GIS). The Netherlands has developed sophisticated computer models for resource allocation. Although such technologies are not yet widely used in other countries, the response to model demonstrations at the WCC'93 was positive, and their use may increase. Only a few case studies reported the use of remotely sensed data, such as satellite images, for inventories and monitoring. It is important to note that skilled human resources were necessary for the utilization of all of these technologies.

The level of sophistication of technologies used in ICZM varies significantly among nations. It appears that the level of sophistication of ICZM technologies is partially determined by available funds and human resources, and by the scale of the coastal problems being addressed. It seems that the use of more expensive, sophisticated technologies can easily be justified in cases where funds are available. In island nations such as Indonesia and Barbados, both of which are implementing top-down programmes funded by development banks, remote sensing and GIS data are being used for inventories and for monitoring resources. On the other hand, it appears that much can be done using "low-tech" methods if funds are limited. In a bottom-up, NGO-supported project in Mexico, for example, low-tech erosion mitigation techniques, crop and fishing rotation schedules were employed. Unfortunately, no information is available on the cost effectiveness of particular technologies.

Several underlying conditions appear to be related to the level of technological sophistication employed. Case studies in urban areas always featured the use of highly sophisticated technologies, while those in rural areas showed no preference between high- and low-tech approaches. This suggests that where natural and human interactions are more concentrated, more advanced technical capacity is required to understand and monitor them. It may also indicate a bias toward dedicating resources to solving urban problems. Three out of four of the case studies characterized as having traditional cultural systems used low-tech approaches, while those with modern cultural systems were evenly split. This suggests that, in some cases, traditional knowledge of indigenous cultures may be deemed sufficient understanding of the critical linkages between human and natural systems. Consensus-based political systems usually supported high-tech approaches, while hierarchical political systems showed no preference. However, this is probably simply a result of including several high-income industrialized nations in the first political category.

Whether or not advanced technologies can be justified and purchased, the availability of human resources defines the practical realm of technological choices. Almost all of the low-income nations surveyed cited underdeveloped human resources as a major obstacle to the successful management of the their coastal zones. Many nations also noted that past and present technical efforts have been motivated and implemented by international consultants. As noted in the case of Bangladesh, this has created a dependency on foreign technical assistance, a situation that is becoming increasingly common in low-income nations. Such dependency might be avoided if emphasis were to be placed on training and the transfer of appropriate technologies.

Management instruments

Management instruments include command-and-control measures (enforcement) such as licences and fines, and incentive-based (market) measures, such as tradable permits, taxes and subsidies. Analysis of the case studies suggested that the type of management instruments used was most closely related to geographical and political variables.

The geographic setting appears to be closely related to the type of management instruments used. Of the continental shore cases examined, the majority featured predominantly enforcement mechanisms. This may simply reflect the fact that highly industrialized nations such as the USA and Germany were included in this category. Experimentation with incentive-based instruments in other areas of pollution control, notably air pollution, may also eventually prove fruitful for coastal pollution control. Interestingly, of the four deltaic areas examined, three favoured incentive-based instruments, perhaps reflecting the fact that such instruments are easier to use for watershed management. The island

Exhibit 3.4 Indonesia: towards integrated planning

Indonesia is the world's largest archipelagic state, with over 17,500 islands, and a territorial boundary of over 80,000 km encompassing nearly 5 million km2. The territory of Indonesia is predominantly (60%) marine and coastal waters. Of the national population of 180 million, about 40 million live in coastal areas, and coastal populations are growing at double the national rate of 1.8% per annum. Marine and coastal resources are of great economic importance to Indonesia. In 1989, marine-related activities generated nearly 25% of the total GDP. Major contributors in this category were shipping and trade, oil and gas, followed by minerals, fisheries and transport. Tourism accounted for only a small portion of GDP, but its contribution is increasing rapidly. It is expected that marine resources will play an even more prominent role in future development.

At the central government level, the institutional structure for ICZM is extensive. The legal basis for environmental management was established in the 1945 Constitution. Since then, at least a dozen national Acts and numerous provisions have been adopted to regulate the various sectoral aspects of the coastal zone. The Environmental Management Act of 1982 assigned the Ministry of the Environment (MOE), in close cooperation with the Ministry of the Interior, general responsibility for environmental management. In addition, the MOE is charged with coordinating the sectoral ministries that impact the environment. The planning process is well developed at the national level. Past resource planning has generally been prescriptive in nature, with an economic or financial emphasis. The principal mode of implementation has been through a 25-year perspective plan and subsidiary five-year plans, administered by the Ministry of the Interior. National plans are disaggregated into sectoral plans concerned with resources (e.g. fisheries), functions (e.g. navigation), or services (e.g. conservation). Sectoral agencies formulate their own development strategies and programmes as inputs to the five-year plans. Regional or provincial planning is undertaken by each of the 27 provinces.

Despite the well developed institutional basis for coastal management, environmental degradation has become increasingly severe. Special concerns include: (i the loss of special habitats, including mangroves and seagrass beds, due to land reclamation; (ii) the deterioration of coral reef ecosystems, due to the impacts of destructive fishing and coral mining techniques; (iii) eutrophication of nearshore waters, due to point and nonpoint sources of pollution. In addition, rapid economic development has led to increased conflicts among the various development interests.

In response, the publication of the Broad Guidelines of State Policy (GBHN) in 1993 gave priority to rational planning for the sustainable development of coastal resources. A particular challenge in achieving this end has been the horizontal integration of ICZM responsibility within the government. In general, there is a need for sectoral plans to take into account the overlapping interests of other sectors. Another challenge is the vertical integration of responsibility among government and local groups. Planning processes, which have traditionally involved only government agencies, are to be extended to encourage the participation of local groups.

In addressing these challenges, the government is placing particular emphasis on strengthening provincial planning capabilities. At the operational level, this is reflected in a number of specific projects that are currently under way. For example, the Fisheries Infrastructure and Port Development Projects aim to inventory resources, to develop an improved marine infrastructure, to strengthen institutional organization and management, and to improve scientific and technological skills.

Recently, the Marine Resource Evaluation and Planning (MREP) Project was initiated to strengthen marine and coastal information institutions. The project aims to improve and support the planning process, especially at the provincial level. Developed and funded with the assistance of the Asian Development Bank, the first phase of the MREP will run from 1993-98. The project was designed in accordance with the government's commitment to sustainable development, and seeks to improve integration of the management of marine and coastal resources. The first phase of the project involves strengthening technical capacity for information gathering and analysis, including the exchange of technological experiences and the development of human resources

Several sophisticated technologies, including Geographical Information System (GIS) software, supported by advanced data acquisition techniques (air and space-borne teledetection), are already available. Under the MREP, technical capacities will be further extended by linking existing databases within sectoral ministries. It is expected that the introduction of these technologies and the training of personnel from relevant agencies will greatly enhance intersectoral cooperation in coastal zone management.

nations appear to be evenly split between command-and-control and incentive-based instruments, although enforcement is slightly more common. Enforcement in island states is logistically difficult, given the geographic isolation of the islands within a nation, so the predominant use of command-and-control regulations in island programmes may be problematic.

Political traditions also appear to be related to the type of management instruments utilized. Political systems rooted in a tradition of consensus decision making seem to favour the use of incentive-based instruments. Those systems more typically involving hierarchical decision making favoured the use of enforcement mechanisms. Unfortunately, no information is available as to the relative effectiveness of these measures. Although cultures classified as traditional and modern showed no difference in the type of management instruments used, some management instruments, particularly those that are market-based, are obviously ill-suited for traditional cultures that rely on subsistence.

Coastal village along the Nile Delta Egypt seriously hit by coastal erosion, a window to the future in case of sea level rise?

Indeed, it might be expected that incentive-based instruments would be more commonly implemented in nations with market economies than in those with subsistence-based economies. But this is not supported by the empirical analysis; in fact, there appears to be no difference. Of the cases examined, three out of four featured market economies. But whether the economy was market- or subsistence-based, command-and-control management instruments were more common. Although this is consistent with the observation that the majority of ICZM efforts were initiated by top-down govern-ment-led efforts, it suggests that market-based instruments for ICZM are not widely used.

Synthesis

The synthesis presented here is based on the limited number of ICZM case studies as analyzed in the previous section. The conclusions should be considered in light of the small sample of experiences available to this stage. The case studies are summarized in the Appendix II.

- **ICZM can be initiated by local groups or national governments.**
  Among the case studies, there were differences both in the starting points for the initiation of ICZM, and in the degree of integration of institutions involved in implementing the evolutionary process. In The Netherlands, the initial call for ICZM was led by local groups concerned with localized issues, and evolved, bottom-up, towards higher administrative and political levels. Proceeding from the recognition of the problem to the development of a plan, the effort expanded to include other impacted and related sectors. Conversely, political awareness at the level of the national government may expand, top-down, to include local political, administrative and societal groups. For instance, Indonesia fits this pattern, with an ICZM effort initiated by national government, and seeking to increase the involvement of impacted local groups.

- **ICZM requires vertical and horizontal institutional integration over time.**
  ICZM typically addresses multiple issues in the coastal region from an holistic viewpoint, with interest groups in different sectors and at different societal, administrative and political levels. The management process initiated to tackle these issues involves the planning, implementation and evaluation phases, generally performed as an iterative and cyclic process. It is found that for the successful establishment of ICZM we have thus to distinguish three dimensions along which integration and iteration will take place: (i) vertically between societal, administrative and political levels; (ii) horizontally between geographic, socio-economic, administrative and political sectors; and (iii) in time between problem recognition, planning, implementation and evaluation. As discussed in Section 3.3, and depicted in figure 3.2, the dominance of either horizontal or vertical integration will vary over time. As discussed in Chapter 2, ICZM offers a valuable framework for the management of long-term risks associated with potential climate change. However, existing ICZM activities tend to focus on short-term problems. Additional efforts are required to encourage the inclusion of mechanisms for dealing with longer-term challenges, such as adaptation to climate change.

- **Technical capacities, encompassing hardware, practices and human skills, appear to be crucial for organizing information.**
  Resource inventories and monitoring exercises provide a basis for a framework for analysis. The availability of human resources to utilize these technologies defines the practical realm of technological choices. Underdeveloped human resources is a major obstacle to the successful management of the coastal zones of most low-income nations.

- **ICZM can be implemented through many different institutional structures.**
  While no single approach for the integrative and iterative

Exhibit 3.5 The Netherlands: policy cycles towards sustainable development

Situated in the delta of the rivers Rhine, Meuse and Scheldt, the Netherlands is a country with a centuries-long history of coastal zone management. Covering a land area of 31,000km2, of which one quarter is reclaimed land, the nation has a population of about 15 million. Without the extensive drainage system and about 3000 kilometres main dikes, sixty percent of the land would be flooded daily. Thirty percent of the country actually lies below sea level. Over the centuries, the Dutch have turned a low-lying, marshy area into a densely populated country with extensive infrastructural facilities. The history of water management in the Netherlands demonstrates the policy cycles of integrated management.

Flood abatement was the earliest focus of coastal management efforts in the Netherlands. First seen as an individual responsibility, flood control gradually became of regional and then national importance. The first water management principle, laid down in the 13th century, reads "One who does not want to stem the water with a dike must leave his property." The ongoing subsidence due to the drainage of the peat land asked for protection and regulation. As this call was heard more and more on a larger scale, the need for local organization was borne. Thus "waterschappen" (water boards) were established, governed by elected representatives of local communities. The rulers of that time recognized the importance of the water boards, rooted in the basic interests of local people, and endowed them with formal responsibilities for water management.

A growing population and economy asked for the organization of infrastructure for transportation, land reclamation and protection works on a national scale. In 1798, a national agency, Rijkswaterstaat, was established to develop and maintain all water related works on a national level. The number of local water boards continued to increase, numbering 2,500 at the beginning of the 20th century. A growing management task (safety, drainage, irrigation, sanitation, pollution control) asked for an effective organizing scale and by 1991 reorganizations reduced the number of "integral water boards" to 130. Their boundaries were defined mainly by natural and artificial drainage systems.

Today, responsibilities for water management are defined by the constitution and by law and are vertically integrated from the national to the local level. At the national level, Rijkswaterstaat is responsible for the national water policy, including flood protection, water supply and water quality and the management of both surface and ground water. In addition, Rijkswaterstaat is directly responsible for the management of the main waters, including marine and coastal waters, the main rivers, reservoirs and canals of national importance. The provinces coordinate the water boards and directly manage groundwater. Local water boards are responsible for the flood protection systems (dike rings) and the management of regional surface waters.

Flood abatement, while still an important priority in coastal and water management, is today carefully considered in the context of functions, values and uses of the water areas. Following the response to the storm surge disaster of 1953, flood protection was given first priority. Consequently, the Delta works were planned. Shortening the coastline by closing off the estuaries between Rotterdam and Antwerp was the most efficient way to do so. In the 1960s and 1970s increased public concern for natural values and fishery led to a revision of the Delta plan. The turning point was the decision on the approach towards the tidal basin The Eastern Scheldt. Parliament decided to maintain its abundant marine flora and fauna, rich tidal salt marshes and the high yield shellfish fishery. This resulted in the construction of a storm surge barrier in the mouth of the Eastern Scheldt tidal basin. This barrier can be closed during storm surges, but otherwise does not obstruct the tides and the marine environment. The Eastern Scheldt example illustrates the evolution of the national policy on water management and typifies the expansion of an effort initiated by a single-sector issue to address related issues.

The first water management policy document (1968) had sectoral missions of developing the infrastructure for flood protection and to satisfy fresh water demand. In the second policy document (1984), water was considered a multifaced resource. Extensive policy analysis helped in decision making in pollution prevention and in furthering investments in infrastructure to find a cost-benefit optimum to serve the multi users. The third policy document (1989) provided a long-term strategy towards sustainable development. Integrated water management was introduced as an instrument and a water system approach further developed, in order to combine the efforts of all governmental levels involved. Long term objectives have been formulated, with a time horizon of 30 years and a strategy towards these goals formulated with 5 year planning cycles. Every 5 years, the progress in sanitation, restoration, conservation and development is evaluated to adjust the planning scheme. The water system approach is an ideal tool to stimulate the participation of local groups and stakeholders. Integration on the national level is established through sharing responsibilities for the policies by all important water related sectors of government and by leap frogging in policy cycles for physical planning, the environment, nature conservation and agriculture.

process towards ICZM can be derived from the case studies, successful approaches generally take social, economic and political variables into account in the design of both the overall programme, and the institutional structures to implement and evaluate the programme. As discussed above, the analysis of the case studies suggests that an understanding of the interplay between underlying geographic, demographic, cultural, economic and political conditions can greatly assist in developing a suitable approach for a given country or area.

- **Specific lessons derived from the case study experiences include:**
  - in many cases the ICZM process can be initiated by concerns over sectoral (e.g. Thailand) or regional (e.g. The Netherlands) issues;
  - whether the institutional arrangements are such that either one or more agencies are responsible for ICZM, the critical condition is the existence of a linking mechanism (e.g. Bangladesh and Indonesia);
  - ICZM is found to be a long, iterative and cyclical process, which may be more apparent in bottom-up approaches (as in the Philippines, Malaysia and The Netherlands), but equally exists in top-down approaches (e.g. the USA);
  - ICZM is most effective when conducted in the context of national/regional planning (e.g. Sri Lanka);
  - a critical element in the implementation of institutional arrangements is the building of human capabilities through training and education (e.g. Egypt);
  - wherever two or more countries are closely related, ICZM in one country can be affected by decisions made in another country, calling for international mechanisms (e.g. the UNEP Regional Seas Programmes for the South Pacific Caribbean and the Mediterranean).

- **ICZM can address climate change, population growth and other long-term issues.**
  While many of today's major concerns dominate the need for ICZM, every coastal state has concerns about the long-term potential impacts of climate change, particularly accelerated sea level rise, and generally recognizes the need to begin to address these issues within the context of ICZM planning. Within the array of possible impacts of climate change, sea level rise may not be the only issue for some coastal states: droughts, changes in storm patterns and increased storm surges, for example, could also have serious impacts on human settlements and economic systems.

- **ICZM can facilitate sustainable development of coastal resources.**
  Many of the areas described by the case studies include low-lying lands, some of which are heavily populated and are widely used for subsistence. In addition, tourism, which is often dependent on the health of coastal ecosystems, is an increasingly important component of many national economies. Consequently, the emphasis on ICZM through different forums such as the UN Commission on Sustainable Development, the Global Conference on Sustainable Development in Small Island Developing States, the UN Framework Convention on Climate Change or through the IPCC, should remain a top priority in the basic call to action for coastal states to begin the long and challenging process of ICZM programme development as soon as possible.

3.4 The Obstacles

What general conditions could improve the performance of the implementation of ICZM, or in other words which obstacles have to be overcome? The obstacles and the needs subsequently identified are discussed below under two broad categories: "institutional strengthening" and "technologies and skills."

Institutional strengthening

In the national ICZM case studies, one of the most widely cited obstacles to ICZM was the lack of adequate institutional arrangements. In the case studies examined, there was generally need for enhancing: (i) inter-agency integration; (ii) citizen participation and awareness, and (iii) the legal and financial bases for management. Inter-agency coordination is needed both within and between government agencies. In several case studies, projects funded by development banks had some initial success in promoting coordination by establishing inter-agency task forces. Education programmes and public hearings were utilized to raise awareness and encourage public involvement, but appear to have been inadequate in many cases. An enhanced legal framework is necessary in some cases to establish ICZM as a priority, and to set up the mechanisms for inter-agency coordination.

In many of the case studies, *government structures* were claimed to be poorly integrated, characterized by national-level over-centralization, the lack of lead agencies, overly complex bureaucracies, and weak inter-agency coordination. One basic characteristic of the administrative structures was the structural absence of an adequate relationship between hierarchically organized executing agencies in the central government and the consensus-based participation mechanisms at all levels of ICZM. In the worst cases, a strict top-down arrangement vested control of all aspects of the programme at the central level, minimizing the opportunity for input by stakeholders. The questionnaire survey findings seem to suggest stronger horizontal (i.e. sectoral) linkages than could be inferred from the case studies alone, but in most cases these linkages appear to be weak or informal.

In general, planning and management regimes should seek to involve local populations which often have primary responsibility for management of coastal resources, and in some cases depend on them for subsistence. The importance of *recognizing traditions and social norms* in order to ensure public participation is noteworthy. In some cases, institutions and management instruments inadequately integrate modern and traditional values. For instance, some modern land management regimes fail to incorporate traditional land tenure or management systems. The value of sensitivity to the cultural

Exhibit 3.6 Ecuador: towards ICZM through technical capacity building

Ecuador's coastline consists of 1,600 km estuarine and 1,250 km open coast and contains a wide variety of ecosystems, ranging from humid tropical forest in the north, where annual rainfall is more than 2000 mm, to a dry arid zone in the south, which receives less than 250 mm. Between 1950 and 1990, the population of Ecuador tripled, reaching 9.6 million, and the populations of the coastal provinces grew from 8%, to 44% of the total population. In the last 20 years, the environmental degradation of the coast has been severe, with a 20% loss of mangrove areas, and a 90% loss of salt water flats.

Among the oceanic influences on the coast, El Niño/Southern Oscillation (ENSO) is perhaps the most important. This event occurs with variable intensity and periodicity, and causes enormous changes in the Ecuadorian coast. Strong ENSO brings increased rainfall, the effects of which are severe, especially in low-lying flood-prone areas. Cold waters from the south and the shallow warm waters from the Panama basin, meet at the Ecuadorian coast, and have an important effect on the climate and on the biological productivity of this region.

Ecuador began a coastal resources management programme in 1986 with a technical cooperation agreement between the University of Rhode Island, USAID, and the government of Ecuador. The aim of the collaboration is to create an integrated national programme for the management of coastal resources, to assist in the promotion and development of the sustainable use of coastal resources through participatory and self-governing procedures. Annual operational plans allow for regular evaluation of the activities and the effectiveness of the structure.

The programme is a continuous process, with local involvement in the planning, policy formulation and evaluation phases. Management areas have been chosen according to ecological rather than administrative boundaries. Within these management areas, proposed economic developments are scrutinized in relation to the sustainability of resource use and other ecological criteria. The programme has harmonized decision making at the government level and implementation at the local level.

With technical support from intersectoral working groups, and inputs from local committees, major concerns were identified and a management plan developed for five areas: the preservation of mangroves and artisanal fish-eries, the development of eco-tourism and mariculture, and the management of water quality and sanitation systems. Specific policies and projects address each of these key concerns, and will be implemented within five special area management plans approved by a National Commission. Funding has recently been obtained for the implementation of the recommended actions.

Education is an important part of the programme, both to raise public awareness, and to encourage public participation. In particular, there has been a surge in the perceived value of maintaining wetlands and mangroves, as awareness of their value as fish nurseries has increased. Under the coastal resources management programme, small-scale management activities that directly involve local groups have also served to strengthen public commitment to sustainable development.

Government leadership was essential to the preliminary success of this programme. The selection of policies and strategies was achieved by presidential decree in 1989, which established and assigned responsibility for specific management tasks to specific institutions. In response, a National Commission was established, with high-level representatives of all concerned ministries.

norms of major groups is well demonstrated by the crisis over land tenure in the South Pacific. In several Pacific island nations, attempts at ICZM have been frustrated by land-owners who perceive ICZM as a threat to their basic rights. In the Marshall Islands, the adoption of Western-style regulations for coastal resource usage failed. If the involvement of the traditional leaders had been solicited in the enforcement and education processes, the outcome may have been quite different.

In many cases an *inadequate legal framework* may underlie institutional weaknesses. Legal weaknesses pointed out by several nations include: (i) administrative rather than legal bases for planning agencies; (ii) resource laws that are strongly sectoral in nature; (iii) the absence of a legal authority to integrate and coordinate endeavours; (iv) the lack of stringent enforcement procedures; and (v) the fragmentation of statutory authority when it does exist. It is important to note, however, that while an adequate legal framework may be considered a necessary condition for ICZM, this in itself is no guarantee of the successful implementation of a programme. Examples abound of nations with legal frameworks for ICZM, where no ICZM is conducted. In practice, political will, based on awareness among the public and government officials, is crucial. Also, technical and financial shortcomings sometimes prohibit institutions from carrying out their legal obligations. The importance of training as an effective vehicle for capacity building has become increasingly apparent, as nations proceed from traditional sector-oriented marine resource management practices, toward the development of new, political, administrative, and technical schemes for ICZM. The need for dedicated funds is also crucial to the continuous implementation of ICZM.

Despite the recognition of their overwhelming importance, institutional arrangements for intersectoral and public-private sector linkages are too often poorly articulated, ineffective and inefficient. In addressing this problem, it is necessary to recognize that different contexts require different mechanisms and structures. The challenge is to design and implement institutional arrangements that are compatible with existing customs and traditions. These arrangements by nature will then strengthen the control and enforcement procedures and provide a legal framework for management.

Technologies and skills

Among the other widely cited obstacles to ICZM is the lack of adequate resources, from human resources to investment capital. A shortage of trained personnel and collective expertise tops the list, followed by inadequate financial resources, data and information. Related to these deficiencies, as well as to the inadequacy or absence of legal bases, is a general lack of administrative capacity for enforcement. The autonomy, sustainability, and long-term effectiveness of enforcement programmes will increase if they are able to generate their own revenues and recover costs, perhaps through the granting of permits and licences, or through direct receipt of special taxes. The case studies reviewed revealed that technical support may be helpful in designing market instruments for enforcement, as well as regimes for environmental monitoring and database management.

Other obstacles mentioned in the case studies and questionnaires often receive comparatively little attention, but significant among these in the near term, are deficient monitoring of resource conditions, and the lack of feedback necessary for evaluation and programme revision. In general, a strategic dimension, which would facilitate the identification of long-term problems (such as climate change and sea level rise) and the design of mitigating actions in the context of day-to-day ICZM, is often lacking. In developing national programmes for ICZM, it is necessary to establish ongoing monitoring and evaluation programmes. Specifically, flexible tools need to be developed for use in: (i) monitoring the quality and distribution of coastal resources; (ii) monitoring development activities and resource usage, and (iii) managing coastal data to facilitate meaningful policy analysis.

Since many coastal nations are facing similar problems, it should be possible to develop technical tools that will have wide application. In low-income nations, the baseline data and institutional structure needed for assessments and inventories is often lacking. The urgency of coastal problems, as discussed in Chapter 2 and Appendix I, calls for quick and efficient methods for overcoming these constraints. It is imperative that the techniques developed make maximal use of existing data, and that they can be readily updated as new information becomes available. The cost of initiating much-needed monitoring and assessment networks could be minimized by adapting the approaches used in one area for use in similar areas. For instance, an environmental assessment programme developed in one island nation, while specific to that nation, could be adapted at relatively low cost for use by another island nation. With wide application to coastal states, tools developed could be disseminated via regional technical assistance and institution strengthening programmes.

3.5 Conclusions

Based on the ICZM case studies discussed, and other materials submitted to the WCC'93, it was concluded that:

> *"Integrated coastal zone management involves the comprehensive assessment, setting of objectives, planning and management of coastal systems and resources, taking into account traditional, cultural and historical perspectives and conflicting interests and uses; it is a continuous and evolutionary process for achieving sustainable development."*

Recognizing the difficulties that coastal states face in initiating ICZM, WCC '93 concluded:

> *"Coastal states that are in the process of defining and implementing a national programme for integrated coastal zone management have encountered obstacles that constrain the effective development of national programmes."*

Exhibit 3.7 WCC'93 Conference Statement on Elements and Obstacles

Elements

Integrated coastal zone management involves the comprehensive assessment, setting of objectives, planning and management of coastal systems and resources, taking into account traditional, cultural and historical perspectives and conflicting interests and uses; it is a continuous and evolutionary process for achieving sustainable development.

A national ICZM programme should facilitate integrated decision making through a continuous and evolutionary process for cooperation and coordination among sectors, integrating national and local interests in the management of activities concerning the environment and development. These programmes include coordination of activities throughout the coastal zone, taking into account, where appropriate, river basins, ecosystems or entire islands. Coordination is also required within and among national programmes, regional organizations and international institutions.

The basic elements of ICZM can include:

- identification of priorities and problems in consultation with local interests;
- identification of opportunities for the future development of coastal-related functions;
- local and/or national policy and other initiatives to address coastal problems with clear goals that are understood and supported by the public;
- legislation and/or institutional arrangements at local, national and, where applicable, regional levels, including means and/or authorities for coordination;
- programme development, integration and implementation over the short-, medium- and long-term, including guiding principles, functional planning of land use and terrestrial and marine resource use and analysis of natural and socio-economic systems;
- assessment of the environmental impacts of development and other coastal activities;
- education, public awareness and an equitable process for the participation of all stakeholders;
- systems for the collection, verification, retrieval, access and management of data and information;
- trained professional, supporting and extension staff;
- programme review and modification, including feedback mechanisms into all elements of ICZM;
- enforcement;
- research, monitoring and assessment;
- wide application of the precautionary approach according to the capabilities of each state; and,
- financial resources for multi-year planning, capital investments and operation and maintenance expenses.

Obstacles

Coastal states that are in the process of defining and implementing a national programme for integrated coastal zone management have encountered obstacles that constrain the effective development of national programmes.

Constraints and obstacles are found at both national and local levels and include:

- limited understanding of and experience in integrated coastal zone management;
- limited understanding of coastal and marine resources, processes and opportunities;
- fragmented institutional arrangements;
- single-sector-oriented bureaucracies;
- competing interests and lack of priorities;
- inadequate legislation and/or lack of enforcement;
- lack of knowledge of land tenure regimes and other social factors; and,
- lack of information and resources (funds, trained personnel, relevant technologies, equipment, etc.).

4 Building Capabilities

Opportunities for strengthening Integrated Coastal Zone Management

4.1 Introduction

The participants of the WCC'93 demonstrated that there is a clear consensus in their concerns over both the present deterioration of coastal areas and resources and the threat of future climate change. The consensus views of the participants are summarized in the Conference Statement. In view of the rapidly increasing stresses on coastal areas due to population growth and economic development, the WCC'93 concluded that individual nations need to manage the use of their coastal resources now in order to reduce vulnerability to climate change in the future. Such an approach has been strongly encouraged by UNCED and is fully consistent with the goal of sustainable development. Integrated coastal zone management (ICZM) is seen as the most appropriate strategy to enable policy makers to deal with both the short- and long-term needs of nations, in order to achieve sustainable use of critically important coastal resources today while, inter alia, dealing with the effects of climate change and other future hazards.

The WCC'93 Conference Statement set the tone and direction for future activities towards integrated management of vulnerable coastal areas (see Exhibit 4.1). The WCC'93 participants' conclusions address:

- the urgency of the need for coastal nations to begin the process now to develop ICZM capabilities;
- the serious obstacles and challenges that must be overcome in order to develop and implement effective national ICZM programmes; and
- the recognition that ICZM capabilities could be developed at the local, national and international levels in a mutually reinforcing way.

How can these future activities be accomplished? What can be hoped for, what can be expected, and what activities will assist the global community to be better prepared to meet the challenges of the 21st century? While much of the burden will fall on individual nations, there is a clear spirit of international cooperation. This has been demonstrated through bilateral and multilateral activities, and the ongoing and anticipated efforts of regional and international organizations to satisfy the needs of developing nations and to share information and techniques. In the years to come, working through the diverse programme activities of relevant international organizations (see Appendix III), there will be many opportunities for nations to direct their attention and energies towards providing workable solutions to the challenges.

Future activities
A suggested schedule for future activities in the field of ICZM, for consideration by responsible authorities and international organizations is shown in Exhibit 4.4. The suggested activities focus on strengthening further cooperation, exchanging experiences, developing and sharing common techniques and embedding the results of WCC'93 in international frames.

4.2 Strengthening International Responses

Effective ICZM can be achieved through better coordination among national, regional and international organizations and institutions. Such coordination will help to avoid unnecessary duplication, and will enable the development of the concepts, tools and networks that will be needed to facilitate the complex process of developing and implementing national ICZM programmes.

Regional approaches can also complement and strengthen activities at the national and international levels. These could involve formal agreements, priority-setting exercises, workshops and the exchanges of practical experiences. A regional ICZM approach is often essential, for example, in programmes related to enclosed and semi-enclosed seas.

Nations, including non-coastal states, and regional and international organizations are urged to consider strengthening their support for building the capability for ICZM in a number of areas, particularly information; education and training; concepts and tools; research, monitoring and evaluation; and funding.

Information
ICZM will be ineffective unless there is strong support (from elected officials, agency managers, the public, and various interest groups) for building the institutional capability required for integrated management. Narrow interest groups and bureaucrats often try to maintain single-purpose rather than multipurpose agencies and single-purpose rather than multipurpose management.

In many of the WCC'93 presentations it was emphasized that many elected officials, economic development officials, and the general public are still unaware of the importance of coastal resources and how their actions affect the coastal environment. Public education and participation is a critical factor in mobilizing and maintaining long-term public support for ICZM.

Community groups can be encouraged to become involved in day-to-day ICZM tasks, such as monitoring ambient water quality in streams, carrying out clean-up activities on coastal lands such as beaches, "adopt-a-stream" campaigns, monitoring discharges from various activities, and helping to develop watershed management activities. Considerable energy and enthusiasm are often just waiting to be tapped.

Exhibit 4.1 WCC'93 Conference Statement on building ICZM capabilities

Strengthening national responses:

Coastal states are urged to identify their priorities for integrated coastal zone management, to identify their most pressing needs to improve their capabilities for integrated coastal zone management, to undertake national measures to increase their capabilities, and to identify their special needs for assistance.

The following are examples of measures that could improve capabilities for developing, implementing and strengthening national programmes for integrated coastal zone management:

- multidisciplinary studies and assessments to determine the potential importance of the coastal zone and its vulnerabilities, in particular those that limit its ability to achieve sustainable development;
- an institutional body or mechanism to investigate the need and potential benefits and costs of developing an ICZM programme;
- a long-term and effective, body or mechanism to prepare, recommend and coordinate the implementation of a permanent ICZM programme;
- a continuing monitoring and assessment programme to collect data, assess results and identify the need for change or improvement;
- an ongoing research programme, including an investigation of the potential effects of global climate change, to improve the analytical foundation for the decision making process;
- a policy to increase the availability and accessibility of information to all interested parties;
- active support for local initiatives, exchange of practical and indigenous experiences and enhancement of public participation;
- education, training and public awareness efforts to increase the constituency for integrated coastal zone management; and,
- coordination of financial support for relevant activities and investigation of innovative sources for additional support.

Strengthening international responses:

Effective integrated coastal zone management can be achieved by coordination between national, regional and international organizations and institutions. This will help to avoid unnecessary duplication and to develop the concepts, tools and networks needed to facilitate the development and implementation of national programmes.

The development and implementation of national ICZM programmes is a complex process that can be accelerated and enhanced through international cooperation.

Regional approaches can complement and strengthen activities at the national and international levels. They involve formal agreements, priority-setting exercises, workshops and the exchange of practical experiences. A regional approach, for example, can give proper recognition to the importance of ICZM in enclosed and semi-enclosed seas.

WCC'93 Conference Statement on building ICZM capabilities

Nations, including non-coastal states, and regional and international organizations are urged to consider strengthening their support for ICZM capacity building, including in the following areas.

Information

- Strengthen regional and international networks, including South-South relationships, so that documents, expertise, project information and training on ICZM are easily accessible to all coastal states and interested parties in a form that is understandable and relevant to the decision making process.
- Increase public awareness.

Education and training

- Enhance education and increase training activities through the development of:
  - specialized interdisciplinary curricula, particularly at the university level, in order to broaden the knowledge and skills of coastal managers;
  - information on ICZM training centres and on specialists in various fields of expertise;
  - enhanced opportunities for human resource development by coordinating existing efforts and addressing emerging requirements;
  - networks to facilitate coordination among support agencies and countries.

Concepts and tools

- Support the development and improvement of methodologies and guidelines (including the IPCC Common Methodology for assessments of vulnerability, methodologies for social, cultural and economic analyses, and guidelines for ICZM).
- Promote and facilitate the use and further development of computer-based models and decision support systems, and other ICZM concepts and tools, that take into account national needs and circumstances.
- Facilitate the presentation of information in a form that is understandable and relevant to the decision making process.

Research, monitoring and evaluation

- Strengthen support for ICZM programme development with respect to:
  - the routine collection of basic environmental information, e.g. water level and other oceanographic measurements, meteorological and hydrological changes, water quality, land-based sources of marine pollution, shoreline changes, sediment budgets and biological productivity;
  - the enhancement of systems modelling capabilities, with special attention to the distinction between human-induced and natural changes in coastal processes;
  - research on comparable methodologies that will facilitate the decision making process given the current uncertainties in scientific knowledge;
  - research on socio-economic and cultural factors relevant to ICZM, including traditional indigenous sustainable practices;
  - research into the extent and the rate of global climate change.
- Facilitate the exchange of international ICZM experiences by developing comparable methodologies for a monitoring and evaluation framework, including appropriate indicators, for:
  - the changing conditions of coastal situations, and
  - the effectiveness of management interventions.

Funding

- National and international funding institutions, including development banks, are urged:
  - to assist coastal states, particularly developing countries, in the formulation and implementation of ICZM strategies and programmes that take fully into account the existing environmental, scientific, technical, social, political, cultural, and economic contexts of individual nations, and which enhance socio-economic objectives directed towards the achievement of sustainable development;
  - to support ICZM programme development and implementation, including capacity building at the local, national and regional levels so that the ICZM process can ensure that development projects are well designed and properly sited.

Information can be exchanged through regional and international networks, including south-south relationships, and being relevant to the parties involved. An international survey of institutions that collect and hold data and information that can be used by coastal states to improve their existing databases for ICZM can be the first step towards such exchange of information.
International attention for threatened ecosystems (wetlands, mangroves, coral reefs) may stimulate public awareness of the inhabitants of nation's coastal zones.

Education and training
The development human resources by means of education and training was frequently cited by the WCC'93 participants as a major prerequisite for the success of ICZM. A number of the country case studies showed that qualified personnel are needed to conduct climate change impact studies, monitoring, and other activities. Because of the nature of ICZM, qualified staff will be needed to manage difficult and complex programmes.

Developing countries in particular face acute shortages of personnel with the necessary knowledge, technical skills and managerial ability to meet the new challenges. These will involve the application of integrated approaches to the formulation and implementation of plans for the sustainable development of coastal and marine areas.

Some studies have indicated that it may take more than 20 years to develop an ICZM programme, because first appropriate courses at the college level need to be established, before an ICZM programme can progress. While many types of studies, including assessments of vulnerability to climate change, may be undertaken through contractual work or consultancies, permanent staffs of specially educated and trained individuals are required to run government programmes such as ICZM.

However, as stated above, raising public awareness is also crucial for the success of ICZM, as well as increasing the general level of understanding among decision makers such as utility managers, development planners and local and national politicians.

In June 1993 the United Nations convened a special workshop on education and training needs (see exhibit 4.2). The outcome of this workshop was a Draft Action Plan for human resources development and capacity building for the planning and management of coastal and marine areas, which was discussed at the WCC'93 and the pre-conference workshops. The Action Plan identifies specific target groups and recommends activities to be conducted within a five-year period (1993-97). The implementation of the Action Plan would advance education and training requirements, along with the many individual efforts conducted with bilateral assistance.

Concepts and tools
The quality of the data and information gathered in the course of studies and assessments needs to be improved. In addition, the results of such exercises need to be synthesized and presented in forms that are meaningful for managers and decision makers, as well as clear to users of coastal resources and the public, since their support is essential for the success of the ICZM process.
The WCC'93 provided an excellent opportunity for the demonstration of concepts (i.e. frameworks that contribute to the development of analytical approaches for the formulation, analysis and evaluation of ICZM plans, such as the use of the Common Methodology) and tools (i.e. analytical techniques that are instrumental in the preparation and execution of analyses for ICZM, such as models and Geographical Information Systems). In the further development of common concepts and tools, it is necessary that the approach chosen takes into account the wide variety of natural conditions and management situations (social, economic and cultural). The development of a common framework for analysis, incorporating the suggestions of the various stakeholders, could then focus on common denominators.

Research, monitoring and evaluation
The wide ranges of uncertainty in the human and natural variables that affect ICZM emphasize the need for continued research and monitoring. The quality of coastal assessment and monitoring exercises could be significantly improved if international and regional research efforts are supported and strengthened.

There is a long-term need for resources and energies to be channelled to improve data acquisition and analysis, since decisions as to how to respond to climate change and coastal resource use conflicts will be no better than the information on which those decisions are based. The consequences of poor decision making in coastal areas will far outweigh the cost of gathering the information that can ensure more rational decisions that will save lives and property, and conserve natural resources.

For example, many countries referred to the need for local tide gauge stations, connected to regional networks, so that accurate measurements of sea level can be made. They noted that it is academic to talk about sea level rise when only limited permanent tide gauge data are available, as is the case in South America and Africa. The Intergovernmental Oceanographic Commission (IOC) coordinates a Global Sea Level Observing System (GLOSS), although there are still many gaps and the system requires increased international support. Similarly, the efforts of the IOC to develop a Global Ocean Observing System (GOOS), including a "coastal" module, should be supported.

Funding
The WCC'93 highlighted the difficulties faced by many developing countries in funding ICZM programmes. Unlike

Exhibit 4.2 UN initiative on education and training needs

The UN/DOALOS and UNDP initiative identified three major target groups: (i) policy makers and planners at the highes level of decision making; (ii) coastal and marine managers (responsible for implementation (iii).The users, implementers and operators refering to the operational agents with a wide range of responsibilities

The knowledge, skills and attitudes required for effective management of coastal and marine areas include:

Knowledge
- Ocean/coastal/atmosphere system
- Ecology
- Geology
- Hydrography
- Marine/coastal geography
- Major ocean/coastal issues and their implications
- Resource economics
- Spatial economics/urban regional economics
- Location analysis
- Environmental engineering
- Law of the Sea/international conventions/national law
- Institutional framework at all levels (other than legislation)
- Sociology

Skills
- Strategic analysis and planning
- Administrative and organizational relationships
- Negotiation/conflict resolution
- Leadership
- Environmental assessment
- Environmental impact assessment
- Risk assessment
- Interpretation, synthesis and presentation of complex sets of information
- Boundary delimitation
- Pollution prevention
- Programme evaluation
- Public education and participation techniques

Attitudes
- Ethical dimension
- Seriousness of endeavour
- Importance of people
- Professionalism

The Draft Action Plan that resulted from this initiative identified the following major areas of action:

1. Development of human resources. The United Nations University (UNU) will set up a database for the comparative analysis of training programmes and exchange of courses and materials.
2. Institution building for training. Centres of excellence will be identified. The UNESCO Intergovernmental Oceanographic Commission (IOC) will coordinate the assessment of associated institution building requirements (technological, scientific, organizational, financial, etc.) to achieve sustainability of efforts in the medium and long terms.
3. Training programmes will be developed or adapted. A common course format will be developed by DOALOS and UNDP to allow maximum utilization and distribution worldwide.
4. Implementation mechanism. An informal network will be developed to exchange data and information, research results and training materials.

developed countries, they often do not have the economic base that can provide the funds required for such programmes. Other, higher priority domestic and international problems often drain limited funds and hamper their ability to finance ICZM. The pressure on many developing countries to revitalize their economies, and to obtain hard currency in the short run, often encourages them to exploitation of their natural resources, including coastal resources.

In most cases, it is unlikely that immediate funding for ICZM will be made available solely to address the potential long-term problems arising from climate change. There may be more immediate interest in allocating funds to improve water quality and to reduce storm damage, for example. However, the current widespread concern about climate change, and the recognition that international action is required, has stimulated the allocation of at least some resources for analyses of ICZM problems. These resources can be used effectively to begin to develop the capacity for overall ICZM.

Improved coordination among the international donors already financing ICZM studies and projects in developing countries would help to improve the efficient use of available resources (see Appendix III). Financing the development of ICZM in developing countries will require the assistance of the developed countries, non-governmental organizations (NGOs), UN agencies, and the various multilateral development banks. However, to be effective in the long run, capacity building will require substantial efforts from developing countries in a true partnership relationship. In many cases a mix of both national and international funding will be necessary to get ICZM off the ground.

In providing financial support, international donors should seek to assist in the formulation and implementation of ICZM strategies that: (i) complement and enhance the socio-economic objectives of programmes directed towards the achievement of sustainable use of coastal areas; (ii) are workable within the existing socio-economic, cultural and political contexts of the host countries; and (iii) are directed towards the achievement of sustainable use of coastal resources.

4.3 Strengthening National responses

The WCC'93 participants urged coastal states to identify their priorities for ICZM, to identify their most pressing needs in improving their capabilities for ICZM, to undertake national measures to increase their capabilities, and to identify their special needs for assistance.

Assessment of needs

An assessment of the vulnerability of a coastal area, including management capabilities, can give direction to the further development of a coastal zone management programme. An example of such an assessment framework is the IPCC's Common Methodology for assessing vulnerability to climate change and accelerated sea level rise. This approach can be used to identify management priorities and to identify the need for assistance. This type of analysis can lead to a national action plan for:

- enhancing the effectiveness of institutional arrangements;
- improving the dissemination of information;
- strengthening education and training;
- developing and improving concepts and tools;
- improving research, monitoring and evaluation; and
- ensuring adequate long-term funding.

The WCC'93 and its pre-conference workshops reviewed 46 case studies of vulnerability to climate change and accelerated sea level rise, and studies of the current status of ICZM programme development and implementation. The results of these studies and assessments provide a rich source of information for individual countries. The synthesis of the results has provided insight into regional and global similarities and trends. Through these studies, countries could consider the importance of the impacts of climate change on society. For the first time, many countries are investigating the potential magnitude of the problems they may face in the future, and considering the options that are available for coping with these problems. Exhibit I.2 describes the ICZM planning process in Egypt.
Although these studies focused on accelerated sea level rise, many countries are beginning to understand that other impacts of future climate change may be even more significant (for example, increased or reduced precipitation, more frequent storms and floods). Less than half of coastal nations have conducted assessments of their vulnerability to accelerated sea level rise, and the existing assessments need to be expanded to include other potential effects of climate change. The need for additional studies and assessments continues.

Strengthening institutional capabilities

Alternative institutional arrangements for ICZM do not imply that a single agency needs to be designated to carry out all management tasks. However, ICZM may require the introduction of formal institutional mechanisms to link the various agencies that will carry out the required tasks of ICZM; trained professional staff; adequate financial resources; public education; and public involvement throughout the entire ICZM process. Some nations may wish to seek to meet these required conditions for ICZM as soon as possible; others may wish to focus their initial efforts on the critical task of establishing a formal mechanism for coordinating the many institutions involved in ICZM.

Local, regional, and national institutional capabilities needed for the implementation of ICZM may be developed through policies and action programmes that are sufficiently flexible to accommodate changes in the socio-economic and political conditions and new information on coastal systems, including ecosystems, as it arises. Policies for ICZM will inevitably require compromises among several sets of sectoral objectives, such as for regional economic development;

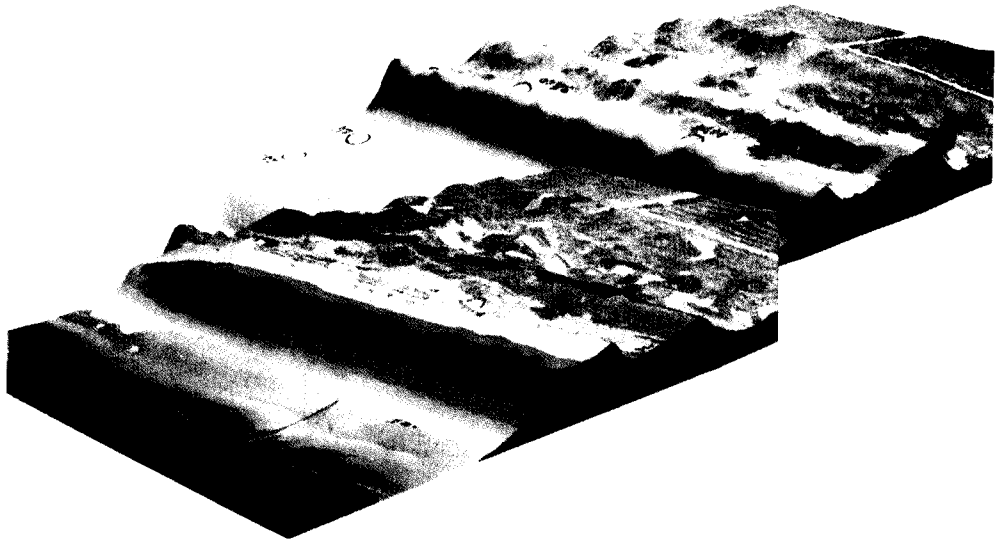
Exhibit 4.3 The Netherlands: information for shoreline planning and management

Constant effort is demanded to carefully guard the Dutch sandy coastline, because ongoing coastal erosion causes more then half of the coastline to recede. In 1990 the Government of The Netherlands announced the chosen alternative of "dynamic preservation". The decision was based on a careful analysis of long term trends in coastline development and a comprehensive discussion on the values, interests and functions of the natural coastal system (beaches and dunes). The benefits and costs of the policy alternatives (ranging from retreat to full preservation) are calculated for the period 1990 to 2090 and for different scenarios of sea level rise. Further retreat and loss of coastal resources were considered unacceptable. It was recognized that a coherent, national scale policy for the dynamic preservation of the coastline was barely needed, rather than just reacting to devastating erosive storm damages.

A schema of measures has been evaluated to meet the goal of dynamic preservation. This implies that measures should allow for the natural dynamic movement in the coast line, while combatting the structural erosion. Foreshore and beach nourishment were identified as the most flexible and "soft" tools and has been applied on a large scale since.

Techniques were developed to monitor the sand volume in the active coastal zone, weighting the trends in dune and beach profiles. A routine monitoring programme elaborated to evaluate dynamic movements and to identify structural erosion. The "classical" profile analyses are well supported by advanced technologies as remote sensing, Digital Elevation Models and Geographical Information Systems, to enhance decisions on how to anticipate the natural dynamics, how to serve the values, uses and interest and where and how to nourish.

Applying these modern information technologies, with centralized databases and decentralized monitoring centres, coastal managers, coastal provinces and waterboards can anticipate efficiently and periodicall adjustments executed effectively.



This 3D digital model shows the results of data collection by ortho air photo mosaics. The difference between two surveys is represented in yellow to red colors, illustrating the quantified dune and beach losses.

agricultural, environmental and recreational land use; and the practical constraints and capacities of natural systems of the coastal environment. ICZM decisions and actions made today should aim to maintain or maximize flexibility to allow for future responses to the long-term impacts of climate change. Many adaptations and responses to existing coastal problems are also likely to reduce vulnerability to potential future problems associated with climate change. Such "win-win" actions should be encouraged. It is essential to establish ICZM capabilities and institutional arrangements that are workable within and relevant to local and/or national government structures, and which are consistent with local cultural norms and traditions.

Information

As the power of computers increases, so data storage and retrieval systems are becoming more widely used, and the need for and the benefits of exchanging data and information on a continuous basis are becoming more apparent. Coastal managers, whether dealing with the long-term uncertainties surrounding climate change, or making decisions on the integration of specific coastal uses and needs, are increasingly basing their decisions on analytical and scientific information. However, one of the major concerns in conducting assessments of vulnerability to sea level rise is the lack of reliable information upon which to base those assessments. In view of time and resource constraints, many assumptions may have to be made, and consequently the results of the assessments may not be reliable enough to serve as the basis for national policy.

Baseline information on coastal resources, coastal oceanography, shoreline profiles at increments of a metre or less, historical shoreline erosion rates, etc., are only some of the many types of data that are vitally important. Data collection is often expensive and difficult, so that it is necessary to identify the most relevant information required to feed into the ICZM process to assist managers and decision makers. Continuous improvements are being made in the collection and interpretation of data and information, such as through the use of satellite images and remote sensing. The sharing of databases and information would help many nations to commence the process of ICZM programme development, and to better understand their resources and the processes that govern coastal environments. This will also help to develop experience in the use of such data in the decision making process (see exhibit 4.5).

Significant untapped sources of information on coastal change and coastal processes may exist in every country. Examples include maps, charts, aerial and other photographs, and documentary, cultural and geomorphological information. Efforts that are directed towards understanding the historical evolution and management of coastal areas could help to improve the accuracy of forecasts in the future.

Education and training

Regional training, education, and technical assistance are required to prepare professional staff for the implementation of ICZM. A regional approach can help to maximize the use of scarce human and financial resources. A high priority is to "train" the trainers, who can then reach out to broader audiences. Trainers must be dedicated and committed to the long term. Specialized, multidisciplinary curricula need to be developed and transferred to interested nations in order that their professionals can acquire the broad knowledge base and the "integrating" skills necessary to deal with ICZM analyses and day-to-day operations.

Education efforts related to coastal issues should be directed towards a broad-based audience, including elected officials, ministers, regional and local policy makers, user groups, as well as the public. Such efforts will help to build the constituency support that is essential for the success of ICZM programmes over the long term.

Research, monitoring and evaluation

The wide ranges of uncertainty in the human and natural variables that will affect ICZM emphasize the need for national research and monitoring on an ongoing basis. The quality of coastal assessment and monitoring can be significantly improved if national research efforts are supported and strengthened. The results of scientific research and information from monitoring activities need to be integrated into policy development, planning, and decision making throughout the ICZM process.

Funding

The financing of ICZM programmes is one of the greatest challenges facing coastal nations. A wide range of options for obtaining national funds (such as charges, licences and permit fees) could be considered in addition to international sources. Developing and proposing a "bundle" of sources of finance, i.e. "spreading the burden", is more likely to achieve support from the national political process than dependence solely on direct government appropriations, or from international, multilateral or bilateral assistance.

To the extent possible, direct users/beneficiaries should pay a substantial proportion of the costs they impose on the coastal system. To the extent that virtually all stakeholders in a coastal area benefit from the management of common property resources, some portion of the costs should logically be borne by the general public. More efficient use could be made of the funds available for ICZM by developing an integrated budget for all, or at least the major, agencies involved in ICZM for any management area.

Exhibit 4.4 Suggested schedule for future activities

1994-1995

- Support the recommendations of the Global Conference on the Sustainable Development of Small Island Developing States, particularly those that relate to the measures needed to deal with climate change, including sea level rise, natural hazards, and the call for the development of integrated coastal zone management.
- Ensure the important reports, findings, and recommendations from WCC'93 are taken into consideration in the development of the IPCC Second Assessment Report.
- Undertake a survey of institutions that collect and hold data and information that can be used by coastal states, individually or collectively, to improve their existing databases for ICZM/climate change-related issues. Include data availability (data sets, costs, etc.).
- Begin development of a master curriculum for training CZM managers and their staffs in universities, in regional centres of excellence and in host countries.
- Countries sponsoring country studies under the Climate Change Convention are encouraged to include criteria that call for coastal states to conduct vulnerability assessments and adaptation responses (including ICZM), and to share information that may be used to continue to improve, among others, the global vulnerability index study supported by the IPCC.

1995

- Use the UN Conference on Land-based Sources of Marine Pollution to develop and discuss further a framework for analysis for ICZM.

1995-1996

- Use the review of Chapter 17 on oceans of Agenda 21, conducted by the UN Commission on Sustainable Development as a major milestone in evaluating the progress in implementing the WCC'93 Conference Statement, and foster by this conference the actions needed to reach the objective that coastal nations with vulnerable coastal zones should have introduced ICZM programmes by the year 2000.

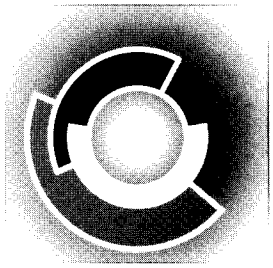
2000

- Hold a World Coast 2000 conference to assess the state of the world progress achieved over the six years since WCC'93.

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs"

Appendix I

Vulnerability Assessment Case Studies



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1 Introduction

The vulnerability of coastal areas to a predicted acceleration in sea level rise and other impacts of climate change will be exacerbated by degradation and unsustainable uses. In 1990 the IPCC called for assessments of vulnerability to climate change. Up to 1992, over 20 studies of different coastal areas had been conducted, and were analyzed in the report of the IPCC Coastal Zone Management Subgroup, *Global Climate Change and the Rising Challenge of the Sea* (IPCCCZMS 1992). The 46 studies initiated to date formed an important contribution to the WCC'93.

Sustainable development requires of the actors involved a comprehensive view, which, by definition, has a long time horizon. This is well understood in subsistence economies and societies that have survived for centuries by carefully exploiting their environmental resources. A long-term planning horizon and the associated way of thinking is typically the responsibility of governments in developing economies, but in many cases is outweighed by more pressing day-to-day problems in the decision making process.

Stimuli and catalysts can help to improve strategic thinking and planning by governments. It is acknowledged that hazardous events, such as potential climate change, can serve such a function and the Vulnerability Assessment of coastal areas to climate change offer a way of helping governments to review existing capabilities and preformances in coastal zone planning and management. The Common Methodology for Vulnerability Assessment could therefore be regarded as one possibility to improve the planning and management process by introducing long-term thinking as a step towards sustainable development (figure I.1).
This appendix considers procedures for conducting Vulnerability Assessments (VAs), in particular using the IPCC Common Methodology. The results of VA studies, including the Global Vulnerability Assessment (GVA), are reviewed, and these experiences with the application of the Common Methodology are examined in light of future VA studies and their links with ICZM. Finally, possible improvements to VA studies are suggested.

2 Vulnerability Assessments

The role of vulnerability assessment using the IPCC Common Methodology is to examine a coastal nation's ability to cope with the consequences of global climate change, including accelerated sea level rise. This includes identifying the populations and resources at risk, investigating the costs and feasibility of possible responses to adverse impacts, and examining the institutional capabilities of implementing those responses. Until a country assesses the costs and benefits of alternative responses, it has no way of knowing the possible long-term implications of climate change for the management and development of its coastal zone.

In collaboration with experts from other international bodies, the IPCC CZMS (1992) developed a seven-step "Common Methodology" for conducting Vulnerability Assessments, as shown in figures I.2.

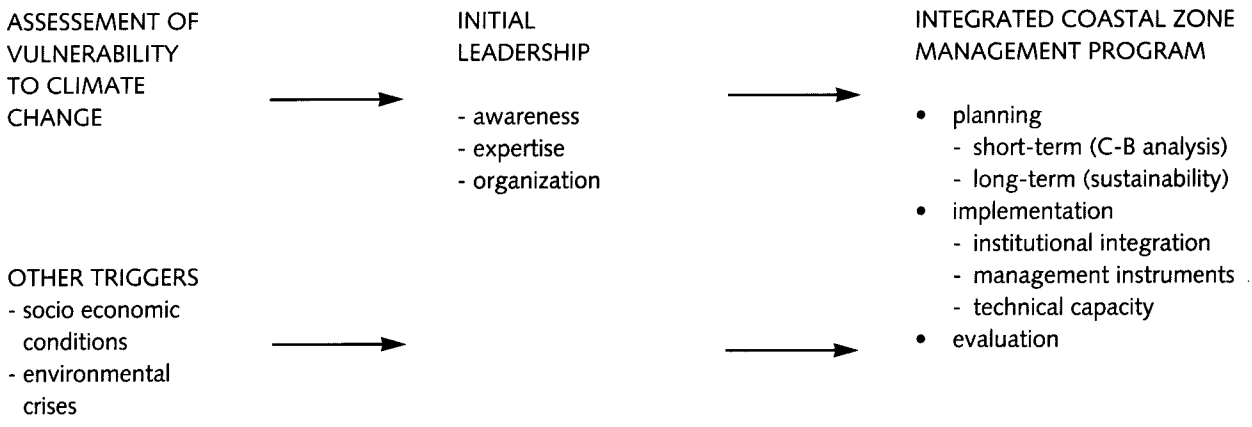


Figure I.1. Vulnerability Assessment, a possible trigger for ICZM.

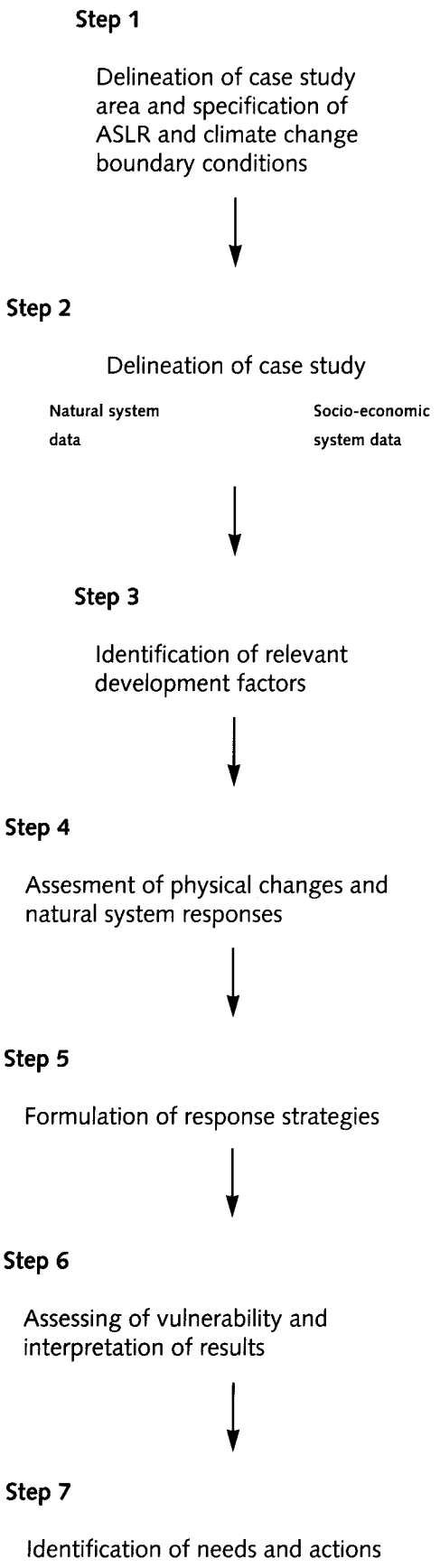


Figure I.2 The seven steps of the Common Methodology.

The *objectives* of the IPCC Common Methodology are:

- to identify and assess physical, ecological, and socio-economic vulnerabilities to accelerated sea level rise and other impacts of global climate change on coastal zones;
- to understand how development and other socio-economic factors affect vulnerability;
- to clarify how possible responses can mitigate vulnerability, and to assess their residual effects; and
- to evaluate a country's capacity for implementing a response within an ICZM framework.

The IPCC Common Methodology includes three scenario variables: global climate change, local development, and response options. It considers national or local development extrapolated 30 years from the present situation. The Common Methodology encourages coastal nations to consider a full range of response options, but at least the extreme options of retreat and total protection. In assessing vulnerability to sea level rise, the Common Methodology considers potential impacts on population, on economic, ecological, and social assets, and on agricultural production. It uses the present sea level and global rises of 0.3 and 1.0 metres by the year 2100. These two climate change scenarios approximate the low and high estimates of the IPCC 1990 Scientific Assessment.

It was envisaged that each VA analysis would be completed in less than six months. Each VA study produces a vulnerability profile for the identified factors. This structure is suitable for aggregation of the results to regional and global scales. It also helped to summarize the available VA results for the UNCED conference in Brazil (June 1992).

There are important links between VA and ICZM. The identification of adaptation needs in a VA study may serve two roles. In countries without any formal ICZM, it may act as a trigger for efforts towards ICZM. In countries more actively engaged in coastal management, climate change is an additional long-term stress whose implications must be assessed. Hence, climate change provides a focus for addressing the key issues of long-term use and sustainability of the coastal zone.

3 Review

3.1 Vulnerability case studies

In January 1994, 46 vulnerability case studies had been completed or were in progress; these are summarized in tables I.1-I.5. Although some of the studies were initiated prior to the adoption of IPCC Common Methodology in September 1991, they were all assessed in terms of the framework defined by the Common Methodology. This level of activity

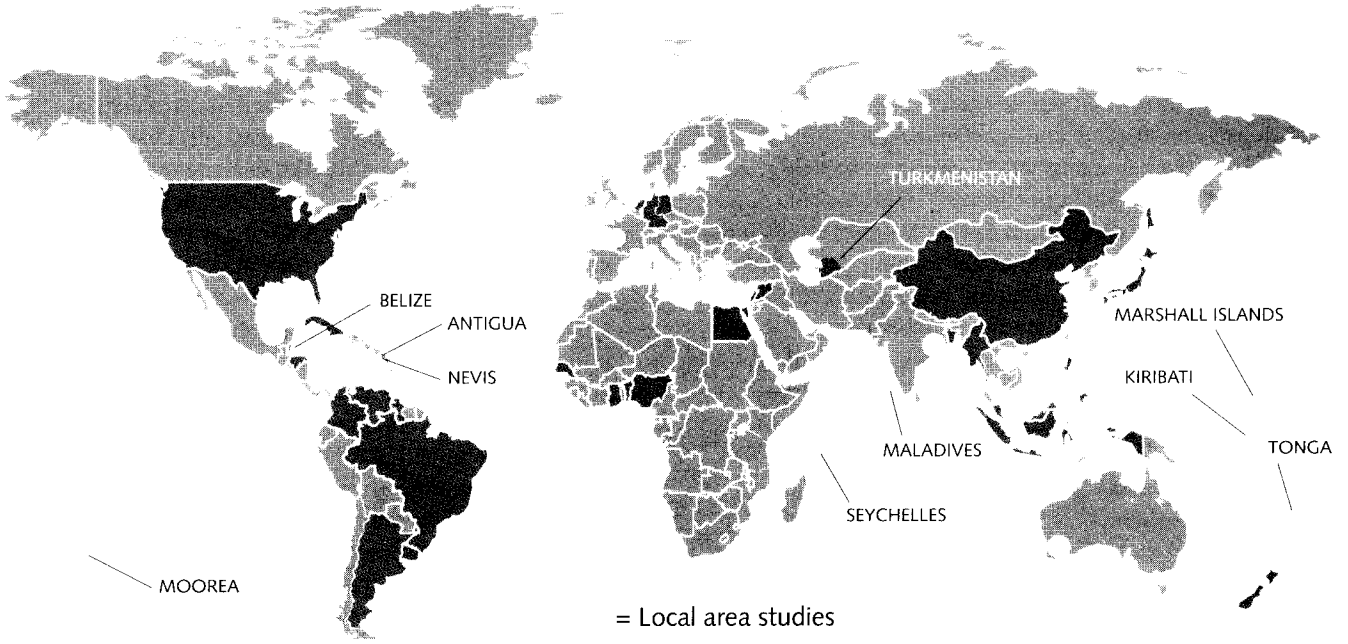


Figure I.3 VA case studies

demonstrates that there is considerable concern around the world about the potential coastal implications of climate change and accelerated sea level rise.

Of these studies, 30 provided quantitative results for at least one factor. These results have been compared and aggregated, using common scenarios, to identify patterns of vulnerability on both regional and global scales. The common scenarios are presently limited to a one metre rise in sea level in 100 years and the current pattern and level of development. The results therefore tend to overstate the implications of sea level rise, and to understate the implications of other changes in climate, and pressures and development due to socio-economic trends. This limitation reflects the fact that only eight studies completed step 3 of the Common Methodology: socio-economic scenarios for 30 years in the future.

Aggregation of case studies

The factors selected for aggregation, the definitions adopted, and comments on the difficulties encountered and the results developed are summarized in the following.

- *Population affected*
  This factor is defined as the number of people living in the risk zone, the area that, in the absence of any existing sea defence, would be subject to inundation/erosion or flooding at least once in 1000 years with a one metre rise in sea level. Both absolute and relative values were extracted; the latter expresses the former as a percentage of the population of the country or the local area. In some studies, the population affected was reported without defining the risk zone or the method of calculation. In other studies the population requiring relocation due to land loss was given. This was used as a minimum estimate of the population affected.
- *Population at risk*
  This factor is defined as the population affected by a one metre rise in sea level, multiplied by the probability of flooding. In general, this is the probability of the failure or the overtopping of the coastal protection system. The result is a statistical estimate of the numbers who will experience flooding within a certain return period. In this analysis a period of one year is considered, further referred to as annual flooding (see also the Global Vulnerability Analysis). The population at risk is aggregated for both the present state of coastal protection systems (no measures), and an additional protection option (with measures). The population at risk was evaluated in just seven studies, suggesting that the determination of this factor presents problems. Most studies did not describe existing levels of protection in terms of the frequency of overtopping of coastal defences, or information on the water level, apparently due to lack of data.

Great care is needed in estimating the frequency of flooding. For instance, in The Netherlands, 1200 people are currently at risk to annual flooding, rising to 24,000 people at risk after a one metre rise in sea level, based on the present level of protection. However, if the integrity of the dune protection is allowed to deteriorate over the next 100 years by progressive erosion, the probability of failure of the protection system would increase dramatically. Then, over 3.7 million people would be at risk. This emphasizes the high sensitivity of the "population at risk" factor to estimated frequency of flooding, and therefore the critical importance of the proper use of the defined factors.

- *Capital value at loss*
  This factor is defined as the capital value of the dry land and infrastructure that will be permanently lost by inundation or erosion due to sea level rise. This factor is aggregated as absolute and as relative figures, the latter expressed as a percentage of the national or study area GNP. For high capital value losses, the gross value may exceed the GNP, resulting in a relative figure exceeding 100%. Some studies note that they could provide only incomplete inventories of capital value at risk. It was not clear in many other case studies whether capital values at loss included infrastructure, industries, production losses, etc. This means that the estimated losses should generally be considered as minimum estimates.

- *Area of land at loss*
  This factor is defined as the area of land (both dry land and wetland) that will be permanently inundated or eroded due to a one metre rise in sea level. This factor is aggregated as an absolute and as a relative figure, expressed as a percentage of the total national or local area. Some studies defined land loss as the land subject to at least annual flooding, rather than permanent inundation, and in other studies it was not clearly stated what criteria or methods were used. (Note that the IPCC 1992 report considered the area of dry land at loss. In some countries, however, such as Senegal and Nigeria, wetland loss is large, even in terms of the national land area, and dry land loss is relatively small. Therefore, for this analysis it seems more meaningful to aggregate dry land and wetland loss). For reference, total land loss is nearly 170,000 km^2, while total dry land loss is about 113,000 km^2, including the effects of wetland migration in the USA.

- *Wetlands at loss*
  This factor is defined as the natural areas of coastal wetlands that will be lost or dramatically changed due to a one metre rise in sea level. Wetlands are recognized to be of international ecological importance as breeding, feeding and nursing grounds for many bird species, and they serve many other important and valuable functions, depending on type and location. In some case studies the types of wetlands considered (e.g. marshes, mangroves, or intertidal areas) were not clearly defined. The estimates of land loss are sensitive to the approaches and assumptions made, but these were often incompletely stated. In addition, the potential for wetland migration (dry land to wetland conversion as sea level rises) was generally not considered. Finally, the potential impact of protection measures and development on wetland areas was not clearly elaborated. Despite these uncertainties, it is clear that coastal wetlands in most locations are highly vulnerable to sea level rise.

- *Protection and adaptation costs*
  This factor is defined as the protection and other adaptation costs required to maintain a protection status (after a one metre rise in sea level) which is equivalent or better than the present design standard of the case study area. Present price levels are assumed. To allow comparison with GNP, it is assumed that the lifetime of the protection infrastructure will be 100 years. The annual cost is then 1% of the total cost. The annual maintenance costs could be significant, but are excluded. The costs are

Exhibit I.1 Proposed vulnerability classes

Impact categories	Vulnerability classes			
	Low	Medium	High	Critical
Population affected (no./total) x 100%	<1%	1-10%	11-50%	>50%
Population at risk (no. x probability)/1000	<10	10-100	100-500	>500
Capital value at loss (total loss/GNP) x 100%	<1%	1-3%	3-10%	>10%
Land at loss (area/total area) x 100%	<3%	3-10%	10-30%	>30%
Protection/adaptation cost (total cost/GNP) x 100%	<0.05%	0.05-0.25%	0.25-1%	>1%
Wetland at loss (area/total area) x 100%	<3%	3-10%	10-30%	>30%

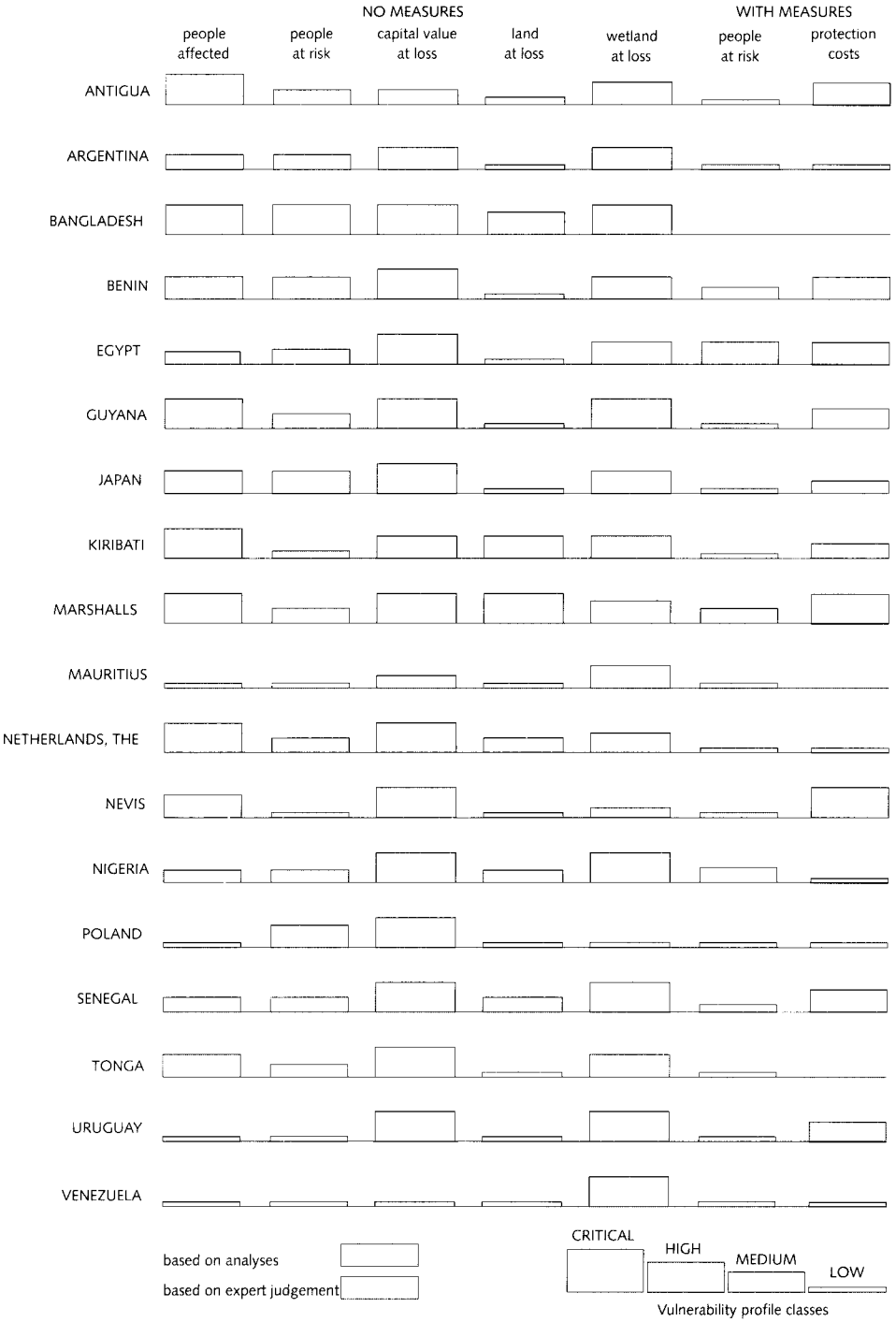


Figure I.4 Vulnerability profiles for selected countries, based on country case studies. The factors were derived from each study report or expert judgement. Only integer values are used.

expressed in absolute and relative figures. The former is given as total cost and the latter is expressed as a annual percentage of GNP.

Results

In summary, the aggregated results of the available country and local studies suggest the following minimum impacts for a one metre rise in sea level (see also Tables I.2-I.4):

- nearly 179 million people could be affected (displaced from their homes, or experience increased flooding, primarily due to storm surges; based on 24 case studies);
- about 800,000 people are at risk without measures, declining to 270,000, or a 66% reduction, with measures (based on only six case studies);
- assets with a current value of more than US $1100 billion could be lost (based on 16 studies);
- an area of dry land of 113,000 km^2 could be lost due to erosion and inundation (based on 26 studies);
- 62,000 km^2 of coastal wetlands could be lost, or dramatically changed (based on 15 studies).

Although these aggregated figures are based on a limited number of vulnerability studies, they clearly suggest that a one metre rise in sea level would have significant impacts at a global scale. Further aggregation would be useful as more studies become available in order to better understand regional and global vulnerability, including analysis of a wider range of factors.

Vulnerability profiles

Vulnerability can be expressed as a profile for a number of factors, expressed in relative terms. Here, national vulnerability profiles are presented for a one metre rise in sea level and seven impact categories as presented in figure I.4. The first five impact categories are for no adaptation (no measures), while the last two impact categories consider the implications of possible adaptation (with measures).

The boundaries of the vulnerability classes (exhibit I.1) represent a *preliminary* interpretation of the available information. Further, not all the elements required for a complete vulnerability profile are available. In these cases, an assessment is made using expert judgement after studying the case study report. This estimation approach is meaningful based on the range of the vulnerability classification.

Figure I.4 shows 18 country case studies that provided enough information to estimate a vulnerability profile. Estimated values are clearly indicated. Six countries have a *critical* vulnerability with respect to people affected by a one metre rise in sea level rise, while four countries have a high vulnerability. For capital value at loss, 13 of the 18 countries have a *critical* vulnerability. Only Venezuela has a low vulnerability and the country study notes that it provides a low estimate of capital value at loss. Considering land at loss, 12 country case studies indicate a low vulnerability, but the Marshall Islands have a *critical* vulnerability and Kiribati and Bangladesh have a high vulnerability. Coastal wetlands appear almost universally threatened, six countries have a *critical* vulnerability, and ten have a high vulnerability. Finally, the annual costs of protection structures and adaptation measures are often significant with respect to existing GNP. Two small island countries have a *critical* vulnerability: the Marshall Islands and Nevis; while five countries appear to have a high vulnerability: Antigua, Egypt, Guyana, Senegal and Uruguay. Further, most of the protection/adaptation costs presented here are for basic protection against land loss and exclude any adaptation to flooding or increasing salinity in surface and groundwater. Therefore, more complete VA studies will raise many country's adaptation costs significantly.

Importantly, the vulnerability profiles show considerable variations from country to country (figure I.4), and from region to region. This reflects that certain areas and settings are more vulnerable than others. This conclusion is widely supported by all the country studies that are available. Small islands, deltas and coastal ecosystems are particularly vulnerable.

Small islands are heavily oriented towards coastal activities and hence are physically and socio-economically vulnerable to sea level rise. At the same time their relatively small economies may make the costs of adaptation prohibitive. In global terms the population of small islands is relatively small, but a number of distinct societies and cultures are threatened with drastic changes in lifestyle, and could possibly be forced to abandon their ancestral homelands if the sea level rises. Coral atolls are particularly vulnerable.

The low-lying nature of deltas makes them physically vulnerable to sea-level rise. There are a number of densely populated deltas where sea level rise threatens large populations and adaptation will be challenging. Based on the global aggregation already described, nearly 90% of the people affected live in deltaic settings, particularly Bangladesh and China. Significant vulnerable populations live in deltaic settings elsewhere, particularly in Asia, but these are poorly quantified.

Coastal ecological systems such as coral reefs, sea grass beds and coastal wetlands, including mangroves, may decline given accelerated sea level rise. At present, only data for coastal wetlands is available from the country studies. Based on this preliminary information a significant global decline of coastal wetlands appears inevitable given accelerated sea level rise.

Other implications of the vulnerability case studies

The country studies show that global sea level rise is often not the most *critical* issue, particularly in the most vulnerable areas where long-term climate change will ultimately interact with or exacerbate existing problems and hazards. For small islands, population pressure and urbanization, coastal pollution and over-exploitation of resources are often already *critical* problems. For deltas, other impacts of climate change, such as changing rainfall and runoff in the catchment area, as

well as increased storms and storm surges could have significant impacts. A number of non-climate-related factors are also important, including water and sediment management, particularly where rivers cross administrative boundaries. Subsidence, which is a natural geological phenomenon in deltas, is often exacerbated by excessive groundwater abstraction. Near Tianjin, China, for example, subsidence is up to 5 cm/yr which will produce a local rise in sea level of one metre in only 20 years, as opposed to the century or more expected from global changes.

In many parts of the world, coastal wetlands are already being lost as a direct result of land reclamation, and may not survive to be inundated by sea level rise. In the longer term, land use planning will have important implications for the survival of coastal wetlands. The protection of adjoining dry land prevents the possibility of wetland migration as sea level rises. Therefore, rather than a decline in wetland area, a total loss will occur.

The urgency of the short-term problems described above shows that effective adaptation to climate change, including maintaining options for future generations, requires integrated coastal zone management at all time scales. Solving immediate coastal problems will make coastal systems more resilient in the longer term, when climate change and accelerated sea level rise may become important issues.

3.2 Global Vulnerability Analysis (GVA)

One of the tasks of the IPCC is to provide worldwide estimates of the socio-economic and ecological implications of accelerated sea level rise (ASLR). As part of this effort, a Global Vulnerability Assessment (GVA) was conducted using the Common Methodology. Therefore, the results are comparable with the local and national studies described above. When combined, these exercises can be seen as a combination of a "bottom-up" approach from the case studies, to validate the GVA, and a "top-down" approach from the GVA. A meaningful and validated GVA is useful to provide a regional reference for the smaller-scale case studies.

Individual factors

The GVA is presently limited to national estimates of the effects of sea level rise on four coastal zone impact categories:

- population affected and at risk;
- protection costs: (a) basic protection costs to maintain existing conditions, and (b) (higher) revised protection costs, which will also reduce the risk of flooding to acceptable levels.
- wetlands at loss;
- rice production subject to change (for South, Southeast and East Asia only);

These impacts describe key factors concerning people, land use, the environment and the economy. It should be stressed that the global data sets are limited, and they require a number of assumptions before they can be utilized. The results of the GVA are best used at the regional or aggregated scales, since individual country estimates could contain large errors. The findings of the GVA can be summarized as follows.

Coastal storm surges

- At present, 200-250 million people are estimated to live below the maximum storm surge level. About 50 million people experience flooding annually, based on estimates of existing protection levels.
- A one metre rise in sea level would increase the population subject to annual flooding to about 60 million. If population growth to the year 2020 is considered, this number may increase substantially to about 100 million. Therefore, population growth over 30 years will increase the population at risk more than a one metre rise in sea level over 100 years.
- Because of regional differences in regimes of storm surge events, the increase of flooding risk due to sea level rise is greater than average for Asia, especially the Indian Ocean coast of Asia, the South Mediterranean coast, the African coast, and the coasts of the Caribbean and other small islands states.
- Increases in the frequency and severity of storms would further increase the population subject to annual flooding.
- The global costs for basic protection works are estimated at $1000 billion. In some regions the costs would constitute a substantial part of current GNP, especially for small island states in the Indian and Pacific Oceans.
- In terms of the number of people protected from flooding, and protection costs as a proportion of GNP, it appears that South and Southeast Asia, the Pacific coast of South America and the southern Mediterranean will be easier and cheaper to protect than many other regions.

Coastal wetlands

- All over the world, coastal wetlands are presently being lost at an increasingly rapid rate, often exceeding 1% per year. The increase in the rate of this loss is closely connected with human activities such as groundwater abstraction (leading to enhanced subsidence), shoreline protection, the removal of sediment and development activities, such as land reclamation and aquaculture development. Based on current trends, nearly 40,000 km2 (or over 10%) of the world's wetlands could be lost by the year 2020.
- ASLR will increase the rate of net coastal wetland loss. In combination with human activities, a one metre ASLR over the next century would threaten over half of the world's (up to 170,000 km^2) coastal wetlands of international importance. In some areas, valuable coastal wetlands could be virtually eliminated, because their ability to migrate inland is limited both by human activity and the long time scales required for migration.
- If additional protection to the year 2020 is considered, the estimated losses are increased by 10,000 km^2. This is a

Exhibit I.2 Five thousand and twenty years: from problem recognition to planning institutional arrangements for ICZM in Egypt

Five thousand years ago, two major physical conditions were instrumental in the settlement and development of agriculture in the Nile delta: a sharp decline in the previously rapid rate of sea level rise after the Ice Age, and the abundance of fertile Nile sediments. Thus the Nile delta emerged as a centre of unprecedented cultural development, the monuments to which were sculpted in solid stone, designed to withstand eternity.

Today, both critical conditions have changed as a result of population growth and economic development. Sediments are no longer deposited at the coast, and the rate of sea level rise is increasing, threatening the entire coastal area and human development itself. Moreover, the demand for land in the Lower Nile Delta is increasing for agriculture, housing, and other human development needs.

In the early 1970s, it was realized that the serious erosion of the Nile delta coast observed in previous years could have a structural origin, possibly associated with the construction of the Aswan High Dam. The increased rate of coastal retreat at several locations on the delta was brought to the attention of the national authorities by the inhabitants and local authorities. In the mid-1970s the international scientific community assisted in a six-year (Egyptian-UNESCO) project to determine the causes of and solutions to the problem of accelerated coastal erosion. Other problems, such as the pollution of marine and coastal waters, were identified in the 1970s and early 1980s.

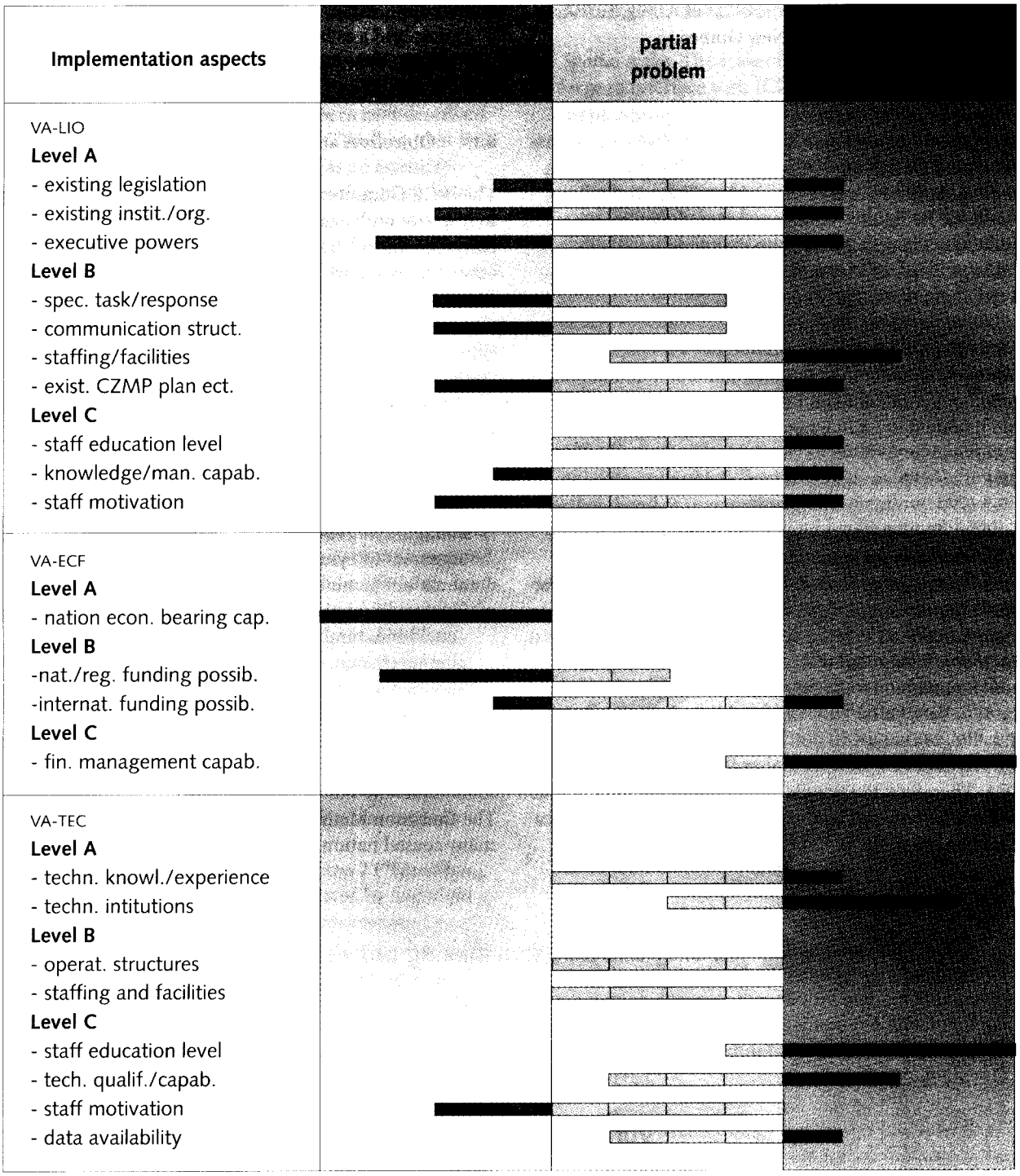
An historic change in the nature of planning in Egypt is now taking place. It is essential that the side effects of all individual developments are integrated into the planning process itself. The problem is how to do this, and to determine how to change the nature of planning in order to preserve what is good, and to add what is lacking. Vulnerability assessments have indicated two major areas of concern: the need for coordination and for information. Information technology can provide the necessary tools, but those tools can only work when they are used effectively and are embedded in well coordinated planning and implementation procedures.

A decade later the first assessment of the impacts of climate change, such as accelerated sea level rise along the Mediterranean coast, was prepared for the Egyptian government, funded by the Commission of the EC (CEC). This impact study formed the basis for the IPCC Vulnerability Assessment (VA) of the entire Egyptian coast, with special reference to the Nile delta, following the Common Methodology. This analysis revealed several types and degrees of vulnerability, one of which is the implementation of solutions identified through ICZM. The Egyptian VA team identified several constraints on the implementation options (see table), ranging from "serious" problems with basic requirements (A); operational aspects (B); and "minor" problems related to effectiveness (C). The analysis also identified the most promising opportunities for strengthening institutional capabilities in the field of ICZM.

As the next step in the implementation of ICZM in Egypt, a seminar on integrated planning will be held for a broad audience ranging from high-level officials to coastal users at the community level. This could stimulate the establishment of a high-level Egyptian panel on ICZM, with several subgroups reflecting user functions linked to inputs from various disciplines.

The establishment of a national capability for ICZM was one of UNCED's main recommendations, and this has been reflected in Egypt's recent (January 1994) Environmental Law. ICZM will take into account both short-term (e.g. pollution) and long-term (global climate change) aspects in the identification of integrated solutions to coastal problems.

Exhibit I.2 Five thousand and twenty years: from problem recognition to planning institutional arrangements for ICZM in Egypt



VA = Vulnerability Assessment
LIO = Legislative institutional organization
ECF = Economical financial
TEC = Technical

Level A: constraints in basic institutions and requirements
Level B : constraints in operational and implementation aspects
Level C: constraints in quality and effectiveness

result of increased dry land protection and hence the reduced possibility for wetland migration.
- Losses of coastal wetland of international importance are expected to be higher than average for the USA, the Mediterranean Sea, the Atlantic coast of Africa, East Asia and Australasia, and Papua-New Guinea.

Rice production
- Approximately 85% of the world's rice is produced in South, Southeast and East Asia; about 10% of this in areas that are estimated to be vulnerable to ASLR, threatening the food supplies of more than 200 million people. Less favourable hydraulic conditions may reduce rice production yields if no adaptive measures are taken.
- The large deltas of Vietnam, Bangladesh and Myanmar (Burma) are particularly vulnerable.

Comparison with country studies
A comparison of the country studies and the GVA was conducted at a regional scale, or using country aggregation (figure I.4 and table 2.2 in Chapter 2). This reduces the inherent errors in the GVA at the single country scale. For the population affected, wetlands at loss, and basic protection costs, the GVA produces useful estimates at the regional and global scales. Further, the revised protection costs appear to define a lower limit for realistic adaptation costs. No comparison for changes in rice production was possible. The GVA definitions must always be considered. For instance, the GVA only considers flooding due to storm surges. In contrast, some case studies also considered increased flooding due to sea level rise resulting from other causes: in Japan, increased tsunamis; in Bangladesh, higher river levels due to sea level rise and climate change. In both cases the populations affected were about five times higher than those predicted by the GVA. Therefore, the population at risk of flooding due to sea level rise determined by the GVA should be regarded as a minimum estimate.

Given the continued interest of the IPCC and others in VA and ICZM, it is important to evaluate the Common Methodology. This section reviews the objectives and limitations of the Common Methodology, and experiences with its application.

4 Evaluation

4.1 Objectives and limitations

The IPCC Common Methodology initiated from an attempt to improve understanding of the socio-economic consequences of climate change, with more limited interest i other changes in the coastal zone. It therefore represents a first step to examine the possible need for ICZM in light of climate change. Apart from climate change, other kinds of triggers for ICZM, such as demographic changes, are only crudely examined. The limitations of the Common Methodology are as follows:

- It is not designed for developing policy, but rather to sho the need for policy.
- Timing is a key issue; the mismatch between climate change scenarios (100 years) and socio-economic scenarios (30 years) reflects the uncertainty in applying socio-economic scenarios beyond 30 years.
- To simplify analysis, the Common Methodology does no consider natural controls on coastal evolution other than climate change.
- It does not consider progressive adaptation at the local scale, such as the raising of dikes.

4.2 Experiences

The Common Methodology has focused the attention of many coastal nations on climate change and has contributed

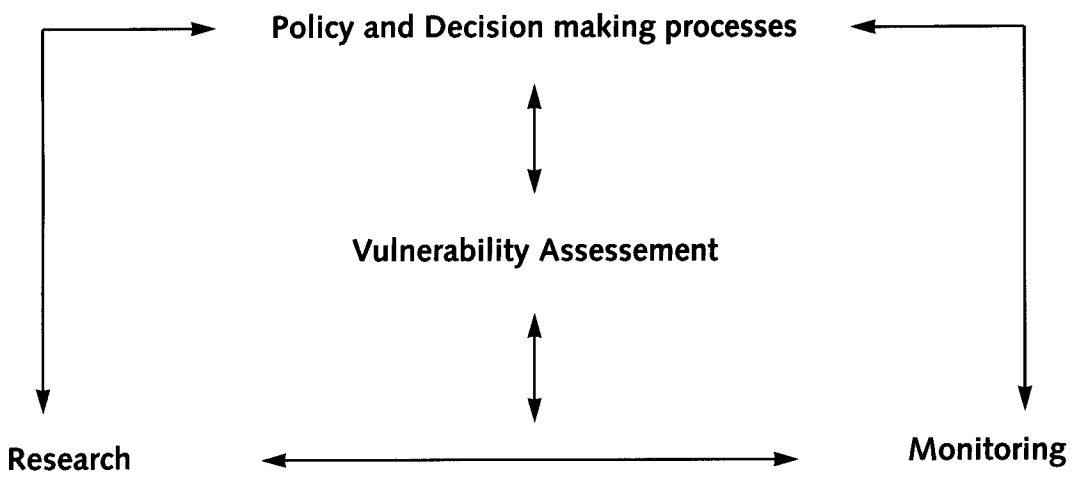


Figure I.5 VA: A potential link between research and monitoring, and policy and decision making process

to long-term thinking about the coastal zone. It has helped to highlight the interrelationships between the long-term impacts of climate change and existing, short-term coastal zone problems. In some countries this has clearly contributed to greater efforts to develop and improve ICZM. Importantly, the Common Methodology was conceived as a beginning rather than an end: it initiates an awareness of the problems associated with sea level rise and climate change in general, and stimulates efforts towards ICZM. Experiences described at the preparatory workshops for the WCC'93 show that the IPCC Vulnerability Assessment is viewed as an essential component in linking research and monitoring to decision making (figure I.5).

However, a number of criticisms and problems have been raised by the Common Methodology:

- *Interpretation.* To some, it provides insufficient guidance for the application of the seven-step procedure; whereas to others it is too rigid in the application of the steps. From a local perspective, both criticisms are valid, and reflect the diverse conditions and expectations around the world and inevitably challenge any "common approach".

- *Data availability.* The data requirements and ease of data availability appear to have been seriously underestimated. However, this has helped to identify the *critical* data needs for VA, and ultimately ICZM, at local, national, regional and even global scales. It also shows that ICZM plans often have to be formulated with limited knowledge, at least in their initial stages. Most studies took longer than expected, and are often incomplete. For instance, most studies failed to consider all three impact zones: land loss due to erosion; land loss due to inundation; and land prone to flooding. Further, the significant efforts required to identify impacts means that less effort was made to interpret the results.
- *Institutional resistance.* In particular, Step 7 ("Identifying future needs and actions") was completed by few of the studies. "Constraints related to implementation feasibility", an issue that lies at the heart of a vulnerability analysis, was not considered in most studies. In some cases, this may reflect institutional resistance in order to avoid being seen as criticizing national governments.

- *Market evaluation assessment.* Market evaluation assessment frameworks have proved inappropriate in many subsistence economies or traditional land tenure systems, and they fail to describe many important non-market values. This raises the reasonable concern that market values will dominate the decision making process over other less easily assessed values. This should be avoided and both vulnerability assessments and more comprehensive efforts towards ICZM should be careful to properly consider non-market values. Further, analyses of the vulnerability of coastal systems may fail to identify the physical and socio-economic resilience of these systems. Increasing resilience is one general adaptation to climate change.

- *Timescales.* The conflicting timescales of development (30-year scenarios) and sea level rise (100 year scenarios) prevents the application of cost-benefit analysis techniques. Establishing a common time frame, as in the East Anglian case study, provides one solution.

- *Spatial scales.* The scale of most VA studies may be too large to interface with ICZM planning efforts. The East Anglian case study, which contained 113 flood compartments, illustrates this problem. At a regional level, protection was always the best response option, but retreat is the best response in 17% of the flood compartments even for a global sea level rise of only 10 cm by 2050. This shows that the scale of study is highly significant and, in practice, a variety of responses to climate change are best employed within a national or regional coastal zone. Better specification of appropriate geographic limits in step 1, plus the application of tools such as a Geographical Information System (GIS) may help future vulnerability analyses to overcome these difficulties.

- *Other impacts.* There is considerable concern about other possible impacts of climate change, particularly increased storms and changing precipitation and runoff patterns. Unfortunately, although we can construct plausible scenarios for global climate, including sea level rise, reliable regional climate changes are beyond our present capability. However, this does not preclude sensitivity analyses to examine arbitrary, but plausible changes in *critical* climate parameters. The Bangladesh case study followed this approach for precipitation. In general, such analyses can and should be included within future vulnerability analyses, and are entirely consistent with the Common Methodology as originally defined.

5 Possible Improvements

Experience from the application of the Common Methodology and related efforts suggests a number of possible improvements that should be carefully considered by IPCC and other organizations interested in VA and ICZM. In particular, the relationship between VA and ICZM needs to be considered.

The Common Methodology was always intended as a platform of concepts and a structure for thinking rather than a precise menu-driven analytical methodology, and should evolve with experience. The role of VA as a trigger for ICZM has been stressed in this report. However, the boundary between VA and ICZM is not precise and will vary with the study area characteristics. It is not always essential to reach step 7 to trigger further efforts towards ICZM. Further, ICZM will consider the questions raised by the seven steps of the Common Methodology in considerably more detail, and more than once, as an ICZM programme evolves. Therefore,

the existing Common Methodology continues to have merit as a "quick and dirty" approach, as long as its role as a trigger for further action is understood. If time and funds are limited, all seven steps do not need to be completed; an analysis consisting of steps 1, 2, 4 and 5 can serve as a useful and preliminary phase of a VA.

Such flexibility of application could be seen within a broader common framework for vulnerability analysis. A call for such a common framework was made at the Tsukuba IPCC Eastern Hemisphere Workshop. One extension of the Common Methodology could be based on "agents of change" (factors) that affect coastal areas, perhaps classified as: (i) existing natural processes such as shore erosion and accretion; (ii) direct and indirect demands on coastal resources; and (iii) climate change factors such as sea level rise and storms. This classification embraces some ideas on a decision support approach that is currently being developed in Australia.

Under a common framework, the existing Common Methodology could evolve into a number of approaches to suit all perceived needs. As the procedures embrace a larger number of factors, so there will be a move from simple VA towards ICZM. It is important to maintain common concepts that will enable the experience and results to be exchanged. This is one of the strengths of the Common Methodology, and a common framework should aim to maintain as much as commonality as is practical.

6 Conclusions

The VA case studies, supported by the GVA, demonstrate that a one metre rise in sea level would have significant impacts at a global scale. Although they may be poorly quantified, other impacts of climate change could be equally important in coastal areas. Moreover, many coastal areas are already experiencing significant non-climate-related problems, many of which are may be related to human activity. Given that coastal populations will continue to increase, these non-climate-related problems are also likely to increase. In the long-term, climate change impacts may exacerbate many of these problems. This shows that planning for climate change and other long-term problems should not be separated from planning to resolve short-term problems. Climate change should be integrated into the planning and management of coastal zones.

Table I.1 Status of case studies with respect to the Common Methodology

	steps 1	2	3	4	5	6	7
SMALL ISLANDS							
Antigua	X	X	O	X	X:qt	X	X
Australia Cocos Islands	X	X	O	ql	ql	ql	ql
Kiribati	X	X	X	X	X	X	X
Maldives	ql	ql	ql	ql	ql	ql	ql
Marshall Islands	X	X	X	X	X	X	X
Mauritius	X	X	O	X	O	O	O
Moorea	X	X	O	X	O	O	O
Nevis	X	X	O	X	X:qt	X	X
Seychelles	X	P	O	ql	O	O	O
Tonga Tongatapu Is	X	X	O	X	ql	O	O
CONTINENTAL SHORES							
Argentina	X	X	O	Er+In	X	P	P
Australia Geographe Bay	X	X	O	ql	Pr:qt	O	O
Belize	X	X	O	P	O	O	O
Benin	X	X	O	Er+In	Pr:qt	P	P
Brazil	X	P	O	O	O	O	O
Cuba	X	P	O	O	O	O	O
England and Wales East Anglia*	X	X	O	X	X	X	O
England and Wales South Coast*	X	X	O	O	O	O	O
France Rochefort	X	X	O	X	Pr:qt	O	O
Germany	X	P	O	P	P	O	O
Ghana	X	P	O	ql	O	O	O
Guyana	X	X	X	X	Pr:qt	X	P
India Orissa	X	X	O	X	Pr+Re	O	O
Japan	X	X	O	X	X	O	O
Japan Tokyo	X	X	O	X	ql	O	O
Malaysia	X	X	O	ql	ql	ql	O
Mexico Rio Logartos	X	X	O	X	ql	O	O
Nicaragua	X	X	O	O	O	O	O
Nigeria	X	X	O	Er+In	X	X	X
Peru	X	X	O	ql	O	O	O
Poland	X	X	X	X	X	X	X
Senegal	X	X	O	Er+In	X	X	X
Turkmenistan	X	P	O	O	O	O	O
Uruguay	X	X	O	Er+In	X	X	X
USA	X	P	O	Er+In	Pr	P	O
Venezuela	X	X	O	Er+In	X	X	X
DELTIAC AREAS							
Bangladesh	X	X	X	X	P	P	P
China	X	P	O	X	ql	ql	O
China Bohai Bay	X	X	O	X	Ac+Pr	O	O
China Huanghe Delta	X	X	O	X	Ac+Pr	O	O
China Laizhou	X	X	O	X	Ac+Pr	O	O
Egypt	X	X	X	X	X	X	X
India West Bengal	X	X	O	X	Pr+Re	O	O
Netherlands, the	X	X	X	X	X	X	X
Nigeria	X	X	O	Er+In	X	X	X
Vietnam Red River	P	P	O	O	O	O	
TOTAL (per step)	**46**	**46**	**8**	**40**	**34**	**22**	**18**

LEGEND:

X	Fully accomplished
P	Partially available at this stage
O	Not accomplished
ql	Qualitative description given
qt	Quantitative estimate made
Ac	Accommodation response strategy analyzed
Pr	Protection response strategy analyzed
Re	Retreat response strategy analyzed
Er	Coastal erosion impacts studied
In	Inundation impacts studied

Table I.2 Aggregated results of case studies (local area studies only, no measures) January 1994

	People affected		People at Risk	Capital value at Loss		Land at Loss		Wetland at Loss
	*People * 1000*	*% Total*	*People*	*(million US$)*	*%GNP*	*km²*	*%*	*Total Km²*
Australia (Geographe Bay)	44	-	-	-	-	-	-	-
Australia (Cocos Islands)	0.6	100	-	-	-	-	-	-
China[1] (North China Coastal Plain)	n.a.	n.a.	520000	12000	95	12030	25	-
England and Wales (East Anglia)	>54	-	-	2000	-	-	-	-
England and Wales (South Coast)	96	-	-	5500	-	-	-	-
France (Rochefort sur Mer)	-	-	-	-	-	5	1.2	-
India (Orissa and West Bengal)	737	1	-	500	6	4850	-	3250
Mexico (Rio Lagartos, Yucatan)	3	65	-	-	-	9	1.8	-
TOTAL	935		520,000	20,000		16,894		3,250

Table I.3 Aggregated results of case studies (no measures) January 1994

	People Affected		People At Risk	Capital Value At Loss		Land at Loss		Wetland at Loss
	*#People * 1000*	*%Total*	*#People*	*Mil US$*	*%GNP*	*km²*	*%Total*	*km²*
COUNTRY STUDIES								
Antigua	38	50	1900	-	-	5	1.0	3
Argentina	-	-	-	5600[3]	6	3400	0.1	1100
Bangladesh	71000	60	-	-	-	25000	17.5	5800
Belize	70	35	-	-	-	1938	8.4	-
Benin	1350	25	-	126	12	230	0.2	85
China	72000	7	-	-	-	35000	-	-
Egypt	4700	9	30000[5]	59272	204	5800	1.0	-
Guyana	600	80	60000	4000	1115	2400	1.1	500
Japan	15400	15	-	807000	72	8900	2.4	-
Kiribati	9	100	-	2	8	4	12.5	-
Malaysia	-	-	-	-	-	7000	2.1	6,000
Marshall I.	40[1]	100	20000	175	324	9	80	-
Mauritius	6	1	-	-	-	10	0.5	-
Netherlands	10000	67	24000	186000	69	2165	5.9	642
Nigeria	3200[2]	4	-	18000[3]	52	18600	2.0	16000
Poland	235	1	196400	24000	24	1700	0.5	36
Senegal	180[2]	2	-	700	14	6100	3.1	6000
St Kitts-Nevis	-	-	-	-	-	1	1.4	1
Tonga	30	47	-	-	-	7	2.9	-
Uruguay	13[2]	<1	-	1800[3]	26	96	0.1	23
U.S.A.	-	-	-	-	-	28400[4]	0.3	17000
Venezuela	62[2]	<1	-	350[3]	1	5700	0.6	5600
SUB-TOTAL	**177,948**		**332,300**	**1,107,025**		**152,465**		**58,790**
TOTAL (LOCAL STUDIES) (from Table I.2)	**935**		**520,000**	**20,000**		**16,894**		**3,250**
TOTAL	**178,883**		**852,300**	**1,127,025**		**169,359**		**62,040**

1. National estimate.
2. Minimum estimates: number reflects estimated people displaced.
3. Minimum estimates: capital value at loss does not include ports.
4. 16,900 km2 of dry land is lost, but about 5,500 km2 are converted to coastal wetlands.
5. The population at risk increases with measures from 30,000 to 120,000 in Egypt, reflecting that adaptation allows people to remain in areas that would otherwise have to be totally abandoned due to inundation without measures.

Table I.4 Results of case studies (with measures) January 1994

	People At Risk	Protection/Adaptation Costs, 100 Years	Protection/Adaptation Costs/Year
	# People	Mil US$	% GNP
Antigua	7700	76	0.32
Argentina	-	3300	0.04
Bangladesh	-	>1,000[2]	>0.06
Benin	-	>430	>0.41
Egypt[1]	120000	13,133	0.45
Guyana	-	200	0.56
Japan	-	>159,000	0.12
Kiribati	-	3	0.10
Marshall I.	2000	>380	>7.04
Netherlands	1200	12286	0.05
Nigeria	-	1800	0.05
Poland	9900	1500	0.02
St Kitts-Nevis	-	53	2.65
Senegal	-	2200	0.40
Uruguay	-	3800	0.46
U.S.A	-	143000/305000[3]	0.03/0.06
Venezuela	-	2600	0.04
SUB-TOTAL	140,800	344,761/506,761[3]	
LOCAL AREA STUDIES			
China (North China Coastal Plain)	130000	500	0.04
France (Rochefort sur Mer)	-	135	-
India (Orissa and West Bengal)	-	310	0.04
Mexico (Rio Lagartos, Yucatan)	-	6	-
TOTAL	270,800	345,712/507,712[3]	

1. Results for Egypt include development scenarios.
2. Only gives protection against a 1 in 20 year event, and no other adaptation.
3. Range of possible response costs given for the USA.

Table I.5 Inventory of case studies

Country	Study type	Remarks
Antigua	Country study	Excludes Barbuda Island
Argentina	Country study	
Australia	Local study areas	Geographe Bay and the Cocos Islands
Bangladesh	Country study	
Belize	Country study	Preliminary results
Benin	Country study	
Brazil	Country study	Largely qualitative study
China	Country study	Preliminary estimates, plus case studies
Cuba	Country study	Preliminary results
Egypt	Country study	Emphasis on the Nile delta
England and Wales	Local study areas	East Anglia and South Coast
France	Local study area	Rochefort sûr Mer
Germany	Country study	Preliminary results
Ghana	Country study	Qualitative study
Guyana	Country study	
India	Local study area	Orissa and West Bengal
Japan	Country study	Emphasis on Tokyo Bay area
Kiribati	Country study	Betio Island
Malaysia	Country study	Largely qualitative study
Maldives	Country study	Qualitative study
Marshall Islands	Country study	Majuro Atoll
Mexico	Local study area	Rio Lagartos, Yucatan
Moorea Island	Country study	Qualitative study
Netherlands	Country study	
Nicaragua	Country study	Preliminary results
Nigeria	Country study	
Peru	Country study	Qualitative study
Poland	Country study	
Senegal	Country study	
Seychelles	Country study	Qualitative study
St Kitts-Nevis	Country study	
Tonga	Country study	Tongatapu Island
Turkmenistan	Country study	Qualitative study (Caspian Sea)
USA	Country study	Land los and protection costs
Uruguay	Country study	
Venezuela	Country study	
Vietnam	Local study area	Red River delta (preliminary results)
Global Vulnerability Assessment (GVA)	Global study	Population at Risk Wetlands at Loss Change in rice production Protection costs

Appendix II

Coastal Zone Management Case Studies

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1 Introduction

To prepare for WCC'93, coastal nations conducted case studies on ICZM. These ICZM case studies, based on a questionaire (Work Document 6 of WCC '93) focused especially on a nation's institutional arrangements for the management of coastal zones and how these arrangements have evolved and developed in the context of the specific situation and setting. The results were discussed during the pre-conference workshops in New Orleans, U.S.A. and Tsukuba, Japan, and during a special preparatory expert meeting in Hat Yai, Thailand. All these preliminary efforts resulted in an analyses compiled on the basis of the material made available through the ICZM case studies. The results were published in a special WCC'93 document titled Management Arrangements for the Development and Implementation of Coastal Zone Management Programmes.

During WCC'93 a further series of ICZM case studies have been presented. Elaborating on the pre-conference preparatory activities an evaluation of all ICZM case studies is presented in this Report. The challenge is to identify the commonalities in the management arrangements by analyzing the differences in circumstances and settings. The results of this survey are discussed in Chapter 3 of this Conference Report. This Appendix gives an overview of the 23 national ICZM case studies available. The notion is that the number of studies is limited and that the information provided is restricted, taking into account the complexity of the subject. The information made available here should be seen as a first indication of the types of obstacles encountered, the progress made and the solutions applied. Nonetheless, this basic information can be of importance and may be of value to all who face the challenge of strengthening ICZM capabilities.

2 Context of the survey

The case studies on ICZM aim to complement the picture provided through the case studies on Vulnerability Assessment (VA case studies) as presented in Appendix I. The VA case studies focused on a nation's ability to cope with the coastal consequences of global climate change, including accelerated sea level rise. As discussed in Chapter 2, the Conference participants concluded that "There is an urgent need for coastal states to strengthen their capabilities for integrated coastal zone management, working towards the development of appropriate strategies and programmes by the year 2000". In chapter 3, the Conference participants concluded that "A national ICZM programme should facilitate integrated decision making through a continuous and evolutionary process for cooperation and coordination among sectors, integrating national and local interests in the management of activities concerning the environment and development" Moreover the Conference participants

Table II.1 The status of national ICZM programmes

country case studies

Country	Research/ inventory	CZM authority, linkages between departments	sectoral plans	ICZM planning	Implementation in progress	Evaluation and feedback
BANGLADESH	√		√			
BARBADOS	√	√		√		
BELIZE	√	√	√	√		
CHINA	√	√	√	√		
ECUADOR	√	√	√	√	√	√
EGYPT	√	√				
ISRAEL	√		√		√	√
NETHERLANDS	√	√	√	√	√	√
NEW ZEALAND	√	√		√	√	√
SRI LANKA	√	√	√	√	√	√
SYRIA	√	√	√	√	√	√
USA	√	√	√	√	√	√

√ = Elaborated or available

The status of national ICZM programmes

local area case studies

Country	Research/ inventory	CZM authority, linkages between departments	sectoral plans	ICZM planning	Implementation in progress	Evaluation and feedback
CHILE		√		√	√	
CROATIA	√		√		√	
TURKEY	√		√	√		√
GERMANY	√					
GREECE	√			√	√	
INDONESIA	√	√	√			
MALAYSIA	√	√		√		
MEXICO	√	√		√		
PHILIPPINES	√	√	√	√	√	√
TANZANIA	√		√	√		
THAILAND	√	√	√		√	

√ = Elaborated or available

identified one of the important elements of an ICZM programme as "legislation and/or institutional arrangements at local, national and, where applicable, regional levels, including means and/or authorities for coordination".

In the majority of the VA cases studies it was reported that planning and response mechanisms were either nonexistent or inadequate. The guiding question that emerged during the evaluation of the ICZM case studies is:

How to structure effective and efficient management arrangements for integrated coastal zone management.

Different circumstances will require different approaches to the organization of management arrangements. In preparing for WCC'93 the endeavour was to distil the commonalities in circumstances that lead to differences in management arrangements. Management arrangements are defined here as the total set of institutional arrangements and management instruments available to control the process in accomplishing of policy objectives.

As described in Chapter 3, some essential prerequisites for the development of an ICZM programme can be identified. The first of these is the need for initial leadership for the planning

Exhibit II.1 Management arrangements

Institutional arrangements or governance			Management instruments	
Organizational structure (includes government and non-governmental organizations)	Legal framework	Traditions and social norms	Structural measures	Regulatory or incentive-based measures
- organizations their mandates and capacities - linking mechanisms	- laws - standards - guidelines - international conventions	- customary laws - ownership - historical rights	- dikes - green belts - beach nourishment - land use plans	- permits - charges - subsidies - quotas

Source: WCC'93 Organizing Committee (1993c)

process. For effective ICZM, institutional responsibility must be distributed intersectorally and hierarchically, both within the government and between government and local groups. Thus, the second necessary element of ICZM is the provision of institutional arrangements. This may involve creating new institutions, but will more commonly involve improving horizontal and vertical linkages between existing ones. Third, technical capacity (both technological and human capacities) is necessary for compiling inventories in the planning phase, during the implementation of the programme and for monitoring the changes. This may include simple methods for crop rotation, field surveying or resource conservation. At the other end of the spectrum, sophisticated technologies as remote sensing, computerized databases and model simulations may be used. The final necessary element of ICZM is management instruments. These include tools ranging from command-and-control to incentive-based, all with the aim of encouraging stakeholders to comply with the ICZM plan. The development and role of these prerequisite elements will deviate with specific geographic, demographic, cultural, economic, and political conditions and settings. The following conditions and settings are considered as a basis for such grouping:

- geography: continental shores, deltas and small islands;
- demography: urban and rural societies;
- culture: modern and traditional societies;
- economy: market and subsistence economies; and
- political: consensus-based and hierarchical systems.

In the analysis, assessments were made as to which conditions and settings are most applicable to each of the 23 ICZM case studies. A discussion on the analysis is given in Chapter 3.

Synthesis

The synthesis presented here is based on the limited number of ICZM case studies as analyzed in Chapter 3. The conclusions should be considered in light of the small sample of experiences available to this stage.

- **ICZM can be initiated by local groups or national governments.**
  Among the case studies, there were differences both in the starting points for the initiation of ICZM, and in the degree of integration of institutions involved in implementing the evolutionary process. In The Netherlands, the initial call for ICZM was led by local groups concerned with localized issues, and evolved, bottom-up, towards higher administrative and political levels. Proceeding from the recognition of the problem to the development of a plan, the effort expanded to include other impacted and related sectors. Conversely, political awareness at the level of the national government may expand, top-down, to include local political, administrative and societal groups. For instance, Indonesia fits this pattern, with an ICZM effort initiated by national government, and seeking to increase the involvement of impacted local groups.

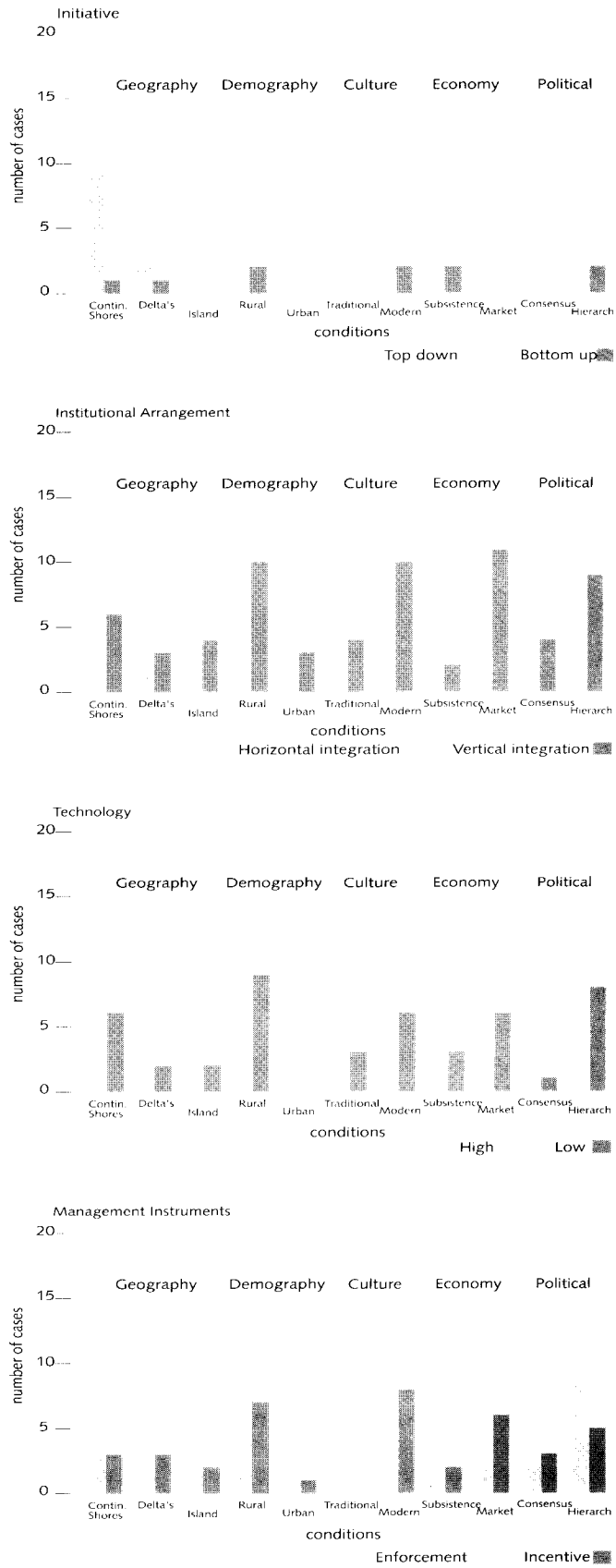


Figure II.1 Summary of the ICZM case study survey. The underlying geographic, demographic, cultural, economic and political conditions were compared with leadership initiation, institutional arrangements, technical capacity, and management instruments.

- **ICZM requires vertical and horizontal institutional integration over time.**
  ICZM typically addresses multiple issues in the coastal region from an holistic viewpoint, with interest groups in different sectors and at different societal, administrative and political levels. The management process initiated to tackle these issues involves the planning, implementation and evaluation phases, generally performed as an iterative and cyclic process. It is found that for the successful establishment of ICZM we have thus to distinguish three dimensions along which integration and iteration will take place: (i) vertically between societal, administrative and political levels; (ii) horizontally between geographic, socio-economic, administrative and political sectors; and (iii) in time between problem recognition, planning, implementation and evaluation. The dominance of either horizontal or vertical integration will vary over time.
  ICZM offers a valuable framework for the management of long-term risks associated with potential climate change. However, existing ICZM activities tend to focus on short-term problems. Additional efforts are required to encourage the inclusion of mechanisms for dealing with longer-term challenges, such as adaptation to climate change.

- **Technical capacities, encompassing hardware, practices and human skills, appear to be crucial for organizing information.**
  Resource inventories and monitoring exercises provide a basis for a framework for analysis. The availability of human resources to utilize these technologies defines the practical realm of technological choices. Underdeveloped human resources is a major obstacle to the successful management of the coastal zones of most low-income nations.

- **ICZM can be implemented through many different institutional structures.**
  While no single approach for the integrative and iterative process towards ICZM can be derived from the case studies, successful approaches generally take social, economic and political variables into account in the design of both the overall programme, and the institutional structures to implement and evaluate the programme. The analysis of the case studies suggests that an understanding of the interplay between underlying geographic, demographic, cultural, economic and political conditions can greatly assist in developing a suitable approach for a given country or area.

- **Specific lessons derived from the case study experiences include:**
  - in many cases the ICZM process can be initiated by concerns over sectoral (e.g. Thailand) or regional (e.g. The Netherlands) issues;
  - whether the institutional arrangements are such that either one or more agencies are responsible for ICZM, the critical condition is the existence of a linking mechanism (e.g. Bangladesh and Indonesia);
  - ICZM is found to be a long, iterative and cyclical process, which may be more apparent in bottom-up approaches (as in the Philippines, Malaysia and The Netherlands), but equally exists in top-down approaches (e.g. the USA);
  - ICZM is most effective when conducted in the context of national/regional planning (e.g. Sri Lanka);
  - a critical element in the implementation of institutional arrangements is the building of human capabilities through training and education (e.g. Egypt);
  - wherever two or more countries are closely related, ICZM in one country can be affected by decisions made in another country, calling for international mechanisms (e.g. the UNEP Regional Seas Programmes for the Mediterranean).

3 ICZM Case Studies

The following summaries are prepared on the basis of the available ICZM case study reports, with emphasis on the ICZM prerequisites, conditions and settings. These summaries are reviewed by the authors of each individual ICZM case study.

Bangladesh

The population and economic activities of Bangladesh are frequently affected by flooding during monsoons and by droughts during the non-monsoonal periods. The country is densely populated and the natural resource base is dwindling. Through Bangladesh flow the Ganges, Brahmaputra and Meghna rivers, which together form one of the world's largest river systems. Managing these water resources is of prime concern to the inhabitants of Bangladesh, and the water resources sector has evolved into a vast administrative area of government.

Coastal zone management in Bangladesh is incorporated in the water resources sector. The following aspects are most relevant when discussing issues on coastal zone management:

- disaster management: flood, cyclone and storm surges;
- flood control, irrigation and drainage;
- land reclamation;
- coastal protection;
- groundwater management; and
- water quality management.

For disaster management, a National Disaster Management Council has recently been developed, seeking improved and more effective disaster relief approaches in Bangladesh. An UNDP supported programme for comprehensive disaster management is currently under way, and will include disaster

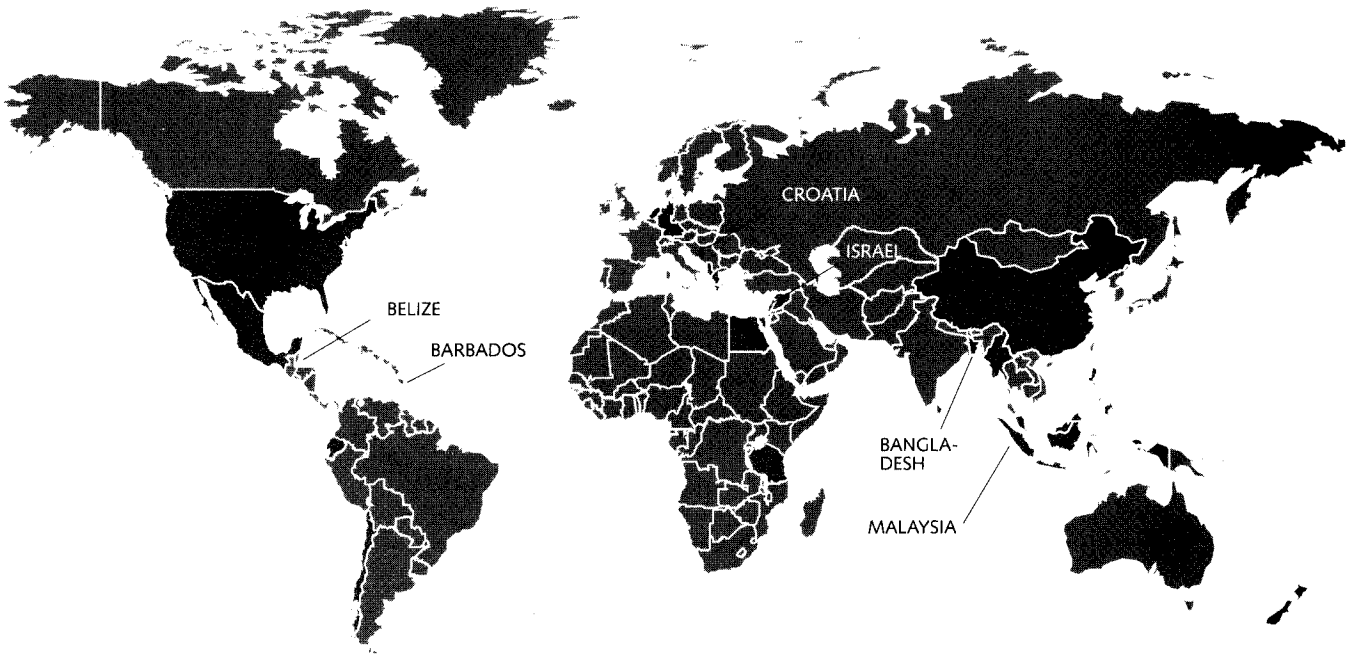
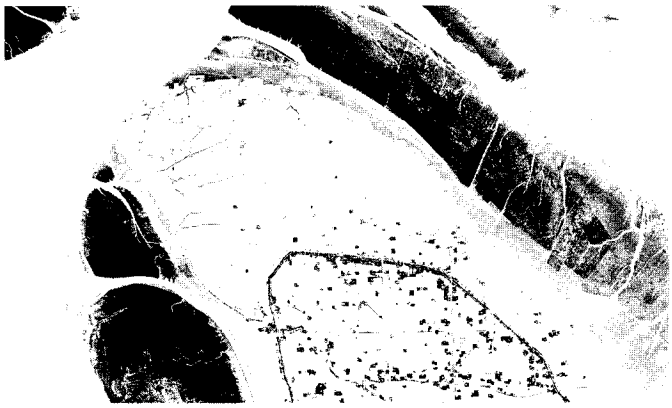


Figure II.2 IZCM case studies.



Flood prone "khas-land" in Bangladesh, farmers are moving into these vulnerable tidal flats, lying in between the mangrove belts and the empoldered farmland.

prevention and preparedness, as well as emergency responses and long-term rehabilitation.

The Ministry of Irrigation, Water Resources and Flood Control prepared a National Water Plan in 1986, in co-operation with UNDP and the World Bank. The plan, which was updated in 1991, details the allocation and use of water for various sectors. It mainly involves a database containing a composite of information. There is also a mechanism for discussions at high government level with India on cross-boundary water issues. The Local Government Engineering Department (LGED) has no nationwide programme on flood control and irrigation, although it does carry out small-scale projects at the local level.

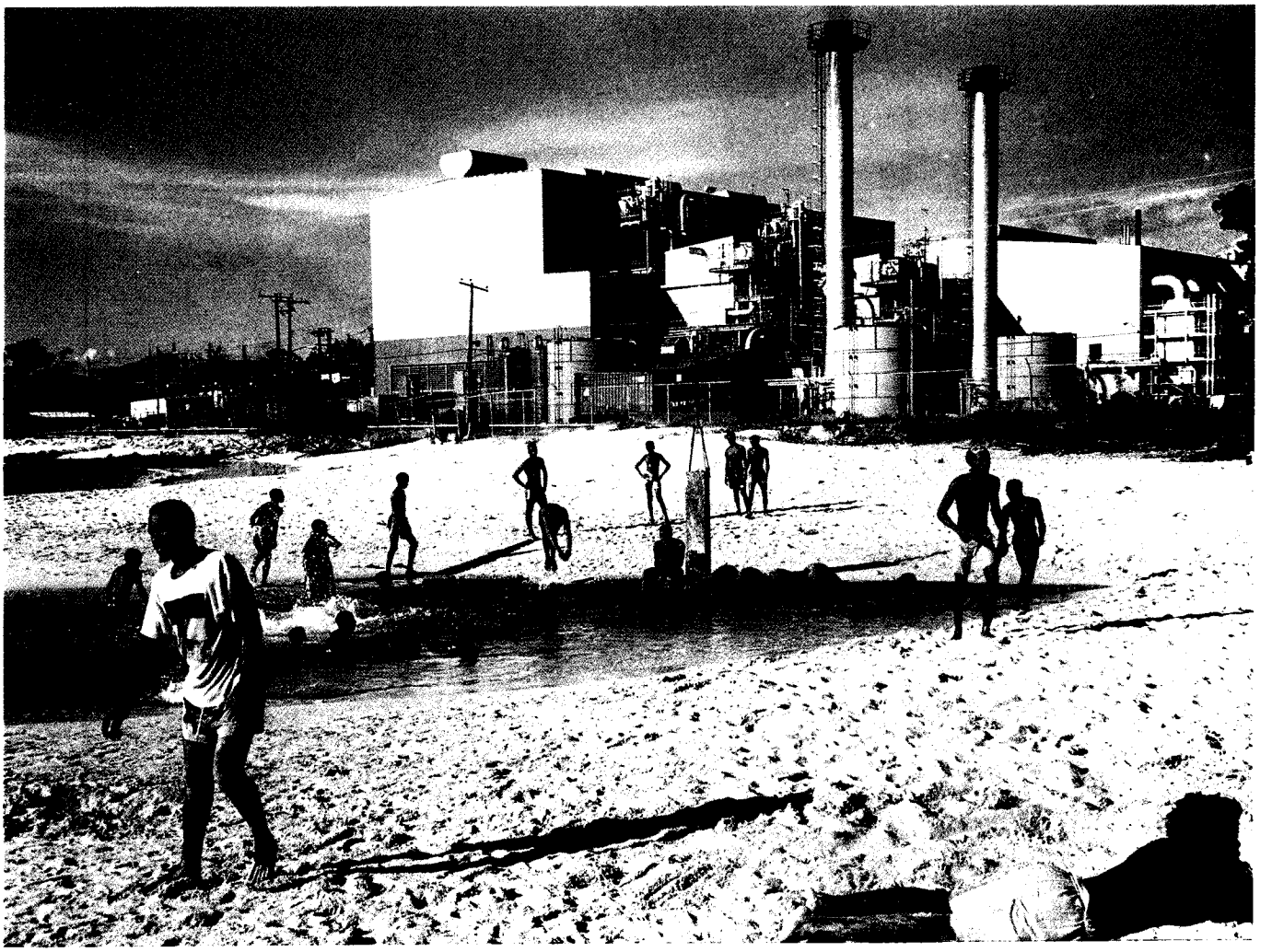
Land reclamation is still very much governed by national sedimentation and erosion processes. These processes dominate to a high degree the social and economic developments in many of the coastal and fluvial-coastal transitional areas. Many farmers in these areas become landless due to extensive erosional processes. Initially, these farmers have access to newly accreted lands (Khas lands or government lands) as long as agricultural operations are still risky. After becoming more secure, these Khas lands often become subject of complicated legal procedures in application of land allocation and reform laws, affecting the base of subsistence for the farmers occupying the marginal lands.

Coastal protection through infrastructural works belongs to the responsibility of the Ministry of Irrigation, Water Resources and Flood Control. It usually is connected to empoldering projects, providing irrigation and drainage facilities to coastal areas. Coastal protection through mangrove belts, which belongs to the tasks of the Ministry of Environment and Forestry, is of growing importance in Bangladesh. Developments are assisted by a seven-year Forest Resources Management Project.

Bangladesh is dependent on donor funding for the development of plans and programmes, although past experience has shown that this has often failed to meet the people's needs and priorities. The people are largely bypassed in the overall process of development, and their participation in the various stages of planning, monitoring and evaluation is minimal. It is realized that for appropriate and efficient development, public participation at all stages of ICZM is necessary.

Barbados

Barbados has few natural resources, so the post-colonial development of the economy has moved away from sugar-



Near shore located industrial plant in Barbados. Short term opportunities but a long term problem?

based industry towards tourism with a strong coastal bias. The resident population of Barbados is 248,000, who host some 400,000 long-stay visitors per year, on an island 32 km long and 27 km wide. Infrastructure for tourism dominates developments on the two most densely populated south and west coasts. The concentration of residential and tourism developments, port and fishing facilities, petroleum refineries and storage facilities, electricity generation and light industry on these coasts has created numerous multi-use conflicts, and generic as well as multiple problems. Since income from tourism represents about 38% of GDP, the government has strongly emphasized the need for improvements in this sector, especially in the physical and environmental conditions on the south and west coasts.

The study area incorporates roughly 45 km of the heavily developed western and southern coasts. It is a multidisciplinary study involving all sectors, whose primary objective is the sustainable management of the coastal resources of Barbados in order to meet the goals of national economic development. The need to integrate coastal zone activities developed out of an earlier feasibility and diagnostic study, which indicated a strong linkage between ecosystem degradation and human impacts throughout the coastal zone. It is essentially a government (top-down) initiative, although it does provide significant opportunities for the meaningful participation of all interest groups and stakeholders.

The project comprises two linked parallel studies; one focuses on institutional strengthening for the implementation of the CZM programme (CZMP) (including the preparation of a legislative framework and enforcement mechanisms); and the other aims to provide the multidisciplinary technical input for the full integrated CZM programme. The programme is guided and monitored by a high-level steering committee, supported by a technical review panel, combining local, regional and international skills. The initiative is jointly funded by the government of Barbados and the Inter-American Development Bank, at a cost of $7.3 million, over 3-4 years. The project is also considering effective cost recovery mechanisms for further integrated CZM and coastal restoration works, with emphasis on primary beneficiaries.

The CZM programme is currently being prepared, and a draft will be ready for national review by October 1994. A draft Coastal Zone Management Act and Marine Pollution Control Act were being considered by the national government for approval by parliament in early 1994. The government has already established a department of coastal zone management, staffed by a multidisciplinary team of professionals. Its mandate is to oversee the implementation of the CZMP and coordinate with other relevant government and non-governmental organizations.

Belize

Belize, in Central America, has a 250 km coastline on the Caribbean. The dominant coastal feature is the coral reef that extends for 250 km from the Mexican border to the Sapodilla Cays in the south. The coral reef is the longest in the Western hemisphere and is of significant importance to global biodiversity. At the moment it is undamaged, although recent developments are threatening its existence. The mangrove ecosystems are also an important coastal resource, and for similar reasons they are also threatened.

Tourism is the largest foreign exchange earner for Belize, and fisheries form the fourth largest foreign export sector. About 40% of the population of Belize lives along the coast. The realization of the impacts of development on these resources led to an International Coastal Resources Management Workshop held in the summer of 1989, one of the recommendations of which was to establish a coastal zone management unit (CZMU). This was set up in 1990, under the control of the Fisheries Department, with technical assistance from the IUCN. The CZMU prepared a planning document on the management of the coastal zone of Belize, as a result of which a major three-phase project was undertaken.

Phase 1 consisted of the collection of data from the literature, fieldwork and interviews with experts. These data were mapped and stored in a database, which formed the basis for the production of a GIS. The data cover physical parameters, habitats and resources, uses and their impacts, as well as an inventory of land ownership and uses. These maps and databases are used in planning and policy making, and are continuously updated and revised.

Phase 2 led to the preparation of special area management plans. A major focus of the plan has been the expansion of the network of marine and coastal protected areas. The CZMU has also introduced coral reef and coastal water quality monitoring programmes.

Phase 3, which is yet to be undertaken, will involve the development of an action plan that will include a zoning scheme for the coastal zone and definitions for a management framework, policies and legislation. It will also expand on the previous activities by recommending additional protected areas, introducing further monitoring mechanisms, and describing priority areas for further research.

The CZMU has identified major issues that can be separated into four categories:

Impacts of industries (tourism, agriculture, fishing, aquaculture). Tourism is the prime industry of Belize, but has led to damage of the coral reef by divers and anchors, together with the clearance of mangroves for resort development. Land is being cleared for agriculture, and the increased use of agrochemicals, especially fertilizers, is increasing sedimentation. This encourages algal growth, which is disturbing the balance and leading to the outpacing of coral growth. This situation is exacerbated by the uncontrolled disposal of untreated sewage. Over-exploitation of fish stocks is already noticeable, with declines in some of the major export species. Aquaculture, mostly situated behind the mangrove belt, is seen as a priority by the government although it is leading to the destruction of valuable resources such as mangroves and the degradation of water quality.

Management of coastal habitats and protection of biodiversity. The main threats to coastal habitats are the industries listed above. A national mangrove managementplan has recently been drawn up and is expected to protect the critical areas of this coastal habitat. Some of the islands have traditionally been used by the Belizeans for recreation and it has been recognized that these areas should be preserved.

Insufficient public awareness and participation in management. The CZMU has addressed the need for public participation by working with schoolchildren, broadcasting weekly radio programmes, hosting special events and developing special educational materials.

Weak institutional arrangements for management. To improve the ad hoc nature of management by the various departments involved, a CZM technical committee was established in 1991, including government departments, NGOs, the private sector and academics. It was also recommended that the CZMU be established as a statutory CZM authority, in order to increase its effectiveness in the implementation the CZM Action Plan.

Chile

The study area is the Biobio River basin, which covers an area of 24,260 km^2, and which remains relatively untouched by development. Water resources use planning has been the basis of land use planning accounting for social, economic and environmental issues. This was found to be a suitable starting point for the formation of a programme dealing with the development and conservation of marine and coastal resources, including identifying the carrying capacity and the needs, and to suggest the "best use" of available resources.

The EULA project was set up, financed and supported by the Council of Europe and was carried out by the government of Italy and the University of Concepción, Chile. Part of the funding was used for education and training at both the technical and graduate levels. The project began by identifying the manpower required by the relevant scientific and technical sectors, and continued with an interdisciplinary and intersectoral approach, including interactions with national, regional and local authorities, as well as private institutions.

The study concluded in March 1993 and produced a series of proposals for various management sectors such as agriculture and forestry. An important achievement was the collection of data on biological, chemical, physical and socio-economic parameters of the Biobio region. These data were subsequently compiled using mapping techniques.
One result of the project was the establishment of the EULA-Chile Centre, which now provides technical assistance in the form of Environmental Impact Assessments (EIAs). The Centre is used for the education and training of South American as well as international staff, using the EULA model developed for the Biobio region. The emphasis of the EULA project is on the analysis and development of management proposals. Although a conceptual model exists that can be used in the development of coastal policies, the concept of integrated coastal zone management is still in the future.

Elements of integrated CZM are already in place, such as personnel training and the EULA-Chile Centre, and promoting the idea of integrated CZM through conferences and seminars. As the components of integrated CZM are realized they will be incorporated into the present river basin management.

China

The 32,000 km long coastline of China -14,000 km around islands and 18,000 km on the mainland -crosses temperate, subtropical and tropical climatic zones. The 1,800 silt-laden rivers that flow to the coast play a major role in the formation and evolution of the coastal zone. The coastline faces many of the familiar problems of conflicting developments, erosion and saltwater intrusion, and industrial and domestic sewage. In particular, in the four large coastal plains (the lower Liaohe deltaic plain and the North China coastal plain in the north, the East China coastal plain in the central, and the Pearl River deltaic plain in the south) are situated some of the largest cities: Guangzhou, Shanhai and Tjanjin. These low-lying deltas are close to or even lower than high water, and hence suffer from frequent attack by storm surges and sometimes severe sea flooding. These coastal plains will be the most vulnerable to a future sea level rise of even 50 cm.

Research relating to coastal and marine resources began in the early 1980s. A comprehensive seven-year investigation by the State Oceanic Department led to the compilation of an inventory of economic, geographical, environmental resources and uses. This study subsequently provided the basic data and scientific background for the development, preservation and management of China's coastal resources. Pilot projects have been undertaken, mainly concerning the development and utilization of coastal land, including engineering projects and farming developments. The pilot projects have prompted legislation on the coastal zone.

A Coastal Zone Management Act and various coastal zone management regulations are now being drawn up, and coastal provinces are in the process of conducting research on coastal zone legislation and of formulating related laws and regulations. Of them, the Jiangsu provincial government was the first to issue a Provincial Coastal Zone Management Act in as early as 1986.
Substantial legislation exists for the protection of marine resources, and an active zoning scheme was introduced in 1989-92. This led to the establishment of over 60 marine reserves, at both national and local levels. The preparation of a national marine development plan began in 1991, which specifies in the rational development of ocean resources. The time scale of the plan is 1995-2020 and includes the coastal zone as one of its regional priorities. The plan accounts for long-term interests as well as national and local interests.

An environmental pollution monitoring system has been established to strengthen the monitoring of major estuaries, harbours and bays, areas of red tide, fishing grounds and nature reserves. In the last five years, sea level rise and storm surges have also been closely monitored. Since 1992 some local governments, such as Guangdong and Shanghai, have organized research projects on the impacts of accelerated sea level rise on their coastal areas in terms of coastal zone management.
Coastal management has tended to evolve out of traditional fisheries, the salt industry and available communication lines. Regions, provinces and municipalities are managing their marine resources effectively, although it is recognized that for the effective management of the coastal zone, existing laws and regulations will need to be amended.

Ecuador

Ecuador has a long and varied coastline, with humid tropical forest in the north and a dry arid zone in the south that receives only 250 mm rain per year. The coast is constantly subjected to vast changes due to the effects of the El Niño/Southern Oscillation (ENSO). The climate and biological productivity of the region is greatly influenced by these coastal currents. The coastal zone is home to 44% of the total population.

The coastal resources management programme of Ecuador began in 1986 with a technical cooperation agreement between the University of Rhode Island, USAID and the government of Ecuador. The aim of the collaboration was to create an integrated national programme for the management of coastal

resources, that would promote and develop the sustainable use of coastal resources through participatory and self-governing techniques. Annual operational plans allow for the regular evaluation of activities and the effectiveness of the structure.

The programme is a continuous process with local involvement in the planning phase, policy formation and evaluative feedback into the programme's activities. Management areas are chosen according to geographical rather than administrative boundaries, and economic development is scrutinized alongside the resource use and considerations of ecological criteria that support the sustainable use of natural resources. The programme has also led to the formation of a decision making audience at government level alongside local implementation.

Data collection involves organized technical information as well as traditional local knowledge. Five critical coastal areas were selected for special area management plans, as a result of the initial data and identification of the major issues. These included ecosystems, resource uses, specific environmental problems and conflicts among users, selection of priority issues, examination of the legal and institutional structure for effective development, and the creation of management options.

Awareness raising through education is an important part of the programme, and also helps to increase public acceptance of the decisions taken. These relate to the perceived value of maintaining wetlands and mangroves and other aspects of conservation of the resource base. Small-scale management activities, promoted by the coastal resources management programme, create awareness and encourage organized user-groups, thus building strong local commitment.

The selected policies and strategies, enforced by presidential decree in 1989, set out specific tasks of management and institutions responsible for those tasks. A National Commission has been established to link the relevant ministers concerned. These integrated committees were formed down to the local level and supported technically by intersectoral work groups.

The programme is implemented within the five special area management plans which are approved by the National Commission. Specific policies and projects address each key issue: mangrove management, tourism, water quality and environmental sanitation, mariculture management and artisanal fishing. Recent funding should provide for the implementation of many of the recommended actions.

Egypt

The Nile has been the undisputed central lifeline of Egypt for thousands of years. The crucial importance of fresh water as the basic natural resource for Egypt is reflected in the emphasis placed on National Freshwater Management, as expressed in terms of technical, institutional, financial and organizational capacities. This will remain so in the future.

Currently Egypt's major economic activities (agriculture, industry, trade and tourism) show a very strong departure from the traditional focus inland towards the coastal areas. This diversion will inevitably be confronted by the continued encroachment of the sea, which is manifested in the permanent processes of coastal erosion, land subsidence and saltwater intrusion. At present, massive long-term national investments in technical infrastructure for various economic sectors are in the process of being planned and implemented. Until 1989, minimal attention was paid to developing an integrated approach for coastal zone management, in the sense of a combined analysis of long-term trends in socio-economic developments and in climate change and associated accelerated sea level rise. Since 1989, however, joint pilot studies carried out by Egyptian and Dutch scientists have assisted in triggering a more comprehensive approach to coastal zone management in Egypt.

A plan has been prepared to establish a practical form of integrated coastal zone management. This plan will first compile an inventory of the current and future problems and plans related to the Egyptian coastal zone. Then, the information that will be required to evaluate and compare the various planning options will be defined. Subsequently, a survey will be made of existing Egyptian institutions and their present capabilities, to see how they are able to deal with information and its evaluation. Finally, an estimate will be made of the type and duration of technology transfer that will be needed to assist the institutions to prepare and implement their studies and plans.

A high-level seminar will be held in the near future, and a National CZM Committee is being established to coordinate implement the plan. To strengthen the necessary foundations for the sustainable development of Egypt's coastal areas, the present strong "freshwater axis" (the crucially important management of the Nile) should be supplemented with an additional "saltwater management axis", called integrated coastal zone management.

Germany

The study summarizes the preliminary results of a Vulnerability Assessment of the coastal zone of Germany (both the North Sea and the Baltic), to be completed by the end of 1994, with respect to coastal protection as a primary component of integrated coastal zone management. The objective is to protect people, values and natural ecosystems by means of coastal protection master plans in combination with land use planning. These master plans are drafted on a regional scale for each of the five coastal states.

The area for the ICZM study comprises the German North Sea coast from the Danish border to the Elbe estuary,

representing the west coast of the state of Schleswig-Holstein. The potential for increased vulnerability due to increased storm (surge) frequency and accelerated sea level rise is recognized in this study area, and is accommodated in a recent initiative to adjust the current master plan (dating from 1966 with supplements in 1973 and 1986) to this situation. The initiative is top-down at the state level (the federal government is not involved in the regional planning process), taken by the Ministry of Agriculture and assisted by the Ministry of Environment and the State Planning Authority. Communities and other stakeholders are involved and are able to indicate local demands or raise objections. The original coastal protection planning process, partially guided by federal laws, is fed into (and out of) the land use or community planning. The coastal protection framework plan and community land use plans have to be compatible in terms of both required protection schemes and nature conservation demands. A federal law provides the basic principle for necessary decisions at the state and local levels. The state will approve the new master plan after coastal protection, nature conservation and land use requirements have been met.

Specific and alternative options for protection measures (construction, reclamation, local setback, etc.) are evaluated for successful application by the state authorities. Major (costly) measures are financed jointly by federal (70%) and state governments (30%), while on a smaller scale, communities must bear part of the burden, assisted by the state. Within the next five years, the master plan for Schleswig-Holstein will be revised, taking into account the results of the ongoing vulnerability assessment, as well as those of more detailed regional studies still to be carried out. As a result of this research an "important area protection" strategy might be adopted, as opposed to the "full protection" option of previous master plans and political decisions.

Indonesia

Indonesia, the world's largest archipelagic state, with more than 17,000 islands. Approximately 3.1 million of the 5 million km2 of Indonesia's territory is composed of marine and coastal waters. All but the interiors of the largest islands can be considered to be related to the coastal zone. Indonesia's shoreline is estimated to be approximately 81,000 km long. The territory that makes up the marine and coastal sector is therefore immense, covering most of the national territory. Indonesia still possesses an enormous wealth of natural resources, renewable as well as non-renewable.

At present the coastal area accounts for over than 80% of all marine-related activities, and contains about 22% of the total population of 180 million (1992). Its marine and coastal resources include more than 3.8 million ha of mangroves, and about 5 million ha of tidal swamp forest and seagrass beds, which are found in nearly all coastal areas. The diverse range of coastlines are exposed to wind, wave action and sea level dynamics and are subject to high rates of erosion.

For the development of the Indonesian coastal and marine sector, the government has embarked on conscientious planning of this sector, taking into account its potential and the impacts of all natural threats, including sea level rise, tectonic movements, wind, tsunamis, etc. The Marine Resource Evaluation and Planning (MREP) project is a model of an integrated, as well as interdisciplinary approach, for the sustainable development of marine and coastal areas. The project started effectively in 1993 with a duration of five years. The project focuses on areas where development pressures are greatest. These can be classified into two types: marine areas close to the land, together with their coastlines and certain other marine areas that are in need of rational management. The first phase of the project plans for institutional strengthening of marine and coastal resource information infrastructure and the development of a mechanism in the planning process through the introduction of GIS technology and database networking.
At the national level, a Project Coordination Board provides policy direction. At the departmental level a Technical Coordination Committee, comprising participating agencies/institutions, is responsible for implementing the project in an integrated way. The Project Management Office acts as the project secretariat to handle the day-to-day management. Ten Marine and Coastal Management Areas (MCMAs) and three Special Marine Areas (SMAs) have been selected as priority areas. MCMA planning is set in the context of provisional planning, and complements land area planning. The SMAs are primarily of national interest, focusing on the development of a national approach to marine area planning (mainly internationally important shipping lanes which are vulnerable to pollution resulting from shipping accidents).

Israel

In 1970 the National Planning and Building Board (NPBB) recognized that Israel's coastline should be treated as a resource of national value, and issued an order for the preparation of a national plan for the sea and lake shores. These include the Mediterranean, the Red and Dead Sea coasts, and the coast of the Lake Kinneret (Sea of Galilee).

The first stage of the National Outline Scheme for the Mediterranean coast was approved in 1983. The main objectives of the plan were to prevent developments that had no connection with the coast, to protect large sections of the coastline as nature reserves, national parks and coastal reserves, and to allocate coastal areas for tourism and recreational activities. The master plan included a highly effective clause prohibiting development within 100 m of the coastline, although for some functions this is occasionally relaxed with the approval of the NPBB.

To help provide a comprehensive long-term guide to planning policy, beyond the general guidelines in the approved master plan, the NPBB commissioned a more detailed report on resource management of the Mediterranean coastline for tourist and recreational activities. The subsequent resource management plan, prepared by the Ministry of the Environment, was recently submitted for approval by the NPBB.

The plan is based on the principles of suitability and sensitivity of coastal resources. The dominant principle adopted for resource management of the coast was the definition of intensity of development. A natural, undeveloped bathing beach offers a totally different experience from an urban beach with multiple visitor facilities. Similarly, overnight accommodation at a village camping site is a different experience from that at an urban hotel. Five levels of development were therefore defined for beaches and their immediate hinterlands, four levels of intensity of accommodation, and three levels of development of hinterland day visitor areas.
Each site designated for tourist and recreational use was allocated a level of intensity of development, initially proposed by the planners on basis of surveys, geological and ecological guidelines, and local site conditions. Alternative proposals were checked to determine whether the level of development proposed would damage sensitive resources on or near the site. Where a conflict was identified, the level of intensity was reduced, the boundaries of the development area changed, or the site cancelled and an alternative selected. The overall national policies proposed for resource management of the coast include:

- development that is not for recreation or tourism should not be permitted along the coast and the immediate hinterland;
- policies for resource protection should range from absolute protection within a designated reserve to the identification of sensitive resources to be considered within the detailed plan for site development;
- highly intensive uses should be confined to existing urban centres; and
- a public footpath should be designated along the coastline to ensure public access by foot to and along the coastline.

Malaysia

Malaysia's coastline of about 4800 km comprises two distinctly different physical formations: mangrove-fringed mud flats and sandy beaches. The coastal zone of Malaysia has special socio-economic significance, being a centre of population and economic activity. A large majority (about 70%) of the total population of 18 million live in the coastal zone. The coastal zone is also the centre of economic activities, encompassing urban areas, agriculture, fisheries, oil and gas exploitation, etc. In addition to the coastal lands, islands, coral reefs, estuaries and lagoons are also important sites for ecological, economic, tourist and recreational activities. A total of 44 of the 1000 islands have been or are in the process of being designated as marine parks.

The government of Malaysia is aware of the need for and importance of sound coastal zone management in light of the increasing incidence of problems related to erosion, resource depletion and environmental degradation in many of the more developed coastal areas. The problem of erosion was the subject of a comprehensive National Coastal Erosion Study (1984-85), which revealed that 27% of the coastline is subject to erosion. Some 60 sites, totalling 196 km of coastline, can be classified as critical erosion areas for which urgent engineering measures are required. A study of the impacts of sea level rise found that erosion was the most serious problem. In addition to short-term measures, it was also stressed that a long-term strategy was needed, emphasizing proper planning and control of future developments in the coastal zone.

Following the completion of the National Coastal Erosion Study, the government prepared the South Johor Coastal Resources Management Plan, the objective of which was to develop a coastal zone management plan for a coastal belt of 300 km which is undergoing rapid economic development. The study provided valuable insight into many of the current issues and problems related to mangrove and coastal forest management, water quality, erosion, sand mining, etc.

The effective implementation of coastal zone management at the regional and national levels requires a system of laws and an effective institutional mechanism for the planning, control, regulation and enforcement of existing and new developments. Two of these laws that have profoundly influenced coastal zone management: the Environmental Quality Act (1985) and the Environmental Impact Assessment Order (1987). The latter lists development activities that require mandatory EIA reports to be submitted for prior approval by the Department of the Environment. Administrative guidelines have also been introduced by the government to streamline or rationalize planning practices.

As a result of increasing awareness of and concern for environmental issues, and in support of the concept of sustainable development, the Economic Planning Unit prepared a National Coastal Resources Management Policy in 1992. An Inter-Agency Planning Group with members of all relevant departments and agencies has been established. Three working groups study issues such as coastal resources, coastal planning and legislative and institutional aspects. Preliminary findings indicate in particular that the legal and institutional constraints need to be resolved. At present, the policy document is being finalized, and it is expected to include the development of a National Coastal Resource Programme with effective planning and coordination of institutional mechanisms at both federal and state levels. This will involve the revision of existing legislation and the formulation of new laws; the enhancement of the capabilities

of relevant federal and state departments; the development of a research and data collection programme; and the development of public education and awareness-raising programmes.

Mexico

The study area is located on the northwest coast of Mexico, a coastal strip about 130 km long and 6 km wide, in the state of Baja California. The major policies of both state and local governments are to encourage economic development through investment in tourism, fisheries and marine transportation, taking into account the tourism, urban development and fishing sectors, as well as local interests, environmentalist groups and academia. This region is regarded as a strategic area for development, but because of the wide variety of coastal resources and habitats, an environmentally feasible development plan was ordered.

The problem was how to achieve economic development (bringing jobs, revenue, and higher living standards) without destroying the resources used for this development. This bottom-up initiative was initially proposed by local (municipal) government with the support of interested sectors. The authorities responsible for coordination were the State Ministry for Urban Development and Public Works, the State Ministry of Tourism, the State Office of Ecology, and the Federal Ministry of Social Development. These government bodies formed a technical committee to coordinate the implementation of the coastal plan. When the plan was finalized, it was reviewed by the state and the local planning committee (a public body integrated by representatives from all sectors), and approved by municipal councils. Once passed, the plan will be supervised and enforced by local government through the office of planning and urban development.

The plan is supported by several laws, depending upon which management strategy is proposed among the laws considered. These include the Federal and State Environmental Law, the Federal Water Act, the Federal Fishing Law and the Federal Law for Urban Development. Finance for the plan was provided as follows: 30% federal, 40% state and 30% private sector.

The plan is now being extensively reviewed by the public, who they are familiar with its details and contents, and is expected to be implemented by January 1994. Future plans are foreseen for two coastal stretches each about 300 km long, in the Pacific coastal states of Oaxaca and Sinaloa.

The Mediterranean

The Mediterranean Action Plan (MAP) is the leading and best developed part of the UNEP Regional Seas Action Programme, in which there are a total of 12 regional programmes. Since 1984 the Priorities Action Programme (PAP) of MAP has been involved in a number of activities within the context of integrated planning and management of Mediterranean coastal areas. The thematic framework of PAP encompasses 10 priority actions (including water resources management, soil protection, solid and liquid waste management and EIAs), all of which are oriented towards coastal zone management. Within these actions a number of national and site-specific case studies were prepared. In 1989 a methodological framework for integrated planning and management of Mediterranean coastal zones was devised, and in 1993 guidelines were drafted for integrated management of coastal and marine areas, with special reference to the Mediterranean basin. In addition, various tools and techniques for coastal management (GIS, EIA, carrying capacity assessments for tourism activities) were adapted to the conditions prevailing in Mediterranean developing countries.

Since 1989, MAP has carried out coastal area management programmes (CAMPs) for selected areas. At present these have been carried out and implemented along the Syrian coast, the Bay of Kastela (Croatia) and the Bay of Izmir (Turkey). By the end of 1994 the programme for the island of Rhodes (Greece) will also reach completion. At the start of 1993 programmes were launched in the areas of Durres-Vlore (Albania) and Fuka (Egypt), and another is planned for the Sfax region (Tunisia) in 1994. PAP has also been involved in the Eastern Africa Project, which includes seven countries of that region, and which is being implemented by FAO and UNEP.

The programme for the **Syrian** Coastal Zone was prepared in 1990-92, in cooperation with the Syrian Ministry of the Environment. The programme used the results from the integrated planning study undertaken by PAP in 1989-90. The draft plan was presented to the ministries and the local communities and their comments were duly incorporated into the final plan. Since the presentation of the coastal resources management plan, the Syrian authorities have already implemented some of the recommendations, including the establishment of an interministerial committee and EIA as a procedure for assessing development projects.

The aim of the Kastela Bay area programme in **Croatia** was to upgrade environmental knowledge, to provide guidelines for water resources management, to reduce pollution in the Bay, and to make recommendations for the future sustainable development of the area. One programme study addressed the question of suitable levels of treatment for urban wastewater. The results of the study led to recommendations to improve wastewater treatment facilities and to establish a permanent monitoring system.

Situated on the Bay of Izmir, **Turkey**'s third largest city Izmir has a rapidly growing population that is expected to double to 4 million in the next 30 years. There is a large inflow of migrants from rural areas seeking a "better life" in the city. The resources are no longer able to cope with this increasing pressure and have thus been degraded. One response to this

pressure has been to install a wastewater treatment plant. There is as yet no single authority that deals with environmental management in the region; this is divided both sectorally and among the various levels of government. The coastal zone management plan produced a series of recommendations that should provide the basis for a new operational planning and management system. The plan was presented to representatives of national and local authorities, ministries and institutions, who were able to comment on and make suggestions for its implementation.

The project on the **Greek** island of Rhodes was one of a series of studies to assess the likely impacts of climate change and the carrying capacity of tourism activities. Of particular importance was the Integrated Management Study, which was seen as a first step towards integrated coastal and marine area management. It undertook the task of identifying the development and environmental issues and suggested activities for achieving sustainable development. Not all the activities for this coastal area management programme have been carried out, although the completed sections were presented to local and national authorities in 1993. The final phase of the programme will be organized in the second half of 1994.

The Netherlands

Over the years, the Dutch have turned a low-lying, marshy area into a densely populated country with extensive infrastructural facilities. In the early days, engineering and water management were directed solely towards survival in a low-lying delta region. At present, lessons learned throughout history are applied and integrated solutions are sought. A balance is sought between socio-economic and environmental aspects. Current planning and development activities are characterized by the elements: *coherence, flexibility and integration.*

The *coherence* is safeguarded by the umbrella plan for physical planning on a national scale. This plan outlines the main planning structures for rural areas and the main waters in the Netherlands. The plan presents, among others, so-called "green course", areas where ecological quality is the guiding principle for planning and development or "yellow course", areas with emphasis on agricultural development.

The lessons of *flexible planning and integration of functional uses* have been learned in the southwest of The Netherlands. During the dramatic storm surge of 1953 large areas were inundated and more than 1800 people died. After the disaster, new flood safety standards where adopted by parliament and a master plan for the restoration of the area was presented. This Delta Plan involved closing off the estuaries from the North Sea, thus shortening and protecting the coastline. The original plan was to close off the Eastern Scheldt completely, but this was altered in 1976 following an intense political debate on the need to protect the ecological and economic value of the tidal marine system, versus protection against storm surges. The result was a compromise in the form of a barrier that could be closed during severe storm conditions only, thus maintaining the tidal characteristics that are vitally important for wetland and fishery functions. An evaluation study revealed that the resilience of the ecosystem, and the biodiversity, productivity and carrying capacity for various functions have been maintained. The change in hydrodynamics and geomorphology resulted in erosion of the edges of the salt marshes, and so plan was developed to flood some agricultural land in order to restore the ecological balance of this valuable wetland.

In the north, the Wadden Sea is one of the few remaining large wetlands of northwest Europe, and large parts of the sea have been designated as nature reserves under the Nature Conservation Act. The national physical planning scheme for the Dutch Wadden Sea (Wadden Sea Memorandum) forms the basis for all future planning, conservation and management activities. The Memorandum is used by seven departments, three Wadden Provinces and 28 municipalities. The Dutch Wadden Sea has deliberately been brought under the jurisdiction of provincial and local authorities to ensure integrated planning at the lowest level, with public participation initiated in the planning phase. The Memorandum presents the overall objectives for the Wadden Sea policy and formulates the target situation for the year 2010. The consequences of all activities within the Wadden Sea must be assessed with respect to the target situation.

New Zealand

The purpose of coastal management in New Zealand is to promote the sustainable management of the coastal environment. This includes the use, development and protection of New Zealand's natural resources. The regime does not include the allocation of fisheries resources, since this is covered under a different management regime.

Prior to 1991, resource management in New Zealand was subject to a bewildering array of contradictory statutes. This was replaced by the Resources Management Act 1991, with the single purpose of sustainable management. Under this Act the Coastal Environment (which includes both terrestrial and marine components) was identified for special management. To achieve this, a national New Zealand Coastal Policy Statement was developed and this is to be implemented through regional coastal plans.

In the development of both the national policy statement and regional coastal plans, the public participation process is mandatory. The entire process has involved considerable inputs from the public and interest groups. Under the Resource Management Act, the Department of Conservation is the national lead agency for coastal management and day-to-day management is carried out by regional and district councils. All non-trivial developments, including those by

central government, require resource consents. Such consents require a public process with the opportunity for judicial inquiry. Any individual can submit a resource consent application.

Projects are evaluated out on the basis of the potential effects of the activity on the environment. All projects are required to provide an environmental impact assessment, the details of which should be appropriate to the scale of the project. The Resource Management Act is now operational, and coastal management is being carried out under the transitional provisions of the Act. Regional Coastal Plans are required to be advertised for public submission by 1 July 1994.
The Resource Management Act provides for a highly integrated system of coastal management. The programme has been only partially implemented, but the integrated CZM system has proved highly effective, both for the developers and in terms of the environmental protection provided.

The Philippines

The Coastal Resource Management Project (CRMP) was started in 1986, using the 160 km long coastline of the Lingayen Gulf on the northwest coast of Luzon as a pilot area. The CRMP was guided by the ASEAN-CRMP funded by USAID. This area was selected on the importance of fishing to the national economy and the resource uses that are threatening it. The project aims to promote sustainable development in the Gulf. Depending on the success of the project, it may be adopted by other coastal areas in the country.

In 1986 a situation analysis was carried out, which provided comprehensive information as the basis of the planning phase. The information covered baseline information and biogeographical, socio-economic, and legal and institutional studies. The second phase contained general management goals, objectives and policies for the area, along with proposed zonation schemes, strategies for management and proposals for plan implementation and institutional arrangements. The plan was finalized in 1992 and proposed 20 projects grouped under eight programme areas:

1 fisheries management programme;
2 rehabilitation and enhancement of critical habitats;
3 rehabilitation of linked habitats (upland and coastal habitat, watershed management);
4 environmental quality management;
5 coastal zonation;
6 alternative livelihoods for fishing families;
7 aquaculture development; and
8 institutional development.

The plan will cost a total of $4 million for the completion of all the proposed programmes. The implementation will be split into two phases: phase 1 lasting two years, after which time it is expected that preparations will be made for each project, for completion in phase 2.

The preparation of the multisectoral plan was a learning and an educational process for the participants. The inputs of future implementers, government agencies, local government units and non-governmental organizations in the planning process, and public participation was encouraged wherever possible. This was achieved through active consultation with the public to ensure their interest and involvement in the plan and its goals. The support and assistance of the public is regarded as essential for the implementation of the plan.

The plans were evaluated at the national level by specialists. Although the plans lacked technical input they were representative of the people living in the area, who would be most affected by the planning decisions taken. There was no further system of public follow-up after the national screening until the implementation phase. The city or municipal level was perceived as the level for resource management and the regional steering committee brought the planning down to this level.

Sri Lanka

Sri Lanka has a coastline of 1585 km and 34% of the population of 17 million live in the coastal region, which also contains most of the manufacturing industry, tourist infrastructure and fisheries. With the growth of human settlements, environmental degradation has increased, necessitating firmer control and management of the coastal zone.

The 1981 Coastal Conservation Act No. 57 decreed the appointment of a Director of Coast Conservation with jurisdiction over the coastal zone; this is defined as a 2 km band of ocean and an adjoining ribbon of land extending 300 m inland. The director was charged with responsibility for administration and implementation of the provisions of the Act; the formulation and execution of coast conservation schemes; and conduct of research in collaboration with other agencies. The Act also required the director to prepare a comprehensive Coastal Zone Management Plan to address the problem of erosion and a variety of other coastal resources management concerns, such as the degradation and depletion of natural habitats and resources, the loss and degradation of significant historical, cultural and archaeological sites and monuments, and the loss of physical and visual access to the oceans due to hotels.

The Coastal Conservation Act did not describe how the plan was to be prepared or what the emphasis should be. The Coast Conservation Department (CCD) therefore developed a set of planning and management principles to provide a purpose and direction to other participants in the planning process. The management of coastal resources and activities affecting these resources will remain the responsibility of many agencies, while the CCD will ensure that all development activities are consistent with the principles of sustainable resource yields. Effective community participation

in the design of management strategies and in the implementation of activities will continue to be refined.

Sea level rise will have an impact on the low-lying coastal areas of Sri Lanka, but more basic data and information are required before countermeasures can be taken. In addition to the Coastal Zone Management Plan, therefore, activities have been proposed to monitor the sea level rise.

The CZM plan was approved by the cabinet of ministers in 1990. It is Sri Lanka's first plan for natural resources management, and is the product of many hours of study, meetings, workshops and considerable research and planning. The plan is only applicable to the national level, and has not yet been translated into local and provincial actions. Provincial, district and local government agencies and NGOs currently have little role in the design and implementation of CZM plans.

The primary mechanism for implementing the CZM plan is a permit system for development activities in the 300 m coastal zone. The CCD has the legal authority to issue these permits and to demolish structures that do not comply with permit conditions. It can also request environmental impact assessments when large-scale development activities with potentially negative impacts are proposed.

The CCD has developed and partly implemented a ban on the mining of coral from offshore reefs as an amendment to the Coast Conservation Act. The revetments constructed to prevent erosion must be high enough to cope with the expected sea level rise. Other measures in the plan include research, coordination and education.

The plan represents the first stage in the development of a management programme for Sri Lanka's coastal areas. Subsequent planning efforts will involve developing objectives and implementing actions for other coastal problems, area-specific management plans, refinement of existing guidelines and suggested amendments to the Coast Conservation Act.

Subsistence fishery in Tanzania, important coastal use that is easy to overrule.

In 1990 the CCD staff and consultants began to consider a broader approach to coastal management. As part of the strategy to rethink the purpose of coastal management and specific management strategies, a "second-generation" coastal resource management programme has been recommended. This programme will be implemented at national, provincial, district and local levels simultaneously. It will include programmes to monitor the utilization of resources such as coastal habitats, fisheries, water quality, mineral resources, etc., and will strengthen the institutional capacity for addressing management problems and increase public education.

Tanzania

Tanzania stretches for 800 km along the East African coast. It is the site of major urban centres and industrial activities, which in turn lead to pollution from wastewater discharges, resource exploitation from the rapidly expanding population, and thus the destruction of some valuable ecosystems that provide protection against coastal erosion.

At present Tanzania is in the process of formulating a national coastal zone management plan. Previous efforts have been made to achieve this goal. In 1987 the government, together with the National Environment Management Council, prepared plans for the management and development of the coastal and marine resources of the Dar-es-Salaam, Zanzibar and Pemba areas. These were based on surveys carried out to assess the status of the resources and institutional structure. These management plans followed the recommendations that were formulated as part of UNEP's Regional Seas Programme for East Africa.

Strong coastal erosion and questionable effective defence works threatens tourism development potential in Tanzania.

The objectives adopted included the identification and development of management plans for both marine and coastal ecosystems, while recognizing their importance for the livelihoods of the coastal population. A network of cooperating institutions and organizations has been established to monitor and manage these ecosystems.

An inventory of the pollution loads and land-based sources of pollution to the sea along the coastline was carried out in 1992. Although in 1981 some areas were designated as being ecologically sensitive and should be protected, for financial reasons it has not been possible for these areas to receive full protection. A management plan for the mangrove ecosystem was drawn up in 1991, in conjunction with a programme to monitor coastal and beach erosion.

Due to lack of finance and expertise, the Tanzanian coastal programme relies heavily on international cooperation in the formulation of plans. Even when the plans are drawn up, however, appropriate arrangements for implementation must be made both during and at the end of the planning process.

Thailand

Thailand has a shoreline of approximately 2,600 km along the coasts of the Andaman Sea and the Gulf of Thailand, within which approximately 11 million people live in the coastal provinces. The coastal areas possess a variety of natural resources, resulting in resource use conflicts. To reduce these conflicts, as well as to apply an integrated coastal resource management system, a Coastal Resource Policy and Planning Project was established by the Office of Environmental Policy and Planning (OEPP) in cooperation with concerned agencies. At present, there is no scope for local and regional government agencies to be involved in managing and taking decisions about their local coastal resources. Instead, central ministries and departments decide on policies.

Although a large number of organizations are involved in coastal problems, coastal zone management as such is virtually unknown to the Thai legal system. There are many laws related to natural and environmental management, each of which formulates the operating procedure for a particular ministry and concerns one single resource or topic. The current Thai government structure contains no mechanisms for the management of different interests in an integrated approach. There are committees and boards from various ministries or departments, but they have no regulatory authority. There are plans to create a new National Water Resources Board that will focus on this one resource only. To test the implementation of the plan, the island of Phuket was selected as a pilot study area prior to the formulation of the National CRM plan and policy. In 1986-89, an action plan was developed which is now being implemented. Based on the experiences in Phuket, the OEPP formulated plans for the long-term sustainability of coastal resources in Thailand, dealing with land use, water quality, solid waste, corals and mangroves. The plans were approved by the cabinet in 1992, and budgets were allocated for the implementation of the programme by the local authorities concerned. Implementation of the projects have to go along with public awareness, public education and law enforcement. From another example, the Pak Phanang case study, it is clear that the successful management of coastal resources requires mechanisms to involve all interest groups. Laws and regulations that do not account for the socio-economic needs of the people in the region are unlikely to be effective. Public participation, together with a proper distribution of tasks and responsibilities among national, regional and local governments is required.

United States of America

The United States has many decades of experience in coastal zone management. This experience, and that gained through USAID-sponsored programmes in low-income nations, reveals important lessons for others undertaking the complex challenge of striking a balance between man and nature at the boundary between terrestrial and marine systems.

In the USA the experience encompasses legislation and programmes including the Clean Water Act (1972), the Coastal Zone Management Act (1972), the Fisheries Conservation and Management Act (1976) and the National Estuaries Management Program (initiated in 1987). At the individual state level it includes 35 coastal zone management programmes and several estuary management plans in various stages of formulation.

In the late 1960s concern for the deteriorating condition of estuaries within the USA led to the Coastal Zone Management Act. The state programmes that subsequently emerged have demonstrated that the problems with holistic approaches to resource management do not lie with the scientific and technical challenges posed by understanding the linkages and the actions that should be taken, but in the institutional, social and economic challenges that holistic approaches to resource management must confront. The interests of powerful agencies with established jurisdictions over traditional sectors and other socio-political complexities made such integration at the federal level untenable. The form of coastal zone management that emerged was concerned primarily with the management of a narrowly defined shore front. In the 1980s, the National Estuaries Management Program, inspired by the management of the nation's largest estuary, the Chesapeake Bay, linked fisheries, water quality and land use in a single, integrated management programme. The success of this most recent generation of coastal management programmes has been due to a sustained commitment to a participatory democratic governance process and issue-driven ecosystem analysis.

In low-income nations, the major challenges from a management point of view also lie not in the technical analysis, but in the need to influence human behaviour and values so that more effective management is socially, economically and politically feasible. Effective action occurs only when the people of a specific place are organized, work out a specific plan of action, and are supported by central government.
The integration of the substance (modelling processes, GIS technologies, governance systems, indicators for monitoring,

etc.) and processes (workshops for government agencies and user groups, public workshops, involvement of communities and private sector, training programmes, etc.) presents a great challenge to the practical coastal manager. The following steps can be identified in the policy process:

- issue identification and analysis;
- selection of programme goals;
- selection of first-generation strategies and objectives;
- design of institutional structures;
- formal adoption and funding of the programme;
- implementation through annual work plans; and
- evaluation.

Sustainable development of coastal ecosystems will rarely be able to be defined and achieved in a single bound. All coastal management programmes must embark upon a learning process. Each completion of the policy cycle can bring us closer to sustainable development. Effective launching of coastal management programmes can be helped by a "two-track" approach whereby local level demonstration projects are linked to and supported by national policy makers. If the programmes initiated do not adopt a learning approach to the management of coastal ecosystems, they will in too many instances result in frustration and little lasting improvement to the management of the primary habitats of our species.

Barrier islands along the east coast of the USA, evidence of a susceptible equilibrium.

Appendix III

International Organizations and ICZM

International Organizations: activities related to ICZM

Many international governmental and non-governmental organizations are undertaking activities and new initiatives related to integrated coastal zone management. The following summaries highlight the major activities of the international organizations represented at the WCC'93, in alphabetical order. The Conference Statement, in reflecting the consensus views of the participants, lists some of the recommendations for strengthening international support for ICZM capacity building. These recommendations relate to information; education and training; concepts and tools; research, monitoring and evaluation; and funding. Table III.1 lists the core programmes of these international organizations.

Table III.1

	Information	Education and training	Concepts and tools	Research, monitoring evaluation	Funding
ADB					
AOSIS					
CSD					
FAO					
GEF					
IGBP					
IOC					
IPCC					
IUCN					
OAU					
OECD					
UN/DAOLOS					
UNDP					
UNEP OCA/PAC					
UNESCO					
UNU					
WB					
WMO					
WWF					

The ADB was established in 1966 to help accelerate economic and social development in the Asian-Pacific Region, by providing financial and technical assistance for projects that will contribute to the economic development of its developing member countries (DMCs). The ADB, whose headquarters are in Manila, is administered by the governments of 36 countries from the Asian-Pacific region and 16 countries from Europe and North America.

To address coastal issues the ADB is currently undertaking a regional technical assistance project to study the effects of global warming and climate change, particularly the consequences of sea level rise, and to develop regional as well as national responses. Another study to identify the sources and sinks of greenhouse gases in selected DMCs (funded by the Global Environment Facility, GEF) will train regional experts to improve their understanding of greenhouse gas emissions and to enhance regional and national capabilities to limit them and to mitigate associated adverse impacts. Based on these studies, the ADB will promote the exchange of relevant scientific, technical and socioeconomic information regarding various response strategies and assist DMCs to develop integrated plans for coastal management, water resources and agriculture, particularly in low-lying island nations.

The ADB promotes regional environmental development planning, a process that introduces cross-sectoral considerations into more traditional project development planning. At the project level, the ADB promotes the use of EIAs to assess significant environmental impacts of coastal projects. ADB investments for coastal resource development fall under the marine, aquaculture and fisheries development sector. Most of the projects belonging to this sectoral category include major components on coastal resources development and management. So far, ADB investments in the sector have totalled approximately $608 million, comprising 12% of the ADB's total environmental lending budget. In terms of technical assistance, the total amount for the sector is $18 million, or 15% of the total technical assistance operations for the environment sector.

For further information, please contact:

The Asian Development Bank
P.O.Box 789
1099 Manila,
The Philippines

Phone: +63 (2) 711 3851
Fax: +63 (2) 741 7961

The Alliance of Small Island States (AOSIS) is an ad hoc coalition of developing countries that share common objectives on environmental and sustainable development issues, particularly those relating to the UN Framework Convention on Climate Change. Members of AOSIS are small islands or low-lying coastal developing countries that share similar or comparable levels of economic development, are members of island regional groupings or organizations, and which are particularly vulnerable to the adverse consequences of climate change such as sea level rise, coral bleaching, and the increased frequency and intensity of tropical storms

For further information, please contact:

AOSIS
Permanent Mission of Trinidad and Tobago to the UN,
5th floor, 820 Second Avenue
New York, NY 10017,
USA

Phone: +1 (212) 697 7620
Fax: +1 (212) 682 3580

The UN Commission of Sustainable Development (CSD) was established in June 1993 to serve as a multilateral institutional focal point and as a central political forum for monitoring and reviewing, in an integrated and coordinated manner, the implementation of *Agenda 21* and other outcomes of UNCED. In 1997, the Commission will undertake an overall review of the implementation of *Agenda 21* in anticipation of the special session of the UN General Assembly that will be devoted to the environment. Over the next three years, the CSD hopes to have covered all areas of *Agenda 21* under the multi-year thematic approach taken in its programme of work. A series of conferences will be held within this time frame, hosted by various countries and addressing different parts of *Agenda 21*. The CSD will become a clearing house for sorting the results of these conferences and integrating them into the future work of the CSD, which is designed to bring about sustainable development, including coastal and ocean areas.

For further information, please contact:

Commission on Sustainable Development Secretariat
610 Fifth Avenue, Suite 311
New York, NY 10020
USA.

Phone: +1 (212) 541 4117
Fax: +1 (212) 757 1607

In the FAO's medium-term plan for the period 1994-99, integrated coastal area management (ICAM) has been identified as one of the cross-sectoral priorities. The FAO Fisheries Department is lead technical unit for the coordination and planning of all ICAM-related programs and activities. The pivotal role assigned to the Fisheries Department is in recognition of the fact that the fisheries sector is almost always affected by unsustainable use practices and environmental degradation of coastal areas and resources. The Fisheries Department is assisted in its work by an ICAM Subgroup of the Interdepartmental Working Group on Environment and Sustainable Development. The Subgroup includes representatives from various technical, economic and social, legal and other divisions of the FAO.

The FAO's ICAM activities can be grouped into two broad categories: field projects and the regular programme activities of its headquarters. Regular programme activities include the provision of policy and legal advice, the compilation of statistical and geo-referenced information, the preparation of high-quality technical publications, including guidelines and manuals, the promotion of international conventions, standards and codes of conduct among member governments, and the provision of training.

The FAO's guidelines include the *Noordwijk Guidelines for ICZM* (see the World Bank entry) and complementary guidelines that specifically address the integration of agriculture (agriculture, forestry and fisheries) into coastal area management and planning. The FAO is also producing guidelines for use at the subsectoral level, such as the *Guidelines for the Promotion of Environmental Management of Coastal Aquaculture Development.* The FAO is also drafting an International Code of Conduct for Responsible Fishing.

As part of its information services, FAO, in consultation with UNDP and in cooperation with the University of Rhode Island (Coastal Resources Center), has initiated a system for the exchange of information on integrated coastal area programs and projects.

In the field, the FAO is collaborating with other UN agencies in carrying out a project on the "Protection and Management of Coastal and Marine Areas in the Eastern African Region", the objective of which is to develop national self-reliance on all matters relating to the integrated development and management of the coastal environment. UNDP is providing funding for another project FAO is implementing on "Integrated Coastal Fisheries Management", which is focusing initially on three pilot sites in Africa, Asian and the Caribbean.

For further information, please contact:

FAO/Fisheries Policy and Planning Division
Via delle Terme di Caracalla
00100 Rome,
Italy

Phone: +39 (65) 797 6394
Fax: +39 (65) 797 3152

UNDP and UNEP are partners with the World Bank in the management of the Global Environment Facility (GEF). The GEF provides grant assistance (provided by donor countries) to developing countries for projects that provide global environmental benefits. There are four criteria for eligibility for GEF financing: protection of the ozone layer, protection of biodiversity, limiting emissions of greenhouse gases, and the protection of international waters.

The last three areas are directly relevant to coastal zone management, although coastal zone management itself is not an eligible category for GEF financing, although some projects come very close, such as the GEF project for the Red Sea coastal waters of Egypt. This project, financed under the biodiversity and international waters criteria, contains all the elements of an environmentally sound coastal zone management project, with protection of the biodiversity of coastal waters and land area, zoning, environmental institution building and strict conditions and provisions for sewage collection and treatment for coastal development financed by a separate loan.

The pollution of international waters is addressed by GEF projects to provide reception facilities for ship waste in the Caribbean and in China to comply with the MARPOL convention. The GEF is in the process of restructuring and could continue to be a major funding source for ICZM projects.

For further information, please contact:

The Global Environment Facility
1818 H Street
Washington, DC 20433
USA.

Phone: +1 (202) 473 1053
Fax: +1 (202) 522 3245 or 522 3240

The IGBP is a non-governmental international research programme, established by the World Conservation Union (IUCN) in 1986. Its purpose is to bring together, and increase

the effectiveness of, a worldwide research effort on the dynamic interplay between living and non-living components of the environment, focusing on key processes operating under conditions of global change. IGBP research is mostly funded at the national level. Sixty-six countries now have national IGBP committees, which assist in the national coordination of relevant studies and ensuring that appropriate links with international research efforts are maintained.

Six core projects have been established to date, including one on the Land-Ocean Interactions in the Coastal Zone (LOICZ). The project office has recently been established at The Netherlands Institute for Marine Research (NIOZ) and a scientific steering committee will guide the implementation of the updated "science plan". The goals of this project include:

- improving the state of knowledge concerning coastal processes;
- determining how coastal systems will respond to global changes;
- examining how coastal systems affect the process of global change; and
- investigating how future human coastal space and resources may be affected by these changes.

For further information, please contact:

IGBP Secretariat
The Royal Swedish Academy of Sciences
PO Box 50005
S-1040 Stockholm
Sweden

Phone: +46 (8) 673 9500
Fax: +46 (8) 166 405

LOICZ Core Project Office
PO Box 59
1790 AB Den Burg, Texel
The Netherlands

Phone: +31 (2220) 69404
Fax: +31 (2220) 69430

The IOC was founded in 1960 as a functionally autonomous body within UNESCO. Scientific input is essential for all aspects of integrated coastal zone management and, inter alia, mapping, establishment of baseline conditions, data management, predictive modelling impact assessments, and systematic long-term monitoring. A goal of IOC programmes is to apply and interpret marine and coastal science for coastal management. The implementation mechanisms are through IOC regional subsidiary bodies that identify priorities, and develop and implement the programmes with international support.

Examples of IOC programs that provide scientific input for integrated coastal zone management include:

- the Global Sea Level Observing System (to facilitate the collection, analysis and distribution of sea level data);
- the International Mussel Watch Program (to assess levels of pesticides in mussels in coastal marine waters);
- the Global Investigation of Pollution in the Marine Environment (jointly sponsored by UNEP to assess the health of the oceans);
  and,
- the Training, Education, Mutual Assistance and Capacity Development Program.

A new IOC initiative, the Global Ocean Observing System (GOOS) will integrate existing monitoring systems to provide long-term data on the coastal and marine environment. The GOOS is a collaborative effort with the WMO, ICSU, WMO and UNEP, and consists of modules designed to address specific objectives, including "Coastal Zone Protection, Management and Development".

For further information please contact:

IOC/UNESCO Secretariat
1, rue de Miollis
75732 Paris Cedex 15
France

Phone: +33 (1) 4568 3983
Fax: +33 (1) 4056 9316

In response to the growing international concern about global climate change, the WMO and UNEP jointly established the IPCC in 1988. The IPCC currently has three working groups: (I) to assess the scientific and technical knowledge related to global climate change; (II) to provide information on the impacts of climate change and response options; and (III) the economics and other cross-cutting issues related to climate change. The Working Group II Subgroup on Oceans, Coastal Zones and Small Islands addresses the impacts and responses to the coastal impacts of climate change, including sea level rise.

Since 1988 this Subgroup has held four international workshops (Miami, 1989; Perth, 1990; Margarita Island, 1992; New Orleans, 1993), has developed a Common Methodology for Sea Level Rise Vulnerability Assessment, and has conducted many case studies. In its First Assessment

Report (1990) the IPCC recommended that all vulnerable coastal nations should develop and implement ICZM programmes by the year 2000, and that these should include measures to reduce vulnerability to climate change. A Second Assessment Report, expected to be completed in 1995, will include information on the status of coastal nations' experience with ICZM.
For further information, please contact:

IPCC Secretariat
Case Postale 2300
1211 Geneva 2
Switzerland

Phone: +41 (22) 7308215
Fax: +41 (22) 7331270

The IUCN's Marine and Coastal Areas Program was established in 1985 to promote activities that demonstrate how conservation and development can reinforce each other in marine and coastal environments; conserve marine and coastal species and ecosystems; enhance awareness of marine and coastal conservation issues and management; and mobilize the global conservation community to work for marine and coastal conservation. The programme is actively engaged in promoting and providing advice on integrated coastal zone management plans in 14 countries and is contributing to the IPCC 1995 Second Assessment Report process.

For further information, please contact:

IUCN, Marine Conservation and Development Programme
28, rue Mauverny
CH-1196 Gland
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Phone: +41 (22) 999 0001
Fax: +41 (22) 999 0025

The Atlantic coast of West and Central Africa stretches from Mauritania to the Congo in central Africa. Coastal erosion is the greatest environmental problem affecting all the countries along the coastline in this region. The prevalence of this problem stimulated the Scientific, Technical Research Commission of the Organization of African Unity (OAU/STRC) to convene a meeting on its control. At this meeting the OAU and UNEP were mandated to explore possible sources of funding for the realization of this project.

The objective of the project is to assist member states of the OAU to contain erosion using low-cost, appropriate technology based on locally available materials. The project will have the added advantage of stimulating regional cooperation through the exchange of experiences and the dissemination of technology.

A pilot project using the Gabion Groin Field System technique was initiated at the New Town beach in Cotonou, in the Republic of Benin. The geomorphology and physical oceanography of the selected site reflects those of other coastal states. The project will be regularly monitored to evaluate the performance of the Gabion groins. The anticipated success of the project will serve as catalyst for other similar "spin-off" projects in West and Central Africa.

The OAU and UNEP are funding the project at the level of $80,000. The pilot project will serve as the basis for a regional approach to the control of coastal erosion in West and Central Africa.

For further information, please contact:

Organization for African Unity
26/28, Marina
P.M.B. 2359
Lagos
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Phone: +234 (1) 263 3430 or 263 3289
Fax: +234 (1) 263 6093

The OECD was founded in 1960, and its 24 members are the democratic nations with the most advanced market economies.
The principal goals of the OECD are:

- to achieve the highest sustainable growth in member countries and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in both member and non-member countries; and
- to contribute to the expansion of world trade on a multilateral, non-discriminating basis.

In recent years, environment and sustainable development have become major priorities for the OECD, and work on these subjects is undertaken across the entire organization, with the Environment Directorate playing a leading role. Particular emphasis is given to supporting major international conventions and programmes, such as the UN Framework Convention on Climate Change, in cooperation with a wide range of other international organizations. The OECD is also establishing links with a wide range of non-

member countries, in the interest of pursuing common solutions to shared problems.

The OECD has been involved for a number of years in work on topics related to ICZM and climate change. One particularly relevant study was on the Costs of Adapting to Sea Level Rise, completed in 1990. This study examined the potential costs of adapting to sea level rise in OECD countries, assuming a changed climate. The OECD also conducted a review (published in 1993) of the policy and management approaches in 17 of its member countries to identify the underlying causes of coastal problems, assess the range of policy instruments and institutional arrangements that countries have adopted; and to develop a conceptual framework for ICZM. The review was supplemented by 16 case studies, many of which focused on specific issues (such as planning for aquaculture development) and geographical areas (such as the Fraser River estuary in British Colombia, Canada).

For further information, please contact:

OECD/Environment Directorate
2, rue André Pascal
75775 Paris Cedex 16
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Phone: +33 (1) 4524 8200
Fax: +33 (1) 4524 7876

The UN Program for the Integrated Management of Coastal and Marine Areas was initiated in 1973. Over the years this programme has included a diversity of activities, including institution building in marine affairs, monitoring national and regional initiatives in coastal and ocean management, publications and reports, workshops and human resources development through training programmes.

The UN/DAOLOS and the UNDP/Division for Interregional Programs joined efforts in June 1993 to convene a Consultative Meeting on Training in Integrated Management of Coastal and Marine Areas for Sustainable Development. The participants included 15 UN officials, as well as 12 representatives of non-UN organizations, including intergovernmental organizations, government bodies, research institutions, universities and NGOs.

At the meeting, the discussions led to development of an outline for a Draft Action Plan for Human Resources Development and Capacity Building for the Planning and Management of Coastal and Marine Areas. The Action Plan covers four major areas: (1) development of human resources; (2) institution building for training; (3) types of training programmes to be developed or adapted; and (4) mechanisms for implementation.

A major recommendation was the establishment of a network through which participants could exchange information on training and education related to the integrated management of coastal and marine areas and on delivery measures for training. The plan was submitted to the WCC'93 for comment and will be finalized in the near future for submission to donor and recipient countries.

For further information, please contact:

United Nations Secretariat
Division of Ocean Affairs and Law of the Sea
Office of Legal Affairs
Two United Nations Plaza
DC2-0482
New York, NY 10017
USA.

Phone: +1 (212) 963 3935
Fax: +1 (212) 963 5847

UNDP was established in 1965 to be the central funding and coordination mechanism for the UN's development assistance activities. The programme's activities are implemented largely by the UN system technical specialized agencies and national governments through a network of 150 field offices in recipient developing countries.

Through *Agenda 21*, UNCED assigned to UNDP a primary role in capacity building and to act as the lead UN agency. Capacity 21, launched by UNDP, is a special trust fund designed to help countries implement *Agenda 21* by incorporating sustainable development into their national planning, to involve local communities and NGOs, and to create a body of experience and expertise. An important recent initiative has been the development of a draft plan for training in "Integrated Management of Coastal and Marine Areas for Sustainable Development" by UNDP and the UN Law of the Sea Office, in collaboration with 12 other UN organizations and 14 NGOs. The recently approved UNDP/UN TRAIN-SEA COAST project will provide a common development methodology for a related course-sharing system.

Over the past few years, with support from the Global Environment Facility (GEF) and inspiration from *Agenda 21*, UNDP has considerably increased its technical assistance. Under the global warming focus, UNDP currently has 22 projects with a total GEF input of $86.9 million. Under the

biodiversity and international waters foci, UNDP has nine integrated coastal zone management projects with a total GEF input of $34.2 million. UNDP has worked with specialized UN agencies, the UN University and the US University of Rhode Island to establish open-ended, shared databases on training courses, ICZM assistance projects and ICZM programmes, respectively. UNDP will continue to support networking in this field and will work with others on the development of a common monitoring and evaluation framework that could facilitate the comparison of ICZM experiences.

For further information, please contact:

UNDP/Division for Global and Interregional Programmes
One United Nations Plaza
FF-1276
New York, NY 10017
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Phone: +1 (212) 906 5866
Fax: +1 (212) 906 6350

The UNEP Regional Seas Programme was established in 1974 as a global program implemented on the regional basis. At present there are 13 regional programmes, involving 145 coastal states and territories. It is an action-oriented programme dealing with the root causes and consequences of environmental degradation, and encompasses a comprehensive approach to address these problems through the rational management of marine and coastal areas. The programmes are implemented regionally through the development of regional action plans, formulated according to regional priorities as defined by the governments concerned.
The actions plans are designed to link assessments of the quality of the marine and coastal environment and the causes of its deterioration with activities for its management and development and the rational use of its resources. Marine pollution monitoring efforts, such as the International Mussel Watch (which monitors contaminant levels in mussels), have been successful at the regional and global levels. In addition, UNEP-OCA/PAC has a lead role in assessing the health of the oceans, as a member of the UN Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP). The first such assessment was produced in 1981 and an update was issued in January 1990.

Work on issues of the potential impacts of climate change and the identification of suitable policy options and response measures has been carried out by Task Teams, established jointly with the IOC, in 11 Regional Seas areas since 1978. Since 1992, two "Global Task Teams" have been addressing the implications of climate change on coral reefs and on mangroves. Site-specific case studies in different regions are being currently being carried out, some as part of comprehensive coastal area management programmes, based on the results of these Task Teams.

In response to the provisions of Chapter 17 of *Agenda 21*, the Regional Seas Programme is placing new emphasis on ICZM, in cooperation with the Food and Agriculture Organization (FAO). Another component involves the development of a training programme through a number of international non-profit institutions and then tested at a university in a developing country. The test case of the implementation of comprehensive ICZM, is presently focused on a small island in the context of the Small Island Conference in Barbados (April 1994).

Other related activities include ICZM guidelines for the Mediterranean, and regional ICZM initiatives in the Caribbean, the South Pacific and other regions.

For further information, please contact:

UNEP/OCA-PAC
PO Box 30552
Nairobi
Kenya

Phone: +254 (2) 621 234
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Several of UNESCO's environmental science programmes include work on coastal zones and their resources. A focus of this work has been to increase scientific understanding of the structure and functioning of coastal zone systems, and to contribute to a firmer scientific basis for reconciling conflicting demands on space and resources in coastal areas. In the late 1970s and 1980s, a number of joint activities were carried out, and it is expected that a new impetus to cross-cutting initiatives (involving land, freshwater and marine systems) will feature in future UNESCO programmes. Some of these programmes include:

- the Coastal Marine Programme (COMAR), which fosters cooperative networks among universities, research institutions and government agencies to address problems of concern in specific regions and strengthen national capacities;
- Training and Education in Coastal Marine Sciences, which focuses on enhancing coastal and marine science teaching and learning globally to better equip scientists,

teachers and planners, and through them, the public at large, for decision making;

- the International Man and the Biosphere Programme, which has two specific projects related to coastal zones: (i) the ecological effects of human activities on the value and resources of coastal areas; and (ii) the ecology and rational use of island ecosystems;
- the International Geological Correlation Programme, which focuses on sea level changes and coastal evolution;
- the International Hydrological Programme, which contributes to scientific efforts for improving basic knowledge of the global hydrological cycle and encouraging proper water management.

For further information, please contact:

UNESCO/Division of Marine Science
1, rue de Miollis
75732 Paris Cedex 15
France

Phone: +33 (1) 4568 3971
Fax: +33 (1) 4056 9316

The United Nations University (UNU) was established in 1975 as an autonomous body of the UN General Assembly. It works closely with the UN Secretariat, UNESCO and other UN organizations, as well as with existing academic institutions throughout the world.

Over the years, the UNU has been involved in research and training activities in the use and management of coastal and nearshore resources. From 1978 to 1985 the UNU implemented a Coastal Resources Project focusing on the use and management of coastal resources in tropical environments. Research and training courses were held in Indonesia in association with the Indonesian Institute of Science and the Institute of Oceanography. The UNU also organized a series of regional workshops in Fiji, Kenya and Saudi Arabia, with a view to stimulating activities in coastal research and management in the South Pacific, East Africa and the Arabian Gulf. Finally, as a supplement to these activities, specific research projects on environmental changes on the coast of Indonesia and on the impact of open-cast mining on rivers and coastal environments in New Caledonia were also undertaken.

A new UNU initiative, a research and training programme on integrated management of protected areas for scientific and cultural purposes has recently been launched in response to the concerns raised in UNCED's *Agenda 21*. The programme is being undertaken in cooperation with the Universities of Sassari and Cagliari, and CORISA (the Sardinian Research Consortium), Sassari, Italy.

The UNU will also collaborate with the UN/DOALOS and UNDP/Division for Interregional Programmes in a joint initiative to establish a database and a network for the exchange of information on training relating to the integrated management of coastal and marine areas.

For further information, please contact:

United Nations University, European Office
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Fax: +33 (1) 4065 9186

Coastal zone management has not yet become a lending category in the World Bank. To date, no country has been granted a loan for coastal zone management. However, the Bank does lend money for a project or projects which are in fact, or could be, parts of coastal zone management plans. A review of World Bank-financed projects with significant coastal and marine components over the last five years revealed 51 projects at a total cost of some $10 billion, of which the Bank lent about $3 billion.

All bank projects are now subject to environmental screening, guided by a directive on environmental impact assessment. Four regional divisions oversee the environmental performance of the Bank's project work and help to prepare environmental projects and loans. Some of these projects are directed at coastal zone management. For example, in 1988 the Bank, together with the European Investment Bank, set up the Environmental Programme for the Mediterranean based on the previous work of UNEP's Regional Seas Programme. This programme focuses on pollution control, water resources management, coastal zone management and biodiversity conservation. A technical assistance programme is now operational that identifies and prepares investment projects and defines policy. Similar programmes are also in place for the Baltic Sea and the Black Sea in cooperation with a consortium of banks and NGOs.
The environmental policy and guidance for World Bank projects is largely provided by the new central vice presidency called "Environmentally Sustainable Development", which has three departments: Infrastructure, Agriculture and Environment.

Projects of the *Infrastructure Department* include sewage collection and treatment, housing, water supply, etc. For the coastal zone, the Bank's guidelines on port and harbour development are especially relevant. The *Agriculture Department* promotes policy reform and the adoption of environmentally sound practices to reduce erosion and

fertilizers in runoff. It has issued guidelines on integrated pest management to reduce the use of pesticides.

The *Land, Water and Natural Habitats Division of the Environment Department* deals specifically with coastal and marine issues. This division, in consultation with UNEP, FAO and various consultants, has developed a set of guidelines for integrated coastal zone management, in response to UNCED's *Agenda 21*. These guidelines were presented at the WCC'93 as the *Noordwijk Guidelines for ICZM*, and are a conceptual representation of how the issue of ICZM can be approached by interested nations, rather than prescriptions as to how it should be done.

Another major activity of the Land, Water and Natural Habitats Division is the preparation of a document to determine priority areas for the conservation of marine biodiversity, most of which will be coastal. For this project the Bank has contracted the chairman of the IUCN's Marine Section of the Commission on National Parks and Protected Areas. This activity has been undertaken because the guidelines for the use of funds from the Global Environment Facility (GEF) specify that 20% of all biodiversity funding should go to coastal and marine biodiversity.

In addition to addressing marine and coastal areas through the GEF, the Bank has started to evaluate the economic feasibility and ecological stability of these areas. The first of these studies was on Bonaire Marine Park in the Netherlands Antilles, which appears to be ecologically stable, as well as a lucrative enterprise for the island. The financing of such models elsewhere could become a part of normal bank lending.

For further information please contact:

The World Bank
Environment Department
Land, Water and Natural Habitats Division
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Since 1929 the WMO has been implementing programmes that deal with data collection, exchange, analysis and predictions of the atmosphere and its interaction with the oceans. The impact of this interaction affects the global climate system, which dictates the course of global warming and its effects on coastal areas. Some of these programmes include the World Weather Watch, a basic programme that ensures the acquisition, rapid dissemination, analysis and processing of weather and climate-related data required for all spheres of social and economic activities.

Operational meteorological, hydrological and oceanographic services are essential for the safe and economic operation of coastal transport, fisheries and recreational activities, as well as natural disaster prevention plans. Marine and oceanographic data are provided to coastal zone management user groups through the Integrated Global Ocean Services System (IGOSS), which is co-sponsored by the IOC.

The WMO also co-sponsors research programmes with the ultimate goal of establishing a predictive capability for climate change though such programmes as the Tropical Ocean Global Atmosphere Programme (TOGA) and the World Ocean Circulation Experiment (WOCE). To ensure the global, permanent and systematic observations necessary for forecasting climate change and for assessing the health and state of the marine environment, the WMO is co-sponsoring the Global Ocean Observing System (GOOS). The climate component of GOOS will serve as the ocean component of the Global Climate Observing System (GCOS), another major interagency cooperative effort that is designed to contribute to the reduction of uncertainties and to increase the ability to predict climate and climate change.

For further information, please contact:

WMO Secretariat
41, Avenue de Giuseppe-Motta
Case Postale 2300
CH-1211 Geneva 2
Switzerland.

Phone: +41 (22) 730 8111
Fax: +41 (22) 734 0954

The WWF is, or has been, actively involved in a large number of coastal management projects in various parts of the world, including the Wadden Sea, Malfi Island in Tanzania in East Africa, the Caribbean, Southeast Asia, and the Baltic. The critical role played by coastal lagoons and wetlands as "multipurpose ecosystems" was clearly recognized by Baltic countries in the Joint Comprehensive Environmental Action Programme, which was adopted by the their Environment Ministers at a meeting in April 1992.

As part of the implementation of the first five-year phase of the programme, management plans will now be developed and implemented for various sites, for example, Matsalu Bay in Estonia, the Gulf of Riga between Estonia and Latvia, etc. In 1993 the Baltic governments asked the WWF to take a leading role in the implementation of this component of the

Action Programme. The WWF was requested to act as the executive agency and to initiate and coordinate the development of these management plans. This is a rather unusual role even for a large NGO like WWF.

In addition, the WWF will continue to play a more traditional NGO role in a number of coastal zone management projects in various regions of the world. Current efforts will continue to support and strengthen local NGOs and communities in high-priority areas so that they can play an increasingly important role in the development of integrated coastal management plans. This will be done, inter alia, through training programmes, institutional support, technical assistance and public awareness and environmental education programmes.

For further information, please contact:

World Wide Fund for Nature
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Country	Country description	Questionnaire
Angola	*	
Australia	*	
Bangladesh		*
Barbados		*
Benin	summary	*
Brunei Darussalam	*	
Cameroon	*	*
Canada	*	
China	summary	
Chile	summary	*
Colombia	summary	*
Comoros	summary	
Congo		*
Costa Rica		*
Croatia		*
Cuba		*
Eritrea	*	*
Fiji	*	
The Gambia	*	
Guinea-Bissau		*
Germany		*
Ghana	*	*
Greece	*	
Guyana	summary	
Indonesia		*
India		*
Israel	*	
Italy	*	
Ivory Coast		*
Kazakhstan	summary	
Kiribati	*	*
Latvia	*	*
Lithuania	*	*
Maldives		*
Malaysia		*
Morocco	*	
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Nigeria	summary	
New Zealand	*	
Pakistan		*
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