# Intergovernmental Oceanographic Commission

**Workshop Report No. 114**

# International Workshop on Integrated Coastal Zone Management (ICZM)

Organized in Co-operation with the National Institute of Oceanography
Ministry of Science and Technology, Government of Pakistan

Karachi, Pakistan
10-14 October 1994

**NOTE: THIS VERSION DOES NOT INCLUDE THE GRAPHICS**

**UNESCO**

**Acknowledgment**

It is a pleasure for me to acknowledge the very significant efforts made by Dr. S.M. Haq to initiate, help organize the Workshop, and in compiling and editing this report. There are also many others who contributed much towards the successful implementation of the Workshop. Allow me to mention Dr. Niaz Rizvi in particular. I also wish to pay tribute to the program experts who delivered lectures and participated very efficiently in the Workshop, and contributed much of their experience and knowledge.

G. Kullenberg
Executive Secretary IOC

## TABLE OF CONTENTS

**ANNEXES**

**EXECUTIVE SUMMARY**

The International Workshop on Integrated Coastal Zone Management was organized by the Ministry of Science and Technology, 10-14 October 1994, Karachi, with the co-operation and financial support of the Intergovernmental Oceanographic Commission (IOC) of UNESCO. It was also supported by the UNDP, and other agencies including the United Nations Environment Programme (UNEP) and the United Nations Industrial Development Organization (UNIDO) participated in the deliberations. The Workshop was organized not only in response to the United Nations Conference on Environment and Development (UNCED) and the Earth Summit that followed (1992), which identified the "Coastal Zone" as one of the top priorities in Agenda 21, but also to the United Nations Convention on the Law of the Sea (UNCLOS), to which Pakistan is a signatory.

The overall objectives of the Workshop were to evaluate the impact of socio-economic development in coastal areas of Pakistan and to draft guidelines for the integrated coastal zone management planning process so as to ensure sustainable development of marine resources and adequate protection of the marine environment for future generations. It also endeavored to recommend measures necessary to enhance national capacity for integrated management of the coastal zone which can be considered an important national resource in itself. In addition to the participation of national experts representing federal, provincial, and local organizations including scientific institutions, universities, industries and municipality, and other private agencies, the Workshop was attended by fourteen foreign experts from Canada, Denmark, France, the Netherlands, U.K., USA and from international agencies including IOC, UNEP, and UNIDO.

Presentation of scientific papers by national and international experts as well as the discussions which followed during the three Working Groups Sessions provided the basis for objective analysis of the existing and projected socio-economic activities along the entire coast of Pakistan, including the Sindh and Balochistan coasts and the Metropolis of Karachi and the related impacts on the coastal environment and its resources. A number of contentions, often detrimental, uses of coastal space and issues were distinguished which include:

(i) the indiscriminate discharge of effluent from domestic, industrial and agricultural sources;

(ii) the impact of activities of coastal industries and power plants that can alter nearshore geomorphology and longshore currents, leading to deterioration of coastal environmental quality and loss and redistribution of resources;

(iii) deforestation of mangroves that threatens the natural defense of the coastal zone and its associated estuaries as well as breeding grounds of commercial species;

(iv) depletion of coastal fisheries and living resources, their sanctuaries and nursery grounds.

A particularly serious impact has been the shrinking of the Indus estuary due to reduced flows and negative sediment budget leading to the progressive encroachment of the sea and salt water intrusion inland. This makes the need for water management an imperative to ensure harmonious balance between the water requirements of irrigation and hydroelectric interests in the hinterland and those necessary to maintain other human uses and environmental quality biological productivity in the coastal zone.

The Workshop also noted the great economic potential of the coastal ecosystems of Pakistan, endowed with natural resources which provide economic goods and services, both marketed and un-marketed at present, e.g., fish, shellfish, aquaculture products, minerals, seasonal exploitation of wave energy, natural products of commercial values from various marine organisms. They offer valuable opportunities and prospects for future economic development. The aquaculture sector which alone is estimated to be worth more than Rs. two billion, can support a large fishing community in the region.

The Workshop recognized that the coastal zone is a complex environment, characterized by dynamic relationships amongst the natural environment and its ecosystems, and the societal demands for space and natural resources, and thus subject to both natural and human influences. Very often such demands exceed the capacity of the coastal zone to provide the desired goods and services. It was noted that if the activities in the coastal areas remain unchecked, they will lead to excessive and unsustainable use of living and non-living resources, degradation of the environmental quality and health, potentially hazardous consequences to human health and property, and irreversible damage to the estuarine resources and the environment. Inland, they will lead to a decline in agricultural potential due to salt water intrusion in the coastal estuaries and aquifers.

The Workshop, therefore, identified Integrated Coastal Zone Management (ICZM) as the most imperative and immediate need for Pakistan. It should identify the combination of outputs and services that can be produced to help ensure sustainable use of coastal zone as an important national resource. The ultimate goal of ICZM should be to promote

national development through rational use of coastal resources and environments in a manner which balances economic, social and environmental goals. The Workshop therefore stressed the need for clearly articulating the value of the coastal zone in terms of economic sustainability to the governments at all levels, local, provincial and central.

The Workshop recommended several steps to move toward improved ICZM and coordination of activities at various levels:

(i) An integration of policy and programmes across different levels of the government and economic sectors and availability of fiscal and material resources to ensure that both short-term objectives and long-term strategic economic value of marketed and non-marketed goods and services provided by Pakistan's coastal zone and the overall goals of coastal zone management are achieved.

(ii) Setting up of a governmental regulatory framework to guide the private and corporate sectors and ensure public participation and involvement in decision making and promoting prudent and environmentally-sound use of the natural resources.

(iii) Linking ICZM at three levels in the government: local, provincial and central government, in consonance with the laws and the rules of the governmental organizations. While the central government is ultimately responsible for the overall plan, including the weighted interest of the various sectors involved and in harmonizing these interests, the various sectoral departments such as science & technology, water management, economic resources (e.g. marine fisheries, forestry, agriculture, minerals and other resources) and finance, contribute to the ICZM plan by providing the informed sectoral inputs. The provincial government may take actions for ICZM in accordance with their jurisdiction: analyzing problems, generating solutions and coordinating ICZM issues with the central government. The local level participates in the ICZM process by implementing the necessary measures and by making direct input concerning local interests and implications within the overall ICZM framework.

(iv) The creation of an appropriate coordination and oversight mechanism to ensure that all significant governmental and private sector actions affecting the coastal zone are consistent with the ICZM policies. Options for a mechanism to oversee this harmonization process include the creation of a new inter-ministerial coastal council, use of an existing inter-ministerial coordination mechanism at the national planning commission level; or the designation, by legislation, of a lead Ministry to perform these important functions.

The Workshop highlighted the need for a clear definition of tasks and responsibilities in consideration of the present situation in Pakistan. The incorporation of the responsibilities at three levels in the ICZM will provide the general support for ICZM and for the implementation of the management actions.

Other Workshop recommendations included the need for establishing information and data center in support of ICZM activities; regular coastal environmental monitoring and measures to preserve biodiversity as well as other contingency measures. The Workshop strongly recommended the Ministry of Science and Technology and its National Institute of Oceanography (NIO) to play a key role in providing required services in support of ICZM at the national level.

The following benefits could accrue for Pakistan if an ICZM plan is adopted:

(i) protection and sustainable development of the coastal zone and its resources (Fisheries etc.) as an important national asset for the present and future generation of Pakistanis;

(ii) protection of the coastal environment from pollution and management of living and non-living resources and valuable ecosystems;

(iii) development and or exploitation of new resources through aquaculture, natural products of commercial value from marine microbes and organisms, and of non-conventional sources of energy (e.g., wave energy) in a manner without detriment to the natural ecosystems;

(iv) protection of important beaches, improvement and maintenance of recreation facilities for the public;

(v) land use planning in coastal vicinity so as to ensure balanced used of coastal space and the environment;

(vi) protection of coastal areas from natural hazards, storm surges, sea- level rise and other external influences.

# PART I

## 1. BACKGROUND

During the past decade the importance of the coastal zone in the context of national economies of coastal and island states has been widely recognized. The World Commission on Environment and Development, the Bruntland Commission, called for a "new era of environmentally sound economic development" and said that "the goal of sustainable development is to meet the needs of the present without compromising the ability of future generations to meet their own needs". Two important trends apparently contributed to this worldwide awareness. One is the steady movement of population over the years into coastal areas which is reflected in 60 percent of the world population at present being concentrated within 60 Km of the coastline. This trend is expected to accentuate with time. Second is the environmental crisis recognized at two levels. One at the global level caused by such events as the potential warming of the climate as a result of greenhouse effects, ozone depletion and acid rains which may degrade the life-support system; and the other more localized environmental crisis that is reflected in coastal erosion, deforestation, species extinction as a result of human activities and excessive pattern of consumption. To the extent that local effects expand, they may eventually become global in nature.

The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil, June 1992, which brought together the heads or senior officials of 179 governments, and officials from United Nations Organizations, non-government agencies and other groups, upheld the idea that the only way to have long term economic progress is to link it with environment protection. This is only possible if nations establish a new equitable global partnership involving governments, their people and key sectors of societies. In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and can not be considered in isolation from it. The Conference also recognized that environmentally sound and sustainable development would require better scientific understanding of the problems as well as sharing of knowledge and innovative technologies to achieve the goal of sustainability.

UNCED Agenda 21, a blue print of major actions required to make development socially, economically and environmentally sustainable was adopted. Two conventions: one the "UN Framework Convention on Climate Change" to stabilize greenhouse effects; and the other the "Convention on Biological Diversity" to conserve the variety of living species were also adopted. The central point of all these initiatives is to ensure that economic development may proceed in a sustainable manner. Agenda 21 recognizes that sustainable development is primarily the responsibility of governments, and national strategies, plans and policies will be required to implement the proposals.

Chapter 17 of Agenda 21, *inter alia*, is devoted to the "Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living Resources". The provisions of this chapter, while recognizing the oceans including all their attributes as integral part of the global life-support system, furnish essential elements for countries to anticipate and prevent further degradation of the marine environment and reduce the risk of long-term irreversible effects. The intent is to make marine environmental protection part of general environmental, social and economic development policies for all countries. The Programme Area entitled Integrated management and sustainable development of coastal and marine areas, including exclusive economic zones is exclusively devoted to integrated management and sustainable development of coastal areas.

At its Seventeenth Session, the Assembly of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, held in Paris, 1993, adopted Resolution XVII.1 "Coastal Zone Activities" in consonance with the emphasis laid down by Agenda 21 on the important role that integrated coastal area management can play in order to achieve sustainable use of the coastal zone for national development. This was done to assist countries to provide for scientifically valid information basis, and to help them engaged in related capacity building.

On the national scene two important trends were discernable in Pakistan. The first acting independently and the second influenced by developments at the international level such as those involving the rapid socio-economic development in coastal areas in particular Karachi. The effects of both have been guided by series of legislative measures adopted by the government encompassing both private and public sectors. While the involvement of various sectors in coastal areas has been either resource-based or service-oriented, interactions between sectors tended to either poorly coordinated or were neglected. In the main, this was due to the paucity of effective coordination or for want of adequate

scientific information and data about the impact of these development on the environment and resources of coastal areas. The consequences of conflicting uses of space is progressively seen in the deterioration of environments and associated resources. Thanks to the efforts of national scientific research institutions over the years the seriousness of the environmental conditions and the danger of irreversible effects to valuable coastal system have been brought to the fore. Immediate action to address these issues at the national level has thus been recognized. Added to this have been the steps taken by the present Government to accord high priority to environment issues and accordingly new institutions have been created to address these problems. It was thus appropriate that an international workshop be organized to examine the situation and suggest strategies that are well suited for Pakistan.

Recognizing the growing seriousness of the problems in coastal Pakistan, the Ministry of Science and Technology took the initiative to organize this International Workshop on Integrated Coastal Zone Management. The Workshop was implemented in close collaboration and with financial support of the IOC. The UNDP Islamabad also provided financial support, while other ministries such as Ministry of Food and Agriculture, Ministry of Communication, Division of Environment and Urban Affairs, University grants commission agreed to co-sponsor the Workshop, and provided support by participation of their respective experts. About fifteen foreign experts participated including two experts representing UNEP and ESCAP. A total of 30 national agencies (See Annex IV) took part in the deliberations.

## 2. OPENING OF THE WORKSHOP

The Workshop was inaugurated by the Chief Minister of Sindh, the Honorable Syed Abdullah Shah, on Monday, 10 October 1994, at the Avari Renaissance Towers Hotel, Karachi.

The Director-General of National Institute of Oceanography, Mr. S.H. Niaz Rizvi, welcomed guests and participants. He expressed thanks to the Chief Minister of Sindh, the honorable Syed Abdullah Shah, for gracing the occasion which was indicative of the importance the Government of Sindh attached to the theme of the Workshop. The Director-General expressed special thanks to the Executive Secretary IOC of UNESCO, Dr. Gunnar Kullenberg, for the technical and financial support provided by his organization and to Dr. S.M. Haq for the valuable support provided through out the preparation of the Workshop. In conclusion Mr. Rizvi outlined the objectives of the Workshop as well as the programme of work and the working arrangements made for the conduct of business.

The Adviser to Ambassador and Permanent Delegate of UNESCO, Paris, Dr. S. M. Haq, thanked the Ministry of Science and Technology, NIO and the IOC for inviting him to assist in the preparation of this Workshop and coordinating various activities from outside. He pointed out that the Workshop was unique in the sense that it not only had representatives from a number of national agencies but that also fifteen foreign experts including four Pakistani expatriate experts had come to participate in the deliberations. He paid tribute to the Director-General and his staff for the job well done.

The Executive Secretary IOC expressed appreciation for the Ministry of Science and Technology to have taken the initiative to organize this forum. In his statement he elaborated the importance of the theme from an international view point and stressed the need for coastal and island states to think globally and act locally.

The Secretary, Ministry of Science and Technology, responded by expressing his appreciation to the IOC for the collaboration in organizing the Workshop. He stated that the theme of the Workshop was complementary to the objectives of his Ministry, since science and technology have crucial roles to play in providing scientific basis for development and management activities. He said the Ministry would attach great importance to the recommendations of the Workshop.

The Parliamentary Secretary for Science and Technology expressed that the convening of the Workshop was very timely considering the rapid advances that had taken place in recent years in marine science and technology which were available to the coastal states to fulfil their obligations and rights for marine resources development and management on a sustainable basis. He made special reference to Pakistan being a signatory to the United Nations Convention on the Law of the Sea (UNCLOS) and the United Nations Conference on Environment and Development. Stressing the need for integrating environment and other socio-economic aspects into development and management strategies, he referred to actions already taken by the Government of Pakistan to reconstitute Pakistan environmental Council, establishment of coastal Development Authority for Sindh and the similar one being proposed for Balochistan. He expressed the hope that the Workshop will be able to adopt recommendations that are well suited to Pakistan's needs which would receive due considerations of authorities concerned.

The Chief Minister, in his inaugural address, welcomed the foreign guests and the representatives from a wide range of national agencies to the forum. He expressed satisfaction that the Workshop was being held at no other place than Karachi which was not only the largest city but also the industrial hub of the country. He stated that coastal zone management was one of the most complex exercise of all government endeavors. The complexity was derived not only from multiple uses of the area involved, but from multisectoral involvement in the whole question of management. There were questions of ownership and governing authority that were applied to inland areas, coastal land, coastal waters and offshore waters falling within the jurisdiction of federal, provincial and local governments. Each sector was involved in promoting its own interest and in its area of jurisdiction. There was always competition amongst sectors. Then there was the interest of the poor fishermen community living along the coast since the lives and aspirations for economic well being of the people concerned were inextricably linked to the sustainable productivity of coastal resources. He stressed the need to harmonize various interest in terms of resource exploitation and utilization of space in a manner that would ensure the integrity of the coastal environment and its valuable ecosystem for the good of present generations and of posterity. While expressing the understanding that the task before the Workshop by no means was easy, he hoped that the participants would be able to propose strategies most suitable to Pakistan and make recommendations for the relevant authorities in the Government to consider in planning future actions.

The Senior Joint Technical Adviser Mr. Abdul Rashid, presented a vote of thanks. He expressed thanks to IOC for the full support provided, to the UNDP for financial support and to UNEP and to ESCAP for sending their experts to this forum. He thanked various ministries that had co-sponsored the Workshop for sending their representatives to the Workshop. He thanked all the organizations that were represented in the Workshop for their interest and participation. He also paid special tribute to ten different business groups who contributed towards organizing various social functions during the Workshop.

## 3. THE OBJECTIVES OF THE WORKSHOP

The purpose of the Workshop is to provide a forum to share experiences amongst users of coastal zone including scientists from academic and researching organizations, representatives from national agencies responsible for land use and planning, fisheries, agriculture, coastal industries, tourism, port and shipping, as well as with experts from countries of the Indian Ocean and outside. The detailed objectives of the Workshop were as follows:

(i) review basic principles of integrated coastal zone management;

(ii) review current state of affairs with regard socio-economic development trends in coastal areas of Pakistan;

(iii) Based on identification of key issues affecting the coastal environment and resources, recommend formulation of recommendations on:

- (a) guidelines for management strategies aimed at systematic planning and integration of coastal and marine environment so as to ensure sustainable development of marine resources and protection of the marine environment;
- (b) measures for monitoring coastal environment;
- (c) capacity building including creation of information and data base facilities in support of a coastal zone management programme ;
- (d) institutional arrangements for government action to ensure balanced and integrated development of the coastal zones of Pakistan.

In the framework of the IOC, the Workshop was seen as a regional follow-up of UNCED, at the level of the intergovernmental regional subsidiary bodies for the Central Indian Ocean (IOCINDIO) and for the Co-operative Investigation in the North and Central Indian Ocean (IOCINCWIO).

## 4. ORGANIZATION OF THE WORKSHOP

The Workshop agreed to conduct its business in two parts. The first two days were devoted to presentation of papers by participants in plenary sessions. For each session a Chairperson and Vice-chairperson were elected. Titles of papers along with the names of speakers are provided in Annex III. For the last two days the Workshop conducted its business through three Working Groups. For the overall conduct of its business the Workshop elected the following persons:

| | |
|---|---|
| Chairperson: | Professor Robert Knecht |
| Rapporteur: | Mr.R.S. Arthurton |

The Workshop agreed to form the following three "Sub-working Groups" for de liberation on problems and issues of three distinct coastal areas identified on the basis of their bio-geophysical characteristics and elected Chairpersons for each of them as follows:

Working Group I: Definition of the Coastal Zone
Chairperson: Dr. Bilal U.Haq

Working Group II: Issues and actions for ICZM

Sub Working-Groups:

II/1 Karachi coastal areas
Chairperson: Professor Joost H. J. Terwindt

II/2 Sind coastal area (excluding Karachi)
Chairperson: Dr. Hillary Hildebrand

II/3 Balochistan coastal area
Chairperson: Dr. Jawed Hameedi

Working Group III: Capacity building
Chairperson: Dr. John C. Pernetta

The Reports and recommendations of the working groups were presented in the plenary. The present repor t describes the outcome of the deliberations undertaken by the working groups.

## 5. PRESENTATION OF PAPERS

In all twenty four papers were presented which can broadly be categorized as follows:

(i) Keynote addresses/ presentation of Report:
- a) future of River Indus Delta in view of upstream damming and perils of ignoring coastal zon e management;
- b) global perspectives on coastal area management;
- c) presentation of Summary Report of the Symposium on Indus River: Biodiversity, Resources an d Human Kind, organized by the Linnean Society, London, U.K..

(ii) Coastal zone management planning:
- a) basic concept of and framework for Integrated Coastal Zone Management;
- b) implications of physical change for coastal zone management;
- c) the concept of integrated coastal zone management and its application to coastal Pakistan;
- d) the role of environmental assessment in integrated coastal zone management;
- e) coastal zone management: experiences in the Netherlands;
- f) summary of the outcome of Coastal Zone Canada 94: International Conference; Co-operation in the Coastal Zone, 20-23 September 1994.

(iii) Socio-economic development trends in coastal areas of Pakistan:
- a) land utilization, planning and development in coastal area of Sindh and related legislativ e instruments and policies;
- b) Socio-economic conditions along the Balochistan coast.

(iv) Problems and issues of Pakistan coastal zone:
- a) agroclimatic zone of coastal area and potential for development;
- b) coastal circulation along the Pakistan coast;
- c) water management of coastal rivers and streams for integrated coastal zone management;
- d) management of Indus delta mangroves;
- e) prospects of shrimp farming in the Indus deltaic region;
- f) threats to Biodiversity in the marine ecosystem of Pakistan;
- g) vulnerability of coastal fisheries and other living resources to changes in the marine an d estuarine environment;
- h) overview of pollution along the coast of Pakistan.

(v) Environmental monitoring programmes for ICZM:

a) animal biomarkers as stress indicators: a tool to assess the health of organisms in the environment;
b) strategy for coastal environmental monitoring in Pakistan.

(vi) Information and data requirements:
a) the use of natural resource maps, and related Geographic Information System (GIS) in coastal zone management;
b) information and data requirements for coastal zone management in a changing world.

## 5.1 HIGHLIGHTS OF THE PRESENTATIONS

### 5.1.1 Keynote Addresses and Report

Perils of ignoring ICZN

The first keynote address by Dr. Bilal U. Haq on the future of the river Indus described the impact of the construction of dams and barrages upstream. Three main impacts were noticeable that have affected the Indus estuary. The continuous reduction in river flow over the years coupled with negative sediment budget were reported to have caused the shrinking of the Indus estuary and the progressive encroachment of the sea inland as well as the salt intrusion in the sediments, with serious implications for the contamination of freshwater aquifers. This in turn might unfavorably affect the agricultural activity of the adjacent land areas. The impact of these developments was also seen as increased coastal erosion along the coast.

Global aspect of ICZM

The second keynote address by Dr. Gunnar Kullenberg on global perspective of coastal area management highlighted contemporary developments at the international level (e.g. UNCED, UNCLOS) in the field of ocean management resulting from recent advances in the knowledge about climatic influences on lifestyle. Special reference was made to the growing realization of the interdependence of environment and development at two levels: one at the global level caused by such events as the warming of the climate as a result of greenhouse effect, ozone depletion, sea-level rise and more localized environmental crisis reflected in coastal erosion, water quality, deforestation, desertification, species extinction as a result of human activities and excessive pattern of consumption of natural resources. These changes necessitated the need for scientific and technological input to address regional and global integrated coastal zone management (ICZM) issues which can be simultaneously brought to bear on problems at national and local levels. The need for thinking globally and acting locally was emphasized.

Report of symposium on River Indus

Dr. Bilal U.Haq informed the participants of the main outcome of the Symposium organized by the Linnean Society of London "The River Indus: Biodiversity, Resources and Humankind" held in London, 13-15 July 1994. He informed the participants that IOC was one of the sponsors of the Symposium and that the latter brought together international experts from both developed and developing countries to assess the present state of knowledge about the way the Indus River System works. There were aspects that had relevance to the theme of this Workshop and it was, therefore, appropriate for the Workshop to know the outcome. Delegates at the symposium addressed a wide range of multi-disciplinary topics including Himalayan mountains and foothills and Siwalik range, the central plains, the desert, the tributaries, the deltaic and coastal region of the River Indus and the coastal environment. The Symposium stressed the need for a holistic and integrated approach to all aspects of the river and its effects on the environment and human populations. A number of recommendations were approved which accorded greater importance to integrated research, conservation, management and restoration in a number of crucial areas of the Indus River. Among other things, the symposium drew attention to the need for research in biodiversity of ecosystems, endangered species, the environmental impact of pollution, sediment and water discharge budget, conservation of endangered coastal ecosystem and deltaic mangrove swamps.

### 5.1.2 Coastal zone management planning

Basic concept

On coastal zone management planning seven papers were presented on wide ranging topics. Basic concept and principles of coastal zone management and the associated planning process, as well as the various mechanisms that need to be developed were elaborated. The ICZM is designed to address key issues arising from conflicting uses of the space, the environment and the resources. Key issues commonly referred to include the loss of habitats, resources, pollution of

environment, coastal erosion, deforestation and changes in physical conditions that produce harmful results. The central point in the whole approach towards ICZM is to develop an intersectoral and harmonized approach to resolve those key issues without detracting the users of coastal zone from their mandatory functions and responsibilities. Key elements of integrated coastal zone management planning process such as integration of national efforts vertically at all levels in the government and horizontally across various sectors and agencies, and the need for intersectoral coordination were described, citing example case studies. The implications of physical environmental change for coastal zone management were highlighted. Awareness and understanding of the nature and scale of the physical changes were considered as prerequisites for environmental-policy making and management. Only then the economic implications of the change can be properly assessed and the risks spelled out in time scale and terms of the economic consequences.

Questions regarding the goals of ICZM and other questions concerning what is being managed, who should manage, and how it should be managed were discussed, giving examples of case studies. Various dimensions, functions and degrees of policy integration and the relative roles of national and local governments in respect of ICZM were described. Suggestions were made about various steps that need to be taken to establish an ICZM program in Pakistan.

Environmental assessment

The important role of environmental assessment (EA) in integrated coastal zone management was described in detail. As a formalized process the purpose of EA was described as an attempt to identify and predict the impacts of policies, legislative proposals, programmes, projects and operational procedure on the biogeophysical environment resources and human health, and thus interprets and imparts information that could be used in management. As both the concept of ICZM and the EA process are directly linked to the sustainable development, the adoption of the principles of latter was considered as prerequisites to any management planning process.

Experience of the Netherlands

The experiences of the Netherlands was cited as a case study. In the Dutch procedure for coastal zone management all government levels are included: local, provincial and national authorities. Coastal zone management is achieved by preparing a policy analysis document by representatives of these authorities. Such document defines and explains the existing management problems, it discusses the required targets and developments and outlines the strategies to accomplish the agreed developments. This policy analysis document is then discussed and approved in Parliament and finally put into action by the Government. Such a procedure is repeated every 10 years. This procedure proved to be good means to involve all levels of government in a structured way, discussing the same agenda and producing plans which are achievable and implementable.

Community participation

Dr. Hillary Hildebrand was invited to present a paper describing the salient features of the outcome of the Halifax 94 Conference on Coastal Zone Management, particularly in regard to participation of local authorities and communities experiences in management of coastal zone. The participation of local authorities and communities in ICZM was elaborated. While ICZM is usually a "top down" management process in which the governments are responsible for development of comprehensive legislation and national policies including the design and implementation of institutional reforms, public participation in management issues was considered important elements. The desired public involvement includes joint planning, referred to as " multi-stakeholder processes" which allows a full exchange of information and thus assists decision making. Public information and education efforts by the government agencies was considered integral to important aspect the partnership between the people and their government.

### 5.1.3 Socio-economic development trends

Sindh coast

A detailed description was given of the five sectors into which the Sindh coast is divided for management purposes. Salient features of socio-economic conditions in each sector has been described (see Part II: Sub-Working Group II/2). These sectors have been subject to ever expanding anthropogenic influences. Some of the major activities reported from the region, such as, reclamation of wetlands, dredging of the navigational channels, discharge of industrial effluent and urban waste, uses of insecticides, destruction of mangrove forests for various uses, trash fishing, indiscriminate killing of wild life, and the damming of the Indus river in the northern parts have been reported to be the main factors causing the destruction of coastal areas, especially the Indus delta, thus disturbing the ecological balance.

Reference was made to the coastal community which rely heavily on coastal resources such as mangrove, fish and shrimps and, in this context, to the community development programme in Rehri, which is being implemented with the technical advice under the IUCN programme covering three aspects including income generation, environmental awareness and community organizations.

On the management planning of coastal zone in Sindh, a number of institutions were reported to be involved: they represent local, provincial and federal governments, *ad hoc* bodies, researching institutions, non-governmental organizations and private parties. More than 30 agencies were cited to have jurisdiction/concern in the area. A number of institutions are concerned with the management structure encompassing land sale/lease, quality development, law enforcement, tourism, promotion of development, education, maintenance and coordination (see Table). Reference was made to the steps taken by the Government to establish Coastal Area Development Authority for Sindh which is at a planning stage.

Balochistan coast

For the sparsely populated Balochistan coast, extending from Lasbela near Karachi to Makran coast at the Iranian border, the existing socio-economic conditions were described with particular reference to the limited resources that are available in terms of agriculture crops, livestock, educational facilities, health and availability of essential support systems such as water and energy. Reference was made to the plans to attract investment from both public and private sectors to support development activities around Gawadar, a fish harbor, Pasni, a fishing port, Ormara, Jewani and other coastal towns. High priority is reported to have been given to develop accessibility to various coastal areas by constructing road network through out the coastal region. As part of water management in the coastal area the projected construction of dams on the Hingole river, at Mirani on Dasht river and Acra near Gawater were briefly discussed.

### 5.1.4 Problems and Issues of Coastal Pakistan

In all, eight papers were presented dealing with current environmental and resource problems facing the Sindh coast, the possible effects of changes in the environment on the organisms and strategic design for coastal monitoring programmes.

Sea encroachment and its implications

See keynote address, 5.1.1, referred to above.

Nearshore agriculture

Agroclimatic zones of Sindh coast and their potentials for agriculture development was described. The study indicated some coastal areas to have great potential for many other fruits, nuts and the industrial crops and such climate zone covers Mirpur Sakro, Ghorabari, Jati and Sujawal areas, besides the coastal creek zone. It was noted that the data on the extent of salt intrusion inland was either lacking or non existent. The need for investigation into this aspect was considered highly desirable to better understand the implications of salt intrusion for the future agriculture prospects of the near shore areas.

Pollution

Based on the analysis of scientific data the nature of three major sources of pollution in the coastal areas of Karachi were described. These include effluent from industries, domestic sewage and oil. From industrial sector (6000 units), the major sources include: the industrial complexes around Karachi such as KITE, LITE, HITE, ship breaking industry, power plants, West Wharf industrial area, Steel Mill complex, oil refineries and others. Most of the sewage (200 MGD) flows to Karachi harbor, Gizri creek and Boat Basin area from Lyari river and Malir River and through a dozen open sewers. Some of the heavily polluted areas by oil include Korangi creek, Gizri Creek, Clifton beach, Chinna Creek, Boat Basin and in the main harbor. Oil slicks in coastal area and tar balls on beaches have been reported. Major impact of pollution was seen around the discharge points of coastal industries. Due to poor quality of water many coastal areas are devoid of benthic fauna and flora. High concentration of heavy metal such as Fe, Zn, Cu, Ni, Cd, Pb, Hg and Co, have been recorded in marine biota and sediments. It was recognized that there was a general lack of scientific data on the resident time of pollutants in enclosed areas, especially in the creeks, as well as about their dispersal mechanism.

Threat to biodiversity

Several natural and man-made threats to biodiversity were reported. Changes in physical factors such as high temperature, high salinity, upwelling of deoxygenated layers, erosion of the beaches due to negative sediment load from the river have caused considerable stress to the animal community. Disappearance of certain species of bivalve mollusc including oysters and clams from the Sindh coast is specially mentioned. Several invertebrate species were reported to have disappeared from the intertidal zone due to pollution and due to ecological ineptitude and exploitation.

Mangrove destruction

A detailed description was given about the current status of mangrove system within the deltaic region which

represent by far the most valuable ecosystem, occupying an area of 612,370 hectors. Mangrove cover in the Indus delta is reported to have decreased from 43 % to 23 % in 1990, threatening the survival of the natural resources and there by the

livelihood of a large number of fisherman. Reference was made to the indiscriminate exploitation and its deterioration, which was attributed to changes in the environmental conditions in the coastal areas such as hypersalinity, decreased alluvial flow, pollution, soil erosion, dredging and felling. The average consumption of mangrove wood per head was estimated to be 7 Kg per day, with the estimated total consumption per year of the order of 502,248 munds (20,102 tons). The impact of loss of mangrove on associated marine community as well as management strategies to address those problems were discussed. Under the IUCN project efforts are being made to rehabilitate the degraded area with indigenous species of mangrove such as *Rhizophora mucronata* as well as the most common *Avicinia marina*, working very closely with coastal communities to develop packages for encouraging local management and sustainable use of mangrove.

Loss of fisheries

Productivity of the mangrove areas was reported to be much higher (365-780 gC/ M2 / year) as compared to coastal waters (50-200 gC / M2/ Year) which accounts for greater potential for fisheries yield in the former area. Vulnerability of fisheries resources of the coastal areas and deltaic region to changes in the environment was discussed. Apart from over exploitation, the loss of fisheries was accounted for high salinity regimes extending into the distant parts of certain creeks resulting from reduced freshwater flow in the estuarine system. Other factors reported to have affected fisheries include increasing pollution and mangrove destruction, endangering the potential nursery grounds and sanctuaries, particularly the shrimp fisheries which account for significant contribution in foreign exchange.

### 5.1.5 Proposals for Environmental Protection

Environmental monitoring

Environmental monitoring, together with pertinent research and assessment activities was considered as a key element of ICZM and an iterative and evolutionary process that strives to harmonize resource use strategies, socio-economic factors, and institutional arrangements in order to ensure sustainable benefits of the coastal zone. Monitoring programme should be comprehensive to include spatial distribution and long term trends in contaminant concentrations in the environment, biota and ecosystems and validation of models aimed at predicting consequences of different environmental management scenario and actions. It was proposed that future coastal environmental monitoring in Pakistan, or collectively in the north Arabian Sea region, follow a tiered approach in sampling intensity; a sparse network of permanent monitoring sites encompassing the whole region; and intensive, relatively short-term monitoring of specific areas that are most directly affected by and are at risk from coastal pollution and habitat losses. The programme must be tailored to address specific environmental and ecosystem management needs, based on the relative importance of different pollutant categories encompassing: conventional pollutants (suspended solids, oil and grease, fecal coliform bacteria); non-conventional and priority pollutants such as metals, organo-chlorines, and other xenobiotic substance. This strategy was considered particularly relevant to Pakistan where different physiographic segments of the coastline also have markedly different environmental issues such as the Indus Delta coast (reduced freshwater flow from Indus River affecting mangrove ecosystems, shrimp aquaculture sites and biological productivity), Karachi coast (massive and large uncontrolled pollution from municipal and industrial sources causing degraded habitats, diminished aesthetic values and risks to human health), Lasbella coast (nascent shellfish fishery, recreational use of beaches, and impending industrial development sites), and the relatively pristine Makran coast (sea-level change, marine biodiversity, fisheries economy, and potential development of mineral resources).

Stress indicators

The paper on "animal biomarkers as stress indicators..." described how biological effects caused by anthropogenic elements could affect various physiological/biochemical/metabolic processes whereby organisms might not be able to maintain homeostasis. Altered metabolic rate if not compensated by adaptive mechanisms of the organism may affect its survival and or reproduction. Many physiological and biochemical bioassay or biomarkers have been developed over the last decades which can be used as indicators of exposure, effects and/or stress. These assays or biomarkers represent a xenobiotically-induced variation in cellular or biochemical components or processes, structure and functions in a biological system of an organism. Reference was made to the two types of biomarkers, namely, the biomarkers for general pollution and the other more specific biomarkers that affect the nervous system, damage the genetic material and other functions in the organisms. Selected examples of biomarkers in aquatic organisms in fish and invertebrates were discussed.

### 5.1.6 Information and Data Requirements

GIS system

Paper on Geographic Information System (GIS) highlighted the scope of this programme being implemented by UNEP on a global scale. Planning was regarded as a fundamental step in any ICZM activity. The need for information

and data on the environment and the resources of the area to be managed was considered as prerequisites for any planning process. Wrong decisions without a proper planning could cause irreversible effects. Resource maps could be excellent tools for determining the scope and scale of management as well as thematic approach; they are cheap and could be used by a variety of professionals including planners, demographers, NGO's as well as for raising public awareness. Maps do not compete with other description material. Stressing the need for a national data centre for GIS system, it was stated that Pakistan, having already acquired considerable know-how in marine environmental and resource studies, has reached the stage for GAS system to be introduced.

Information and data

A wide range of interdisciplinary and intersectoral information required for the purpose of ICZM were described. These include information and data on physical environment, climate, geomorphology, hydrology, oceanography, biological environment, non-biological resources, impact of developments on the environment, cultural, recreational and socio-economic aspects. Most of the information on physical conditions could be derived from satellite imageries for which facilities do exist in Pakistan.

### 5.1.7 Opportunities for New Resources Development

Potential for shrimp farming

Potential for shrimp farming in the vast deltaic region was discussed. A considerable part of Indus delta, 192,000 hectares, is shown to be suitable for shrimp farming. The potential of shrimp farming has been estimated in the Indus deltaic region, based on the surveys and results of experimental shrimp farming undertaken by NIO. Through semi-intensive shrimp farming it is possible to produce a crop of shrimp *Penaeus merguinsis* of the order of about 800 million Kg/year from an area of about 92,000 hectares, and through practicing extensive shrimp farming technique some 81 million Kg/year on an area of 100,000 hectares. It is estimated that the shrimp farming in the Indus delta has the potential of generating 20 million US dollars of shrimp exports per year on a two crop basis.

## 6. SUMMARY OF THE FINDINGS

### 6.1 OVERVIEW

In considering the need for introducing ICZM in Pakistan at the present time, the Workshop reviewed the problems of the coastal zone in three perspectives; provincial, national and inter-governmental. As signatories of UNCED, Agenda 21, Pakistan supported the intergovernmental efforts promoting sustainable development of the coastal zone. At the national level the coastal zone is recognized as a resource of great economic importance with a considerable potential for development, while, at the provincial level, both Sindh and Balochistan provinces were beneficiaries of the coastal zone resources while, at the same time, they had responsibilities for their well-being and sustainability.

In addition to its UNCED commitments, Pakistan is party to the new Law of the Sea Convention, which will enter into force in November this year, and was a contributor to the intergovernmental World Coast Conference held in the Netherlands in 1993, in which an agenda to prepare to meet the coastal challenges of the 21st Century was set out. At the national level, the importance of the coastal zone as a focus for trading infrastructure and industrial development serving the nation was recognized, as was the importance of the marine fisheries industry. The Workshop noted the potential of the coastal zone as a source of power through the seasonal exploitation of wave energy. Another issue of national importance that impacted on the coastal zone was that of water management, ensuring a harmonious balance between the water requirements of irrigation and hydroelectric interests in the hinterland and those necessary to maintain environmental quality in the coastal zone.

At the provincial level, the Workshop recognized and acknowledged the commitment by the Sindh Government in the formation of the Coastal Development Authority dedicated specifically to planning, developmental and management issues in the provinces's coastal zone. This commitment served as the basis for this ICZM Workshop. While the developmental pressures were presently focused on the Sindh coastal zone, in particular the Karachi conurbation, the Workshop recognized that the Balochistan coast has a considerable development potential, with various infrastructure projects in the planning stage. There was agreement that a principal goal was the enhancement of the socio-economic conditions of the coastal zone, with emphasis on environmental protection and resource issues such as fisheries and aquaculture development and management.

The Workshop stressed the need to clearly articulate the value of the coastal zone, in terms of economic

sustainability, to government at all levels, local, provincial and national. The message should state the present problems and future prospects for the coastal zone, as well as the opportunities and benefits that the zone presents. The statement should be based on the substantive principles of sustainable development. The aim of this Workshop was to produce a document that would sensitize government at all levels to the problems and issues within or impacting on the coastal zone. If possible, the issues and problems should be prioritized. Recognizing the lead taken by the Ministry of Science and Technology in sponsoring this Workshop, it agreed on the importance of targeting the highest levels of government, those with a capacity for implementing the plan's recommendations. In order to facilitate the implementation process, it was necessary to develop a mechanism for co-ordination including a proper understanding of the existing institutional framework. The Workshop agreed that the plan should be implemented as far as possible through existing institutions.

The Workshop acknowledged that the main driving force for the plan should be science and technology. This was consistent with Agenda 21 of UNCED. However, the plan's scope should extend well beyond this in its consideration of socio-economic and legal issues.

The Workshop recognized that much work had already been carried out in the analysis of Pakistan's coastal zone issues. In particular, the publications of the National Institute of Oceanography were noted. It further noted that ESCAP were producing a review statement for ICZM in Pakistan in collaboration with NIO; this would lead to a Coastal Environmental Management Plan. Coastal zone issues are also addressed in various strategy papers including the Balochistan Provincial Environmental Strategy. The aim of the Workshop should be to build upon the foundation of existing work. There should be a clear message that development and the environment were interdependent.

Regarding the formulation of the ICZM Plan, the Workshop considered the disciplines to be covered and the range of agencies that should be involved. The Sindh Coastal Development Authority was potentially a key player. It was agreed that the private sector should be involved, and also NGOs and the general public. The feelings of local communities were important and should not be underestimated. In general, there needs to be transparency in communication and a mechanism for all stake holders to feel that they have had their say. A clear organizational framework would be required. Two published documents that might serve as a model for the plan were tabled for the Workshop; the Noordwijk Guidelines for ICZM from World Coast 93 and a World Bank paper on a framework for ICZM in Africa.

In considering the requirements for data, there was consensus in the Workshop that data collection or compilation was an important first step. Much data already existed in a variety of fields, e.g. the water sector. But it was important to identify the gaps in data. It was vital to gather data on the basic inventory of the coastal zone - physical, chemical and biological - and on the processes affecting the inventory. This was the baseline information against which monitoring results would be compared and changes assessed. Much existing data could be held by national agencies, but all existing data needs validation.

In view of the rapidly growing population of Pakistan, and of the stress it is producing on the coastal ecosystems, the Workshop recognized the long-term strategic value of these coastal resources. Associated with Pakistan's coastal ecosystems is a complex array of natural resources which provide economic goods and services. These goods and services are both marketed, e.g. fish, shellfish and non-marketed, e.g. mangroves, for their medicinal uses, and their functions as nursery areas for juvenile fish and buffers to storm damage. These goods and services have an extremely important long-term strategic value. It is possible to realize economic models which will reflect the flow of both economic and environmental goods and services with reasonable accuracy. The coastal development policies must therefore undertake an accurate and holistic valuation of the coastal ecosystem.

Unfortunately, despite the growing recognition of the strategic value of coastal resources worldwide, coastal planning and management in Pakistan is largely dominated by sectoral approaches which inherently favor single purpose usage. As such these sectoral approaches ignore the valuation of other sectors in the economic equation. Ignoring the long-term optimal utilization of coastal goods and services is contrary to the objectives of sustainable development. Thus, a comprehensive integrated national approach is required through a policy statement which would ensure long-term strategic economic value of marketed and non-marketed goods and services provided by Pakistan's coastal ecosystems.

It was clear to the Workshop that Pakistan should now give urgent attention to the preparation of a plan for the integrated management of its coastal zone. Such a plan, properly implemented, can both help protect the unique and valuable resources of the coastal zone, and ensure that their considerable benefits remain available to the people of Pakistan on a long-term, sustainable basis. Pakistan will also, in this way, join the community of nations that are taking actions in support of the decisions made at the Rio Earth Summit (UNCED) in 1992.

A short "issue paper" describing both the need for an ICZM plan for Pakistan and the benefits that will flow from

the implementation of such a plan, should be prepared, and transmitted to the highest level of government as soon as possible. The issue paper should explicitly suggest government approval to undertake the development of an ICZM plan for the nation. If possible, the issue paper should be "endorsed" by the key national ministries involved in coastal and ocean affairs, and the two provincial governments. The issue paper could suggest that the preparation of the ICZM plan itself could be undertaken under the supervision of an "inter-agency working group" composed of representatives of the key agencies at the national, provincial and local levels of government and the principally affected "user" groups. Clearly, Sindh's new Coastal Development Authority could play a key role in this process, especially if its mandate is broadened to include the full scope of integrated coastal zone management.

The major achievements of this Workshop were:

(i) a clear identification of the interrelated problems pertaining in the Pakistan Coastal Zone relevant for the integrated management of the Coastal Zone;

(ii) all people present, coming from various agencies and institutions at all levels, have shown the willingness to discuss openly and to implement coordination and harmonization of problems and measures related to the integrated management of the coastal zone;

(iii) for several important items there was a willingness to take responsibility and action now.

In all three aspects the Workshop was certainly a success.

## 6.2 THE NEED FOR ICZM AT THIS TIME

The coastal areas of the world are under stress due to intense human activity. A variety of factors, such as rapid population growth, competition for both land and water resources, industrial and urban pollution are the cause of this stress and are undermining the potential social and economic benefits and opportunities that the coastal zone presents. As such, sustainable use of the natural resources and management of human activities in the coastal areas represent one of the most complex challenges to modern society.

The UN Conference on Environment and Development (UNCED), expressed, in Chapter 17 of Agenda 21, the urgent need for coastal states to develop capabilities for Integrated Coastal Zone Management (ICZM) for the purpose of addressing current and long-term coastal resource use and environmental management issues. To be effective, ICZM plans must adopt the following substantive principles of sustainable development:

(i) development is necessary for the satisfaction of basic human needs and inspirations;

(ii) ecological integrity must be maintained within the limits of ecological carrying capacity;

(iii) equity and social justice must be applied in the per capita use of resources between nations and generations; and

(iv) while government regulations are necessary to guide the private and corporate sectors, public participation and involvement in decision making is necessary in promoting prudent and environmentally sound use of the natural resources.

The coastal zone is a complex environment. It is a zone of intense and dynamic relationships amongst the natural environment and its ecosystems; it is subject to societal demands for space and natural resources; and to external natural and human influences. Very often, societal demands outpace the capacity of the coastal zone to provide the desired goods and services. If unchecked, they lead to an excessive and unsustainable use of fisheries and other living resources; exhaustion of minerals and other non-living resources; degradation of environmental quality and health of coastal ecosystem; and potentially hazardous consequences to human health and property. Integrated Coastal Zone Management has been identified as the most appropriate process for addressing what combination of outputs and services should be produced to ensure sustainable use of the resources.

ICZM links the responsibilities of local, provincial and national government, according to the laws and rules of governmental organization. The central government is responsible for the overall plan, including the weighted interests of the various sections, coordinating and harmonizing these interests and taking the final decisions. The various sectorial departments like water management, environment, economics and finance, contribute to the ICZM plan by providing the sectorial aspects. The provincial government may take actions for ICZM according to their jurisdiction: analyzing problems, generating solutions and discussing ICZM matters with the central government. The local level participates in the ICZM process by implementing the necessary measures and by presenting their suggestions, interests and implications of the measures on the ICZM at the local level. A clear definition of tasks and responsibilities have to be worked out in consideration of the present situation in Pakistan. The incorporation of the three levels in the ICZM provides the general support for ICZM and for the implementation of the management actions.

The ICZM process may include a number of steps, for example:

(i) description of the natural environment including its biological productivity and yields of the commercially valuable fish species, shoreline erosion and accretion rates, and status of environmental quality;

(ii) assessment of resource use conflicts arising from existing or proposed industrial development and other economic activities that could impact the natural coastal environment and its resources;

(iii) collection and collation of data and construction of models describing the timing and magnitude of the natural events (river run-off, storm surges and geological events) that could damage coastal structures and installations; and

(iv) integration of policies and programmes across levels of government and economic sectors as well as those of available fiscal and material resources to ensure that both short-term objectives and long-term goals of coastal zone management are accomplished.

The coastline of Pakistan stretches 1,046 km along the southern beaches of Sindh and Balochistan, providing access to fisheries and other natural resources in marine areas encompassing at least 250,000 km sq. For the most part, the coastal areas of Pakistan are sparsely inhabited except for Karachi, a large sea port and the hub of Pakistan's economy. Karachi is also among the most populated cities of the world, its current population of nearly 10 million is increasing rapidly and may reach 12 million by the year 2000 (WCC 1993). In addition to the economic output of the commercial base in Karachi, rich fishing grounds are present from which some 95,000 fishermen find their livelihood, and which annually contributes some Rs. 2,000 million to national economy. Oil and gas, hard minerals, marine recreation and tourism are presently not being exploited due, for example, to inadequate exploratory surveys and lack of support facilities outside Karachi. Local residents have traditionally used mangroves as firewood, cattle fodder and building material, but their total and direct contribution to the national economy is marginal. However, mangroves may have a critical role as spawning grounds and nursery habitats for several commercially important species of fish and shell fish.

The Indus river delta has been altered in recent years due to a reduction of sediment load and the amount of water that reaches the coast due to upstream use of river water for irrigation and hydroelectric power generation. The area of active delta plain has been drastically reduced and some of its uses curtailed, e.g. rice cultivation. Industrialization and functioning of factories and power plants may have significantly altered coastal geomorphology and longshore currents have contributed to the deterioration of coastal environmental quality and the loss of coastal amenities. Several management issues and coastal resource use conflicts in Pakistan have been identified in a recent report of the National Institute of Oceanography (Rizvi 1993). These, as well as some newly emerging issues, must be addressed in a timely and effective manner.

This report outlines the development of relevant policies and institutional arrangements that are deemed necessary to address those issues. The ICZM process can provide for a more effective and prudent way of handling coastal development and it may also resolve certain conflicts that are inherent in the present multiple use of resources.

There is an urgency to commence ICZM now. It begins the implementation of some of the commitments made in Rio (UNCED) in 1992. It is consistent with the national obligations contained in the Law of the Sea convention due to enter into force in November 1994. It is also a way to safeguard and realize the great potential of the Pakistan coastal area. In addition, the science and technology necessary to support ICZM is now readily available. Finally, ICZM is in progress in many parts in the world. Participation in this endeavor: "Learning by doing", may be beneficial to Pakistan.

## 6.3 FORMULATING THE ICZM PLAN

The ultimate goal of integrated costal zone management is to promote national development through the rational use of the coastal resources and environments of Pakistan in a manner which balances economic, social and environmental goals.

The coastal and nearshore waters of Pakistan are not uniform, but may be spatially divided into units reflecting the distinct geology, climate, vegetation, oceanographic conditions and the levels of present use and consequent rates of change in terms of resource depletion and habitat degradation. It is clear that the biological, physico-chemical and socio-economic conditions of Balochistan differ considerably from those of Sindh and that within Sindh the present rate and future prospects for the coast line of Karachi differ from those of the Indus delta. In the case of Balochistan, the opportunities for proactive planning and management of major development on the coast line are considerable, whilst for the Karachi area most short-term management will be reactive, addressing existing problems of resource depletion

and environmental degradation.

Formulation of the ICZM Plan must, therefore, be based on a recognition of:

(i) the spatial heterogeneity of the coastal environments of Pakistan;

(ii) the present and potential future use of coastal resources (including space) and environment;

(iii) the impacts of development and management decisions inland which alter the flux of freshwater, nutrients, sediments and pollutants from land to sea; and

(iv) the seasonal, inter-annual, and episodic variation in boundaries and boundary conditions of the coastal zone.

Steps to developing a National ICZM Plan should involve:

(i) problem definition and data assembly. This initial step involves an assessment of the distribution and abundance of resources and current uses i.e.:

  a) identification of coastal and marine resources, living and non-living, including: habitat distribution, species (rare, endangered, indicator, etc.) distribution, sites of cultural and historic importance;

  b) identification and characteristics of the spatial and temporal variations in physical (geological, climatic, oceanic), biological and demographic characteristics of the coastline;

  c) location and extent of present marine and coastal resource use including - fisheries, forestry, waste disposal, tourism and recreation etc.; and

  e) effects of resource and environment use in terms of areas and extent of habitat degradation and depleted resources,

(ii) assessment and analysis. The data and information assembled in the first step provide the foundation for:

  a) assessing the environmental and resource limits to potential development and future use;

  b) identification of socio-economic constraints to present and future use of coastal environments and resources;

  c) the legal, administrative and institutional frameworks required to resolve present conflicts; and

  d) the organizational framework required for inclusion of stakeholder interests and involvement in ICZM Plan development and implementation,

(iii) issues and options. The analysis required must be based on spatially referenced data and encompass an historical as well as a present and future perspectives. The following are the minimum components based on the data assembled under steps 7.3 (i) and (ii) above:

  a) identification of current conflicts between alternate uses;

  b) identification of future potential uses, i.e. an assessment of potential yield compared with present yield, and identification of new or unused resources (e.g. fish stocks); and

  c) identification of potential conflict between proposed alternative developments.

## 6.4 CONTENT OF ICZM PLAN

This should be based on a synthesis of the output and results of steps 6.3 (i) - (iii) above and include as a minimum:

(i) statement of overall policies and goals;

(ii) detailed plans, activities and programmes to address issues and conflicts;

(iii) institutional arrangements including identification of collaborating agencies and a definition of their responsibilities and mode of collaboration;

(iv) necessary new laws or amendments to existing legislation;

(v) requirements for training and capacity building;

(vi) a phased implementation plan including a realistic timetable;

(vii) a future awareness and participation component; and

(viii) monitoring, evaluation and enforcement procedures.

A concept central to the formation of the ICZM programme is integration. This involves reconciling issues and conflicting interests and determining and adopting the optimal mix of alternative approaches. This involves a continued process of information dissemination, consultation and consensus building amongst all parties with a stake in the coastal zone. It must also include regular feedback between the components.

The selection of an appropriate coordination and oversight mechanism is one of the more important tasks of the plan development phase. Effective ICZM requires that all significant governmental and private sector actions affecting the coastal zone, its resources and its environmental condition be consistent with the coastal policies that the nation adopts as a part of the ICZM process. Options for a mechanism to oversee this harmonization process include the creation of a new inter-ministerial coastal council (including representatives of the two provincial governments sharing the nation's coastal zone), use of an existing inter-ministerial coordination mechanism at the national planning commission level; or the designation, by legislation, of a lead ministry to perform these important functions.

### 6.5 ADOPTION

The ICZM policies, programmes and plans which are developed, must pass through a formal adoption procedure in order for them to be implemented. This requires an action plan for the adoption procedure which outlines the actions that need to be taken, a time frame for their execution, a recognition of external constraints (e.g. schedule of parliamentary sessions), and a feedback mechanism.

This approach is necessary because adoption may involve formal endorsement and approval by responsible institutions at different levels: (i.e. the national level, the provincial level, concerned communities, local stakeholder, e.g.: industrial estates, fishermen and other affected organizations.

Proposals (e.g. for policies, new legislation) may need to be revised if they conflict unnecessarily with existing legislation.

### 6.6 IMPLEMENTATION

Implementation may have to be carried out incremental. The ICZM policies, programmes and plans are likely to challenge the existing situation and thus should proceed in such a way that adjustment can be made in parallel rather than acting as a block to progress.

This approach is necessary because the creation of new institutions or the significance of modification of existing ones, may be challenged, or take time to adjust to. A similar situation will also exist in the case of new legislation, which may radically change existing laws, environmental standards or guidelines. This would involve the development of mechanisms for dealing with such conflicting resolutions.

### 6.7 MONITORING, EVALUATION AND FEEDBACK

The ICZM process for Pakistan must provide for continuous monitoring and evaluation of the successes and failures of the policies and activities which have been adopted. It is imperative that the results of monitoring and evaluation are fed back into the earlier steps of the process. This will allow for adjustments to compensate for failures in foresight or for changing conditions.

This process is necessary because:

(i) new policies and programmes or plans, however well thought out and negotiated, rarely prove to be exactly what was anticipated or totally appropriate. It is really impossible to anticipate and plan for all contingencies actually encountered during implementation; and

(ii) environmental and/or socio-economic or institutional situations may change between the time of programme development an implementation. Institutions, individuals or special interest groups may not comply with the plan.

## 7. RECOMMENDED NEAR-TERM ACTIONS

(i) An immediate need for a detailed profile of Pakistan's coasts is recognized. A coastal profile will be a prerequisite for mapping the areas of greatest concern within the coastal zone, where the short- and long-term attention need to be focused within an ICZM plan. The profile will also help chart those areas that are relatively unaffected by man's activities. Some of these areas can be identified as potential natural and/or biosphere parks, serving as areas of national heritage for the future.

(ii) Pollution around Karachi and the mitigation of its detrimental effects on the coastal areas may be the most pressing issue for a management plan. Several on-going regulatory activities have a bearing on this issue. During 1994, a Coastal Development Authority was established by the government of Sindh. A similar coastal authority is also being discussed for the Balochistan Coast. In addition, national environmental quality standards (NEQS) have been established to which all new industry must conform after July 1994. Previously established industries must all confirm to the new standards by July 1996. A marine pollution control board has also been established recently to

monitor these activities. New industries also must undertake environmental impact assessments before they are established.

(iii) The capacity of the existing sewage treatment plants that serve Karachi is planned to be upgraded from handling 40 MGD to 120 MGD by the year 2000. However, the growing population needs are estimated to far outstrip the planned capacity by that time.

(iv) Periodic review and updating of the NEQS as they apply to marine pollution is strongly urged. A continuous monitoring of water, sediment and biotic quality in terms of organic and inorganic pollutants in key areas could begin immediately at a relatively modest cost. Over the longer-term, an effective mechanism must be found for the enforcement of environmental regulations.

(v) In the area of mangrove research, an ongoing project funded by the World Bank will endeavor to reforest and rehabilitate mangroves on an experimental basis in the Indus delta. This work will also experiment with the introduction of *Phyzophora*, a saltwater-tolerant species, as an alternative to the local species. Further studies are needed to establish the minimum required water and nutrient levels necessary to halt degradation and sustain the existing biomass of the mangroves. Over the shorter-term, existing regulations against indiscriminate harvesting of mangroves for use as fodder and fuel need to be enforced. Over the longer term, a water management plan needs to be put in place for the sustained health of the mangrove forests.

(vi) Coastal Fisheries is another area ripe for greater and more integrated management. The fisheries suffer from over exploitation and lack of regulatory enforcement against detrimental fishing practices (e.g. indiscriminate trawling, use of narrow-meshed netting). Effective management practices, such as closed seasons and areas for restocking, bag limits and use of new, more effective fishing methods, can be put in place in the shorter term. Over the longer term, greater emphasis on aquaculture, especially for shrimp culture, may be very desirable.

(vii) Coal and oil-fired power plants serving Karachi may be the single, most significant source of environmental change and pollution in the coastal zone. These plants draw a large amount of water, together with their contained fish eggs and larvae and other microscopic biota. After cooling the plant, the hot water is expelled into coastal waters along with other effluent. The use of chlorine against biofouling and anti-corrosion paints are some of the added pollutants. Heavy metals may be discharged with water and $N_20$ and $SO_2$ gases emitted to the atmosphere. Further mitigation actions could include more deliberate siting of new power plants where they would be least detrimental to the environment. Delayed discharging of water to lower its temperature, and control of gas emissions and effluent could mitigate some of the problems. An ICZM plan needs to develop an overall strategy for proper siting and outfall control for all industrial and commercial users of the coastal zone and its resources.

(viii) Other issues that will require more research and actions over the longer term under an ICZM plan include the control of habitat loss and preservation of biodiversity, remediation of saline-water intrusion into coastal aquifers, and control of erosion in the delta.

## 8. CLOSING SESSION

Mr. Shahid Aziz Siddique, Additional Secretary, Ministry of Communication, presided over the concluding session of the Workshop. The Chairpersons from the working groups presented the reports and the recommendations of their respective groups, summarized earlier in this Report.

Mr. Shahid Aziz Siddiqui referred in detail to the state of environmental degradation and hazard in many areas of Karachi arising from rapid expansion in socio-economic activities along with increase in population and the need to address those problems. He explained that the Government is aware of these problems and have taken steps to respond to mitigate degradation of environment and resource depletion problems by improving conditions for treatment of domestic sewage and industrial effluent at source. He referred to the actions taken by the Government to improve coordination at intersectoral level in respect of coastal and marine areas and in this regard referred to the emerging role of maritime security agency. He referred to his own Ministry's involvement to improve conditions to avoid congestions

in coastal areas, in particular port and harbor and others in the vicinity of Karachi. He made reference to the extensive plans of the Government to improving communication and to build extensive network of roads to promote development activities in coastal areas in Sindh and Balochistan and several other proposals the conditions in coastal areas of the latter.

At the end he expressed his deep appreciation for the work done by the Workshop, which he thought was convened at an appropriate time when the Government is considering these matters. He said the role of scientific institutions such as NIO and others in the University would be very important in providing the scientific information and relevant data on which future management decisions could be based.

Admiral S.M. Chaudhri (Rtd), the first Commander-in-Chief of the Pakistan Navy, who was the special guest on this occasion, stated that the achievement of the Workshop was an important development. He remarked that government alone is not expected to do integrated management of coastal zone; the participation of all and in particular public in decision making and implementation is one of the most important dimension that need to be bear in mind. He thought public awareness through the use of various media would be an important step to take.

The Workshop noted with satisfaction the enormous amount of work carried out by each working group which was represented by participants from different disciplines and sectors from federal, provincial, local bodies including semi-governmental, NGOs and private sectors. It recognized the valuable contributions these working groups made in identifying the problems confronting coastal zones of Pakistan and the immediate need to consider and implement as appropriate various recommendations that have been put forwarded.

The Workshop recognized that the situation facing Karachi, the Sindh coast and the coast of Balochistan were quite different in nature as well as in magnitude, and that there was the need to approach their respective problems differently. For the Karachi coast where socio-economic development has reached a peak with rapidly increasing population, there was an immediate need to adopt strict regular measures to control conflicting uses of the valuable coastal ecosystem and resources. This require co-operation amongst scientific institutions and those entrusted with development and management. For the remaining part of Sindh and the entire Balochistan coasts, where population is sparse, the integrated coastal zone management activities would essentially be dealing with promotional activities in the socio-economic and related development sectors so as to mitigate the expanding anthropogenic influence. Here, the lessons learned from Karachi coastal area could be extremely valuable.

The Workshop also stressed that the attention of the Government at all levels be drawn to the outcome of the Workshop, first by sending an "Issue document" giving a succinct account of the main achievements and recommendation of the Workshop.

Finally, the Chairperson, Mr Shaid Aziz Siddiqui, expressed his great appreciation to all the participants and the foreign experts who worked very hard to make the Workshop so successful in its achievements. On behalf of all and on his personal behalf he also thanked the excellent arrangement made by the host institution, NIO, and the co-operation extended by all its staff, and paid attribute to Mr. S.H. Niaz Rizvi for his leadership in all these matters.

# PART II

## REPORTS OF THE WORKING GROUPS

## 1. WORKING GROUP I DEFINITION OF THE COASTAL ZONE

Chairperson Dr. Bilal U.Haq

### 1.1 PREVIOUS DEFINITIONS

The Working Group considered the broad definition of the coastal zone as defined by the US Commission on Marine Science, Engineering & Resources (1969), which considers "the coastal zone as an area representing that part of the land affected by its proximity to the sea and that part of the ocean affected by its proximity to the land". Although this definition was considered an excellent starting point, it was deemed to be too broad for the specific definition of Pakistan's coastal zone.

### 1.2 GEOLOGICAL PERSPECTIVE

The group approached the issue of defining the coastal zone for ICZM purposes from several different perspectives, namely geological, biological, physical and meteorological as well as from the human use point of view. From the geological perspective, the Balochistan coast (and part of the Sindh coast as well) is distinct from the Indus delta (Sindh coast) in its present-day tectonic and morphological features. The former is tectonically active, forming a subduction margin and prone to frequent earthquakes, during which parts of the shoreline can rise up to 1 meter. The Sindh coast is largely a passive margin, composed of a deltaic region with appreciable thicknesses of coastal sediments. While the Balochistan shelf is narrow (up to 30 km in width) the Sindh shelf extends as far as 100 km. Geologically, the sea level has varied considerably over the past 15000 years during which time the shoreline moved up to 200 km inland and seaward beyond the shelf edge.

### 1.3 BIOLOGICAL PERSPECTIVE

From the biological viewpoint, the influence of the sea extends inland some 16-17 km in the estuarine areas. However, during high water of the SW monsoon season, it may extend up to 30 km inland. Mangroves are normally found only up to the high water point.

### 1.4 PHYSICAL INFLUENCES

Physical influences along the coastline include tides, waves and marine inundation. During the SW monsoon, the inactive delta may be flooded by saline water intrusion, leaving behind a curst of salt. Severe storms are rare in the Indus Delta area. However, the 100-year storm may extend salt water intrusion over much of the delta. The most relevant physical point of reference may be the highest astronomical tidemark (HAT), which is reached at least once a year.

### 1.5 HUMAN INFLUENCES

The Working Group held an extensive discussion of the human dimensions influencing the coastal zone. The Balochistan coast was considered to be largely devoid of anthropogenic influence. However, in the Karachi metropolis and in the Indus delta man's activities have major impacts on the coastal zone, either directly or indirectly. Karachi city is the single, most important source of effluent discharge in the coastal waters. Both domestic and industrial pollution are rampant. On the Indus Delta, the human influences are largely remote. For example, upstream damming has reduced water and sediment supply to the delta affecting both its stability and the health of its ecosystems.

### 1.6 LANDWARD BOUNDARY

By giving due consideration to the above factors, the Working Group decided to define the landward boundary of the coastal zone as follows:

(i) Balochistan: 5 km inland from the highest astronomical tide (HAT) mark;

(ii) Karachi city: important to include the entire inhabited part of the city within the coastal zone. This landward boundary was considered to be an especially dynamic boundary, which would be reviewed periodically (perhaps every five years) to include new areas that should come under the purview of ICZM;

(iii) Sindh (except Karachi city): 5 km inland from the highest astronomical tide (HAT) mark. This definition would include all areas that are variously influenced by the sea, as discussed above.

### 1.7 SEAWARD BOUNDARY

For the seaward limit of the coastal zone, the Working Group deliberated on various terrestrial influences on the coastal waters. Freshwater flow into the coastal seas and sediment flux was not considered very extensive at the present time and this influence extended perhaps only as far as the shelf edge. However, because fisheries and fishing practices would become important elements of an ICZM plan, the present fishing limits were considered relevant. Such a limit extends to 35 miles seaward. This limit was considered a convenient boundary for management purposes on the Balochistan coast. The seaward boundary on the Sindh coast can be placed more conveniently at the shelf edge at 200 m water depth, since much of this shelf may come under the direct influence of commercial use in fisheries and hydrocarbon exploitation in the near future.

### 1.8 REVIEW REQUIREMENT

Although these boundaries have been demarcated to identify areas that may potentially come under the purview of an ICZM plan, they should be considered dynamic, to be regularly reviewed and updated to include or exclude areas according to changing needs.

## 2. REPORT OF SUB-WORKING GROUP II/1: THE KARACHI AREA

Chairperson: Professor J.H.J. Terwindt

The Karachi area extends from Cape Monzá to Vadi Kotti. The group (12 persons) identified 8 major issues relevant for integrated coastal zone management, pertaining to the Karachi harbor (s.l.) and adjacent coastal areas:

(i) pollution control;

(ii) harmonization and enforcement of legislation;

(iii) exploitation and safe-keeping of marine resources;

(iv) public and environmental health;

(v) environmental problems specially pertaining to the harbors;

(vi) monitoring of environmental conditions and set up of a data base;

(vii) urbanization; and

(viii) public awareness and people's participation.

The group recognized that all these problems are interrelated and that all have an almost equal priority. In addition it was recognized that much has already been done, but that much can also be extended by close cooperation, interaction and harmonization of the various agencies, authorities and institutions on national, provincial and local level. Such coordination and harmonization is essential in integrated coastal zone management.

### 2.1 POLLUTION CONTROL

The Group concluded that pollution control is the most important issue of coastal zone management in the Karachi area. There is a very urgent need to establish the level of pollution in the Karachi area, especially in the harbor and the influenced coastal zone for both the bed material and the suspended and dissolved materials. In addition it is essential to locate the sources and contributions of pollutants and to acquire reliable data on the discharges of pollutants from various sources. An intensive study is needed in this respect. (see Table 1). Besides this inventory action should be taken to reduce pollution by the various governmental and public agencies and the society. Items of pollution control are:

(i) Effluent from industrial pollution should be treated before releasing into the sea;

(ii) Accidents, causing oil pollution from oil spills should be avoided by adequate safety measures and all

precautions should be taken. In addition measures and devices should be available to combat spills;

(iii) Domestic waste from urban as well as rural areas should be treated properly before discharging it into the water or dispose it on land;

(iv) Agricultural waste should be avoided by reduction of the use of harmful chemicals. Biological controls and monitoring should be used to detect the harmfulness of fertilizers and pesticides;

(v) Ship waste should be reprocessed or eliminated and not introduced into the sea;

(vi) Nuclear waste should be treated in the energy plants instead of dumping into the water; and

(vii) Proper arrangements for the dumping/dredging spoil and other waste in the coastal zone should be taken.

There is a need for a multi-purpose numerical modeling system. An adequate knowledge of oceanographic conditions e.g. current speeds, circulation patterns, water stratification, mixing rate, wave climate and wave refraction patterns, distribution of salinity, temperature, dissolved oxygen and nutrients is essential for coastal zone management. A multi-purpose numerical modeling system is indispensable for a good evaluation of the distribution of pollutants and other substances into the channels, creeks and in the coastal zone. Models can be beneficial to the determination of the flow circulation, residual flows, effects of storm surges on the distribution of matter; the wave effects in navigation channels, the rate of littoral sediment transport; the water quality e.g. BOD-DO, oxygen depletion and bacterial decay balances, organic nitrogen-, ammonia-, nitrate and nitrite balances; eutrophication e.g. phytoplankton, benthic algae, zooplankton, oxygen balances and mineralization estimates; heavy metals distribution patterns and waste discharge and concentration studies. At present there is a great need for a training program for the set up and elaboration of such a modeling system.

## 2.2 HARMONIZATION AND ENFORCEMENT OF LEGISLATION

Legitimate action for pollution control: it is essential that the existing legislation should be harmonized and enforced. The legitimate system and administrative set up for pollution control can be upgraded by exercising the responsibilities of the various agencies and actors:

(i) responsibility of the central government: the Government (Ministry of Pollution and Environmental Control) is responsible for formulating and implementing fundamental and comprehensive policies with regard to pollution and environmental control and should exercise regular checks with appreciation and fines;

(ii) responsibility of the local government: the local government through its designated Ministry is responsible for formulating and implementing policies with regard to pollution and environmental control corresponding to national policies and other policies in accordance with the natural and social conditions and with their jurisdiction.

(iii) responsibilities of corporations: the corporations are responsible for taking the necessary measures to prevent environmental pollution and ensure proper disposal of wastes. The are responsible for the reduction of environmental loads in the course of their business activities in accordance to the policies of the Government.

(iv) responsibility of citizens: citizens shall make efforts to reduce the environmental loads, associated with their daily lives.

Harmonization of legislation addresses the harmonization of the existing legislation. There is a must, according to the Group, to adapt the Forest Act so that it includes not only the Sindh Coast but also the Karachi area including the Port Quasim Authority to arrive at a uniform legislation along the Karachi coast. It was also mentioned that there is confusion for the management of the fisheries potential between Provincial and Federal Fishery Departments.

Enforcement of the legislation: environmental conditions can be improved if the existing legislation is harmonized. The enforcement of the legislation can best be implemented by the Maritime Security Agency, Pakistan Coast Guard, Karachi Port Trust (KPT) and Customs, which are already performing this duty. A closer interaction is required amongst these agencies for better results. Besides interaction and coordination each agency should have a specific area of operation e.g. the KPT may be responsible for enforcing the legislation within the harbor; the Coast Guard for the coastal area; the MSA up to the maritime boundary of the EEZ and Customs within the parts. Research Institutes may be engaged in delivering background environmental information and techniques.

Extension of the Coastal Development Authority: the Coastal Development Authority has been created recently and is responsible for the overall development, improvement, quantification and coordination of the coastal areas of Thatta and Bad Districts. The Group recognized that CDA may be extended to the Karachi District East (Karachi Coast) in order to have a central body for the coordination of the whole area as mentioned above.

Establishment of environmental impact assessment: environmental impact assessments should be applied for all major activities producing wastes and pollutants. Especially the distribution and extension of the waste should be evaluated and monitored.

**Table 1. Waste Water Standards for Pollution Control**

| NO. | CONTROLS | | PAKISTAN STANDARDS | WORLD BANK STANDARDS | JAPAN STANDARDS |
|---|---|---|---|---|---|
| 1 | PH | | 6-10 | 6-9 | 5-9 *, 5.8-8.6** |
| 2 | BODs | mg/L | 80 | 58.9 | 160 |
| 3 | CODs | mg/L | 150 | 412.7 | 160 |
| 4 | Suspended solids | mg/L | 150 | 39.2 | 200 |
| 5 | n-Hexane | mg/L | N M | N M | 30 |
| 6 | Phenols | mg/L | 0.1 | 0.4 | 5.0 |
| 7 | Copper | mg/L | 1.0 | - | 3.0 |
| 8 | Zinc | mg/L | 5.0 | - | 5.0 |
| 9 | Dissolved Iron | mg/L | 2.0 | - | 10.0 |
| 10 | Chromium | mg/L | 1.0 | 0.9 | 2.0 |
| 11 | Chromium (hexavalent) | mg/L | - | 0.1 | 0.5 |
| 12 | Dissolved manganese | mg/L | - | - | 10 |
| 13 | Arsenic | mg/L | - | - | 0.5 |
| 14 | Lead | mg/L | - | - | 1.0 |
| 15 | Cyanide | mg/L | - | - | 1.0 |
| 16 | Cadmium | mg/L | - | - | 1.0 |
| 17 | Mercury | mg/L | - | - | 0.005 |
| 18 | Sulfide | mg/L | 1.0 | 0.3 | - |
| 19 | Chlorine | mg/l | 1.0 | - | - |
| 20 | Fluorine | mg/L | - | - | 15.0 |
| 21 | Total dissolved solids | mg/L | 3500 | - | - |
| 22 | Ammonia | mg/L | 40 | 58.2 | - |
| 23 | Oil & Grease | mg/L | 10.0 | 17.6 | - |

* Coastal ** Others

## 2.3 EXPLOITATION AND SAFE-KEEPING OF MARINE RESOURCES

Sustainable exploitation: the Group recognized that there is a need for clear definitions and measures to achieve sustainable exploitation of marine resources. More particularly attention was focussed to shrimp, oyster and other products. At present the number of shrimp trawlers are more than the optimal effort level to get a biological MSY. Extra numbers of shrimp trawlers should be concerned with other types of fishing gear. Attention should be given to the utilization of unexploited/less exploited resources e.g. small and large pelagic, squid, seaweed, mussels, clams etc. Measures should be taken to improve the quality of the sea food product. In addition measures should be taken to protect the marine shore line e.g. removal of sand and dumping of waste in the nearshore waters. Nursery areas should be prohibited for commercial exploitation by shrimp trawlers. Finally socio-economic studies should be conducted on the interaction between artisanal and industrial fisheries

Water quality control: in order to safeguard the marine resources actions should be discussed and formulated to control the water quality of the coastal zone.

Interaction and coordinated research between fishery authorities: interaction and coordinated research between these authorities and scientific institutions may be beneficial in formulating standards and improvements of fishing techniques, quality control etc.

## 2.4 PUBLIC AND ENVIRONMENTAL HEALTH

In the Karachi harbor the group identified the connected problems: sanitation - water management - waste management. The combination of these problems determines the conditions and the uses of water from the harbor. In order to improve these conditions a joint action is necessary for all agencies involved. An improvement plan may be set up to combat the negative effects of domestic waste effluent, agricultural effluent, industrial pollution, oil pollution, ship waste dumping etc.

Concerning the interaction between the harbor and the sea, the pollution pathways, either dissolved or suspended from the harbor to the sea have to be identified in order to determine the reaches of influence of the harbor water into the coastal zone. Modeling of these pathways, using systematic measurements of the relevant parameters should be set up. Here are interactions between the involved agencies and the scientific groups that should be established. In addition the sediment fluxes and the distribution of habitats in the coastal zone should be studied. Fresh water supply to improve the quality and health requirements of fish products should be implemented.

## 2.5 ENVIRONMENTAL PROBLEMS SPECIALLY PERTAINING TO THE HARBORS

Regarding the dredging and dumping of spoil, these activities, necessary as they are, will affect the water quality and bed conditions. The selection of dumping sites either in or outside the harbor should be made taking into account the effects on the water quality, the natural habitats and fishery conditions.

Concerning the risk of navigational and natural hazards, ship stranding either in or out of the main shipping routes may have detrimental effects on the environment. Appropriate methods to contact these effects, and rescue policies may be developed. The same holds for earthquake and tsunami risks.

## 2.6 MONITORING OF ENVIRONMENTAL CONDITIONS AND SET-UP OF DATA BASE

Identification of the data base parameters: a discussion should be started between the scientific groups and the involved agencies on the parameters to be measured for the short term but also for the long term monitoring. In addition sampling stations should be selected and organization and handling of the data base should be fixed. These activities can already be done now.

Standardization of the procedures: data gathered by different agencies and laboratories should be exchangeable. This means that the methods of analysis should be coordinated and harmonized. Ring analysis procedures should be established to arrive at standard procedures. This work too can start immediately.

## 2.7 URBANIZATION

Further urbanization along the coastal zone may affect the water quality if the effluent are discharged untreated into the sea. In addition illegal settling of migrants along the coast may cause similar effects.

2.8 PUBLIC AWARENESS AND PEOPLE'S PARTICIPATION

The group stated that pollution control and reduction of waste disposal depend to a certain extent on the awareness of the local people of the environmental issues. Here lies a specific task for the scientific institutions to disseminate the results of studies in an understandable way. Interaction should be sought by other institutions working on public awareness and peoples participation.

## 3. SUB-WORKING GROUP II/2 SINDH COASTAL AREA

Chairperson: Dr. Hillary Hildebrand

3.1 BIOPHYSICAL FEATURES OF SINDH COASTAL ZONE AND CURRENT MANAGEMENT SCENARIO

The coastal zone of Sindh is divided into 7 sectors for land utilization and development purposes, which are referred to below:

(i) Jhill Hills Peninsula - Hub River Estuary Goth Bungalow, Pacha Beach and Paradise Point: west of Karachi, the sector borders with Balochistan. It is exposed to the open sea, the coastline is pollution free or spare pollution, there are a few fishermen villages, it is rich in marine life, there are several pockets of small beaches;

(ii) Plains and Lagoon area - Paradise point, Hawkesbay, western backwaters, Sandspit and harbor backwaters: west of Karachi harbor, the coast is endowed with recreation beaches and sanctuary of green turtles. The western backwaters of Karachi port is an important ecological unit with mangroves and wetlands providing breeding grounds for several species of migratory birds and a variety of marine life. Untreated effluent from Karachi city and sewage is drained through the Lyari estuary. It is the location of some old coastal settlements including fishermen villages, main salt pans in northern parts of backwaters, and the Karachi Nuclear Power Plant. This area is managed by KPT, KMC, KDA and BOR(Sindh). Karachi Development Authority has designated 20,000 acres near Hakesbay for housing and recreation development;

(iii) Portuary and urban complex area - Karachi harbor, Karachi Fish harbor, Karachi shipyard, Marine Academy, Marine Fisheries Department, and a number others are located here. There is Manora island ( a popular beach), and on the eastern backwaters, the Chinna creek. The area is managed by KPT and to some extent by KMC and Pakistan Railway.

(iv) Clifton to Gizri Creek - Clifton beach, Seaview beach and Gizri creek: the coastline from Clifton to Sea View covers the most popular and easily accessible beaches of Karachi with developed housing. On the eastern front is the industrial development zone. The rate of accretion along this coast is reported to be maximum. Pollution from the city is high. During monsoon the Malir River on the east, with an encatchment area of about 2590 squire miles, brings fresh water.

(v) Western deltaic region - Bundal and Buddo islands; Korangi shoreline, Lat Basti-Gharo creek; Port Bin Qasim-Ghagar nala; Gharo creek - Gharo town, with creeks and mangrove forest down south to Keti Bunder.

(vi) Eastern deltaic region - Shah Bandar coast-Sir Creek: about two hundred years ago there were eleven mouths of the River Indus opening in the Arabian sea including Phuleli/ Pinyari river system, Bhagir river system, and eight other branches, namely, Piti, Juna, Kukewari, Khediwari, Rechal, Hajamro, Sir and Kori . After the great earthquake in 1819, the first three rivers were abandoned *(see Figure 3*). Changes in the Indus river channel and its mouth over the years created many creeks and the wetlands in the intertidal zone.

The entire western and eastern deltaic regions now represent the main Indus delta, about 104,000 square Kilometer square in area with more than 200 Kilometers long coast line. The area is abundant with mangrove swamp, fifth largest in the world, rich in fish life, serves as sanctuary for migratory birds and provides fodder and fuel wood to the coastal settlements.

Main socio-economic activities are:

(i) ports: Port Bin Qasim, Korangi Fisheries harbor (under construction) located in Korangi creek, which in turn is connected to Phitti creek, Kadiro creek and Gharo creek which are navigational channel;

(ii) industrial zone: Korangi township, Steel mill, Landhi Industrial Estate, Sindh Alkalies etc.;

(iii) fishing villages/agricultural farms/salt pans: Mirpur Sakro, Buhara, Gharo, Gharabai, Johl and Keti Bunder (all connected by road), Goth Rehri, Lat Basti;

(iv) archaeological sites: Ratto Fort at Muchak island along Phitti creek, Bhambore along Gharo creek near Dhabeji, Juna Shah Bandar Fort near Mirpur Sakro;

(v) aquaculture farming: Mirpur Sakro and Gharabari.

On the eastern deltaic region, from Keti Bundar to Sirr creek, the coastal area is mainly marshy, full of wetlands and mangrove forest, and serves as sanctuary for the migratory birds. The main town in the area is Shah Bandar beyond which at the southern extreme end are the marginal parts of the great Rann of Kutch in the Thar Parker area.

## 3.2 KEY ISSUES IN COASTAL ZONE MANAGEMENT

For management purposes, the Sindh coastal zone encompasses the entire coast of the province, excluding the Karachi area, which will have a separate management focus. The Working Group identified the following key issues:

(i) freshwater Supply: ecological significance and multiple uses;
(ii) mangrove: loss and degradation; other values and uses;
(iii) fish migration;
(iv) sea-level rise: archaeological resources in delta under threat.

The Working Group recognized the need for action in the following:

(i) understanding the system;
(ii) improving socio-economic conditions;
(iii) protection/multiple use of mangroves;
(iv) involvement of users and scientific community;
(v) public awareness.

The Working Group identified the following activities that should be carried out in the near-term:

(i) resource/issue assessment and mapping;
(ii) creation of an issue advisory body within the coastal development authority;
(iii) development of a model fishing village;
(iv) alternatives to mangrove use pilot study;
(v) development of public awareness - mangroves.

## 3.3 UNDERSTANDING THE SYSTEM

There is an abundance of existing information on the Indus system (country studies, foreign studies, Linnean Society Report). This information has not been collated or assessed and issues remain unresolved. There is presently no basis for assessing the significance of this information or management priorities.

It is recommended that:

(i) the (Sindh) Coastal Development Authority (CDA), the NIO and Karachi University should collaborate in convening (with support from IOC) a Workshop which brings together all of the agencies and institutions which have collected and/or hold data and information on the physical, biological, chemical, cultural and socio-economic attributes of the area;
(ii) that the data and information be collated, analyzed for accuracy and completeness, and summarized in a status report; the information concerning natural resources, uses and human activities be mapped; and
(iii) the 'traditional knowledge' of local people be solicited and added to this assessment and map(s).

## 3.4 EXPANSION OF THE MANDATE OF THE COASTAL DEVELOPMENT AUTHORITY TO ADDRESS ICZM AND CREATION OF AN ADVISORY BODY OF RESOURCE USERS AND SCIENTISTS

The CDA has been given a legal mandate for planning development along the Sindh coast. The Governing body of the Authority comprises many of the sectoral agencies in the province. However, it does not currently include all of the necessary sectoral and environmental perspectives required for ICZM.

It is recommended that:

(i) the CDA Governing Council (GC) accept the recommendation of this Workshop to broaden its perspective to include all aspects of ICZM in Sindh; and

(ii) that the CDAGC create an Advisory Body comprising representatives of resource users, managers and the scientific community CDA, to address cross-sectoral issues.

## 3.5 MODEL FISHING VILLAGE

Socio-economic conditions in many coastal villages in Sindh are grossly inadequate to meet basic human needs. Services in communication are lacking or inadequate and transport (roads) electricity, safe water, education and health care are chronic. A model fishing village is currently under experiment (Kaka Village) through a partnership between Karachi University, NGO and villages.

It is recommended that:

(i) this model village serve as a provisional demonstration of locally-oriented sustainable development;

(ii) support be provided, as required, to involve the local people in identifying and demonstrating alternative resource harvesting and management approaches, employment opportunities and health care and education services;

(iii) the University and the NGO invite certain researchers and agencies to conduct needed studies and experiments in this village which will help the people understand their local system and better manage it; and

(iv) the results of this experiment be shared with other villages and promoted as a practical means of improving local environmental, resource and socio-economic conditions.

## 3.6 ALTERNATIVES TO MANGROVE USE - PILOT STUDY

Mangroves are being cut and/or degraded by a variety of activities. Much of the loss results from cutting by local people for subsistence. There are few apparent alternatives available to these people.

It is recommended that:

(i) a pilot area be selected to investigate the feasibility of introducing alternative fuel supplies (e.g. gas or solar power);

(ii) a feasibility assessment be made of how many people are using the resource, and the cost of providing an alternative;

(iii) IUCN experience with this type of assessment should be drawn upon; and

(iv) the CDA initiate this pilot study.

## 3.7 PUBLIC AWARENESS - MANGROVES

The mangroves of Pakistan are an invaluable natural resource which is critical to the continued functioning of coastal ecosystem and human uses. The mangroves are being lost or degraded through a variety of stresses. Few people understand or appreciate the value and importance of this resource. Practical alternatives must be provided to reverse this trend of degradation and destruction.

It is recommended that:

(i) the Department of Communications compile the existing information on Pakistan's mangroves (e.g. what they are, why they are important, what stresses they are under, and assess their current state and alternatives to their present exploitation) and target a series of public awareness products at all segments of society;

(ii) an early effort be targeted at the people who currently live in mangrove areas; and

(iii) a variety of media be employed.

## 4. SUB-WORKING GROUP II/3: BALOCHISTAN COASTAL AREA

Chairperson: Dr. Jawed Hameedi

### 4.1 BIOPHYSICAL FEATURES AND SOCIO-ECONOMIC CONDITIONS OF BALOCHISTAN COASTAL AREA

Balochistan is the largest and least populated province of Pakistan. It also predominates the Pakistani coastline, comprising nearly 70% of the total. The coastline, extending from Hub River to the Iranian border, is geomorphologically divided into two segments: Lasbela and Mekran coasts. The Lasbela coast, situated between the Hub River to the East and the Hingol River to the West, is characterized by sandy beaches and a fairly large Sonmiani Bay. Two offshore islands, Churna and Kiou islands, are located in an area off the Hub River and Miani Hor. A group of submarine mud volcanoes is located just offshore. The presence of mud volcanoes, formed by gas-charged water escaping to the surface, indicates an active geotectonic setting that is characteristics of the entire Balochistan coast. The Mekran coast, stretching some 500 km, is bordered by arid, mountainous terrain. It is tectonically very active, being situated in a subduction zone where the Indian Ocean plate moves northward under continental crust. The coastal terrain is an accretionary wedge of deformed sediment ranging in age from late Cretaceous to the present. The coastline is inundated by a number of small rivers that can cause local flooding following short periods of heavy rainfall. The entire coast, lacking embayments and significant land promontories, is vulnerable to heavy erosion and loss of materials offshore.

Typical of the province as a whole, the coastal Balochistan has lagged in economic development and suffers from a general lack of industrial infrastructure. There are no major municipalities, and no reliable energy transmission, water distribution, and transportation systems either. Village inhabitants utilize coastal resources for subsistence and shelter as they have done for hundreds of years, with little or no value-added commodities of local origin. Pakistan's marine fisheries, with a predominant contribution from waters off Balochistan, as much as 70% according to some estimates, have progressed steadily. The annual fish catch, with a decade average of ca. 350,000 metric tons per year and primarily consisting of rays and skates, sharks, Indian oil sardine, sea catfish, black pomfret, kawakawa (tuna), and prawns, has remained steady. Nonetheless, considerable inequities remain between the amounts harvested by the Karachi-based and local fishermen.

A number of coastal development schemes and industrial projects for Balochistan have either recently been approved or are being seriously considered for implementation by the Government of Pakistan. These projects, to be implemented with private sector involvement and international financial arrangements, will likely transform the present physical environment and resource use activities along the Balochistan coast for ever. They include, for example, further development of an industrial site in the Hub region, Hub Power Company's mammoth electricity production and distribution project, plans for importation of natural gas by pipeline from Qatar via Iran, expansion of Gwadar port to accommodate commercial fishery and defense-related operations, and construction of Mekran Coastal Highway linking coastal Balochistan with major Pakistani markets and international road systems.

### 4.2 GENERAL OBSERVATIONS ON ISSUES RELATING TO INTEGRATED COASTAL ZONE MANAGEMENT

The Working Group recognized the largely undeveloped coast and relatively pristine coastal and marine environments off Balochistan that include several areas of high biological productivity, species richness and fisheries yield. The group further recognized that unbridled and scientifically unfounded economic growth has had negative consequences just about everywhere, both to the natural environment and public amenities and health.

The Working Group surmised that industrialization, commercialization, and potential urbanization along the Balochistan coast should only proceed without ravaging the natural resources, endangering the health and welfare of local residents, grossly polluting the air and water resources, or damaging coastal ecosystems. Further, the group recommended that coastal communities must also benefit from economic development and growth in the region. It also underscored that judgmental process involves not only scientific understanding of the consequences of human activities, but also the economic and societal realties, which play key and often overriding roles. In light of the above, the group unanimously agreed to promote integrated policy- and decision-making to ensure long-term, sustainable development of the coastal and marine resources of Balochistan and implement Integrated Coastal Zone Management principles. In simplest terms, sustainability implies that the needs of the present generation should be satisfied in a manner that does not jeopardize the ability of future generations to meet their own needs (Waldichuk 1991). 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 historic perspectives and conflicting interests and uses; it is to be viewed as iterative and evolutionary process for achieving sustainable development (WCC 1994). Both the concept of sustainable development and the Integrated Coastal Zone Management approach were endorsed by the United Nations Conference on Environment and Development (UNCED).

## 4.3 RESOURCE USE ISSUES

The Working Group addressed a number of issues relating to resource estimates, resource management, and resource use conflicts in Balochistan's coastal and marine regions. For the most part, there was a dearth of scientific data and information on the environment and resources of the region. However, the group considered the following as important natural resource assessment and management issues:

(i) Mineral resources: the coastal and upper continental shelf areas of Balochistan are known to have placer deposits of titanium, zirconium, chromium, uranium and garnet (a semi-precious gem composed of silicates of calcium, magnesium, iron and manganese). Some of these minerals are highly valued and may have strategic importance. There are no reliable estimates of the amounts and locations of these deposits, although the group believed that resource assessment data might be available at cognizant government agencies. Without such information, it is not possible to estimate the economically feasible or recoverable quantities.

The Balochistan coast has received some interest during petroleum exploration surveys in offshore areas of Pakistan, particularly since there are known petroleum seeps and mud volcanoes in the region. No economically recoverable resources have been discovered to date. However, it appears that the southern flank of the Pasni anticlinorium, lying just offshore from Pasni, may have some potential. Significant amounts of sand, gravel and limestone may be found in ancient river beds and deltas along the coast of Balochistan, but neither the amounts nor the areas of their aggregation have been delineated. Presently, the exploitation of these materials from land-based resources appears to be economically and environmentally feasible.

(ii) Fisheries resources: as noted earlier, the fisheries resources of the Balochistan region are quite substantial and figure prominently in the total marine fin-fish and shellfish catch of Pakistan. The total catch has increased significantly since the early 1980s largely owing to mechanized boat operations and not necessarily on the basis of better resource estimates and allocation of catch. The group recognized that a large part of the fish catch off Balochistan is by fishermen based in Karachi, and that successful harvest by local fishermen is hampered by inefficient fishing methods, dilapidated boats, and a general lack of modern fish landing, processing and distribution facilities in Balochistan. Often, a large part of landed fish catch is spoiled. It was recommended that measures be taken to ensure equitable distribution of fish catches between the Sindh and Balochistan fishermen, assist Balochistan fishermen in modernizing their vessels and fishing practices, and set up mechanisms for improved industrial infrastructure.

(iii) Other biological resources: coastal communities of Balochistan have a long tradition of utilizing coastal resources for subsistence use and shelter. For example, mangrove trees are used a firewood and fodder for cattle; dwarf palm -- locally known as "pish" -- is used for making baskets, ropes and mats; and some fossilized coral reefs are used for household construction. In addition, there has been a recent increase in the harvest of the gastropod *Babylonia* sp., whose operculum is used in the manufacture of cosmetics and, as such, it is highly valued. No information is available on the size or sustainability of these resources, and no management plan exists for their conservation. There is a clear danger that some or all of these resources will be extirpated in the near future.

(iv) Natural hazards: much of the Balochistan coast is subject of severe erosion and inundation by storm waves, and it is also considered vulnerable to tectonically induced tsunamis. A general lack of scientific data on the severity and frequency of natural hazards to the Balochistan coast precludes formulation of scientifically valid and operationally useful coastal forecast and analysis systems. Such systems or models may be designed to determine probabilities of occurrence of episodic events (e.g., maximum significant wave height, maximum sustained winds); conduct seismic exposure analysis, including estimation of strong ground motion, under a variety of credible scenarios; or simulate hydraulic conditions that could cause sediment slumping or sustained erosion that could damage coastal and nearshore installations. Without them, no mitigation strategies can be

prescribed. The working group recommended preparation of a comprehensive, multi-parametric, and long-term data acquisition plan, including remotely-sensed data, that would lead to improved understanding of coastal hazards and adoption of or

improvement upon existing models. The plan, following its approval by a panel of experts, should be implemented under government sponsorship.

## 4.4 INSTITUTIONAL FRAMEWORK

As is the case in most developing countries and democratic governments, Pakistan has a number of agencies that are responsible for specific activities relating to natural resources and jurisdictions. For example, in Balochistan, inland and coastal fisheries are managed by the Department of Fisheries of the provincial government, and fisheries in the Exclusive Economic Zone of Pakistan, beyond the 12 mile territorial waters, are managed by the Marine Fisheries Directorate of the central government. Coastal areas are managed by government agencies either exclusively or in concert by private entities, viz., Hub Industrial Estate, Balochistan Development Authority of the provincial government, and the central government, e.g., the Pakistan Navy.

A key component of Integrated Coastal Zone Management is to foster inter-agency coordination of efforts, and to institute both vertical (involving local communities and governments, provincial governments, and central government) and horizontal (involving different sectors) integration, both of which are essential for effective management. For example, effective management of anadromous fish resources would require integration of policies governing timber harvest (silted streams, removal of canopy, increased temperature), water and power use (water impoundment and dams, nitrogen supersaturation), farming practices (water use, pesticides), and urban activities (ports and causeways, effluent and outfalls, economic infrastructure, recreational activities, and non-point source pollution). The Working Group recognized the importance of such integration efforts and recommended resolution of ownership and jurisdictional conflicts.

## 4.5 ENVIRONMENTAL DEGRADATION AND COASTAL POLLUTION

For the most part, the marine environmental quality of coastal Balochistan is good as stresses from anthropogenic activities have been minimal. However, the current rate of population increase along the coast is high, as much as 7% per year, and several major industrial development projects are being contemplated for the region. The Working Group recommended a program to establish a quality controlled data set on the spatial distribution and scales of contamination in the coastal and offshore waters of Balochistan. Its purpose would be to establish a credible baseline against which any future spatial and temporal trends could be described. The suite of measurements should include concentration of toxic metals, industrial organochlorines and pesticides, petroleum hydrocarbons, and organometallic compounds in sediment and sentinel organisms. In addition, the group recommended extensive biological surveys and specific ecological studies to delineate critical biological habitats and ecosystems that might need special protection.

The Working Group agreed the following overarching objective: to promote integrated policy- and decision-making to ensure long-term sustainability and development of the coastal and marine resources of Balochistan.

(i) Development of mineral reports:

- a) placer deposits of titanium, zirconium, chromium, uranium, garnets, estimated Amount: 2.5+106 tons, estimated Value: $100-600/ton, data available at AEC, NI, other government agencies;
- b) exploratory surveys for petroleum;
- c) shell lime for pharmaceuticals;
- d) building materials: sand gravel crushed stone lime.

(ii) Inadequate synthesis of existing data:

- a) availability of data from different agencies and organizations;
- b) data quality;
- c) availability of satellite imagery and regional maps, fisheries and biological resources, water resources, coastal use patterns.

(iii) Development of industrial infra-structure:

- a) fish landing facilities;

b) fish processing and preservation facilities;
c) communication and transportation (along the coast and to the interior);
d) energy and power distribution: capacity is there to meet immediate electric power demands.

(iv) Coastal erosion, siltation and natural hazards:

a) erosion and siltation control;
b) land use and sea-level change considerations in planning and development.

(v) Institutional problems:

a) inter-agency cooperation;
b) legislative authority for coastal development and resource management;
c) intergovernmental coordination - "vertical integration";
d) resolution of ownership and jurisdictional conflict: Gwadar central government Pasni Provincial Ormara Navy, fisheries;
e) logistics, equipment and training facilities (Provincial Science and Technology Department).

(vi) Environmental degradation and coastal pollution:

a) industrial development sites, existing and proposed;
b) population increase in coastal Balochistan (7% per year);
c) environmental assessment process improvements to include: evaluation of long-term impacts; options to the proposal for development; and, meaningful public participation;
d) critical habitat and ecosystem protection.

(vii) Subsistence and traditional use of resources:

a) mangroves (fuel wood, fodder);
b) Dwarf palm "pish" - for making mats, baskets, ropes;
c) *Operculum of Babylonia* sp., a gastropod used as a base material for cosmetics [$1000-1500/kg];
d) traditional conservation measures for fish and shellfish resources;
e) improved inter-provincial coordination in commercial fishing;
f) indiscriminate use of fossilized coral reefs used in construction, found in Jiwani, Gwadar.

## 4.6 CONCLUSION

The working group concluded that the current policy of the Pakistan government for economic development in coastal Balochistan should be viewed as a catalyst for establishing an Integrated Coastal Zone Management structure and policies for the region. This is also an opportunity for different government agencies and the private sector to agree on a comprehensive policy to guide ocean use activities, integrate and converge their respective responsibilities, and set up specific goals in relation to: coastal and ocean resource conservation, preservation of biodiversity and valued ecosystems, marine transportation and waste disposal activities, and a long-term environmental monitoring and assessment program. Coastal Balochistan could be a test case where a relatively pristine and productive environment can be shown to endure and enhance economic opportunities for the region, and still allow for sustainable use of its varied resources.

## 4.7 RECOMMENDATIONS

The Working Group made a number of recommendations for action by cognizant authorities. The desired time frame for action is immediate, mid-term (2-5 years from now), and long-term (beyond 5 years from now). The recommendations are listed below:

(i) Immediate:

a) that a Coastal Development Authority be established for Balochistan;
b) that data assessment and resource mapping using a computer-based system, e.g., a Geographical Information System (GAS), be carried out;
c) that biological surveys be carried out to delineate areas of special use and sensitivity to pollution; and
d) that monitoring sites and measurement protocols, similar to those for the US National Status and

Trends Program be established along the coast.

(ii) Mid-term:

a) that existing fishing method s and regulations should be strengthened to ensure sustainable use o f fisheries and other biological resources;

b) that a feasibility study to provide potable water to residents of small coastal communities (e.g., Chur, Kalmat, Gunz) be carried out, including options for tube wells, desalination plants, and delayed-action dams;

c) that education and outreach programs for local residents be instituted through schools and community centers;

d) that retrospective analyses for assessment of present coastal resource use and sustainability be carried out, including environmental and socio-economic considerations;

e) that field surveys and detailed studies be carried out to identify and delineate spawning and rearing areas of the commercially important fin-fish and shellfish species; and

f) that coastal oceanographic research be carried out on a regional basis to determine areas of erosion and accretion, sea-level changes, permanence of gyres, residual circulation, and coherence between winds and currents.

(iii) Long-term:

a) that coastal seismic monitoring stations be established to eventually become part of a regional network;

b) that a College of Fisheries and Environmental Sciences be establ ished (or special curricula dealing with these sciences be added in existing institutions);

c) that coastal areas and critical habitats needing special protection be designated;

d) that marine field stations be set up at Ormara, Jiwani and Sonmiani;

e) that oil spill response capabilities be developed and joint contingency plans with adjacent coasta l states be set up; and

f) that a cross-sectoral, inter-disciplinary resource management framework be formulated an d implemented following UNCED recommendations and the results of this Workshop.

## 5. WORKING GROUP III: CAPACITY BUILDING (WORKING GROUP 4)

Chairperson: Dr. John Pernetta

### 5.1 SUMMARY

The Working Group identified the following three main areas in which the indigenous capacity require d strengthening:

(i) professional levels relating to Integrated Coastal Zone Management;

(ii) public awareness education to enhance the capacity of all levels of society to participate in the ICZM process;

(iii) institutional capacity building related to existing structures and linkages.

### 5.2 PROFESSIONAL CAPACITY BUILDING

The needs for professional capacity building are as follows:

(i) basic training in ICZM, which is a "new" field for Pakistan to provide a cadre of national CZ managers;

(ii) to train "trainers" for all levels from management, research and monitoring to community education specialists;

(iii) to expand the capacity of existing institutions such as universities and CEMB to produce greater numbers of qualified scientists, managers and planners;

(iv) to identify new and emerging fields such as bioassay/ecological health and train specialists in these fields;

(v) to strengthen overall national planning capacity in all fields but particularly those related to coastal areas;

(vi) to develop capacity in natural resource accounting;

(vii) to develop capacity in Environmental Impact Assessment including *inter alia* the socio-economic aspects of assessment, resource valuation, prediction and scenario linking;

(viii) to enhance the indigenous capacity for all types of modeling;

(ix) to enhance the indigenous capacity for information and data management.

It was clear from the Working Group's discussion that in areas such as remote sensing Pakistan has significant capacity at present, but in others, such as planning and coastal zone management, capacity is weak or non-existent. Therefore, the Working Group felt there was an urgent need to review present capacity on a sector by sector basis as they relate to ICZM, and to produce an overall Manpower Development Plan for ICZM to guide the Government in achieving the needs outlined above.

## 5.3 PUBLIC AWARENESS/EDUCATION AND INVOLVEMENT

Recognizing that to be effective integrated coastal zone management must involve all sectors of society, including governmental, non-governmental, commercial and community, the group identified the following urgent needs:

(i) improved and strengthened capacity to initiate and implement public awareness campaigns which reach all sectors of society (e.g. posters, booklets, articles in the mass media) concerning the need for and purposes of ICZM and the maintenance of environmental quality;

(ii) to develop and enhance the school curricula coverage of the important role of coastal zones to Pakistan's sustainable development;

(iii) to strengthen the role of marine parks and practical areas in public education concerning the importance of the coastal zone, through training of Park managers, rangers and others;

(iv) to train non-professionals in coastal zone issues, problems and solutions;

(v) to encourage the development, and strengthen the involvement of NGOs in developing and implementing coastal zone management particularly in the private and commercial sectors whose livelihood is based on coastal resources; and

(vi) to strengthen wide public awareness of the role and responsibilities of different agencies and institutions in the ICZM process.

## 5.4 INSTITUTIONAL CAPACITY BUILDING

The Working Group recognized that rather than create new institutions, existing institutions should be strengthened and their capacity enhanced to meet the challenge of ICZM and that stronger linkages needed to be developed between institutions at all levels.

The following issues were raised:

(i) there exists a need to strengthen the technical capacity of certain institutions in fields such as: physical oceanography, design of sampling programmes for monitoring analysis of pollutants such as sea pollutants, environmental impact assessment;

(ii) GIS application to coastal zone management. It was noted for example that strange standards for some pollutants existed, the capacity to monitor a number of these does not exist at present;

(iii) the Working Group noted the need to strengthen the indigenous capacity to model various processes and that although in a number of cases such models had been developed by certain consultants and experts, they were not available for use in-country;

(iv) it was felt that too great a reliance on short-term visits by foreign experts led to dependence and that cooperative linkage with international agencies/institutions in joint programmes was a more profitable way to strengthen indigenous capacity and make use of the required external expertise;

(v) information and data flow need to be enhanced between the institutions involved in coastal zone issues, and it was suggested that a cross-sectoral technical committee was needed, as was a centralized data bank which could be easily accessed by all institutions;

(vi) linkages need to be developed between the commercial sectors and research organizations;

(vii) close links need to be established between the SUPARCO and agencies concerned with the collection of in situ data to provide ground truthing;

(viii) although SUPARCO has two coastal stations for marine monitoring, these have yet to be deployed since their

safety cannot be guaranteed. Their deployment would enhance coastal monitoring;

(ix) the capacity of responsible institutions to undertake environmental, compliance monitoring in coastal areas is presently constrained by manpower and equipment limitations;

(x) to enhance the capacity for proper environmental monitoring, national agencies should be encouraged and assisted to participate in inter-calibration exercises organized by international organizations such as the IAEA and IOC;

(xi) greater international involvement of national institutions and agencies should be encouraged in order to develop a capacity to evaluate technological options for developments such as industrial and power generation plants;

(xii) there exists a need to develop the capacity to sample and monitor remote areas and to provide results rapidly concerning the state of the environment;

xiii) the need to develop capacity to predict the future state of the environment under different scenarios of development will require enhanced modeling capability in all fields and disciplines related to coastal area;

(xiv) existing legislation and enforcement procedures need to be reviewed and revised in harmony with the development of capacity for ICZM and planning.

Overall, the Working Group felt that the coastal zone should be recognized as a distinct and additional sector of development by the Planning and Development Division, Government of Pakistan, to provide appropriate and adequate attention to the specific needs of project planning, implementation and review in this sector.

**ANNEX I**

**AGENDA**
**Monday, 10 October 1994**

8:30 REGISTRATION

9:30 Arrival of the Chief Guest Syed Abdullah Shah, Chief Minister of Sindh,
Visit to the Coastal Zone Management Exhibition
Recitation from Holy Quran
Welcome Address by Mr. S.H. Niaz Rizvi, Director-General, National Institute of Oceanography
Address by Dr. S.M. Haq, Adviser to Ambassador and Permanent Delegate to UNESCO, Paris
Address by Dr. Kullenberg, Secretary, Intergovernmental Oceanographic Commission (IOC), UNESCO, Paris
Address by Sardar Talib Hasan, Parliamentary Secretary, Ministry of Science and Technology Government of Pakistan
Address by Mr. Parvez Ahmad Butt, Secretary, Ministry of Science and Technology, Government of Pakistan

Inaugural Address by Syed Abdullah Shah, Chief Minister of Sindh
Vote of Thanks by Mr. Abdul Rashid, Joint Technological Adviser, Ministry of Science and Technology

10:45 Presentation of souvenirs

11:00 REFRESHMENTS

Plenary Session I: Keynote addresses
Chairperson: Mr. Saiyed Ahmad Siddiqui, Chief Secretary Government of Sindh, Karachi
Co-Chairperson: Mr. S.H. Niaz Rizvi (NIO)

11:30 Dr. Bilal U. Haq, National Science Foundation, USA.
Future of River Indus Delta in View of Upstream Damming, and Perils of Ignoring Coastal Zone Management

12:00 Dr. Gunnar Kullenberg, IOC, UNESCO, Paris
Global Perspectives on Coastal Area Management

12:30-14:00 LUNCH

Presentation of papers
Plenary Session I: Integrated Coastal Zone Management and Related Aspects
Chairperson: Dr. Gunnar Kullenberg (IOC)
Co-Chairperson: Professor Dr. Nasima Tirmizi (University, Karachi)

14:00 Dr. Bilal U. Haq (NSF, USA)
Presentation of Executive Summary on the outcome of the Symposium on River Indus, held by the Linnean Society of London (13-15 July, 1994)

14:25 Dr. S. M. Haq (Paris)
Basic Concept and Framework for Integrated Coastal Zone Management

14:50 Dr. R.S. Arthurton (U.K.)

Implications of Physical Change for Coastal Zone Management

15:15 Dr. R. Knecht (USA)
Legal and Policy Considerations in Coastal Zone Management

15:40 Professor J. H. J. Terwindt (The Netherlands)

16:15 TEA / COFFEE

Plenary Session III: Ecosystem, Mangrove & Fisheries Resources of Coastal Pakistan
Chairperson: Rear Admiral Sajjad Akbar (retired)
Co-Chairperson: Mr. Bahaddin Sirhindi, Secretary, Department of Forestry & Fisheries, Government of Sindh

16:35 Professor Muzamil Ahmed
Threats to Biodiversity in the Marine Ecosystem of Pakistan

17:00 Professor S. M. Saifullah
Management of Indus Delta Mangrove

17:25 Mr. Moazzam Khan
Vulnerability of Coastal Fisheries and Other Living Resources to Changes in the Marine and Estuarine Environment

**Tuesday, 11 October 1994**

10:00-13:00 *Ad hoc* SESSION: Guideline for Coastal Zone Planning Process and Related Aspects for Coastal Pakistan
Chairperson: Dr. R. Knecht (USA)
Vice-Chairperson: Dr. S.M. Haq

11.00 TEA/COFFEE

12.30 LUNCH

14:30 General discussion and formation of Working Groups I-III

16.00 TEA/COFFEE

16.15-18:00 Working Group Sessions (continued)

**Wednesday, 12 October 1994**

Plenary Session IV: Estuary, Geographic Information System Biomarkers and Coastal Engineering
Chairperson: Dr. G. Kullenberg (IOC)
Co-Chairperson: Professor Dr. Muzammil Ahmad (Karachi)

9:00 H. Niaz Rizvi
Prospects of Shrimp Farming in the Indus Deltaic Region

9:25 Mr. D. Von Speybroeck (UNEP)

The Use of Natural Resource Maps and Related Geographic Information System in Coastal Zone Management

9:55 Professor Tarique Mustafa (Denmark)
Animal Biomakers as Stress Indicators: A Tool to Assess the Health of Organisms in the Marine Environment

11:00 TEA/COFFEE

Plenary Session V: Coastal Development Scenario, Karachi Water Management, Coastal Hydrodynamics
Chairperson: Dr. Nuzrat Yar Khan (Canada/Kuwait)
Co-chairperson: Professor Dr. S. I. Ahmed (USA)

11:20 Mr. Syed Abu Hamid Naqvi (KDA)
Land Utilization, Planning and Development in Sindh Areas and Related Legislative Instruments and Policies

11:45 Mr. M. Tahir Quraishi & Mrs. Mehar Marker Nowsherwani (IUCN Karachi Branch)
Socio-economic Development: Present & Future Planning along Sindh Coast

12:10 Mr. M. H. Panhwar (Karachi)
Agroclimatic Zone of the Coastal Area and Potential for Development

13:00-14:00 LUNCH

Plenary Session VI:
Chairperson: Dr. Abdul Majid Kazi (Coastal Development Authority (CDA)
Co-chairperson: Dr. M. Ishaq Mirza, Member (SUPARCO)

14:00 Muhammad Tausif Akhtar (University of Balochistan)
Socio-economic Conditions along the Balochistan Coast

14:30 Tariq Masood Ali Khan (NIO)
Coastal Circulation along the Pakistan Coast

15:00 Mr. Mohiuddin Khan, Indus River System Authority, Lahore
Water Management of Coastal Rivers and Streams for Integrated Coastal Zone Management

15:30 Mr. S. H. Niaz Rizvi (NIO)
An Overview of Pollution along the Pakistan Coast

16:00 TEA / COFFEE

Plenary Session VII: Monitoring, Impact Assessment and Information and Data Requirements
Chairperson: Dr. S. M. Haq
Co-Chairperson: Dr. Javed Hameedi

16:15 Dr. Javed Hameedi (NOAA, USA)
Strategic Design for a Coastal Monitoring Programme

16:45 Dr. Nuzrat Yar Khan (Canada/Kuwait)
Role of Environmental Impact Assessment in Resolution of Key Issues and Conflicts of Coastal Zone

17:00 Dr. John Pernetta (LOICZ: The Netherlands)
Information and Data Requirements for Coastal Zone Management in a Changing World

17:45 Dr. Hillary Hildebrand (Canada).
Aspects of Participation of Local Authorities & Communities Experiences from the Halifax 94 Conference on Integrated Coastal Zone Management

**Thursday, 13 October 1994**

10:00-18:00 Working Group I: Scientific Basis for Definition of Coastal Zone Boundary Limitations for Sindh and Balochistan Coasts

Chairperson: Dr. Bilal U. Haq

Working Group II: Issues and Actions for integrated Coastal Zone Management
Sub-Working Group II/1: The Karachi Area
Chairperson: Professor J.H.J. Terwindt
Sub-Working Group II/2: Sindh Coastal Area
Chairperson: Dr. Hillary Hildebrand
Sub-Working Group II/3: The Balochistan Coastal Area
Chairperson: Dr. Javed Hameedi

Working Group III: Capacity Building

# ANNEX II

## SPEECHES

### A. Welcome Address by Mr. S.H. Niaz Rizvi
### Director-General, National Institute of Oceanography, Karachi
### 10 October 1994

Honorable Chief Minister of Sindh, Mr. Syed Abdullah Shah,
Parliamentary Secretary for Science and Technology, Mr. Sardar Talib Hasan,
Secretary Ministry of Science and Technology, Mr. Pervaiz Ahmad Butt,
Secretary of the Intergovernmental Oceanographic Commission of UNESCO, Dr. Gunnar Kullenberg,
Distinguished Guests,
Ladies and Gentlemen,

On this auspicious occasion of the opening of the International Workshop on Integrated Coastal Zone Management, I should first of all like to welcome, on behalf of the Ministry of Science and Technology and on my own behalf as Director-General of National Institute of Oceanography, the honorable Chief Minister, Syed Abdullah Shah. Our profound gratitude to you, Sir, for having shown keen interest in this Workshop and for gracing the occasion by your presence, despite your numerous engagements. This is in itself an ample testimony of the importance that the Government of Sindh attaches to sustainable development and coastal zone management in particular.

I should also like to express my deep appreciation to our Parliamentary Secretary for Science and Technology, Mr. Sardar Talib Hasan, who, despite pressing engagements, has very kindly accepted our invitation and came all the way from Islamabad to attend this function. This also indicates the value he accords to the very vital theme of integrated coastal zone management.

Finally, I should like to thank the Secretary, Ministry of Science and Technology, Mr. Pervaiz Ahmad Butt, for the personal interest he has taken in organizing this activity and for the support he and the Ministry have provided.

The Workshop is organized in close co-operation with the Intergovernmental Oceanographic Commission of UNESCO and I have very great pleasure in welcoming the Secretary, Professor Dr. Gunnar Kullenberg. On behalf of NIO I should like to say how much we all appreciate the support that he and his organization has provided to us. In this context, please allow me to also mention of the attendance of Professor S. M. Haq, who has been my teacher. As most of you might know Dr. Haq was the founding Director of Centre of Excellence in Marine Biology, University Karachi. Later, he served as a senior official of the IOC for a number of years, and is now the Adviser to Pakistan Ambassador and Permanent Delegate to UNESCO. Professor Haq has been the force in coordinating all external arrangements for the Workshop from Paris and I should like to express my profound indebtedness to him for the encouragement and the moral support that he has provided us not only in this activity but also in the promotion of marine sciences in Pakistan.

In conclusion, I should like to extend my warm welcome to our foreign guests who have come a long distance from Canada, Denmark, the Netherlands, U.K., USA as well as the experts representing international organizations, namely, UNEP and ESCAP. We are grateful to them for having accepted our invitation. I am sure their expertise and long experience on the subject of coastal zone management will not only enrich our deliberations but will assist us in achieving the objectives of this Workshop. I should like to say that we have made all possible arrangements to make their stay in Karachi comfortable. Our staff will be available to assist them in whatever way possible. I hope they will enjoy their stay here in Karachi. We apologize in advance for any inconvenience and shortcomings that may eventuate.

Last but not least, I welcome our participants from some forty five different national agencies representing: federal, provincial and local governments; Coastal Development Authorities of Sindh and Balochistan; scientific institutions and universities including zoological and geological surveys; SUPARCO; development sectors in the coastal areas including fisheries, forestry, power stations, water and power development authority, coastal installations including port and harbor authorities, oil refineries, steel mill and from other public and private sectors; the Pakistan Navy; non-

governmental organizations such as IUCN Branch in Karachi and Pakistan Maritime Affairs (PIMA). The representation of national expertise from such a wide range of institutions and agencies with interest in the coastal zone make the occasion unique, perhaps the first of its kind ever held in Pakistan.

Pakistan's coastal zone is some 600 miles long and belong mainly to two provinces namely, Balochistan and Sindh. Though they differ considerably in geophysical features, both are blessed with high biological productivity, comparing favorably with some of the most productive regions of the world. The complex creek system of the Indus Delta in particular, supports one of the most rich and diverse of biological resources associated with mangrove forests. This area serves not only as a sanctuary, breeding and nursery ground to a variety of fish and shrimp, but also provides opportunity for development of a variety of new resources through, for instance aquaculture. This alone according to one estimate, has the potential of shrimp production of the order of ten billions rupees.

The coastal zone is a complex dynamic system influenced by natural and human activities such as exploitation of living and non-living resources and the use of space (both dry and wet parts) for a variety of purposes. Such activities encompass a variety of socio-economic activities such as port and harbor facilities, marine transportation, recreation, settlements, fisheries, forestry, a variety of industrial processes. All these development activities must be made sustainable since they either compete for space in the coastal zone or often result in conflicting uses to the detriment of the coastal environment, as a whole.

Effluent discharged from major domestic sources and agriculture and from more than 6000 small and large scale industries into coastal areas has posed a serious threat to the environment. Not only do the impacts of multiple uses often conflict with each other but they have resulted in deterioration of the coastal environment and the resources. The impact of activities in the hinterland and up the streams of the River Indus seem also to have considerably influenced the geomorphology of our shores. It has for instance been reported that the negative sediment budget resulting from reduced flow of the Indus has caused encroachment of the sea with the result that serious damage has been sustained by the immediate coastal areas. Unless immediate steps are taken to resolve these problems, the damages caused to the coastal environment and its resources by such ever increasing anthropogenic influences, may in time become irreversible.

The Workshop is designed to review the current state of affairs affecting our coastal zone. Its main objective is to analyze the current state of affairs in relation to the various uses of our coastal zone and to identify key issues that are affecting our environment. To meet this objective we will discuss options and alternatives to resolve such problems and suggest guidelines for multiple use strategies to redress those issues. We will also identify needs for capacity building and mechanisms to deal with this complex multidisciplinary and intersectoral problems to ensure sustainable development of this valuable national resource.

The Workshop is designed to be an educational experience for those who are unaware of the complexity of the subject in the hope that they will be able to re-examine their respective roles with our society and contribute to formulating a national strategy for sustainable development.

I would like to thank you all for extending to me your patient attention and I wish you a great success in your deliberations.

## B. Address by Dr. S.M. Haq
### Adviser to Ambassador and Permanent Delegate to UNESCO, Paris
### 10 October 1994

Honorable Chief Minister, Syed Abdullah Shah, Federal Secretary of the Ministry of Science and Technology,

Mr. Pervaiz Ahmad Butt, Secretary of the Intergovernmental Oceanographic Commission,

Dr. Gunnar Kullenberg, Director-general of NIO,

Mr. Niaz Rizvi. Friends and Colleague from the distant seas,

Distinguished Guests,

Ladies and Gentlemen,

I should, first of all, like to join earlier speaker in expressing our sincerethanks to the honorable Chief Minister, Syed Abdullah Shah for gracing the occasion by his presence. I should also like to thank both our Federal Secretary of the Ministry of Science and Technology, Mr, Pervaiz Ahmad Butt, and the IOC Secretary, Dr. Gunnar Kullenberg,

Executive Secretary IOC, for inviting me to assist in the development of the proposal and to co-ordinate various external arrangements for the Workshop from Paris on behalf of both the Ministry and the IOC. I merely wish to say how pleased I was to be able to help our national institution.

On this auspicious occasion when we are going to deliberate on a subject of great national importance, I am reminded of a couplet from our eminent philosopher poet Allama Iqbal:

When translated it means that "if blind following had been a good practice, then, even the prophets would have followed the path of their fore fathers". But they did not. They in fact responded to the pressing need of the time for the good of the society and the people, and thus left the imprints of their works on the sands of time, for the posterity to follow.

The theme of this Workshop "The integrated Coastal Zone Management" goes beyond what the title seems to imply. The Workshop responds to the urgent need of our time that we accord serious consideration to an important national resource which is faced with an unprecedented threat due to impact of ever expanding human activities.

Let me briefly share with you some of the highlights of the development trends on the subject of ocean management which over the years have led to the world wide support for integration into national development planning.

The concept of " development planning " in a number of developing countries, followed the post war reconstruction of Europe under the Marshal Plan in the late forties, which was initially focussed on a few sectors such as agriculture, fisheries etc. With the sociological changes that followed in the early fifties, increasing demand for public participation in economic development activities, the concept of " development planning " was progressively changed to "integrated economic development". This took the place of an isolated and fragmented approach to take account of rapidly emerging social objectives so as to foster public participation in various economic endeavors. It was soon recognized that one of the major obstacles to resource development was the lack of adequate scientific information about the processes that govern productivity of a given natural resource. There have been several important events in the past three decades which determined the course of evolution of ocean management in subsequent years.

The impact of rapid advances in sciences and innovative technologies (e.g. satellites, remote sensing, telecommunication) in the 1970's provided new tools as well as opportunities for resource exploration of the coastal and oceanic region and thus added a new dimension to the development planning in the marine sector. It was internationally recognized that resource development as well as environmental protection are essentially science based. Let me emphasize this point by quoting what Professor H.B. G. Casimir, a Past President of the Royal Netherlands Academy of Arts and Sciences said in his address to the UN colloquium on science and technology held in 1979. He went so far as to say that "Science and technology can not be applied to development. Science and technology are essential parts of development. One does not apply one's lung to respiration, nor one's heart to the circulation of blood, nor one's legs to walking. If we regard science and technology as a crutch, it will at best provide a halting gait. If we regard them as a transplanted heart, it will sooner or later be rejected by the receiver".

During the seventies and the eighties rapid advances in ocean science and technology yielded new scientific discoveries of ocean features and processes, fostered penetration of the industrial revolution into the ocean, enhanced realization of the importance of marine resources and multiple uses of the ocean space in national and international economies, and triggered off the transition from a " laissez-faire" attitude to the oceans to the system of management of marine areas under national jurisdiction. All the foregoing having brought about radical changes in the conduct of marine research as applied to the development process.

Until a decade ago not many in the developing countries had the slightest idea of the significance of the coastal zone as an important national resource. Over the years it was increasingly recognized that the development of the coastal zone was to a large extent driven by market forces. It was also realized that role of government, in this context, is to respond to these market forces and correct failures, wherever applicable, in a manner so as to conserve the resources, protect the environment so as to ensure sustained development. This necessarily involved adoption of corrective measures and their effective implementation at all levels.

The world wide recognition of the importance of the coastal zone, as a significant national resource is further exemplified by the manner in which it is received today. Out of 218 sovereign states, 80 %, i.e. 177, are coastal and island states. Of these, 66 include a number of developing countries in Africa, Asia and Latin America, which have already embarked on integrated coastal zone management programme during the past one decade accounting for no less than 140 efforts, all combined. This trend will continue to increase with time.

I should also mention that this " International Workshop on Integrated Coastal Zone Management " also responds to the " Resolution of the Assembly of the Intergovernmental Oceanographic Commission " (IOC) of UNESCO, at its Seventeenth Session held in 1993, on "Coastal Zone Activities" which called upon the Secretary of the Commission to assist its Member States in their plans to develop integrated coastal zone management, together with related comprehensive training, education and capacity building. The IOC was recognized by the United Nations Conference on Environment and Development (UNCED), held in Rio de janeiro, Brazil, 1992, as one of the competent organizations to address the question of coastal zone management.

Finally, may I also mention here that this Workshop is unique in the sense that we have amongst us world's best expertise which also include four Pakistani expatriates serving in senior positions. They are all going to impart and share their own experiences on the subject together with the input of national expertise representing various sectors of our marine economy.

We hope that this august forum will undertake a meaningful and objective analysis of the various conflicting issues. These include but are not limited to the impact of indiscriminate exploitation of our resources, marine pollution, encroachment of the sea inland consequent upon reduction of the river runoff. All these and others are threatening our valuable marine resources, as well as the environment, which is the common heritage and also the concern of all. These need to be need to be protected to ensure sustainable development of our nation's very important national resource, the coastal zones, both for the present generation and for posterity.

I am very optimistic that this unique gathering of experts representing various sector will eventually succeed in providing a set of guidelines and an outline of an integrated coastal zone management planning process on which future planning can be based and initiated in Pakistan.

I wish you all successful deliberation and I thank you for your patient hearing.

### C. Address by Mr. Sardar Talib Hasan
### Parliamentary Secretary for Science and Technology, Islamabad
### 10 October 1994

Honorable Chief Minister, Syed Abdullah Shah,
Secretary Ministry of Science and Technology Mr. Pervaiz Ahmad Butt,
Secretary of the Intergovernmental Oceanographic Commission, Dr. Gunnar Kullenberg,
Director-General of NIO, Mr. S. Niaz Rizvi,
Distinguished Guests,
Ladies and Gentlemen,

It is indeed a great honor and pleasure for me to address this gathering of distinguished scientists and experts from abroad as well as those from national institutions and agencies, at the opening of this international Workshop on integrated coastal zone management.

I should like first of all to express my thanks to the Ministry of Science and Technology and the Director-General of NIO, for inviting me to this important forum to share with you the outcome of the deliberations on a subject of great national importance. I also share the view of earlier speakers in expressing our thanks to the Intergovernmental Oceanographic Commission of UNESCO for its valuable support, and to UNDP, UNEP, and ESCAP for the support they have provided either financially or by sending experts to participate in the deliberations. I may mention in passing that this is indicative of the importance that the international organizations attach to the subject of coastal zone management.

Pakistan, as you are aware, is a signatory to the two important United Nations Conferences that have been held recently: the United Nations Convention on the Law of the Sea (UNCLOS) which will come into force in November 1994; and the United Nations Conference on Environment and Development (UNCED), followed by the Earth Summit held in RIO de Janeiro, Brazil, in 1992. Thanks to extensive international efforts these conventions have greatly influenced the thinking of coastal and island states in addressing problems of development which have seriously impaired the environment over the years due to indiscriminate use of the Earths' resources.

Under UNCLOS, coastal and island states have acquired new obligations and rights for the exploration and exploitation of marine resources in the extended areas of national jurisdictions. UNCED, on the other hand focussed on sustainability and the nature of the environmental crisis facing the world. Here, I should like to refer particularly to two important points that have been stressed in various provisions of the conventions adopted by these conferences: first the need to integrate environment into all development processes so as to ensure sustainable development of resources for equitable distribution to the present and to the future generations; and second the urgent need to establish a new equitable partnership involving governments, key sectors of societies and their people in general to achieve the goal of integrated management. Agenda 21 of UNCED provides a blue print of major actions that may be undertaken to make development socially, economically and environmentally sustainable. I may refer to the Programme Areas entitled " Protection of the Oceans....." and " Integrated management and sustainable development of coastal and marine areas, including exclusive economic zone" referred to in Chapter 17 of Agenda 21, which call on countries to anticipate and prevent further degradation of the environment and reduce the risks of long-term irreversible effects, and to make marine environmental protection part of general environmental, social and economic development policies.

It is therefore important to bear in mind that in order to achieve sustainable development of our coastal zones, environmental protection should constitute an integral part of all development processes. It is here that science and technology must play a pivotal role in bringing forward the relevant scientific data and information on which coastal development may be based. Concerning the different role of all sectors involved, I may also add that the management decisions must go beyond the scope of any one scientific institution, as these matters fall within the purview of governments and relevant development sectors. The role of scientific institutions will be essentially service oriented, providing factual information and data, which are of crucial importance to policy and decision makers and to the user-community in determining the course of action with regard to sustainable development and management.

I am happy to say that the present Government is fully aware of these developments on the international scene and has already accorded high priority to environmental issues. This is very much reflected in the reconstitution of the Pakistan Environmental Council, and in the establishment of Coastal Development Authorities for both our coastal provinces, namely, Balochistan and Sindh. These decisions in my view are timely and very pertinent to the objectives of this international Workshop on integrated coastal zone management.

Against the backdrop of these developments on the international scene, as well as considering the impact of rapid development of socio-economic activities on our coastal environment and resources, referred to by earlier speakers, we regard the convening of this international Workshop in Pakistan, as not only appropriate but timely.

I am pleased to note that we have here experts from foreign institutions and from a wide range of national agencies who are going to take part in the deliberations on this crucial subject. I am confident that you will do the best in identifying the key issues involved and to suggest strategies and recommendations to resolves the problems so that we have an adequate basis for the eventual establishment of a workable coastal zone management planning process. We will be looking forward to the outcome of your fruitful discussions. I wish you all a great success in your deliberations.

## D. Inaugural Address by the Honorable Syed Abdullah Shah
## Chief Minister of Sindh
## 10 October 1994

Parliamentary Secretary for Science and Technology, Mr. Sardar Talib Hasan,
Federal Secretary, Ministry of Science & Technology, Parvaiz Ahmad Butt,
Secretary of the Intergovernmental Oceanographic Commission, Dr Gunnar Kullenberg,
Director-general of NIO, Mr. S. Niaz Rizvi,
Distinguished Guests,
Ladies and Gentlemen,

It is indeed a great pleasure for me to inaugurate this Workshop. I should like first of all to welcome our foreign guests as well as our own experts from a wide range of institutions and agencies, from various provinces, representing public and private sectors, who have gathered here to deliberate on the subject of sustainable development in the context of integrated coastal zone management. I wish them a pleasant stay and a successful deliberation.

I am happy that this international forum is being held at no other place than the city of Karachi, which is not only the largest city of Pakistan in terms of its population and size but also the industrial hub of the country. Situated at the

extension of an arid zone and at the border of the Arabian sea, en route of one of the busiest shipping lanes originating from the Persian Gulf, the city also serves as the largest port in the region. Its population has been growing exponentially during the past four decades, from about one million five hundred at the time of independence, to about thirteen millions today. From the beginning development activities were focussed on the main land unaware of the harmful influences that such land based activities have caused to the adjacent near shore environment. The economy of metropolitan Karachi developed as either service oriented or industrially based with no less than 6000 small and large scale industries concentrated around the coastal areas.

From the adjacent sea and the estuary of the River Indus the exploitation of fisheries has been the main resource, which contribute significantly to our economy. There are about one fifty thousand fishermen who live in coastal areas and depend so largely on fishing and or related living resources for their sustenance. The lives and aspirations for economic well being of these coastal residents are inextricably linked to the sustainable productivity of coastal resources.

With current growth rate of 3 percent annually, it is to be expected that the population of the city will be doubled to 26 millions in the next 18-20 years. The pressure that will be exerted on the coastal environment and its resources will be much increased, and, therefore, the need for a comprehensive plan for the management and sustainable development of coastal zone cannot be over-emphasized.

Coastal zone management is one of the most complex exercise of all government endeavors. The complexity derives not merely from the multiple uses of the area involved, but from the multisectoral involvement in the whole question of management. There are questions of ownership and governing authority that are applied to inland areas, coastal land, coastal waters and offshore waters falling within the jurisdiction of the federal, provincial and local governments. Each sector is involved in promoting its own interest in its own area of jurisdiction. There is always keen competition amongst the sectors, which often conflict with each other.

The key word in the whole process of coastal zone management is "integration" which calls for unification of all processes operating amongst these sectors, between those operating on the land and the adjacent near shore water, vertically at various levels of government and horizontally across all agencies involved in the use of this region. In short, while the environment of the coastal zone is a common entity of concern to all people and the nation, development processes cut across many sectors involving people, the resources of the land and the adjacent waters. Rather than accepting the deteriorating conditions as an ecological apocalypse, we should undertake critical examination, assessment and analysis of the situation within economic and social context to provide the basis for sustainable use and management.

I must add that not all interactions between sectors are problematic. There is, also the need to understand the nature of interactions that are mutually beneficial or even neutral. Let me give one example. Fisheries managers will be concerned with fisheries development, while integrated coastal management will be concerned with the impact of land based pollution on fisheries, nursery grounds and important sanctuaries. In this respect there is a need to introduce environmental impact assessment from the very beginning of new project development and this should be a continuing exercise at various stages of project implementation.

Ladies and gentlemen, it is my feeling that we should examine the possibility of immediately creating and implementing plan for environmentally sound and sustainable development for the coastal marine environment in Pakistan. We should have relevant economic and sustainable development assessment for the coastal region and in this context make an effort to focus on major coastal system by addressing resource allocation and management. We should also look into various socio-economic issues relating to rehabilitation of coastal communities affected by changing environmental conditions, the solution of conflicts generated by land access and the degree and way in which local populations take part in the decision-making process concerning matters relating to their livelihood and way of life. We should also consider of rehabilitation of degraded ecosystems, such as mangrove. Here, I think we should also look into the question of peoples' participation in the management process since no government alone can do this job by itself adequately.

Many sectors are governed by their own legislative measures. The purpose of any management strategy should be to harmonize the legislation and not to detract from their respective mandatory functions and responsibilities.

Finally, we also should focus attention on aspects such as capacity building of marine scientific and other institutions to study on a continuing basis the changes in the ecosystems, biodiversity and the state of health of the environment that may occur under the influence of socio-economic development, so as to serve as a feed back to, and to allow appropriate adjustment in, management processes. We also need the capacity to involve members of the community into the planning process so that all points of view can be considered properly before major decisions are taken. All these will require appropriate institutional arrangements to deal with the management issues.

I am fully aware of the challenging task in front of this august body. But I am also very optimistic that the interactions between our national and foreign expertise will help come up with recommendations on initiation of an integrated coastal zone management planning process best suited to our conditions in Pakistan. I wish you all success.

## E. Closing Address by Mr. Shahid Aziz Siddiqui
## Additional Secretary, Ministry of Communications, Islamabad
## 10 October 1994

Distinguished Guests,
Ladies and Gentlemen,

I feel greatly honored to have been invited to address the closing Session of this international Workshop on integrated coastal zone management. I should like to express my thanks to the Director-General of NIO Mr. S.H. Niaz Rizvi for the privilege.

About six months ago Mr. Niaz Rizvi and Dr. S.M. Haq, on the occasion of latter's official mission from Intergovernmental Oceanographic Commission to Pakistan, visited our Ministry and we had long discussion on the theme for this Workshop. I am very happy that the proposal to convene this Workshop has eventually materialized with remarkable success, and that the activity was able to produce cohesive and coherent recommendations. I can assure you that our ministry looks forward to considering the resulting recommendations so as to improve our own coastal zone management strategy in whatever way possible.

I am happy to inform you that the Government of Pakistan has given serious consideration to coastal management aspects and, in this regard, an outline for a " National Maritime Division " has been drawn. this administrative unit in the future will be used to strengthen coastal zone management policies. There is also a proposal for the establishment of a federal coastal authority which is under active consideration of the Government.

In the Province of Sindh a coastal zone management programme is in the process of development. The Government may, however, take a decision to build up such a programme only when all economic issues are put together. Administrative arrangements are being made to guide the socio-economic developments through the newly established " Coastal Development Authority". For control of pollution from domestic sources along the coast of Karachi, there are plans for the construction of new sewerage treatment plants, garbage collection and disposal of solid waste material for the city. A high level " Marine Pollution Control Board " has been set up to check marine pollution along the coastal areas of Pakistan. This board has representation from major relevant agencies and institutions. All legislation regarding the development and coastal area management in Pakistan is also being reviewed in order to provide better management of the coastal zone.

In the communication sector, the Government is giving serious attention to the sustainable development of coastal areas. Plans for construction of all-weather coastal roads are being actively pursued and plans are underway for broadening the connecting road between Keti Bunder and National Highway for future access to the fish harbor , situated in the estuary of the River indus. For the city of Karachi, there are plans for northern and southern by-pass roads which will ease congestion.

In the Balochistan Sector, planners are engaged in the study of conditions along the coast where large stretches of land now is totally unserviced by any sector of communication. At the last session of the National High Way Council the proposal for building the Makran Coastal Road was formally approved, which, subject to availability of funds, will stretch from Lyari (near Karachi) westward to Ormara, Pasni, Gwadar and Jiwani, which is about 700 Km long. The estimated cost of this project is about 300 millions US dollars. The second alignment will provide linkage with other smaller towns which will open Gawadar and Jiwani Sector across the breadth of the Makraan Division of Balochistan and link it to Rotodero, where it will continue up to Afghanistan, ECO and the central asian states. All these development will eventually lead to the Balochistan coast offering tremendous economic prospects for Pakistan in the future.

In regard to water and power in the coastal area of Balochistan, we have a 18 m.w power station at Pasni of which 5.m.w will be supplied to Gwadar and another 5.m.w. to Ormara. As for the water, Akra dam is being developed and should be able to supply 50,000 gallons of drinking water to Gwadar by the end of next year. The proposed Mirani dam will provide additional water needs for sustained growth of the coastal system of Balochistan. On the fisheries

aspect, the Pasni harbor is being operated in Balochistan province, while Gawadar has been treated as a fisheries port since 1950. All these development give us the sense of optimism and we hope the private sector will do their job and enough funds will be available for sustainable growth of the Balochistan coast.

In all these development programme, the role of marine science, undoubtedly will be crucial in achieving the goal of integrated coastal zone management. Multidisciplinary scientific research will be necessary and will continue to be a guiding force in providing valid information and data about the coastal ecosystems and the important resources that need to be protected. The implications of land based development activities on the environment and on those resources which future development strategies for integrated coastal zone management could be based will require considerable attention by the Government.

Finally, I would like to thank all the participants for their valuable contributions and to once again assure you that the recommendations of this Workshop will receive careful consideration by the Government.

## ANNEX III

## LIST OF PAPERS PRESENTED

"Threats to Biodiversity in the Marine Ecosystem of Pakistan"
Professor Muzamil Ahmad, Centre of Excellence in Marine Biology, University of Karachi, Karachi

"Socio-economic Conditions Along the Balochistan Coast"
Mr. Mohammed Tausif Akhtar, Department of Economics, University of Balochistan, Quetta, Balochistan

"Implications of Physical Change for Coastal Zone Management"
Mr. R. S. Arthurton, Coastal Geology, British Geological Survey , U.K., Kingsley Dunham Centre
Keyworth, Nottingham, U.K.

"Strategic Design for a Coastal Environmental Monitoring Program"
Dr. M. Jawed Hameedi, National Oceanic & Atmospheric Administration (NOAA)
National Oceanic Administration Silver Spring, MD, USA

"Future of River Indus Delta in View of Upstream Damming and Perils of Ignoring Coastal Zone Management"
Dr. Bilal U. Haq, National Science Foundation, Arlington, Virginia, USA

"Basic Concept of and Framework for Integrated Coastal Zone Management"
Dr. S.M. Haq, Former Staff member of IOC, UNESCO, Paris

"Summary of the Outcome of Coastal Zone Canada 94: International Conference; Co-operation in the Coastal Zone , Halifax, N.S., Canada, 20-23 September 1994"
Dr. Hillary Hildebrand, Environmental Assessment and Pollution Prevention Division
Environmental Protection Branch, Environment Canada, Atlantic Region, Dartmouth, Nova Scotia, Canada

"Coastal Circulation along the Pakistan Coast"
Dr. Tariq Masood Ali Khan, National Institute of Oceanography, Karachi

"The Role of Environmental Impact Assessment in the Resolution of Key Iczm Issues and Conflicts"
Dr. Nuzrat Yar Khan (Canada), Environmental Sciences Department, Kuwait Institute for Scientific Research, Kuwait

"Water Management of Coastal Rivers and Streams for Integrated Coastal Zone Management"
Mr. Mohiuddin Khan, Indus River System Authority, Lahore

"Vulnerability of Coastal Fisheries and Other Living Resources to Changes in the Marine and Estuarine Environment"
Mr. Moazam Khan, Marine Fisheries Department, West Wharf, Karachi

"Institutional, Legal, and Policy Considerations in Coastal Zone Management"
Dr. Robert W. Knecht, University of Delaware, Newark, Delaware, USA

"Global Perspectives on Coastal Area Management"
Dr. Gunnar Kullenberg, IOC of UNESCO, Paris

"Animal Biomarkers as Stress Indicators: a Tool to Assess the Health of Organisms in the Environment"
Dr. Tarique Mustafa, Institute of Biology, University of Odense, Odense, Denmark

"Land Utilization, Planning and Development in Sindh Areas, and Related Legislative Instruments and Policies"
Mr. Syed Abu Hamid Naqvi, Regional and Coastal Development Planning, Master Plan and Environmental Development Control Department, Karachi Development Authority

"Socio-economic Development: Present and Future Planning along Sindh Coast"
Mr. M. Tahir Quraishi & Mrs. Mehar Marker Nowsherwani, IUCN, Karachi Branch
"Agroclimatic Zone of Coastal Area and Potential for Development"
Mr. M.H. Panhwar, Research and Development Engineers, Karachi

"Information and Data Requirements for Coastal Zone Management in a Changing World"
Dr. John C. Pernetta, Land Ocean Interactions in the Coastal Zone (LOICZ)
Netherlands Institute for Sea Research, Texel, the Netherlands

"Overview of Pollution along the Coast of Pakistan"
Mr. S.H. Niaz Rizvi, National Institute of Oceanography, Karachi

"Prospects of Shrimp Farming in the Indus Deltaic Region"
Mr. S.H. Niaz Rizvi, National Institute of Oceanography, Karachi

"Management of Indus Delta Mangroves"
Professor S.M. Saifullah, Department of Botany, University of Karachi, Karachi

"The Use of Natural Resource Maps, and Related Gas, in Coastal Zone Management"
Mr. Dirk Van Speybroeck, Coordinator of the Eastern African Database and Atlas Project
United Nations Environment Programme (UNEP), Nairobi, Kenya

"Coastal Zone Management: Experiences in the Netherlands"
Professor Dr. Joost H.J. Terwindt, Institute for Marine and Atmosphere Research, Utrecht (IMAU)
Department of Geography, University Utrecht, Utrecht, The Netherlands

**ANNEX IV**
**LIST OF PARTICIPANTS**

Mr. R. S. Arthurton
Manager, Coastal Geology
British Geological Survey , U.K.
Kingsley Dunham Centre
Keyworth, Nottingham
U.K. NG12 5GG
phone: (0602) 363486
(*direct*) (0602) 363100
fax: (0602) 363 460

Mr. G. Daconto
UNIDO Associate Expert
Environment Section/Environment and
Natural Resources Management Division
Economic and Social Commission for Asia
and the Pacific
The United Nations Building
Rajadamnern Avenue
Bangkok 10200
Thailand
phone: 662-2881234
fax: 662-2881000

Dr. M. Jawed Hameedi
National Oceanic & Atmospheric Administration(NOAA)
National Oceanic Administration
Chief, ORCA2 Project
1305 East West Highway
Silver Spring, MD 20910
USA
phone: *ofc* (1-301)713-30-34
fax: (1-301)713-43-88

Dr. Bilal Haq
Program Director
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230
USA
phone: (1-703) 306-15-86
fax: (1-703) 306-03-90

Dr. S.M. Haq
Adviser to Ambassador and Permanent
Delegate of Pakistan to UNESCO & IOC Consultant
34 Boulevard de Grenelle
75015 Paris
France
phone: (33-1)45772830
fax: (33-1)45752774

Dr. Hillary Hildebrand
Environmental Assessment and
Pollution Prevention Division
Environmental Protection Branch
Environment Canada, Atlantic Region
15th Floor, Queens Square
45 Alderney Drive
Dartmouth, Nova Scotia
Canada B2Y 2N6
phone: (1-902) 426.9632
fax: (1-902) 426.8373

Dr. Nuzrat Yar khan (Canada)
Presently Research Specialist
Environmental Sciences Department
Kuwait Institute for Scientific Research
P.O. Box 24885
13109 Safat
Kuwait
phone: (965)483-61-00 x 4450
fax: (965)483- 04-32

Dr. Robert W. Knecht
Center for the Study of Marine Policy
Graduate College of Marine Studies
University of Delaware
Newark, Delaware 19716
USA
phone:(1-302)-831-80-86
fax: (1-302)-831-36-68

Dr. Gunnar Kullenberg
Secretary
Intergovernmental Oceanographic Commission of UNESCO
UNESCO Headquarters
1 Rue Miollis
75015 Paris
France
phone: (33-1) 4568-39-83
fax: (33-1) 4065-99-76

Dr. Tarique Mustafa
Associate Professor
Institute of Biology
University of Odense
Campusvej 55
DK-523 Odense M
Denmark
phone: (45) 66 15 86 00
fax: (45) 65 93 04 57

Dr. John C. Pernetta
Project Manager
Land Ocean Interactions in the Coastal Zone (LOICZ)
Netherlands Institute for Sea Research
P.O. Box 591/90 AB
Dan Burg, Texel
The Netherlands
phone: (31)22.20 69404
fax:(31)22.20 69430

Mr. Dirk Van Speybroeck
Coordinator of the Eastern African Database and Atlas Project,
United Nations Environment Programme (UNEP) OCA/PAC
P.O. Box 30552
Nairobi
Kenya
phone: (254-2) 62 26 13
fax: (254-2) 62 27 88

Professor Dr. Joost H.J. Terwindt
Institute for Marine and Atmosphere Research Utrecht (IMAU)
Department of Geography
University of Utrecht
Heidel berglaan 2
P.O. Box 80.115
3508 TC Utrecht.
The Netherlands

**NATIONAL PARTICIPANTS**

Miss Bilquis Bano Zaidi
99-H/2 PECHS
Karachi
phone: 455.332

Capt. M. Nouman Alvi
Harbor Master
Karachi Port Trust
Manora
phone: 263.5786/263.5731-35

Mr. Peter John Meynell
IUCN Bath Island Road-1
Karachi
phone: 573.082
fax: 587.087

Mr. Saadat Ali Khan
Zoological Survey Department
Block-61, Pakistan Secretariat
Shahrah-e-Iraq
Karachi
phone: 586.0842

Mrs. Akhter Wajahat
C/p Social Welfare Department
Government of Sindh
Karachi
phone: 568.6777

Mr. Khalid Khan (NBRI)
F/40, Hub River Road
Karachi
phone: 294.319

Mr. Engr Saifuddin Ahmed
National Building Research Institute
F-40, S.I.T.E
Hub River Road
Karachi
phone: 294.319

Dr. Iqbal Ali
Director and Professor
Institute of Environmental Engineering and Research
NED University
Karachi
phone: 496.9263-8
fax : 496.1934

Dr. Waseem Akhtar
Institute of Environment Engineering and Research
NED University

Mr. Nadeem Ahmed Siddiq
Department of Zoology
Karachi University
Karachi
phone: 426.295

Mr. S.M. Tarique
Korangi Fisheries
Harbor Authority
Korangi Creek, Landhi
Karachi
phone: 330098
fax: 021-330096

Mr. Mohammed Aslam Baloch
Pasni Fisheries Harbor Authority
phone: 541

Mr. Mohammed Moazzam Khan
Marine Fisheries Department
Government of Pakistan
West Wharf
Karachi
phone: 202.795-98, 201.758
fax: 464.168

Mr. Muhammad Ali Shah
Syed Mullah Village Abraham
Hydri Coastal Area
Karachi
phone: 506.2385, 506.3729

Captain Shahid Ashraf S.Bt
Pak Navy
Hydrographic Pakistan Navy
Naval Headquarters
Islamabad

Mr. Khurshid Ali
407, Uni-Shopping Center
Abdullah Haroon Road
Saddar
Karachi 74400
phone: 525.522 (R) 407.561

Capt S.A.S Bokhari P.N.
Director Project
Naval Head Quarters
Islamabad
phone: 820.03346

Mr. Amanullah Turk
Chief Eng Site Ltd.
Manghopir Road
Karachi
phone: 256.206
fax: 256.1213

Mrs. Farzana Panhwar
54-D- Block-9 Clifton
Karachi-75600
phone: 534.105
fax: 570.547

Mr. Jorge G. de las Alas
WMO Expert
Pakistan Meteorological Department
University Road
Karachi
phone: 811.0740
fax : 811.4756

Mr. Muhammad Tousif Akhtar
C-12 University Complex
University of Balochistan
Quetta
phone: 442.501

Mr. Muhammad Wasim Khan
Marine Fisheries Department
West Wharf, Fish Harbor
Karachi.
phone: 202.795-98 201.758

Mr. Muhammad Salim Warsi
Chief Engineers
Hydrology Waters Management
WAPDA
236-WAPDA House
Lahore
phone: 212.668

Mr. Habib Akhtar Dar
70/4 Timber Road
Mercantile Marine Department
Kemari
Karachi
phone: 270.117-9

Mrs. Feroze Akhtar Ansari
Karachi Shipyard Engineering Work Ltd
Karachi
phone: 231-091620 2760-29
fax : 2415952

Mr. Muhammad Wasim Khan
Marine Fisheries Department
West Wharf, Fish Harbor
Karachi.
phone: 202795-98 201758

Mr. Muhammad Hussain Panhwar
54-D, Block-9 Clifton
Karachi
phone: 534105
fax: 590547

Dr. Javed Mustaquim
CEMB
University of Karachi
phone: 470572

Mr. Jameel Ahmad
Fisheries
79 Al Rahman Chambers Blue Area
Islamabad
phone: 216.936

Mr. Munir Ahmad Choudhry
Director (WEC) WAPDA
B-30, WAPDAS House
Lahore
phone: 630.1675
fax : 631.1965

Mr. S.B. Hasan
General Manager
MM Pakistan Pvt. Ltd
17A/1 Azfar Rd Lahore Cant
Lcch Society (Defense)
phone: 892.531

Dr. Itrat Zehra
Centre of Excellence
Marine Biology
University Karachi
phone: 479.078

Mrs. Razia Sultana
PCSIR Laboratories Complex
Karachi -75280
phone: 4967603-8

Mr. Abrarul Hasan
Zoological Secretariat
Department Block No. 61
Pakistan Section Shahra-e-Iraq
Karachi
phone: 634.1170
*ofc* 568.0842

Mr. Bhutto Muhammad Ramzan
Divisional Forest Officer
Jinnah Avenue, Malir
Karachi-27
phone: 450.3023

Mrs. Ishrat Ara Huda
Block 61, Shahrah-e-Iraq
Pakistan Secretariat
Karachi

Dr. Syed Wajahat Ali
9/B Rufi Height (I) Block 17
Gulshan-e-Iqbal
Karachi. 75290
phone: (021) 811.4993
fax : (021) 496.7608

Mr. Naqi Zaidi
Business Associate
Environmental Pollution
Control Society
99-H, Block -2
P.E.C.H.S.
Karachi
phone: 455.2332

Dr. Nayyer Alam Zaigham
Geological Survey of Pakistan St-17
Block-2, Gulistan-e-Jauhar
Karachi
phone: 811.5920
fax : 811.4957

Mr. Azmat Ansari
Journalist and photographer
Editor Wildlife and Environment
Editor Medical News
phone: 455.4953

Dr. Mustafa Shameel
Director , Institute of Marine Sciences
University of Karachi
Karachi 75270
phone: 479.001/ 2378

Mr. Syed Wali Waheed
376-F, Johar Town
Lahore
phone: (042) 530-1374, 530.1552
fax : (042) 6311965

Mr. Zia-ul-Haq
B-37, Abdullah Apartment
Gulistan-e-Jauhar
Karachi
phone: 8114183

Dr. S. Hasan Rashid
Institute of Material Sciences and Research
Pakistan Steel
Karachi
phone: 757.4264

Dr. Habib-ur-Rahman Khan
Institute of Material Science and Research
Pakistan Steel Mills
phone: 7769.4576

Mr. Mohiuddin Khan
16A EI Road
Lahore
phone: 878.263

Mr. M. Moinuddin Ali Khan
Institute of Material Sciences and Research
Pakistan Steel Mills
Bin Qasim
phone: 7769.4298

Mr. Nayyar Zuberi
Daily Business Recorder Road
Karachi
phone: 721.0311
fax : 722.8644

Mr. Mushtaque Hashmi
Daily Awami Awaz
Namco Centre, New Chali
Karachi
phone: 2625282-7 217400
fax: 2623918

Mr. Abdul Mannan
RRPI, Atomic Energy Medical Center
J.P.M.C.
Karachi
phone: 521.837
fax : 521837

Miss Farida Habib
OGDC-101 West, Blue Area
Islamabad
phone: 218046

Mr. A. Rahim
Marine Consultants
Old Ralli Brothers Building
Talpur Road
Karachi
phone: 241.5486, 242.4459
fax : 241.1019

Dr. Abdul Raouf
RSA Division Ssparcent SUPARCO
P.O. Box 402
Karachi- 75300
phone: 814.1211-5

Mr. Kalimullah Shirazi
Deputy Secretary
Environment Urban Affair Division
phone: 8134925

Dr. R.B. Qadri
PCSIR Labss Complex
Off University Road
Karachi
phone: 496.7603 / 9866

Mr. Mohammed Tahir Qureshi
1-Bath Island
1 IUCN Pakistan
Karachi
phone: 573.082 534.0442

Ch. Ghulam Mohyuddin
National Refinery Ltd
Korangi
Karachi
phone: 506.266

Prof Dr. S. M. Saifullah
Boundary Department
University of Karachi
phone: 463.134

Prof. Dr. Muzammil Ahmed
Centre of Excellence in Marine Biology
University of Karachi
Karachi
phone: 470572

Dr. A Sami-uz-zaman
FPCCI
2/59-Q PECHS
phone: 455.0777
fax: 454.1555

Mr. Mohsin Burney
Risk Management
F-69, Block F. North Nazimabad
Karachi
phone: 517.624 517.645
fax: 021-568.3061

Mr. Syed Abu Hamid Naqvi
Additional Director
Karachi Development Authority (KDA)
Civic Centre
Karachi,
phone: 493.0005

Dr. S. Shahid Hussain
Director-General
PCSIR Laboratories Complex Office
University Road
Karachi
phone: 496.7609
fax: 496.7608

Mr. S. Wajahat Hussain Kazmi
Operational Head Environment Protection Department
Pakistan Steel
phone: 754.210 (0) 0201-710068
fax: 773.1462, 422214

Mr. Syed Sadiq Ali Rizvi
Director-General
PSSTC (PCSIR)
phone: 496.9805
fax: 814.0921

Mr. Ishrat Jahan Khan
Zoological Survey Department
Government of Pakistan
Block 61
Pak. Secretariat Shahrah-e-Iraq
Karachi
phone: 568.0842

Professor Dr. N. M. Tirmizi
Director
Marine Reference Collection and Resource Centre
University of Karachi
phone: 473.270

Mr. Muhammad Shakeel
SUPARCO
P.O. Box 8402
phone: 814.11311
fax: 496.0553

Dr. Quddusi .B. Kazmi
Marine Reference Collection and Resource Center
University of Karachi
phone: 473.270

Mr. Abdul Wasiu Mahar
Scientific Officer
SUPARCO
P.O. Box 8402
Karachi
phone: 814.11311
fax: 496.0553

Mrs. Mehrun-nisa Siddiqui
Senior Scientific Officer
Remote Sensing Application Division
SUPARCO
P.O. Box 8402
phone: 814.1311
fax: 496.0553

Mrs. Rizia Zareen
SUPARCO
P.O. Box 8402
phone: 814.11311
fax : 496.0553

Dr. Badar Ghauri
SUPARCO
P.O. Box 8402
phone: 814.11311
fax: 496.0553

Mr. Qaisar Hasan
1-Bath Island Road
IUCN
Karachi
phone : 571.843, 530.442, 530.443

**Participants from the National Institute Oceanography**

Mr. S.H. Niaz Rizvi
Dr. Labeed I Kazi
Dr. M.M. Rabbani
Dr. Ather Ali Khan
Dr. Asif Inam
Dr. Murtaza H. Ansari
Dr. Tariq Masood
Dr. Shaukat Hayat Khan
Dr. Mehrun Nisa
Mr. Naeem Ahamed
Mr. Javed Baquer
Mr. Munawar Saleem
Mr. Mohin Tabraz
Miss Nuzhat Khan
Mr. M. Qasim Memon
Mr. M. Fazal Rahim
Mr. M. Ejaz Khan
Mr. Mehmood Hashim
Mr. Abbas Ali Ghomro
Miss Riffat
Miss Hina Saeed
Miss Saira Ishaq
Mr. Syed Moazzam Ali
Mr. G.M. Memon
Mr. M. Tahir
Mr. M. Danish
Mr. Syed Imran Hasany
Mr. A.H. Bhutto
Mr. Attiq-ur Rehman

St-47, Block-1
Clifton
Karachi
phone: 586.0029

fax: 586.0129

(end of document)