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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
(of UNESCO)

**REPORT ON IOC ACTIVITIES IN SUPPORT OF
THE INTEGRATED COASTAL AREA MANAGEMENT 1996-1997**

The present report, which summarizes the actions taken by the IOC as a follow-up to the decisions of the Eighteenth Session of the IOC Assembly with regard to the integrated coastal area management (ICAM) during the intersessional period 1996-1997, is presented to the Assembly for review and provision of advice as regards future actions.

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1. INTRODUCTION

Integrated Coastal Area Management (ICAM) has been recognized by UNCED, particularly Agenda 21, Chapter 17 as a necessity in order to achieve sustainable development in coastal zones, both at the national and regional levels, and as a process which may help achieve the goal.

With full recognition that marine science and ocean observations play an essential role in the implementation of ICAM, the IOC Assembly at its 17th session, Paris, 25 February - 11 March 1993, established an interim IOC Group of Experts on Coastal Zone Activities, charged with the responsibility of preparing a comprehensive report outlining the needs for research, monitoring, assessment and services to support ICAM.

As a result of the Group of Experts, a Report on Coastal Zone Studies and Co-ordination of Coastal Zone Activities (IOC/INF-987) summarizing the suggestions and recommendations of the Group of Experts on IOC's future actions related to the ICAM, along with a review of IOC's role in the co-ordination of system-wide coastal zone activities and various activities carried out by the IOC both at regional and global basis, was prepared and submitted to the IOC Assembly at its 18th Session, 13-26 June 1995. A proposal on IOC Training Programme on ICAM was also submitted to the Assembly as an addendum to the Report. This report was well received by the 18th session of the IOC Assembly and endorsed as a guideline on IOC further actions in relation to ICAM.

By adopting Resolution XVIII-7: Coastal Regions and Small islands, the Assembly also emphasized the importance of IOC's contribution to research and observations, and endorsed a strong involvement with the interdisciplinary project on Coastal Zones and Small island.

This report provides updated information on IOC activities in direct relation to the integrated coastal area management, as a follow-up to the decisions of 18th session of IOC Assembly during the period 1996 - 1997. Supplementary information is also provided in the Annual Report for 1996.

2. STRATEGY FORMULATION

Strategy formulation has been realized as the first step towards an effective implementation of ICAM, both on the global, regional and sub-regional level. A first bottom-up effort has been made in the IOC/IOCARIBE region.

The Fifth Session of IOC Sub-Commission for the Caribbean and Adjacent Regions, Barbados, 11- 15 December 1995, endorsed the Framework Strategy for On-going IOCARIBE Involvement in ICZM. This was recommended by a Seminar on ICAM for Small Island Developing States (SIDS) held immediately prior to the Session, with the prime objective to drafting a Framework Strategy for on-going IOCARIBE involvement in ICAM which builds on the traditional role of IOC/IOCARIBE in Ocean Sciences.

As stated in the Summary Report of the SIDS Seminar, the Framework Strategy provides the basis for consolidation of IOC/IOCARIBE activities in coastal zone management into a consistent and coordinated policy for future programme development in the Caribbean, and assists in re-focusing of the Regional Secretariat's activities. The Strategy is based on the traditional role of IOC/IOCARIBE in ocean science and management, and aims at facilitating collection and dissemination of oceanographic information, and of providing opportunity for collaborative work programmes amongst the many institutions involved with the science and management of the Caribbean coastal areas.

The Framework Strategy is reproduced from the Summary Report IOCARIBE-V and presented as Annex 1 of this Report: Under Strategy I, which is focused on facilitating data collection of oceanographic data directly relevant to coastal management issues, and creating capacity for data generation in countries with limited research capacity, a series of activities related to baseline requirement and capacity assessment, capacity building, research and data collection have been identified. Under Strategy II, which is to provide for the effective ICAM management with ocean and coastal science information, interpretation, and its dissemination in a form relevant to the site-specific nature of coastal management, creation of user group constituency, information management and dissemination and strengthening of inter-agency linkages have been listed as priority actions. The Framework Strategy may serve as a model for other IOC regional bodies as to how existing ocean science programmes and projects could be adjusted or re-shaped to cater for the need of integrated coastal area management.

3. MULTIDISCIPLINARY STUDIES

Though many of the IOC traditional marine science and ocean services programmes, such as OSLR, OSNLR, GIPME, Ocean Mapping, GLOSS, IODE, already represent IOC inputs to ICAM due to their component in the coastal regions, these inputs are basically disciplinary in nature and are not necessarily designed for serving ICAM purposes. As a result, the existing data are in general not readily available for use by coastal managers. This has been recognized as a barrier between marine scientists and coastal managers/policy makers in the implementation of ICAM. Therefore, the initiation of multi-disciplinary marine science programmes with the sole purpose of better understanding coastal processes and generating necessary data for serving ICAM has become important.

3.1 COASTS

Coastal Ocean Advanced Science and Technology Study (COASTS) may represent a first IOC global programme towards providing direct contribution to coastal zone management through multidisciplinary coastal marine observation and research. The first COASTS Workshop was held in Liege, Belgium, May 1994, with focus on physical processes with some inputs from coastal marine biology and geology. As a result of this workshop, two volumes of "The Sea" on Coastal Oceans: A - Processes and Methods; B - Coastal Regions, are being prepared and will be published before long, based on the workshop contributions.

COASTS will eventually become fully interdisciplinary with emphasis on the interaction between physical-biological-geological-chemical processes. The next global workshop is planned for 1999, and planned activities before then include: (i) facilitation of coordinated research on critical processes; (ii) development of standard remote sensing methods and products; (iii) development of standard generic methods; and (iv) training. The goal of COASTS would be to provide a sound scientific database for coastal management.

3.2 Study of Gulf of Thailand

The Gulf of Thailand Study was originally proposed during the Second Session of IOC/WESTPAC, Bangkok, 25-29 January 1993 as a follow-up action in the WESTPAC region to Agenda 21, Chapter 17 through joint, integrated scientific interdisciplinary studies aimed at solving practical problems in integrated coastal management. Two study cruises have been organized in cooperation with SEAFDEC in the Gulf, based on which the IOC/WESTPAC Workshop on the Co-operative Study on the Gulf of Thailand was held Bangkok, 25-28 February 1997. Scientists from Malaysia, Thailand, Vietnam, Cambodia and Canada participated in the Workshop.

The Workshop started by an assessment of the existing knowledge about the Gulf of Thailand through invited presentations and national reports. The workshop addressed the following issues: oceanographic conditions; existing scientific understanding; salt and heat budget; existing data information in the Gulf of Thailand; data and information management and the best mode of international cooperation to adequately address these matters.. A Scientific Plan was discussed and completed, including the scientific components and topics, data and information management and network, capacity building and training, and cooperative framework.

4. MANUALS AND GUIDELINES

Formulation of guidelines, manuals, procedures, inventories, etc. was recommended by the IOC Group of Experts as one of the priority issues to be addressed by the IOC. In this connection, the Regional Manual on Guidelines for Assessment, Interpretation and Management of Coastal Changes for the Western Indian Ocean Coastal and Island States, GUIDE METHODOLOGIQUE D'AIDE A LA GESTION INTEGREE DE LA ZONE COTIERE, the IOC publication on " Integrated Coastal and Ocean Management: Concepts and Practice", as well as the GESAMP Report and Studies on the Contribution of Science to Integrated Coastal Management, represent contributions one of the main trends of IOC efforts in relation to ICAM.

4.1 Guidelines for Western Indian Ocean

In light of the recommendation of the Coastal Change Conference, Bordeaux, 1995, the IOC Assembly at its 18th Session, 1995, decided that selected case studies presented at the Conference will be used as a basis to produce a set of "cook books" aiming at facilitating the study of coastal changes and management of specific littoral areas facing the joint effects of

human impacts (construction, tourism, etc.) and rapid coastal erosion. Realizing the need for formulating standard methodologies and guidelines that would be followed in coastal erosion studies, assessment, monitoring, and management, and based on an IOC/OSNLR/SAREC coastal erosion project on the "Development of a Regional Manual on Guidelines for Assessment, Interpretation and Management of Coastal Changes for the Western Indian Ocean Coastal and island States", the preparation began in 1996. A draft outline is provided in Annex 2 of this Report. It is expected that a preliminary version of the document will be completed during the second half of 1997, after first having been presented to IOCINWIO-IV.

4.2 Guide Methodologique d'Aide a la Gestion Integree de Zone Cotiere

A second manual in relation to integrated coastal management has been developed by France under the cosponsorship of IOC and such UNESCO programmes as IGCP, MAP and IHP. Drawing upon the case studies in different locations of France as well as in various countries of west Africa, this Guide is focused on the development of scientific approaches and methodologies with regard to integrated coastal area management. It is expected that this Guide will be published in late 1997 or early 1998.

4.3 IOC Book on Integrated Coastal and Ocean Management

A book on " Integrated Coastal and Ocean Management: Concepts and Practice" has been prepared by Profs. Biliانا Cicin-Sain and Robert Knecht, Center for the Study of Marine Policy, University of Delaware, and will soon be published through IOC. With some 400 pages, this book not only addresses the content and substance of integrated coastal management and its fundamental concepts, reviews the evolution of international prescriptions on ICM, presents country case studies, but also provides for a practical guide to ICM. Main parts in the Guide includes:

- Setting the stage for ICM
- Intergovernmental, Institutional and Legal Considerations
- Informing the ICM Process: Building the Science and Information Base
- Formulation and Approval of an ICM Programme
- Implementation, Operation and Evaluation of ICM Programme

4.4 GESAMP Report on Science Contribution to ICM

As a UN system-wide co-ordinated effort toward addressing the need of ICM, the GESAMP Reports and Studies Series No. 61: The Contributions of Science to Integrated Coastal Management has been prepared and published. IOC participated in the Task Force on ICM which prepared the publication and provided the co-chairmanship of the Task Force. This Report serves as a guide on how science could contribute to integrated coastal management.

In the opinion of the GESAMP, successful ICM programmes will involve:

- (I) public participation whereby the values, concerns and aspirations of the communities affected are discussed and future directions are negotiated;
- (ii) steps by which relevant policies, legislation and institutional arrangements (i.e. governance) can be developed and implemented to meet local needs and circumstances, while recognizing national priorities;
- (iii) collaboration between managers and scientists at all stages of the formulation of management policy and programmes, in the design, conduct, interpretation and application of research and monitoring.

In this framework, the Report addresses, inter alia, the contribution of science to the stages of an ICM programme, the relevant techniques in science and management and factors affecting the contributions of science.

5. TEMA IN ICAM

Following the instructions of the 18th session of the IOC Assembly on coastal zone activities, a series of training courses and workshops have been organized both at global and regional levels, emphasizing different aspects of ICAM.

Global

5.1 Florida Workshop 95

The International Training Workshop on Integrated Coastal Management was held in Tampa, Florida, 18-28 October 1995, in conjunction with Coastal Zone '95. The purpose of this workshop was to bring together coastal management practitioners from industrialized and developing countries in an open forum to share experiences and strategies for implementing Integrated Coastal Management. The themes of the workshop include: Perspectives on UNCED's Agenda 21, Chapter 17, US Experience on Integrated Coastal Management, and Case Studies: Developing Countries Addressing Coastal Management Problems in Zanzibar, Tanzania and Mombasa, Kenya. The workshop report is provided in IOC Workshop Report Series, no.120.

Regional

5.2 IOCINCWIO

5.2.1 Training Programme in India

The Training Programme in Coastal Marine Science: Modeling and Monitoring of Coastal Marine Processes, under the sponsorship of IOC, was held in Dehli, at IIT, November 1995 and 1996. This Programme focuses on better understanding of the coastal pollution problems through employing scientifically based modeling and monitoring. Themes addressed

in the course include:

- Coastal pollution problems;
- Land-based activities: hydrological aspect;
- Characterization of waste waters;
- Coastal environmental fluid mechanics;
- Coastal transport models;
- Environmental hazards: storm surges and coastal flooding.

5.2.2 Workshop on ICAM in Madagascar

The IOC-World Bank-Sida/SAREC Workshop on the Integrated Coastal Management took place in Nosy Be, Madagascar, November 1996. This Workshop lays emphasis on using ICAM concept in identifying gaps of the east African region in terms of institutional arrangements and mechanisms for co-ordination and implementation of ICAM-oriented activities, and on the formulation of recommendations dealing with institutional aspects.

As a result of the workshop, concrete recommendations on institutional arrangements towards better management of Madagascar's coastal area were formulated and necessary actions identified. Amongst the main recommendations are the adoption of the EAP's (National Environmental Action Plan) institutional mechanism for the implementation of ICAM; the integration of research institutions and technical expertise into the programmes; the setting up of a coordination office for the research institutions and technical expertise existing in Madagascar for the purpose of improving competencies; the involvement of private sector in the development of ICAM-associated regulations.

The Report of the workshop is available at the IOC Secretariat and the proceedings of scientific presentations are being published by IOC jointly with Sida/SAREC (Sweden) and the Environment Department of the World Bank.

5.2.3 IOC Regional Workshop on Coastal Oceanography and Coastal Zone Management

Held in Comores, Moroi, 16 - 20 December 1996, this workshop specifically addressed the coastal oceanographic and management issues of the Small Island Developing States of the Indian Ocean, including Comores, Mauritius, Seychelles, Reunion (France) and Madagascar (the countries of the Commission de l'Ocean Indien).

In the spirit of the Agenda 21, Chapter 17 and the Global conference on the Sustainable Development of Small Islands Developing States (Barbados, April 1994), this workshop reviewed the on-going and future marine science and coastal management programmes in the western Indian ocean, identified the gaps for improvement. Recommendations were made on the assessment of implications of climate change for the SIDS, human impacts on fragile ecosystems, particularly coral reefs, fishing techniques, marine pollution; the improvement of

monitoring techniques and tools for the management of coastal environment of SIDs in terms of environmental information systems, GIS and remote sensing; capacity building and regional cooperation.

5.3 IOCEA

5.3.1 Regional Workshop on ICAM in Guinea

The IOC Regional Workshop on the Integrated Coastal Area Management was held in Conakry, Guinea, 18-22 December 1995. The report of the workshop is presented in IOC Workshop Report Series no. 121.

Apart from its regional dimension, one major objective of the workshop was to initiate the formulation of a national plan on ICAM in Guinea, taking into account the objectives of the IOCEA programme. Issues addressed during the workshop include the characteristics of the Guinean coast, biological, climatical and hydro-sedimentary parameters, which are considered most critical in the identification of conflict uses of the coastal areas (mainly socio-economic activities) and hence the establishment of an ICAM strategy. The workshop also made recommendations on the management strategy based upon systematic planning of coastal and marine resource use, monitoring measures for the coastal environment of Guinea, as well as the need for capacity building at both National and regional levels.

5.3.2 Seminar on Coastal Zone

The International Seminar on the Coastal Zone of West Africa: Problems and Management, took place in Accra, Ghana, 25-29 March 1996. IOC provided financial support to the participants from western Africa to attend this seminar. Formal presentation on coastal zone management experience from respective countries were made at the meeting. In addition, a series of national level strategy and policy workshops on integrated coastal area management have also been planned in the region with the co-sponsorship of UNIDO and IOC.

5.3.3 LOICZ West Africa Workshop

As a follow-up to the Memorandum of Understanding between IOC and LOICZ of IGBP, IOC and LOICZ co-sponsored the International Workshop on Continental Shelf Fluxes of Carbon, Nitrogen and Phosphorus, in Lagos, Nigeria, 14-18 October 1996.

The workshop studied methods to develop simple water and salt budgets to estimate water exchange, and the use of stoichiometric simplifications to approximate the biogeochemical pathways and estimate net system uptake or release of C, N and P. In addition, the workshop chose four areas as case studies to represent a range of environments and data availability: (i) East China Sea; (ii) North Sea; (iii) Peru-Chile coast, and (iv) Gulf of Guinea.

5.4 IOCARIBE

The workshop on " Integrated Framework for the Management of Beach Resources within the Smaller Caribbean Islands", co-sponsored by UNESCO's Interdisciplinary Project on Coastal Regions and Small Islands (CSI) and the IOC was held in Puerto Rico, 21- 25 October 1996. The workshop brought together coastal planners and environment scientists, as well as educators, researchers and members of the private sector for the Wider Caribbean. A number of regional and international agencies were also represented.

Since there had already been a wealth of local knowledge and experience relating to beaches, the associated problems and management practices, the major objective of this workshop was focused on information exchange, network strengthening, and coordination of further planning. The workshop concluded that in order to achieve effective coastal area management, there is a need for greater cooperation and collaboration at the local, national, regional and international levels. Group discussions were also held for the development of a strategy for Sustainable Beach Management by the Year 2001, with emphasis on beach monitoring, information exchange between government departments and inter-agency committees, awareness augmentation, basic education, experience and legislation review, and strengthening of law enforcement.

5. WESTPAC

A number of workshops on ICAM have been organized in the form of cooperation between the IOC and the host country. Different from others, these workshops lay much emphasis on the inputs of marine science and systematic observation to the integrated coastal area management.

5.1 China Workshop on ICAM

The IOC-SOA International Training Workshop on Integration of Marine Sciences into the Process of ICAM will take place in Dalian, China, 19 - 24 May 1997. The workshop will bring together high-level coastal managers and marine scientists in the WESTPAC region, and concentrates on the contribution of marine sciences and systematic observation to the integrated coastal zone management, with a view to promoting interaction and co-operation between marine scientists and coastal managers/policy makers in the ICAM development and implementation.

This is the first IOC workshop of this kind which aims at demonstrating the important role of science, particularly marine sciences, in the different phases of integrated coastal area management at a regional level. The programme of the workshop is attached in Annex 3 of the present report.

5.2 Korea Workshop on ICAM

A Regional ICAM Training Workshop is also planned in the Republic of Korea, October 1997, with emphasis on ocean survey, data collection and institution building in the development and operation of ICAM.

In addition, an International Symposium on Sea Megalopolis in Asia-Pacific: Scientists and Managers Cooperating in Solving Central Problems, Revitalizing Marine Heritage, is being attempted in Shanghai, China, mid- 1998, in cooperation with the State Oceanic Administration of China.

STRATEGIC FRAMEWORK FOR ONGOING IOCARIBE INVOLVEMENT IN
SUPPORT OF INTEGRATED COASTAL ZONE MANAGEMENT

| STRATEGY | ACTIVITY |
|---|--|
| <p>1. Facilitate the collection of oceanographic data directly relevant to CZM issues, and create capacity for data generation in countries with limited research capacity.</p> | <p>1.1 BASELINE REQUIREMENTS -NEEDS AND CAPACITY ASSESSMENT</p> <p>(i) Determine critical CZM issues, programmes and scales for which data are required at (i) regional and (ii) local level.</p> <p>(ii) Evaluate those existing IOC and non-IOC programmes/parts of programmes which may contribute information to critical CZM needs.</p> <p>(iii) Assess the capacity for research and monitoring in member countries with emphasis on identification of areas where capacity-building through TEMA may be most required.</p> <p>(iv) Analyze the successes/constraints of existing monitoring and data collecting programmes in countries without a formal research framework, to allow for definition of appropriate approaches to capacity building.</p> <p>1.2 CAPACITY BUILDING</p> <p>(i) Provide mechanisms that will allow countries to reassemble existing, fragmented, databases on oceanography, coastal processes and coastal management.</p> <p>(ii) Facilitate the strengthening and expansion of monitoring and research programmes that focus on basic information relevant to CZM needs at appropriate scales.</p> <p>(iii) Sustain and enhance training and support mechanism for countries who need critical CZM data under 1.2a and 1.2b.</p> <p>(iv) Provide encouragement to researchers and institutions both from within and outside of the region to assist with the generation of information that informs critical CZM requirements, through collaboration and counterpart involvement throughout the region.</p> |

| STRATEGY | ACTIVITY |
|--|--|
| <p>2. Provide for the effective management of ocean and coastal science information, its interpretation, and its dissemination in a form which is relevant to the site-specific nature of CZM.</p> | <p>1.3 RESEARCH AND DATA COLLECTION</p> <ul style="list-style-type: none"> (i) Ensure appropriate standards and Quality Assurance/Quality Control on data collection. (ii) Provide mechanisms which allow for linkage between regional research and modelling, and local scale research and modelling of ocean and coastal processes. (iii) Facilitate local CZM case studies which combine regional scale modelling and local data collection needs with management requirements at a nested scale. <p>2.1 CREATE A USER GROUP CONSTITUENCY</p> <ul style="list-style-type: none"> (i) Determine the most effective local (country which is relevant to the site-specific nature of mechanism to assist the IOCARIBE Focal Points in creating an efficient flow of information through the creation of multiple linkages with key groups of users and CZM activists. (ii) Provide training for CZM data users and CZM decision-makers in the applications of CZM information to decision-making. <p>2.2 INFORMATION MANAGEMENT AND DISSEMINATION</p> <ul style="list-style-type: none"> (i) Identify those internal and external data sources and information bases that are applicable to CZM issues in the region. (ii) Provide a coordinating mechanism that will link the users of ocean and coastal information with internal and external sources of this information, recognizing the requirements at different levels of programme development and implementation. (iii) Provide a mechanism for effective dialogue between organizations, institutions and stakeholders who have programmes/interests in CZM information. (iv) Create mechanism which will allow for on-going incorporation of applicable general models and scientific understanding to solution of local scale problems. |

| STRATEGY | ACTIVITY |
|-----------------|---|
| | <p>(v) Disseminate information from local scale case studies of CZM through the inter-group network (2.2b)</p> <p>(vi) Provide system which allows for the evaluation of the use of information provided to, or which is available to CZM managers.</p> <p>2.3 STRENGTHENING OF INTER-AGENCY LINKAGES</p> <p>(i) Coordinate and facilitate linkages between local, regional and global research and monitoring programmes and projects.</p> <p>(ii) Coordinate, and establish as appropriate linkages between IOC/IOCARIBE activities on data collection and management and those agencies responsible for evaluating land-based issues in coastal zone management.</p> <p>(iii) Facilitate inter-agency framework for programme planning and information dissemination in CZM.</p> <p>(iv) Strengthen and promote the inter-agency mechanism for inter-agency mechanism for inter-regional scientific activities.</p> |

ANNEX II

**OUTLINE OF
A REGIONAL MANUAL ON GUIDELINES FOR
ASSESSMENT, INTERPRETATION AND MANAGEMENT OF
COASTAL CHANGES FOR THE WESTERN INDIAN OCEAN COASTAL
AND ISLAND STATES**

CHAPTER I: INTRODUCTION

This will cover the evolution of the modern coasts of the region, their geologic setting especially aspects that predispose coastal areas to coastal erosion. The countries will include Comoros, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Tanzania and Seychelles.

The chapter will review the following aspects:

- * A review of the Pleistocene to recent geology and geological processes that have influenced coastal configuration.
- * Review of the interrelationship between geologic setting, sea level change, sediment budget, anthropogenic factors and coastal erosion.
- * A general review of the coastal erosion on a global and regional scale, covering the occurrence and distribution. This will also cover Quaternary and modern trends in the region.

CHAPTER II: COASTAL EROSION CAUSES, OCCURRENCE AND DISTRIBUTION

Definition of the problem in terms of occurrence, causes, environments affected, long-term socio-economic impacts and needs for understanding the problem and management.

Review of the role of eustatic variables in coastal erosion and case study.

Environments affected

Future trends

Definition of problems

CHAPTER III: COASTAL GEOMORPHOLOGY EVOLUTION AND PROCESS

Shoreline evolution under different depositional environments.

Resultant coastal settings

- * Deltas
- * Coastal dunes
- * Barrier Islands
- * Littoral spits and tombolos
- * Mudflats

Factors influence response of shorelines to coastal erosion

- * Elevation above sea level
- * Protection from wave action
- * Nature of the geology

CHAPTER IV: PRACTICAL METHODOLOGY FOR STUDYING COASTAL EROSION

Methods of assessing and monitoring coastal erosion and those for studying the main driving elements.

Preliminary assessment and inventory of the coastal erosion problem through:

A desk study to understand:

- * Factors that predispose the coasts to erosion
- * Historical behavior of the shorelines

Reconnaissance survey to supplement existing information using:

- * Field survey to assess occurrence of coastal erosion.
- * Methods of determination of erosion trend and possible rates historical records to back reference using coastal structure, maps aerial photographs. (through compilation observation assessment and deduction).

Methods of assessment of the factors driving coastal erosion qualitatively and quantitatively using:

- * currents
- * waves
- * sediment transport
(through observation assessment measurement and deduction)

Classification of the coastal area into contiguous shore zones defined on the basis of their physical geology and the nature of the solid and drift geology.

This classification will be based on methods that identify shore units defined to be of identical geomorphological character and by the nature of shore forming materials, solid or drift geology, near shore morphology and the relative exposure to active coastal processes. The methodology considered will include:

- * Desk study.
- * Mapping methods for the solid and drift geology as a measure of availability to erosional forces based on both the desk study and the field reconnaissance.
- * Determination of exposure of the different units to the erosional agents through stratigraphic mapping relative to mean sea level.
- * Methods for determination of factors governing the depositional equilibrium.

Assessment of vulnerability of the different identical coastal types to shoreline change induced by the different causative factors.

Understanding of the morphodynamics of the coastal areas:

This will be based on developing an understanding of the geology of the coastal area, especially its relative availability to active coastal processes as defined by the shore forming material, solid or drift geology, relative exposure to coastal processes and nature of active coastal processes and the sediment budget through application of the following techniques:

- * Mapping of the drift geology and geomorphology to identify the nature and character of the main shore units
- * Assessment of the sediment budget
- * Determination of the active coastal processes

Monitoring of coastal erosion and the main hydrodynamic parameters:

Research in this section would aim at improving the reliability of the preliminary data on coastline change and its causative factors. This part of the study would aim at better understanding of the coastal erosion problem and developing reliable data on the wave climate and longshore currents, parameters that would be required in designing erosion mitigation and management strategies.

Methodology in this sector would cover:

- * Beach profiling
- * Monitoring of sediment budget
- * Measurement of the wave climate and nearshore current
- * Measurement of sea level

Identification of priority sites for detailed coastal erosion inventory and monitoring.

Development of criteria of selection of priority sites using the following considerations:

- * How representative the site is to the major coastal type (representativity criteria).
- * Availability of human resources and technology to undertake the research task covered by the site (achievability of objectives).
- * Vulnerability of this nature of shore types to erosion (usefulness of the study in other affected area).
- * The socio/economic significance of the site based on socio-economic factors and the magnitude of shoreline change that would be realized in this shore types based on the preliminary observations.

CHAPTER V: PROCESSING AND INTERPRETATION OF COASTAL EROSION DATA

Data integration

Methodology in this sector will cover the following:

- * Database development
- * Approach in compiling field data decision making tools

CHAPTER VI: EROSION MITIGATION AND MANAGEMENT

- * Development of environment friendly and cost-effective mitigation options.

This will cover assessment of the magnitude of threat, area affected the level of investment in affected areas methods used in the socio/economic impact assessment and considerations taken into account in determining the cause of action.

Options will include either:

- * Action, because erosion is too fast and may cause socio/economic disruption (protect or relocate).
- * No action when erosion is insignificant.

These may include either or several of the following:

For socio-economic issues:

- * Benefit transfer analysis
- * Risk benefit analysis
- * Development of a relatively safe land use strategy
- * Development of awareness programmes
- * Development of suitable legislation

Methodology for developing strategies to control natural factors causing coastal erosion.

Evaluation of the evolution style of coastal area will be used to determine suitable mitigation solutions that mimic prevailing natural processes. This would be followed by field pilot tests. Consideration of engineering solution using the geological and hydrodynamic database shall consider the following possibilities:

Hard engineering structure:

- * Groynes, revetments, breakers or sea walls, methodology of choice would be guided by data collected in the coastal erosion study and the nature of the beach being protected.

Soft engineering solutions:

- * Methods considered under this would include beach nourishment where this is likely to provide the most cost-effective solution or conservation.

Conservation approach through:

- * Rational use of mangrove areas in areas where shoreline evolution has been partly influenced by mangroves.
- * Reef conservation, in areas where reefs have played an important role in shoreline evolution.

(In all cases, impact of each measure must be evaluated with consideration of the local geology and the objectives of the protection measure).

**PROGRAMME OF IOC - SOA
INTERNATIONAL TRAINING WORKSHOP ON
THE INTEGRATION OF MARINE SCIENCES INTO
THE PROCESS OF INTEGRATED COASTAL MANAGEMENT (ICM)
(Dalian, China, May 19 - 24, 1997)**

PART I. INTRODUCTION TO THE WORKSHOP

- Workshop Aims and Objectives
- Introduction of Instructions and Participants
- Working Modalities

II. GENERAL LECTURES

1. Emerging International Agreements Relevant to ICM

This section will focus on recent developments at the international level which have made ICM the central organizing framework for the management of oceans and coasts. The discussion will review the prescriptions on ICM found in various international agreements and discuss other international efforts to define and operationalize the ICM concept.

- UNCED and Agenda 21, particularly Chapter 17;
- UN Convention on the Law of the Sea with particular reference to ICM
- Convention on Biological Diversity (1992)
- Framework Convention on Climate Change (FCCC) (1992);
- Agreement on Land-Based Sources of Marine Pollution
- Other relevant international efforts

2. Integrated Coastal Management

This section focuses on the concept of ICM; provides definitions; discusses ICM principles and management tools; discusses alternative institutional arrangements for ICM.

- Definition of ICM
- Basic objectives of ICM
- The ICM process
- Central aspects of ICM
- ICM principles
- Institutional aspects of ICM
- ICM management tools

3. Coastal Marine Science Research and Techniques: How they Can Be Applied to Coastal Management Problems - Natural Science Perspectives

Several sections will discuss research and new technical advances in coastal marine science and

illustrate specifically how these can be applied to typical problems in coastal management such as coastal pollution control, sea level rise, protection of fisheries habitat, coastal erosion prevention, marine disaster prevention/mitigation, aquaculture siting, etc.

- 3a. Coastal Oceanography and Dynamics, Systematic Coastal Observation
- 3b. Coastal Ecological Systems and Biological Processes
- 3c. Coastal Geological Processes and Land-Ocean Interaction (Sea-level rise and its impact on the coastal)
- 3d. Coastal Marine Pollution Research and Monitoring
- 3e. Data Assimilation and Coastal Modelling
- 3f. Coastal Remote Sensing

4. Major International Marine Science Programmes and the Applicability of their Results to ICM

This session will discuss a wide range of international marine science programs and illustrate the applicability of their results to ICM, including discussion of sources of information and data, and how, where, and at what cost nations can benefit from existing sources of international marine science information.

5. Coastal Marine Science Research and Techniques: How They Can Be Applied to Coastal Management Problems - Social Science Perspectives

This session will focus on contributions from the social sciences (political science, economics, anthropology, geography, sociology, planning, law) in addressing ICM management problems and illustrate specifically how these can be applied to typical problems in coastal management such as coastal pollution control, sea level rise, protection of fisheries habitat, coastal erosion prevention, marine disaster prevention/mitigation, aquaculture siting, etc., as well as to the overall organization of an integrated coastal management system.

- Research on coastal populations, patterns of settlement
- Research on preferences and behaviors of organized coastal interests
- Research on alternative policy courses of action to be pursued through ICM
- Research on administrative, fiscal and legal capacity in formulating and implementing ICM
- Research on inter-agency relations in ICM

PART III. GROUP DISCUSSIONS, COMPARISONS AND ANALYSIS - The Contribution of Marine Sciences and Technology to the ICM Process: National, Subnational, and Regional Perspectives

This session will first review obstacles in bringing science and policy together in ICM, obstacles related to the way the sciences are conducted and organized as well as obstacles related to the ICM process. Next a series of case studies will be presented analyzing examples

of efforts to rationalize science and policy at various levels: at a national level, at a subnational or local level, and at a regional (supranational) level.

Following the case study presentations, an overall discussion will take place and participants will be asked to summarize the results of the discussions and to make recommendations.

National level:

- Science in the Application of ICM in Korea

Subnational level:

- Science and Policy at the Local Level: Xiamen, China

Regional level:

- Regional Perspectives of Marine Science Contributions to ICM - A case study of the South East Asian Region

PART IV. IMPROVING THE CONNECTION BETWEEN SCIENCE AND POLICY IN ICM AT NATIONAL, REGIONAL, AND SUBNATIONAL LEVELS

4a. Strategies for Bringing Science into the ICM Process

This session will first review decision-making processes in ICM to ascertain key points when scientific analysis can be especially useful in ICM decision-making. Next, different means of bringing scientists and ICM decisionmakers together will be discussed. Finally, a general discussion of successful strategies for connecting science and policy in ICM decisions will take place.

Lectures:

- The ICM Decision process
- Some Strategies for Connecting Science and Policy in ICM Decisions
- Some Experiences in Bringing Science and Policy Together in ICM

4b. Workshop discussions of successful strategies for bringing science and policy together in ICM

Participants will be organized into discussion groups to discuss successful strategies for bringing science and policy together in ICM. Participants will develop specific recommendations for improving the connection between science and policy at the regional level (WESPAC region), at national levels, and at subnational levels.

PART V. WORKSHOP CONCLUSION AND RECOMMENDATIONS

This session will review the recommendations for improving the connection between science and policy in ICM developed by participants regarding regional, national, and subnational efforts in ICM.