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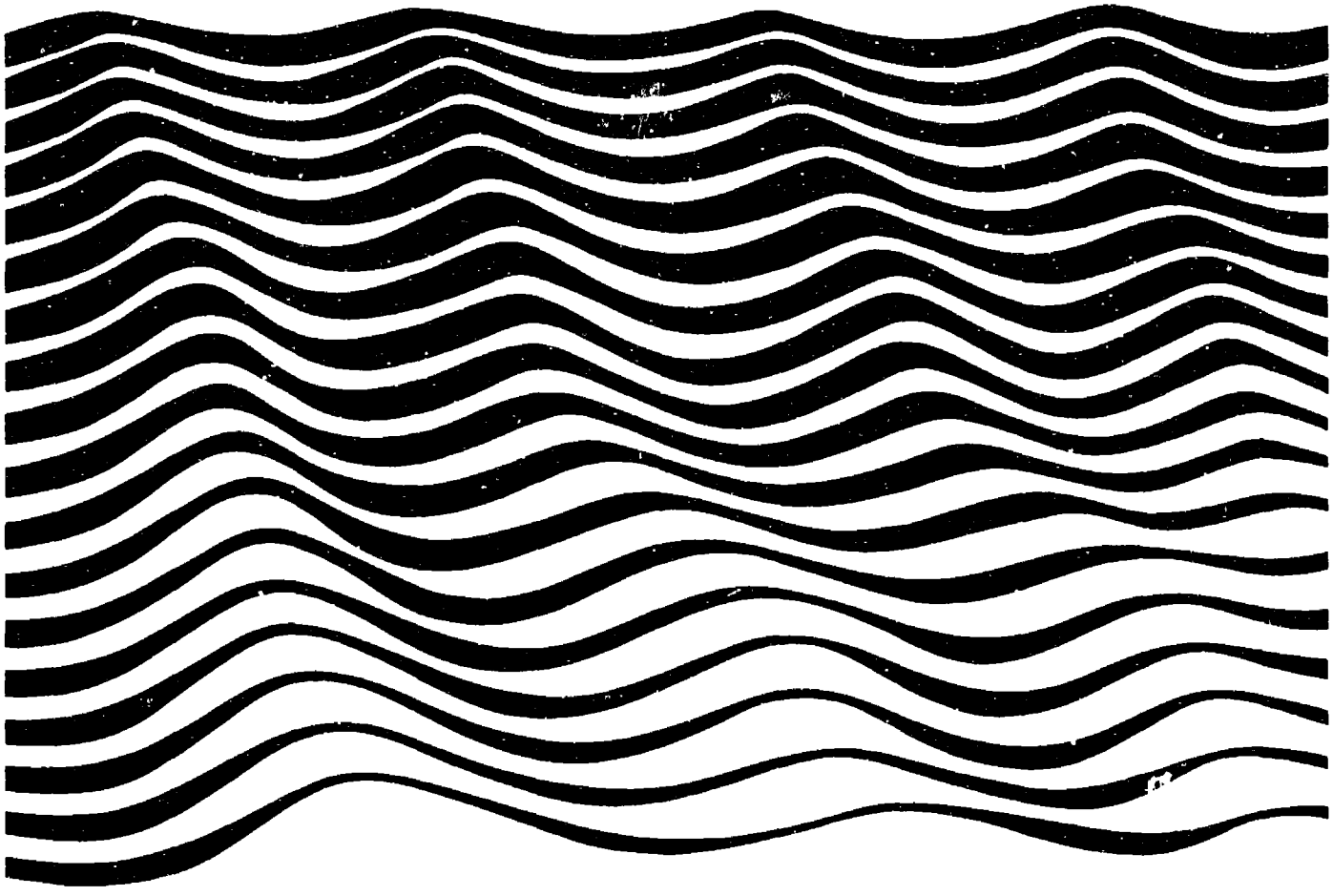
Coastal systems studies and sustainable development

Report of the COMAR
Interregional Scientific Conference
UNESCO, Paris, 21-25 May 1991

co-sponsored by
UNESCO, UNEP, SCOR, IABO



UNESCO 1991

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35	Determination of chlorophyll in seawater Report of intercalibration tests sponsored by SCOR and carried out by C J Lorenzen and S W Jeffrey, CSIRO Cronulla, N S W, Australia, September-October 1978	1980	— —
36	The practical salinity scale 1978 and the international equation of state of seawater 1980 Tenth report of the Joint Panel on Oceanographic Tables and Standards, (JPOTS) Sidney, B C, Canada, 1-5 September 1980 Sponsored by UNESCO, ICES, SCOR, IAPSO Available in Ar, Ch, E, R, S	1981	WG 10
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38	Background papers and supporting data on the International Equation of State of Seawater 1980	1981	WG 10
39	International Oceanographic Tables, Vol 3	1981	WG 10
40	International Oceanographic Tables, Vol 4	1982	WG 10
41	Ocean-Atmosphere Materials exchange (OAMEX) Report of SCOR Working Group 44, UNESCO Paris, 14-16 November 1979	1982	WG 44
42	Carbon dioxide sub-group of the joint panel on oceanographic tables and standards Report of a meeting Miami, Florida, 21-23 September 1981 sponsored by UNESCO, ICES, SCOR, IAPSO	1983	—
43	International Symposium on Coastal lagoons Bordeaux, France, 8-14 September 1981 Available in E and S	1982	—
44	Algorithms for computation of fundamental properties of seawater Endorsed by UNESCO SCOR/ICES IAPSO Joint Panel on Oceanographic Tables and Standards and SCOR Working Group 51	1983	—
45	The International System of Units (SI) in Oceanography Report of IAPSO Working Group on Symbols, Units and Nomenclature in Physical Oceanography (SUN)	1985	—
46	Opportunities and problems in satellite measurements of the sea Report of SCOR Working Group 70 Available in Ar, Ch, E, R, and S	1986	WG 70
47	Research on coastal marine systems Report of the third meeting of the UNESCO SCOR IABO consultative panel on coastal systems, October 1984	1986	—
48	Coastal off-shore ecosystems relationships Final Report of SCOR IABO UNESCO Working Group 65 Texel, Netherlands, September 1983	1986	WG 65
49	Pelagic biogeography Proceedings of an international conference The Netherlands 29 May-5 June 1985	1986	— —
51	Thermodynamics of the carbon dioxide system in seawater Report by the carbon dioxide subpanel of the joint panel on oceanographic tables and standards	1987	—
52	Research on coastal marine systems Review and Recommendations for UNESCO Programme 1987-1989 Report of the fourth meeting of the UNESCO SCOR IABO consultative panel on coastal systems Dakar, 15-17 December 1986	1987	—
53	Code of practice for scientific diving Principles for the safe practice of scientific diving in different environments Compiled and edited by the Scientific Committee of the Confédération mondiale des activites subaquatiques (CMSA)	1988	—
54	The acquisition, calibration and analysis of CTD data A report of SCOR Working Group 51	1988	WG 51
55	River inputs to ocean systems Status and recommendations for research Final Report of SCOR Working Group 46	1988	WG 46
56	The ocean as a source and sink for atmospheric trace constituents Final Report of SCOR Working Group 72	1989	WG 72
57	Coastal marine systems: Review and research recommendations, 1988-1990 UNESCO SCOR IABO consultative panel on coastal systems 15-20 December 1988 São Luis, Maranhao, Brazil	1989	—
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59	Intercomparison of total alkalinity and total inorganic carbon determinations in seawater Recommended by ICES Marine Chemistry Working Group and SCOR Working Group 75 and endorsed by SCOR/UNESCO/ICES IAPSO Joint Panel on Oceanographic Tables and Standards	1991	—
60	Reference materials for oceanic carbon dioxide measurements Report of the sub-panel on standards for CO_2 measurements of the Joint Panel on Oceanographic Tables and Standards	1991	—
61	Manual on marine experimental ecosystems Prepared by SCOR Working Group 85	1991	WG 85
62	Salinity and density of seawater Tables for high salinities (42 to 50)	1991	WG 10

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ISSN 0503-4299

Published in 1991
by the United Nations Educational,
Scientific and Cultural Organization
7, place de Fontenoy, 75700 Paris

Printed in UNESCO's workshops.

PREFACE

This series, the *UNESCO Technical Papers in Marine Science,* is produced by UNESCO as a means of informing the scientific community of recent advances in oceanographic research and on recommended research programmes and methods.

The texts in this series are prepared in co-operation with non-governmental scientific organizations. Many of the texts result from research activities of the Scientific Committee on Oceanic Research (SCOR) and are submitted to UNESCO for printing following final approval by SCOR of the relevant working group report.

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ABSTRACT

This report contains the results of discussions during the Conference on *Coastal Systems Studies and Sustainable Development* (UNESCO, Paris, 21-25 May 1991).

This conference was organized by the UNESCO Coastal Marine (COMAR) programme and was co-sponsored by the United Nations Environment Programme (UNEP), the Scientific Committee on Oceanic Research (SCOR) and the International Association of Biological Oceanography (IABO).

During the conference, emphasis was placed on the regional and interregional aspects of the integrated coastal zone studies and scientific basis of management practices.

In addition to two keynote addresses, over 30 selected presentations as well as poster presentations were made. The conference adopted recommendations for further studies necessary at global, regional and local levels for a better understanding of the functioning of coastal systems.

The proceedings of the conference will be published in the UNESCO Technical Papers in Marine Science series.

RESUME

Le présent rapport expose les conclusions de débats qui ont eu lieu lors de la Conférence sur les études des systèmes côtiers et le développement durable (UNESCO, Paris, 21-25 mai 1991).

Organisée dans le cadre du Programme sur l'aménagement des systèmes côtiers (COMAR) de l'UNESCO, cette Conférence était coparrainée par le Programme des Nations Unies pour l'environnement (PNUE), le Comité scientifique de la recherche océanique (SCOR) et l'Association internationale d'océanographie biologique (AIOB).

Au cours de cette Conférence, l'accent a été mis sur les aspects régionaux et interrégionaux des études intégrées des zones côtières et les fondements scientifiques des pratiques d'aménagement.

Outre deux discours liminaires, plus de 30 communications et plusieurs expositions d'affiches ont été faites. La Conférence a adopté des recommandations sur les nouvelles études qu'il faudrait entreprendre aux niveaux mondial, régional et local pour mieux comprendre le fonctionnement des systèmes côtiers.

Les actes de la Conférence seront publiés dans la série des documents techniques de l'UNESCO sur les sciences de la mer.

RESUMEN

En este informe se consignan los resultados de los debates celebrados en la Conferencia sobre Estudios de Sistemas Costeros y Desarrollo Sostenido (UNESCO, París, 21-25 de mayo de 1991).

Organizó la Conferencia el Programa de Zonas Costeras de la UNESCO (COMAR), siendo copatrocinado por el Programa de las Naciones Unidas para el Medio Ambiente (PNUMA), el Comité Científico de Investigaciones Oceánicas (SCOR) y la Asociación Internacional de Oceanografía Biológica (IABO).

En la Conferencia se hizo hincapié en los aspectos regionales e interregionales de los estudios integrados de zonas costeras y en las bases científicas de los sistemas de gestión.

Además de las dos intervenciones principales, se hicieron más de 30 presentaciones seleccionadas y se organizaron varias exposiciones de carteles. La Conferencia aprobó recomendaciones relativas a nuevos estudios que deben efectuarse en los niveles mundial, regional y local para lograr una mejor comprensión del funcionamiento de los sistemas costeros.

Las actas de la Conferencia se publicarán en la colección de Documentos Técnicos sobre Ciencias del Mar de la UNESCO.

РЕЗЮМЕ

Настоящий доклад содержит результаты обсуждений на Конференции по исследованиям прибрежных систем и устойчивому развитию (ЮНЕСКО, Париж, 21-25 мая 1991 г.).

Эта Конференция была организована программой ЮНЕСКО по прибрежной морской среде (КОМАР) и совместно финансировалась Программой по окружающей среде Организации Объединенных Наций (ЮНЕП), Научным комитетом по океаническим исследованиям (СКОР) и Международной ассоциацией биологической океанографии (МАБО).

В ходе этой Конференции основное внимание было уделено региональным и межрегиональным аспектам комплексных исследований прибрежной зоны и научным основам практики управления.

Помимо двух основных выступлений было представлено свыше 30 отдельных докладов, а также была организована выставка плакатов. Конференция приняла рекомендации в отношении дальнейших исследований, необходимых на глобальном, региональном и местном уровнях для лучшего понимания функционирования прибрежных систем.

Материалы Конференции будут опубликованы в технических докладах ЮНЕСКО в серии по морским наукам.

ملخص

يتضمن هذا التقرير نتائج المناقشات التي دارت أثناء المؤتمر الخاص بدراسات النظم الساحلية والتنمية المستديمة (اليونسكو، باريس ٢١ - ٢٥ مايو/أيار ١٩٩١).

ونظّم هذا المؤتمر برنامج اليونسكو الخاص بالنظم الساحلية (كومار) واشترك في رعايته برنامج الأمم المتحدة للبيئة (يونيب) واللجنة العلمية لبحوث المحيطات (سكور) والرابطة الدولية للأقيانوغرافيا البيولوجية (يابو).

وجرى التركيز أثناء المؤتمر على الجوانب الاقليمية والمشتركة بين المناطق للدراسات المتكاملة للمناطق الساحلية وعلى الأسس العلمية لممارسات تخطيط استغلال هذه المناطق.

وفضلا عن القاء كلمتين أساسيتين، قدم في المؤتمر نحو ٣٠ بحثا مختارا وعدة عروض قدمت في شكل ملصقات. واعتمد المؤتمر توصيات من أجل اجراء المزيد من الدراسات اللازمة على الصعيد العالمي والاقليمي والمحلي من أجل تحسين فهم النظم الساحلية وسير عملها.

وسوف تنشر أعمال المؤتمر في سلسلة دراسات اليونسكو الفنية في علوم البحار.

摘　　要

本报告刊载了沿海系统研究与持久发展会议（教科文组织，巴黎，1991年 5月21--25日）期间讨论的结果。

这次会议是教科文组织沿海海洋计划（COMAR ）筹办的，由联合国环境规划署（UNEP）、海洋研究科学委员会（SCOR）和国际生物海洋学协会（IABO）联合倡议的。

会议期间，着重讨论了沿海地区综合研究和管理实践的科学基础方面的地区性问题和地区间问题。

除了两个重点发言之外，还选出30多篇作了发言，以及书面发言。为了提高对沿海系统的作用的认识，会议通过了关于在全球、地区和地方一级进一步开展必要研究的建议。

会议记录将刊登在教科文组织海洋科学技术论文丛刊上。

CONTENTS

INTRODUCTION

The tenth anniversary of UNESCO's Coastal Marine (COMAR) programme was marked in Paris on 21-25 May 1991 with a meeting entitled 'Coastal System Studies and Sustainable Development'.

The Conference was organised by UNESCO COMAR programme and co-sponsored by the United Nations Environment programme (UNEP), the Scientific Committee on Oceanic Research (SCOR) and the International Association of Biological Oceanography (IABO).

The background to the meeting was as follows: COMAR was formally established by the UNESCO General Conference in 1980, after several years of preparatory work. It consists of various regional and sub-regional projects in Asia and the Pacific, Africa, Latin America and the Caribbean, the Mediterranean, Red Sea and the Gulf, and in Europe. The Programme is carried out in co-operation with the Scientific Committee on Oceanic Research (SCOR), the International Association of Biological Oceanography (IABO), and the International Geosphere-Biosphere Programme (IGBP) of the International Council of Scientific Unions (ICSU). Major achievements of COMAR have been the creation of a coastal research network in Africa; and a seven year project on mangroves in Asia and the Pacific, which culminated in the creation of the International Society for Mangrove Ecosystems (ISME) in 1991. Other activities have included training workshops on coastal ecosystems in south east Asia; networking of Caribbean laboratories co-operating in the study of coastal marine productivity and monitoring, and a project to foster collaborative research among South American scientists working on temperate coastal systems.

The 1991 COMAR meeting, described in this report, was the first time that representatives from all the regional projects had been brought together at one venue, thus enabling a direct exchange of results and experiences. Over seventy participants from 30 countries (which included Africa, Latin America and the Caribbean, South East Asia, Europe and North America, and South Central Asia) took part in the meeting which reviewed the present status of coastal marine environments and research trends related to their conservation and management. The need for interdisciplinary research and training was highlighted, particularly in addressing the major issues and conflicts resulting from the rapidly increasing pressures of modern developments on the coastal zone and its resources.

The meeting was divided into five sessions which reflected the broad base of the COMAR activities. These were, global change and the coastal zone; coastal zone research and the importance of an interdisciplinary approach; the role of human society in the coastal zone; the major projects within COMAR; and finally selected case histories of man-made impacts on the coastal zone and possible solutions to these problems.

Abstracts of papers presented at the COMAR meeting were published as MARINF/85 Document of UNESCO (Paris, April 1991), which is available from the UNESCO Marine Information Centre on request.

This report documents the key note speeches delivered by the Director-General of UNESCO, Mr Fredrico Mayor and the Assistant Director-General for Sciences, Dr A Badran, together with the conference programme, list of participants, a summarised account of the meeting and finally the recommendations of the conference at general, regional, and local levels.

Above: Hank Postma (Netherlands), Conference Chairman, exchanges views with Federico Mayor, UNESCO Director-General, during the COMAR Conference.

ADDRESS BY

MR FEDERICO MAYOR

Director-General, UNESCO

23 May 1991

I am sorry I was not able to be with you for the opening of this Conference - the first interregional COMAR meeting after ten years of activities conducted through the network's different regional components. However, I am pleased to have been able to join you in the course of your discussions to say a few words about the very important topics and tasks before you.

Let me start, though, by thanking all those who responded to our invitation to attend this meeting. Special thanks are due to those organisations, both governmental and non-governmental, that have manifested their interest in the Conference - particularly our co-sponsoring partners UNEP, SCOR, and IABO. I should also like to welcome a number of eminent scientists associated with ICSU and its International Geosphere Biosphere Programme, whom we are happy to welcome to UNESCO on this occasion.

It is generally believed among biologists that the first vertebrate life on land resulted from the timid incursion on shore of some kind of fish or early reptile living in the sea. Whether or not the coasts played a primordial role in the colonisation of the land by animal life (and, possibly, of other forms of life), it is a fact that human occupation of the coasts - estuaries and other aquatic shores (including freshwater) - goes back in time as far as the earliest records of human activity.

Yet it is only relatively recent times that human occupation of the coasts has placed in peril this most precious resource - the very threshold over which life on land probably first emerged. Modern industrialised development and associated population growth have subjected coastal environments to severe pressures and degradation through over-exploitation of resources, pollution of various kinds and destabilisation of the littoral zone, as well as through more global climatic and other changes.

It is indeed the case that only the large metropolitan centres compete with the coastal areas in terms of high density of human population. Moreover, a substantial number of these centres are themselves situated along the coast (e.g. in Brazil, 15 out of such 17 centres). It has been estimated that six out of every ten people now live within 60 kilometres of the coast. Furthermore, the population is growing rapidly in coastal zones as in metropolitan areas. Coastal area populations are expected to double over the next 20 or 30 years.

What we are witnessing is the spread to coastal areas of a modern-style industrialised society originating in the large metropolises, together with their characteristic problems of congestion, pollution and high resource consumption. This imposition of an essentially alien culture on coastal areas poses a double problem; it jeopardises the existence of traditional societies invariably well integrated into their natural environment and respectful of its resources; and it carries with it a very real danger of the destabilisation and destruction of one of the richest and most diversified resource areas of our planet.

Estuaries, extended continental shelves, coastal lagoons, seagrasses, coral reefs, mangroves, etc., constitute a very important and diverse set of natural resources. For example, some 80% of the world's fish catch is coastal-water-dependent. Population growth, migration to the coast, ill-considered use of technology in the exploitation of coastal resources, and increased competition for the limited remaining resources once the ecosystems on which they depend are compromised by a variety of practices (such as mining, dredging, trawling, pollution, and uncontrolled diving) are leading inexorably to the depletion and destruction of these essentially fragile resources. Moreover, disturbing coastal degradation may well have far-reaching consequences offshore.

Today's widespread concern for the environment is in large measure a tribute to groups of distinguished specialists like yourselves who for a decade or more have closely scrutinised and studied the environment - the coastal environment, in your case - and have taken a lead in alerting decision-makers and the public to the dangers of our irresponsible attitudes to our natural surroundings. Motivated by the not unworthy ambition of making our lives easier, more comfortable and more enjoyable (and, it should be said, more equitable), we are creating a high-consumption world that is taking out of nature more than is compatible with its self-regeneration and with the maintenance of essential balances. This incompatibility, with all the light and shadow it implies, is our main headache today.

The problem - as we are all aware - is immense and complex. It encompasses virtually all branches of the natural sciences as well as many aspects of the social sciences, including questions of legislation and policy decision-making at the national, regional, and international levels The area is pre-eminently one in which each scientific discipline must play its role in the context of an interdisciplinary approach and in close association both with those who must learn and with those who must decide. The dilemma, the difficulty, the challenge - whatever one cares to call it - comes from the fact that the decisions about action cannot wait for science to provide all the knowledge; at the same time, they cannot be taken without having the requisite knowledge.

In designing strategies in this area, particularly delicate balances must be struck between disciplines and multidisciplinarity; between inputs from the natural and social sciences, and between the claims of knowledge and decision-making. In this connection, I am encouraged to see from reading the programme of the Conference that the right questions seem to be being posed. I am particularly pleased to note that the COMAR programme, which has so far concentrated on dissecting the complexity inherent in the field, increasing knowledge, providing training and disseminating information on coastal systems, has begun to some extent to influence decisions concerning the need to rehabilitate coastal areas.

As you know, UNESCO is currently engaged, with other organisations of the United Nations family, in preparations for the United Nations Conference on Environment and Development to be held next year in Brazil. With UNCED in mind, I hope that the results of your Conference will constitute a clear statement of the reality of the coastal zone problem in all its scale and scope. I would ask you to provide us with guidance, in the most practical terms possible, as to the conditions for the integration and the harmonious and sustainable development of our society within coastal areas. I have no doubt that, given its high level of competence, your assembly will respond to this call and provide us with the basis for a new departure in coastal zone activities in the face of the challenges to which I have been referring.

OPENING SPEECH

BY DR A BADRAN

Assistant Director-General for Sciences, UNESCO

21 May 1991

On behalf of the Director General I have much pleasure in welcoming you to this interregional COMAR scientific conference on COASTAL SYSTEMS STUDIES AND SUSTAINABLE DEVELOPMENT, especially as this is the first time that, after ten years of activity, the scientists involved in the UNESCO Coastal Marine Programme from the different regions of the globe have the opportunity to meet together. Unfortunately Dr Mayor is unable to be with us this morning because he is chairing the first day of the spring session of UNESCO's Executive Board. As a result of these commitments, Dr Mayor will address your conference on Thursday, May 23 at 0900.

As you are all no doubt aware, UNESCO's interest in coastal areas began in the mid-seventies when the world started to show serious concern about the environment, as expressed at the 1972 Stockholm Conference. At that time the international community of oceanographers principally focussed research on the open ocean and during the early seventies there were many international expeditions, including those to the Caribbean and on the Kuroshio. Moreover, some coastal systems have long attracted the curiosity of scientists; coral reefs, for example, have been fascinating to many scientists since Darwin's day. Other ecosystems, however, such as mangroves, received less attention and their importance was not recognised until many areas had become severely over-exploited or even destroyed.

During the early seventies, however, there was no systematic effort to comprehend the complexity of coastal marine systems, their interactions and processes occurring at the land-sea interface. Although rather ambitious, these were the fundamental objectives of the COMAR Programme. Scientific understanding is only one facet of the overall problem, which with the passage of time, with population growth and socio-economic pressures, has rapidly increased.

In the late 1970s and early 1980s, different expert meetings were organised in the various regions participating in the COMAR programme. Many persons in this room participated in those early meetings. Thanks to their wise advice and that of many of their colleagues, we were able to define the objectives, priorities and activities of the different regional projects. To-day the progress which has been made, over the last ten years, will be reviewed at this conference. A number of projects and activities are ongoing and many questions and problems concerning the coasts around the world still require our urgent attention. The tragic flooding with its consequential loss of life, property and land in low-lying coastal areas of Bangladesh today is an example. UNESCO is at your service to cooperate in trying to define and overcome these problems, but our role is essentially that of a catalyst and you and the authorities of your countries are the main players in the process of defining the objectives and especially of securing appropriate levels of financing from extra-budgetary funding sources. It is my hope that your conference will guide us forward with clear indications and recommendations as a basis for the development of our future programme. I wish you success in your deliberations and look forward to learning their outcome.

PROGRAMME

21 May

Opening by the Assistant Director-General of Unesco for Sciences. **A. Badran.**

Establishment of the Bureau of the Conference.

Keynote Addresses

H. Postma: Coastal Marine Systems research; the Conference's objectives.

M. S. Swaminathan: Human influence and evolution of the demography in the coastal zone.

Session 1: Global Change and the Coastal Zone

Chairman: **R. W. Stewart**
Rapporteur: **E. Jordan**

R. W. Stewart: Sea/Earth relative movement.

P. Lasserre: Consequences of global changes on adaptation of coastal marine living ecology and biodiversity.

P. Holligan: The IGBP Land-Ocean Interactions in the Coastal Zone (LOICZ) Project.

Session 2: Coastal zone research: Contribution of disciplines to interdisciplinary approach

Chairman: **P. Lasserre**
Rapporteur: **J. C. Castilla**

T. Parsons: Coastal Zone Research Biological Communities and Productivity.

J. Milliman: Management of the Coastal Zone: Impact of Onshore Activities on the Coastal Environment.
(presented by R. W. Stewart)

22 May

J. C. Salomon: Physical processes in the coastal zone.

H. Postma: Chemical processes in the coastal zone.

Session 3: The Human Society in the coastal zone

Chairman: **M. S. Swaminathan**
Rapporteur: **P. Narsey Lal**

P. Narsey Lal: Economics of coastal zone degradation: an institutional perspective.

J. C. Castilla: Coastal marine ecology and artisanal fishery.

J. Baker: The Challenges of the Coastal Zone.

Session 4: Unesco Major project on Coastal Systems (COMAR)

Chairman: **H. Postma**
Rapporteur: **J. Baker**

M. Steyaert: COMAR - a regional/interregional cooperative framework.

Asia and the Pacific: Towards rehabilitating the coastal systems

B. Clough: A cooperative research network for the mangroves of Asia.

Africa: Reinforcing and networking African Coastal Marine Research

S. Diop: The COMARAF Project.

A. Semesi: The Coastal systems of East Africa.

Latin America and the Caribbean

E. Jordan: The Caribbean Coastal Marine Productivity Project (CARICOMP).

G. Cambers: Coast and Beach Stability in the Eastern Caribbean Islands.

23 May

Address by the Director-General of Unesco. **F. Mayor**

J. Stuardo: Temperate coastal systems in Latin America.

N. Lanfredi: Coastal Research in the South and West Atlantic Ocean.

The Mediterranean, Red Sea and the Gulf: Coastal lagoons and coastal systems of desert coasts

Y. Halim: Prospect for a cooperative network in the region.

M. Kogo: Replanting green along desert coast.

R. Paskoff: Sand and Beach Evolution and Management in North Africa.

Interregional comparison and cooperation

C. Birkeland: Similarities and differences of coastal systems.

M. S. Swaminathan: (President, ISME) International Society for Mangrove Ecosystems.

COMAR consultative panel session

24 May

Session 5: Case studies of coastal impacts and possible solutions

Chairman: **J. C. Ogden**
Rapporteur: **C. Birkeland**

M. Batisse:	The human pressures: a Mediterranean case history.
O. Ongkosongo:	The North Coast of Java case history.
M. Ivanov:	Causes of appearance of anaerobic conditions in deep waters of the North-Western Shelf of the Black Sea.
D. Shaw:	The 1989 Alaska Oil Spill case history.

Group discussions

Group I: Global Issues

Convenor: **R. W. Stewart**
Rapporteur: **J. C. Castilla**

Group II: Regional Issues

Convenor: **S. Diop**
Rapporteur: **J C Ogden**

Group III: Local Issues

Convenor: **T. R. Parsons**
Rapporteur: **B. E. Brown**

Drafting Committee Sessions

Session of UNESCO/SCOR/IABO consultative panel on coastal systems

25 May

Recommendations and conclusions

LIST OF PARTICIPANTS

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SUMMARY REPORT OF THE MEETING

KEYNOTE ADDRESSES

H. Postma
(Netherlands Institute for Oceanic Science)
Texel, The Netherlands

Coastal Marine Systems Research : the Conference's objectives.

An outline of the history and development of the COMAR programme, paying special reference to future research needs as they affect the coastal zone, in areas such as climate change and sustainable development.

M. S. Swaminathan
(M. S. Swaminathan Research Foundation)
Madras, India

Human influence and evolution of the demography in the coastal zone.

A description of present and future world demographic problems and the potential impact of these on the coastal zone over the next two decades. Particular aspects of coastal zone research and development which were addressed included ecological sustainability, economic efficiency, social equity, and an ability to respond and adapt to natural disasters and sea level changes.

SESSION 1: GLOBAL CHANGE AND THE COASTAL ZONE

R. W. Stewart
(ICSU Global Change Science Office)
Victoria, Canada

Sea/Earth relative movement.

A discussion of factors affecting relative sea level changes and a critical analysis of world climate predictions proposed by the IPCC report as they might affect the coastal zone.

P. Lasserre
(Station Biologique de Roscoff)
France

Consequences of global changes on adaptation of coastal marine living ecology and biodiversity.

An account of the ecological significance of biodiversity of coastal systems and the proposed international projects addressing various aspects of marine diversity (ie. testable theories and experiments; networking of sites; long-term measurements; education and training).

P. Holligan
(Plymouth Marine Laboratory)
United Kingdom

The IGBP Land-Ocean Interactions in the Coastal Zone (LOICZ) Project.

A description of the marine projects within the IGBP whose objective is to develop a predictive understanding of the effects of changes in climate, land use and sea level on global functioning and sustainability of coastal ecosystems. Dr Holligan stressed that considering the coastal zone alone was too restrictive and that more attention should be given to the coastal oceans, particularly with reference to their relationship with ocean boundaries and carbon sources and sinks in coastal and ocean systems.

SESSION 2: COASTAL ZONE RESEARCH: CONTRIBUTION OF DISCIPLINES TO INTERDISCIPLINARY APPROACH

T. Parsons
(Institute of Oceanography)
University of British Columbia
Canada

Coastal Zone Research Biological Communities and Productivity

An analysis of productivity values in salt marsh, sea grass, mudflat/sandbar, and pelagic communities together with an evaluation of man's impact on these habitats in the coastal zone of British Columbia.

J. Milliman
(Woods Hole Oceanographic Institution)
USA
Presented by R. W. Stewart

Management of the Coastal Zone: Impact of Onshore Activities on the Coastal Environment.

Management of the coastal zone must take into account both the effect of human communities as well as impacts resulting from man-induced changes in the coastal zone. This account gave special emphasis to the low lying deltas, particularly those in Southern Asia which may be particularly vulnerable to inundation in the near future.

J. C. Salomon
(Centre Infremer Brest)
France

Physical processes in the coastal zone.

A discussion of the use of physical models in describing water mixing and pollutant distribution in coastal areas and shallow seas using the North Sea as a case history.

H. Postma
(Netherlands Institute for Oceanic Science)
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The Netherlands

Chemical processes in the coastal zone.

An overview of important chemical factors in the coastal zone such as the biogeochemical cycle, eutrophication and the value of the coastal zone as a chemical filter. Specific aspects which were discussed included changes in salinity, pH and sedimentation patterns in coastal waters.

SESSION 3: THE HUMAN SOCIETY IN THE COASTAL ZONE

P. Narsey Lal
(ABARE, Canberra)
Australia

Economics of coastal zone degradation: an institutional perspective.

The interface between ecological, economic, and institutional perspectives in the coastal zone is often poorly defined with resultant market and institutional failures in efficient use of coastal resources. This paper addressed the shortcomings of present institutional structures and highlighted the value of improved coordination of agencies involved in coastal zone development and the use of an extended cost benefit analysis for evaluating alternative uses of the coastal system.

J. C. Castilla
(Departmento de Ecologia)
Portificicia Universidad Catolic de Chile
Chile

Coastal marine ecology and artisanal fishery.

An account of the coastal fishery for the mollusc Concholepas concholepas in Chile, incorporating analysis of the outcome of ecological experiments in a 60ha area in which human predators were effectively eliminated from gleaning the shellfish over the period 1982-88.

J. Baker
(Australian Institute of Marine Sciences)
Townsville
Australia

The Challenges of the Coastal Zone.

The challenges of the coastal zone are best addressed in inter-disciplinary studies assessing the different processes that are involved. This paper outlined the projected research and development of the Australian Institute of Marine Science over the period 1991-96 while highlighting opportunities for international collaboration.

SESSION 4: UNESCO MAJOR PROJECT ON COASTAL SYSTEMS (COMAR)

M. Steyaert
(UNESCO)
Paris

COMAR - a regional/interregional cooperative framework.

An outline of previous COMAR projects preceded discussion of future regional programmes which included the effects of sea level change and coastal zone management in Asia and the Pacific; impact of land-use practices and global environmental change in island and atoll marine habitats; and future coastal projects in Latin America, Africa, Mediterranean, Red Sea and Gulf as well as support of research in marine laboratories throughout Europe through the EC MARS programme.

Asia and the Pacific - towards rehabilitating the coastal systems.

B. Clough
(Australian Institute of Marine Science)
Townsville
Australia

A cooperative research network for the mangroves of Asia.

An account of the achievements of the COMAR based activities which relate to mangrove systems in Asia and the Pacific. Networking of laboratories in these areas have provided an exchange of expertise and information among the national mangrove committees of different member countries. One area of future effort in this area will be an evaluation of the methods that can be used to assess what types of coastal areas could or will be lost by predicted sea level rise and what adjustment could be made to accommodate or mitigate such changes.

Africa: Reinforcing and networking African Coastal Marine Research.

S. Diop
(BREDA)
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The COMARAF Project.

A summary of the COMARAF project, including its main objectives, implementation and principal activities with special emphasis on the major African coastal systems, ie. estuaries, mangroves, coastal lagoons, coral reefs, sandy beaches.

A. Semesi
(Department of Botany)
University of Dar Es Salaam
Tanzania

The Coastal systems of East Africa.

An overview of coastal ecosystems of East Africa, highlighting in particular the local mangrove and coral ecosystems and the limited information available on these habitats for which management policies are so urgently required.

Latin America and the Caribbean

D. E. Jordan
(Univ National Autonoma de Mexico)
Mexico

The Caribbean Coastal Marine Productivity Project (CARICOMP).

An outline of the CARICOMP project, which is currently in its implementation phase. The project aims to contribute toward effective management of coastal ecosystems by increasing the level of scientific knowledge (through networking activities of laboratories involved in surveillance and productivity measurements of selected ecosystems) as well as improving technical and scientific capabilities of scientists throughout the region.

G. Cambers
(Ministry of Natural Resources and Fisheries)
Tortola
British Virgin Islands

Coast and Beach Stability in the Eastern Caribbean.

A review of a programme of training and coastal monitoring which was developed in response to a request to combat beach erosion in the Lesser Antilles. The programme has proved successful in strengthening the capability of islands to monitor and manage their coastal systems and an extension of the activity is planned which will include monitoring of sea level change.

J. Stuardo
(Universidad de Concepcion)
Chile

Temperate coastal systems in Latin America.

An overview of research on temperate coastal systems of Latin America which include intertidal ecology and sandy shores, with special reference to the exploitation of invertebrates and algae of economic importance and the impact of man on the ecological balance. The role of COMAR in enhancing the research capacity of the region as well as providing improved scientific co-ordination in the five participating countries (Chile, Argentina, Uruguay, Brazil, and Peru) was highlighted.

N. W. Lanfredi and J. L. Pousa
(Laboratorio de Oceanografia Costera)
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Coastal Research in the South and West Atlantic Ocean.

This paper described a variety of environmental settings on the Argentine coast and focussed particular attention on the problems of erosion, coastal flooding and the potential impacts of sea level rise. One particular example of poor management practice involved urban development of a sandy coastline to the north of Buenos Aires which has caused elimination of extensive sand dunes (the only available storage bodies for ground water). Beach erosion in this area was also partly due to restriction in sediment supply from the sand dunes.

The Mediterranean, Red Sea and the Gulf: Coastal lagoons and coastal systems of desert coasts

Y. Halim
(Department of Oceanography)
University of Alexandria
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Prospect for a cooperative network in the region.

An account of regional interaction in terms of training and research which has been promoted since 1978 through a series of workshops. One particular topic which has allowed interaction between scientists in Morocco, Algiers, Tunisia, Libya and Egypt has been the study of coastal lagoons. Such lagoons are more productive (10-20 time greater) than the nearby Mediterranean as a result of nutrient and fertiliser drainage.

M. Kogo
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Replanting green along a desert coast.

A description of the successful transplantation and establishment of mangroves in Saudi Arabia and Abyssinia where over-exploitation has led to habitat degradation. One important factor in successful transplantation appeared to be the protection of juvenile plants from wind effects over the first 4-5 years of their life.

R. Paskoff
(University of Lyon)
France

Sand and Beach Evolution and Management in North Africa.

A review of beach formation and erosion on the North African coast including reference to the use of engineering structures to reduce erosion problems. Such techniques have often been counterproductive, resulting in harmful effects on the environment. Alternative strategies discussed included dune restoration and artificial beach nourishment as well as enforcing regulations which defined set back lines and prohibited construction close to the beach.

Interregional comparison and cooperation

C. Birkeland
(University of Guam)
Guam

Similarities and differences of coastal systems.

An overview of the primary productivity of coastal ecosystems in both temperate and tropical zones, while focussing attention on the ecological effects of increased nutrient input in different tropical systems and the management consequences.

SESSION 5: CASE STUDIES OF COASTAL IMPACTS AND POSSIBLE SOLUTIONS

M. Batisse
(UNESCO)
Paris

The human pressures: a Mediterranean case history.

A paper describing the socio-economic factors affecting countries bordering the Mediterranean where many of the problems (ie. population expansion, industrial development, tourist industry) converge on the coastline. Possible future scenarios which could reduce conflicts in resource use would be a voluntary will to protect the environment and/or economic collaboration of countries to the North and South of the Mediterranean basin.

O. Ongkosongo
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Indonesia

The North Coast of Java case history.

An overview of the geomorphology of the coastline of North Java together with an account of the main human activities taking place in the coastal zone and their effects on the environment. Efforts to mitigate problems through environmental legislation, and improved education and training were also discussed.

M. Ivanov and
(Institute of Microbiology)
USSR Academy of Sciences

A. Yu. Lein
(Vernadsky Institute of Geochemistry)
USSR Academy of Sciences

Causes of appearance of anaerobic conditions in deep waters of the North Western shelf of the Black Sea.

A detailed account of the distribution of hydrogen sulphide and other reduced sulphur compounds in the sediments and deep waters of the Black Sea. Anaerobic conditions are also the result of microbiological methane oxidation. Such conditions are in part the result of increasing pollution (domestic sewage and nutrients) discharges into the north western part of the Black Sea. Anaerobic conditions are the likely cause of considerable mortality in shallow water benthic fauna during the summer months.

D. Shaw
(Institute of Marine Science)
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USA

The 1989 Alaska Oil Spill case history.

A paper documenting a major oil spill into Prince William Sound when 40,000 tons of crude oil were released into the waters by the Exxon Valdez. The ecological consequences of the spill were described in the context of the physical and biological setting of the Sound. In addition the immediate and long term responses of both the environment and the socio-economy of the area were examined.

RECOMMENDATIONS

GENERAL

The **CONFERENCE**:

Noting that the COMAR programme has accomplished ten years of activities since its formal establishment by the General Conference of UNESCO in 1980;

Considering that coastal ecosystems are highly dynamic and multi-functional systems;

Recognising the important role exercised by the COMAR programme in promoting coastal systems studies and sustainable development;

Convinced that global research approaches could be viewed as ways and means to integrate the actual research efforts made in the COMAR regional programmes; and

Noting that there are now several initiatives for the study of global change and preservation of biological diversity;

Recommends that COMAR:

1. be strengthened and broadened;

2. should continue to engage in local, regional and global scientific studies relevant to coastal marine systems. At the local and regional levels the work should be dedicated to scientific research that will provide the knowledge for management, sustainable use and conservation of various ecosystems aiming at the preservation of the biological diversity and of a balance natural coastline;

3. should give high priority to specific projects for the rehabilitation of degraded areas and of areas planned for development;

4. recognises the urgent need to encourage basic and applied research on the relationship between near-shore and off-shore physical and biological oceanography;

5. should encourage the long-term regional monitoring of parameters usually evoked in discussions of climate changes, e.g. temperature. sea level changes, particularly in cases where variations of these parameters are large or larger than is expected globally for several or even many decades. When such variations persist an attempt should be made to see in what way ecosystems have adjusted or can adapt to the change;

6. should initiate scientific and socio-economic research programmes on coastal ecosystems directed at formulating coastal zone policies and strategies on environmental and developmental issues; and should encourage the dissemination of the project's results within its programme network, including provision of information to resource managers and to the community at large.

7. should evaluate the problem of literature circulation between the different regional programmes and follow at least these two approaches: (a) make sure that the information published by the different regional programmes effectively reaches intra-regional subprograms and/or related research groups outside the region and, (b) that an effort should be made in order to respond to the bibliographic needs of the programmes, for instance by way of translating key articles, after careful screening;

8. should pay attention to strengthening the cooperation and coordination between its

programmes and those of international organisations, including NGOs, such as the International Society for Mangrove Ecosystems (ISME), the Scientific Committee on Oceanic Research (SCOR), the International Union of Biological Sciences (IUBS), the International Association of Biological Oceanography (IABO), all of them belonging to the International Council of Scientific Unions, and the International Society for Reef Studies (ISRS);

9. should propose projects for implementation within the framework of the GEF (Global Environment Facility) to support research, particularly in developing countries, on the impact of human activities, of climatic change and of single catastrophic events on,

a) the coastal zone and its human community
b) terrestrial and aquatic ecosystems and loss of biodiversity

10. should be designed to make a definite contribution to the International Research Programme on Marine Biodiversity, since this activity is closely related to the maintenance of resource sustainability and is of great importance in the study of global change processes. COMAR would thus make a major contribution to the ICSU/IGBP research effort;

11. should consider applying preventative and corrective measures to the loss of biodiversity and to the imbalance between living and non living systems due to anthropogenic activities or natural episodic and catastrophic events. These measures, including the long-term monitoring of man induced changes of the environment, should be developed from site specific studies within the framework of an interregional project for the use and management of natural ecosystems;

12. in future mangrove programmes, should encourage new research strategies aiming at a better understanding of the complex interactions occurring between coastal mangrove ecosystems and off-shore fisheries;

13. should encourage the establishment of research programmes evaluating the role played by rivers on coastal ecosystems, particularly at places where this type of research has not yet been done;

14. should actively pursue studies on beach erosion and should publicise case studies and information aimed at decision makers and local communities to enable them to take informed decisions concerning development activities on and behind the beach belt. Where possible management measures based on natural dynamic ecosystems which tend to stabilise the coastal zone should be used;

15. should encourage the establishment of new programmes and/or linkages between on-going regional programmes in order to formulate new research approaches aimed at the study of similar ecosystems in different regions of the world. Two attractive ecosystems were identified: (a) the fjord ecosystems of southern Chile, New Zealand, and Canada, and (b) the Benguela and Humbolt currents.

REGIONAL

The **CONFERENCE**:

Noting that the beginning of the decade of the 1990's has seen a rapidly growing concern with global issues in coastal marine research and management; that explosive human population growth is having an increasing impact on coastal marine resources and that we face the possibility of increased rates in global climate change;

Considering these problems within the geographically small, but disproportionately important coastal zone, and that the COMAR regional programmes provide a unique opportunity to focus scientific research directed at sustainable use of limited resources;

Recognising that the COMAR regional programmes in Asia and the Pacific, Africa, Latin America and the Caribbean, the Mediterranean, Red Sea and Gulf, and Europe, all share the following important characteristics:

1. They are international and depend upon institutional networking.

2. They are dedicated to conservation, management, and sustainable use of critical coastal resources.

3. They involve education and training to improve the capacity of countries to use scientific information for sound management.

Recognising that the COMAR regional programmes have made significant progress;

Recommends to Unesco that:

1. The COMAR regional programmes be continued and strengthened;

2. Continuing efforts be made to encourage cooperation and coordination among research institutions within and between the regions;

3. New areas of emphasis are encouraged to be developed over the next decade, such as:

   (a) Workshops, training courses, and publications, and packaged scientific information in a form that is useful to coastal human populations, resource managers, and economists.

   (b) Regional programmes to develop standardised methods and data collection and analysis protocols and to acquire modern data management capabilities in order to facilitate intra- and inter-regional cooperation.

4. The COMAR regional programmes, concentrating research on coastal habitats, should provide critical data to the programmes in biological diversity now developing in the international scientific community. In addition, the regional coastal programmes should provide a scientific network to conduct systematic observations within global sub-regions in threshold ecosystem responses to global climate change;

5. The regional programmes of COMAR that have evolved mechanisms, knowledge and strategies that promote environmentally sound sustainable development in coastal areas, should be used both directly and as models for the follow-up of the United Nations Conference on Environment and Development (UNCED).

LOCAL

The **CONFERENCE**:

Recognising that many local problems in coastal development involve socio-economic issues for which the remedies are not purely scientific; that many coastal resources are exploited as a matter of necessity in developing economies; that for example, the use of coral rock for building destroys reefs which protect islands; that the removal of beach sand for concrete destroys beaches and exposes nearshore buildings to wave damage; that removal of mangroves for building wood, firewood and animal fodder, destroys the mangrove habitat and exposes coastlines to further destruction.

Recognising further that alternative industries such as the tourist industry, harbour construction, aquaculture and industrial development (e.g. airports), which replace natural habitats, are often financed for profit; that the original users of the natural systems are being displaced by a more affluent population; that various industrial processes, which give rise to coastal pollution are also for the benefit of business and may be generally detrimental to local inhabitants; that fisheries exploitation in many cases has been forced through economic considerations to reduce yield of particular species by over fishing; that this situation is perpetuated by raising the price of the product as the commercial species become less plentiful, and finally that ecological consequences of over fishing are seldom considered;

Noting that it has been proven that many of these problems are better dealt with if coastal inhabitants are given a greater role to play in the management of their own resources; that many local problems result from a conflict between large scale development overriding the natural protection, beauty, ecology and productivity of the coastal zone;

Noting also that some natural events may cause local damage to coastal ecosystems, such as for example, crown of thorns infestation of coral reefs; extreme low tides; cyclone and storm damage; earthquakes and tsunamis; natural erosion; sea grass wasting disease and coral bleaching;

Considering that renewed thinking is currently required by scientists involved in assessment of the environmental effects of exploitation of coastal zone resources and that in seeking to mitigate exploitation, effective remedial action will assume increasing importance in the next decade;

Recognising that good environmental management practices must be based on an understanding of the coastal environment, that effective management of the coastal zone during the next decade will involve considerable interdisciplinary collaboration and that scientists have rarely been involved in such activities to date;

Recommends:

1. that governments recognise the detrimental effects of such short-term exploitation and gains and plan for exploitation on a more sustainable basis within their National Development Plans;

2. that scientific research on the coastal environment be strengthened and targeted at outstanding problems in the understanding of the functioning of coastal systems;

3. that, through COMAR training workshops and research teams, site specific problems be addressed through a multidisciplinary approach which might involve participation of socio-economists, engineers, biologists, geologists, physicists, etc., depending on the problem. Among the many problems which may be considered, the following are a few specific examples:

   (a) conflicts of interest in natural resource exploitation for construction vs. tourism and fishing in many remote tropical islands (such as in the Indian Ocean, Pacific Ocean and Caribbean Sea).

   (b) aquaculture development vs. mangrove cutting (such as in Asia, the Americas and elsewhere).

   (c) engineering developments vs. habitat loss (e.g. harbour construction).

4. that in view of recent disasters in Asia caused by cyclones along unprotected coastlines, which had been formerly defended by extensive mangroves, governments take heed of advice and recommendations arising from the COMAR programmes regarding the importance of natural barriers, such as mangroves and coral reefs;

5. that at a local level governments recognise their responsibilities in sustainable development of the coastal zone; that greater use be made of the national media (through

television, newspapers, video material) to publicise the potential detrimental effects of pollution and piecemeal development and that local scientists be encouraged to communicate on these issues with the community at all levels, either through the mass-media or through special workshops.

UNESCO TECHNICAL PAPERS IN MARINE SCIENCE

Titles of numbers which are out of stock

No.		Year	SCOR WG
1	Incorporated with Nos. 4, 8 and 14 in No. 27	1965	WG 10
2	Report of the first meeting of the joint group of experts on photosynthetic radiant energy held at Moscow, 5-9 October 1964. Sponsored by UNESCO, SCOR and IAPO	1965	WG 15
3	Report on the intercalibration measurements in Copenhagen, 9-13 June 1965. Organized by ICES	1966	—
4	Incorporated with Nos. 1,8 and 14 in No. 27	1966	WG 10
5	Report of the second meeting of the joint group of experts on photosynthetic radiant energy held at Kauizawa, 15-19 August 1966 Sponsored by UNESCO, SCOR, IAPO	1966	WG 15
6	Report of a meeting of the joint group of experts on radiocarbon estimation of primary production held at Copenhagen, 24-26 October 1966. Sponsored by UNESCO, SCOR, ICES	1967	WG 20
7	Report of the second meeting of the Committee for the Check-List of the Fishes of the North Eastern Atlantic and on the Mediterranean, London, 20-22 April 1967	1968	—
8	Incorporated with Nos. 1, 4 and 14 in No. 27	1968	WG 10
9	Report on intercalibration measurements, Leningrad. 24-28 May 1966 and Copenhagen, September 1966; organized by ICES	1969	—
10	Guide to the Indian Ocean Biological Centre (IOBC), Cochin (India), by the UNESCO Curator 1967-1969 (Dr. J. Tranter)	1969	—
11	An intercomparison of some current meters, report on an experiment at WHOI Mooring Site "D", 16-24 July 1967 by the Working Group on Continuous Current Velocity Measurements. Sponsored by SCOR, LIAPSO and UNESCO	1969	WG 21
12	Check-List of the Fishes of the North-Eastern Atlantic and of the Mediterranean (report of the third meeting of the Committee, Hamburg, April 1969)	1969	—
13	Technical report of sea trials conducted by the working group on photosynthetic radiant energy, Gulf of California, May 1968, sponsored by SCOR, IAPSO, UNESCO	1969	WG 15
14	Incorporated with Nos. 1, 4 and 8 in No 27	1970	WG 10
15	Monitoring life in the ocean, sponsored by SCOR, ACMRR, UNESCO, IBP/PM	1973	WG 29
16	Sixth report of the joint panel on oceanographic tables and standards, Kiel, 24-26 January 1973, sponsored by UNESCO, ICES, SCOR, IAPSO	1974	WG 10
17	An intercomparison of some current meters, report on an experiment of Research Vessel Akademic Kurchatov, March-April 1970, by the Working Group on Current Velocity Measurements; sponsored by SCOR, IAPSO, UNESCO	1974	WG 21
18	A review of methods used for quantitative phytoplankton studies; sponsored by SCOR, UNESCO	1974	WG 33
19	Marine Science Teaching at the University Level. Report of the UNESCO Workshop on University Curricula-*Available in Spanish and Arabic*	1974	—
20	Ichthyoplankton Report of the CICAR Ichthyoplankton Workshop-*Also published in Spanish*	1975	—
21	An intercomparison of open sea tidal pressure sensors Report of SCOR Working Group 27: "Tides of the open sea"	1975	WG 27
22	European sub-regional co-operation in oceanography. Report of Working Group sponsored by the UNESCO Scientific Co-operation Bureau for Europe and the Division of Marine Sciences	1975	—
23	An intercomparison of some currents meters, III Report on an experiment carried out from the Research Vessel Atlantis II. August-September 1972, by the Working Group on Continuous Velocity Measurements sponsored by SCOR, IAPSO and UNESCO	1975	WG 21
24	Seventh report of the joint panel on oceanographic tables and standards, Grenoble, 2-5 September 1975; sponsored by UNESCO, ICES, SCOR, IAPSO	1976	WG 10
25	Marine science programme for the Red Sea Recommendations of the workshop held in Bremerhaven, FRG, 22-23 October 1974, sponsored by the Deutsche Forschungsgemeinschaft and UNESCO	1976	—
26	Marine science in the Gulf area-Report of a consultative meeting, Paris, 11-14 November 1975	1976	—
27	Collected reports of the joint panel on oceanographic tables and standards, 1964-1969	1976	WG 10
28	Eighth report of the joint panel on oceanographic tables and standards, Woods Hole, U.S.A., sponsored by UNESCO, ICES, SCOR, IAPSO	1978	WG 10
29	Committee for the preparation of CLOFETA Report of the first meeting, Paris, 16-18 January 1978	1979	—
30	Ninth report of the joint panel on oceanographic tables and standards, UNESCO, Paris, 11-13 September 1978	1979	—
32	Coastal lagoon research, present and future Report and guidelines of a seminar, Duke University Marine Laboratory, Beaufort, NC, U.S.A. August 1978 (UNESCO, IABO)	1981	—
37	Background papers and supporting data on the Practical Salinity Scale 1978	1981	WG 10
50	Progress on oceanographic tables and standards 1983-1986: Work and recommendations of the UNESCO SCOR/ICES/IAPSO Joint Panel	1987	—