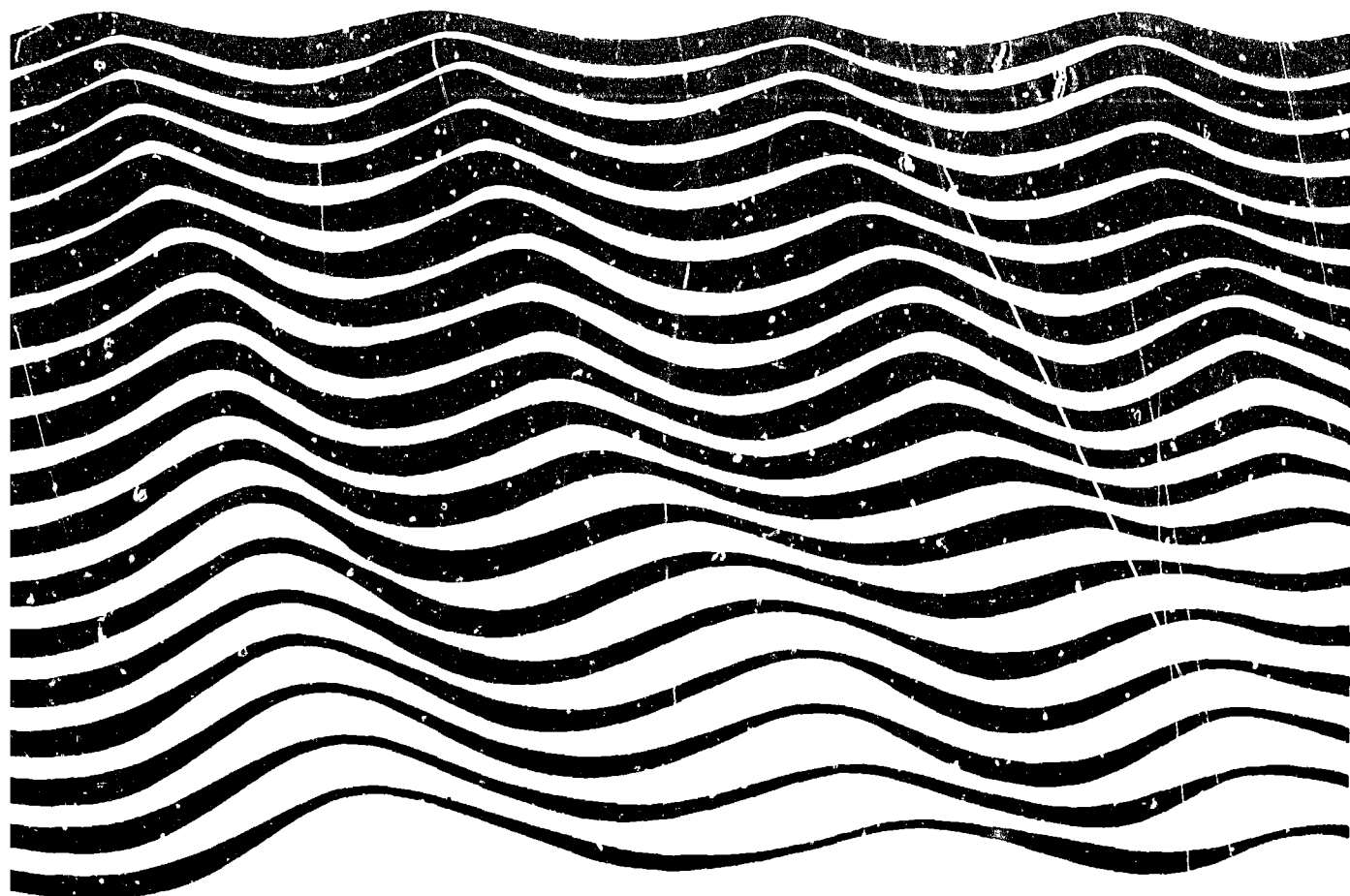


# Research on coastal marine systems Review and Recommendations for Unesco Programme 1987-1989

Report of the fourth meeting  
of the Unesco/SCOR/IABO  
consultative panel on  
coastal systems  
Dakar, 15-17 December 1986

27 JAN. 1988



Unesco 1987

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31 Coastal lagoon survey (1976-1978)	1980	—	43 International Symposium on Coastal lagoons Bordeaux, France, 8-14 September 1981 Available in F and S	1982	—
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	—	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	—
33 Coastal lagoon research, present and future Proceedings of a seminar, Duke University, August 1978 (Unesco, IABO)	1981	—	45 The International System of Units (SI) in Oceanography Report of IAPSO Working Group on Symbols, Units and Nomenclature in Physical Oceanography. (SUN)	1985	—
34 The carbon budget of the oceans Report of a meeting, Paris, 12-13 November 1979	1980	WG 62	46 Opportunities and problems in satellite measurements of the sea Report of SCOR Working Group 70	1986	—
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	—	47 Research on coastal marine systems Report of the third meeting of the Unesco/SCOR/IABO consultative panel on coastal systems October 1984	1986	—
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, F, R, S	1981	WG 10	48 Coastal off-shore ecosystems relationships Final Report of SCOR/IABO/ Unesco Working Group 65 Texel, Netherlands, September 1983	1986	—
(Примечание. Этот доклад (текст идентичен) был первоначально издан только на английском языке под заголовком Tenth report of the Joint Panel on Oceanographic Tables and Standards (Десятый доклад Объединенной группы по океанографическим таблицам и стандартам)). Имеется на арабском, испанском, китайском, русском и французском языках.			49 Pelagic biogeography Proceedings of an international conference The Netherlands 29 May-5 June 1985	1986	—
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	—
38 Background papers and supporting data on the International Equation of State of Seawater 1980.	1981	WG 10	51 Thermodynamics of the carbon dioxide system in seawater Report by the carbon dioxide subpanel on oceanographic tables and standards	1987	—
39 International Oceanographic Tables, Vol. 3	1981	WG 10			

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## PREFACE

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## ABSTRACT

This report contains a detailed analysis, both retrospective and prospective, of the Unesco Major Interregional Coastal Marine (COMAR) Project. The analysis was made by the Consultative Panel at its fourth session, held 15-17 December 1986 in Dakar, Senegal. The report cites achievements during the period 1985-1986 and reviews plans for the various COMAR components for the triennium 1987-1989. Activities under review include: (1) co-operation with ICSU and its various member bodies, such as SCOR, IABO and the new International Geosphere-Biosphere Programme (IGBP), on relevant scientific activities as well as on traditional knowledge and management of coastal systems; (2) regional programmes launched in Latin America and the Caribbean, Asia and the Pacific, the Mediterranean and Red Seas, and Europe; and (3) interregional activities, in particular the comparison of Atlantic and Pacific tropical ecosystems.

## RESUME

Ce rapport contient une analyse détaillée, à la fois rétrospective et prospective, du Projet interrégional majeur sur les écosystèmes côtiers (COMAR) de l'Unesco. Cette analyse a été faite par le Groupe consultatif lors de sa quatrième session tenue du 15 au 17 décembre 1986 à Dakar (Sénégal). Le rapport présente les réalisations accomplies au cours de la période 1985-1986 et récapitule les plans établis pour diverses composantes du COMAR pour la période 1987-1989. Les activités récapitulées sont les suivantes : (1) coopération avec le CIUS et les divers organismes et programmes qui en relèvent, tels que le SCOR, l'AIQB et le nouveau Programme international sur la géosphère et la biosphère (PIGB), en ce qui concerne des activités scientifiques pertinentes ainsi que les connaissances traditionnelles relatives aux systèmes côtiers et la gestion de ces derniers ; (2) programmes régionaux lancés en Amérique latine et dans les Caraïbes, en Asie et dans le Pacifique, dans la mer Méditerranée et dans la mer Rouge et en Europe, et (3) activités interrégionales, en particulier, comparaison des écosystèmes tropicaux de l'Atlantique et du Pacifique.

### RESUMEN

En este informe se expone un análisis detallado, retrospectivo y prospectivo, del Proyecto Principal Interregional de Investigación y Formación con miras a la Gestión Integrada de los Ecosistemas Costeros (COMAR). Este análisis es obra del Grupo Consultivo que lo efectuó en su cuarta reunión, celebrada del 15 al 17 de diciembre de 1986 en Dakar, Senegal. En el informe se mencionan los progresos realizados durante el periodo 1985-1986 y se examinan los planes relativos a los distintos componentes del COMAR para el trienio 1987-1989. Las actividades descritas abarcan: 1) la cooperación con el CIUC y sus distintos organismos miembros, tales como el SCOR, la AIOB y el nuevo Programa Internacional sobre la Geosfera y la Biosfera (IGBP), en las actividades científicas pertinentes así como con respecto a los conocimientos tradicionales y la gestión de los sistemas costeros; 2) los programas regionales iniciados en América Latina y el Caribe, en Asia, y el Pacífico, en los mares Mediterráneo y Rojo, y en Europa; y 3) las actividades interregionales, en especial la comparación de los ecosistemas tropicales del Atlántico y del Pacífico.

### АННОТАЦИЯ

В настоящем докладе содержится детальный ретроспективный и перспективный анализ Основного регионального проекта по исследованиям и подготовке кадров с целью комплексного управления прибрежными системами (КОМАР). Этот анализ был осуществлен Консультативной группой на ее четвертой сессии, состоявшейся 15-17 декабря 1986 г. в Дакаре, Сенегал. В докладе говорится о результатах, достигнутых в 1985-1986 гг., а также рассматриваются планы в отношении различных компонентов проекта КОМАР на трехлетний период 1987-1989 гг. Среди рассматриваемых мероприятий фигурируют следующие: (1) сотрудничество с МСНС и различными органами, являющимися его членами, включая СКОР, МАВО и новую международную программу геосфера-биосфера, в областях соответствующих научных мероприятий, традиционных исследований и управления прибрежными системами; (2) региональные программы, начатые в Латинской Америке и Карибском бассейне, в Азии и на Тихом океане. Средиземном и Красном морях, и в Европе; а также (3) межрегиональные мероприятия, в частности, сопоставление тропических экосистем Атлантического и Тихого океанов.

ملخص

يتضمن هذا التقرير تحليلاً مفصلاً لماضى ومستقبل مشروع اليونسكو الرئيسى المشترك بين المناطق والخاص بالنظم الساحلية البحرية ( كومار ) ، وهو التحليل الذى أجرته اللجنة الاستشارية فى دورتها الرابعة المعقودة فى الفترة ١٥-١٧ ديسمبر / كانون الأول ١٩٨٦ فى داکار ، السنغال . ويذكر التقرير المنجزات التى تتم تحقيقها فى الفترة ١٩٨٥ - ١٩٨٦ ، ويستعرض الخطط الخاصة بشتى عناصر كومار بالنسبة لفترة الثلاثة أعوام ١٩٨٧ - ١٩٨٩ . وتشمل الأنشطة محل البحث ما يلى :

(١) التعاون مع ايكسو ومختلف الهيئات الأعضاء فيه ، مثل سكور وايبسو والبرنامج الدولى الجديد الخاص بالغلاف الأرضى والمحيط الحيوى (IGBP) ، بشأن الأنشطة العلمية الملائمة وكذلك بشأن المعرفة والادارة التقليدية للنظم الساحلية ، (٢) والبرامج الاقليمية التى شرع فى تنفيذها فى أمريكا اللاتينية والكاريبى ، وآسيا والمحيط الهادى ، والبحر المتوسط والبحر الأحمر ، وأوروبا ، (٣) والأنشطة المشتركة بين المناطق ، ولاسيما المقارنة بين النظم الايكولوجية المدارية فى المحيطين الأطلسى والهادى .

## 摘 要

此项报告包括一篇有关教科文组织沿海海洋地区间重大项目（即沿海生态系统综合治理研究与培训地区间重大项目（COMAR））的兼有回顾与展望的详尽分析。这篇分析是协商小组1986年12月15-17日在塞内加尔达喀尔举行第四次会议时作出的。报告列举了1985-1986年期间所取得的成就，并审查了1987-1989三年度沿海海洋地区间重大项目（COMAR）各组成部分的计划。所审查的活动包括：(1) 与国际科学联合会理事会及其所属各团体如海洋研究科学委员会、国际生物海洋学协会、新的国际地理圈-生物圈计划（IGBP）等在有关科学活动以及对沿海生态系统的传统知识与管理方面所进行的合作；(2) 在拉丁美洲和加勒比地区、亚洲及太平洋地区、地中海及红海地区以及欧洲地区开展的地区性计划；(3) 地区间活动，特别是对大西洋与太平洋的热带生态系统所进行的比较研究。



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## **1. INTRODUCTION**

The Consultative Panel on Coastal Systems is co-sponsored by Unesco, the Scientific Committee for Oceanic Research (SCOR)\* and the International Association for Biological Oceanography (IABO). Its terms of reference are to:

- (1) review the present status and to advise on the conceptual planning in order to meet the objectives of the Unesco Major Interregional Project on Research and Training leading to the Integrated Management of Coastal Systems (COMAR);
- (2) review and advise on the scientific quality of the programme and recommend, if appropriate, actions to improve knowledge of the coastal systems;
- (3) review and recommend strategies for transferring scientific knowledge in view of an integrated management of the coastal systems; and
- (4) review and advise on the implementation of the various regional components of the Major Interregional Project COMAR.

This Panel held its Fourth Meeting at the Unesco Regional Office for Education in Africa (BRED), December 15-17, 1986.

The representative of Unesco welcomed the nine panel scientists present and thanked Prof. T. R. Parsons for attending as an observer. Prof. Parsons was engaged by Unesco as a consultant to carry out an evaluation of the COMAR project.

The representative of Unesco called for the elections of chairman and rapporteur. The election results were:

Chairman	:	H. Postma
Co-chairman	:	M. Vannucci
Rapporteur	:	J. Baker.

### **1.1 Provisional Agenda/Agenda**

The provisional agenda was modified by the addition of several items and is included here as Annex I.

### **1.2 List of documents**

The list of documents was noted. Additional papers were added at relevant points and the complete list of documents is included as Annex II.

### **1.3 List of publications**

The list of publications was noted and is included as Annex III.

### **1.4 List of participants**

The list of participants is included as Annex IV.

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\* A list of acronyms used in this Technical Paper is found on page 47

**1.5 COMAR: Achievements; past and future activities.**  
(Document 5.1 refers).

During the last two years COMAR has continued to develop along two main lines:

- a) The promotion of scientific knowledge, as well as the collection and analysis of traditional knowledge and experience on coastal systems and their resources, in co-operation with the international scientific community, i.e. ICSU, SCOR, IABO, etc.
- b) The development of regional COMAR components; essentially in Asia and the Pacific, Latin America and the Caribbean, Africa, the Arab States and Europe.

In contrast to the reduction of about 30% in the Unesco regular budget, extra-budgetary contributions have increased significantly. As at December 1986, the total budget can be summarized as:

	<u>Approximate figures</u>
- Unesco regular programmes	US\$ 300,000 (1986)
- Allocated (by UNDP and IDRC) to Asia and the Pacific	US\$ 3,250,000 (1983-1988)
- Allocated (by UNDP) to Africa	US\$ 1,000,000 (1987-1991)
- Allocated (by Japan and the USA's NSF) to Asia and Latin America and the Caribbean	<u>US\$ 100,000 (1984-1987)</u>
Total	US\$ 4,650,000
- Requested (to UNDP) for Asia and the Pacific	US\$ 1,900,000 (1989-1991)
- Requested (to UNDP) for Latin America and the Caribbean	<u>US\$ 4,000,000 (1987-1991)</u>
Total	US\$ 5,900,000
- Estimated : Caribbean	US\$ 5,000,000

**REMARK 1.**

The Italian Government has allocated 10 billion Lire for the study of the lagoon of Venice on the basis of an International Research project prepared by a joint Unesco/Italy Group of Experts; negotiations are being conducted with the Italian authorities about the modalities for implementing this research project.

**REMARK 2.**

Several countries in the different regions have funded national research projects on the coastal zone in association with a COMAR National Committee.

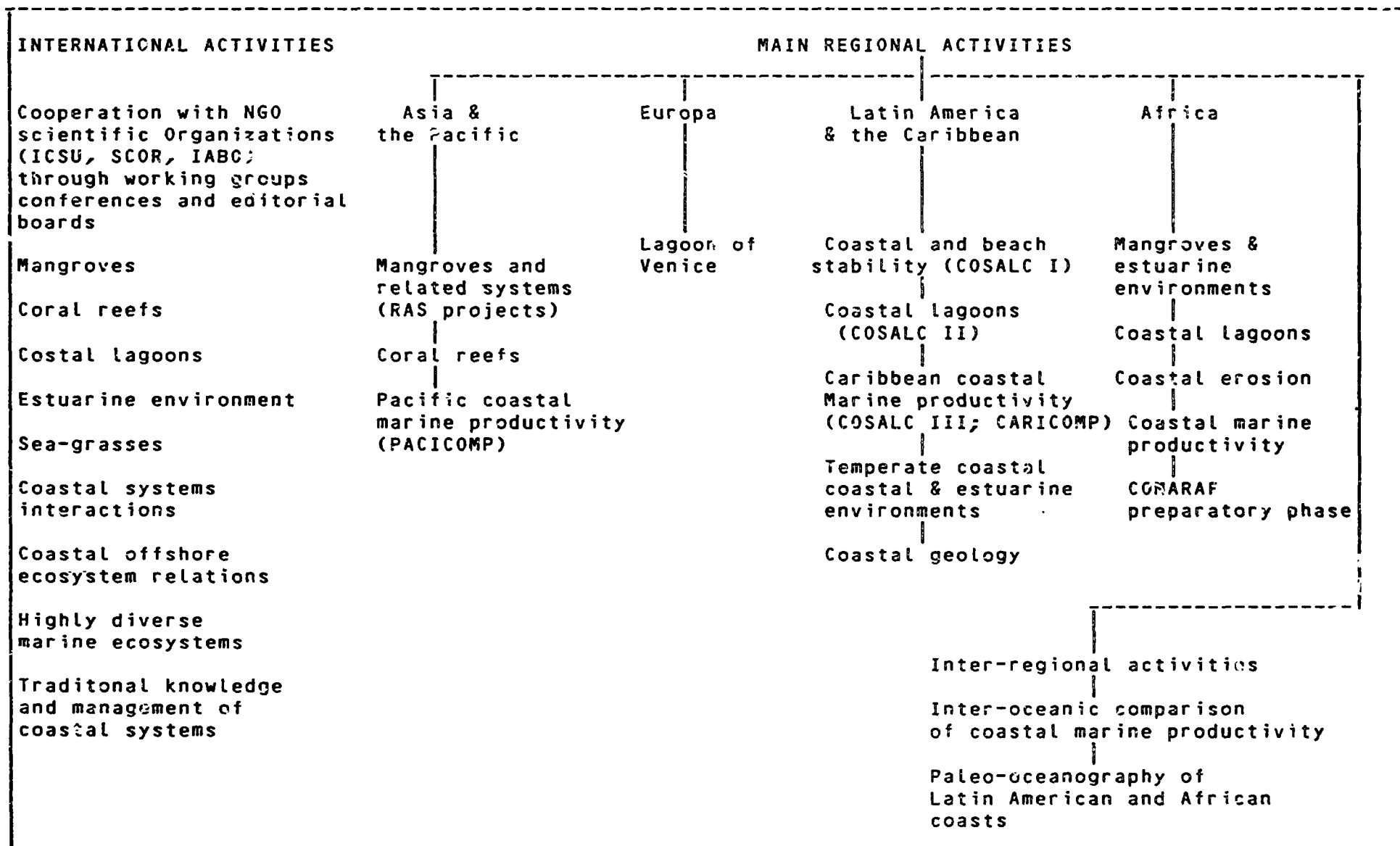
One example is Brazil which, in association with the Brazilian COMAR Committee, has allocated US\$ 840,000 to coastal zone towards research in the country over the period 1985-1986.

In certain regions like Asia and the Pacific, the Project significantly influences research orientations and co-ordination at institution level, public awareness, and government policies concerning the study and management of coastal systems, with particular reference to mangroves and coral reefs.

It should be noted that COMAR, for the great majority of its resources, is "topic-" and "action-"oriented, with only a light infrastructure consisting of the Consultative Panel, which meets every second year, plus the equivalent in annual staff time of one professional and one secretary at Unesco Headquarters (Paris).

# Summary of COMAR's principal international and regional activities

## COMAR



## 2. COMAR: CO-OPERATION WITH SCIENTIFIC NON- GOVERNMENTAL ORGANIZATIONS.

### 2.1 Co-operation with ICSU. (Document 6.3 refers).

The ICSU General assembly in Bern (September 1986) formally decided to create the International Geosphere-Biosphere Programme, (IGBP) and to establish a scientific committee to co-ordinate the programme. Among the reasons given to launch the programme were:

- a growing realization that biotic and non-biotic components of the biosphere are inextricably entwined;
- the fact that human impacts on the earth now approximate the scale of the natural, interactive processes that control the global life support system;
- the need to foster an appreciation for the limits of habitability of the earth; and
- contemporary advances in technology and science which make it possible to study the earth as an interactive system

#### The objectives are:

To understand and describe: the interactive physical, chemical and biological processes that regulate the total earth system, the unique environment that this system provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions.

The IGBP will focus on a restricted set of specific problems within a broad intellectual framework with essential inputs from a number of strong international programmes that are already underway.

Four ad hoc Working Groups had been appointed in October 1985 to consider related programmes, to provide inputs that would further define programme emphasis, and to suggest priority subjects for initial emphasis. The following are the reports and chairmen of these Working Groups:

- Terrestrial ecosystems and atmospheric interactions (F. di Castri),
- Marine ecosystems and atmospheric interactions (J. McCarthy),
- Geological processes, past and present (R. Price),
- Upper Atmosphere and Near Space Environment (J. Roedere), and
- COSPAR Working Group on Remote Sensing (I. Rasool),

These reports were used as resource material for the structuring of a general plan.

The plan outlined for the IGBP is intended to define its scope and relationship to other programmes; guidelines and criteria are provided for initial emphasis and outlines the principles of the Programme's organization. The directing of the IGBP will be provided mainly by an international Scientific Committee for the Geosphere - Biosphere - Programme (SCGB) of about 15 members. Specific scientific research plans for the IGBP will be developed by the Scientific Committee and the problem-oriented Scientific Working Groups that the Committee will appoint.

### Programme Elements of IGBP

The IGBP will require the collaboration of different disciplines in five major areas:

- (i) the conduct of specific process studies;
- (ii) the taking of relevant observations;
- (iii) the development of global models;
- (iv) the recovery of the environmental history of the past, and
- (v) the development of a global data and communication system.

Several types of process studies will be required, including:

- studies of interactive terrestrial process,
- studies of essential interactions in the marine euphotic zone, and
- studies of biogeochemical cycles involving interaction between many disciplines.

Other topics for emphasis include studies of species diversity, the variations and effects of significant inputs to the earth system from space (the "upper boundary condition"), the interactive effects of the land surface, soils, and the hydrology of the planet (the "lower boundary condition") and effects of large random perturbations to the system, through vulcanism and extraterrestrial impacts (the "stochastic boundary condition").

The domain of interest of the IGBP extends from chemical, physical and biological processes at the molecular level, through planetary-scale circulation in the global atmosphere and ocean, to solar and extraterrestrial changes which affect the earth as a whole.

Initially, the approach chosen is to organize programme efforts into multidisciplinary Terrestrial and Marine Sectors, \_ that will merge into a third, on-going and all-encompassing study directed at the overall Global system.

Included in the Marine Sector are transdisciplinary studies of marine ecosystems, particularly of the ocean euphotic zone, and related studies of ocean surface and sub-surface circulation and atmosphere-ocean actions.

Examples of related programmes include WOCE, GOFs, the Greenland Sea Project, TOGA, MIZEX, and other activities of SCOR and of CCCO. Examples of process studies include:

- . air-sea exchange processes,
- . ocean flux studies,
- . processes in the euphotic zone,
- . effects of surface processes on deep-sea chemistry,
- . studies of polar and sea ice, and
- . estuarine and coastal zone studies and land-sea interactions.

Studies within the Global System will aim at the development of comprehensive, global environment models. This will include studies of global processes, the taking of long time series measurements of the global environment and the recovery of environment records of the past.

One specific proposal detailed by the ad hoc Working Group on Marine Ecosystems and Atmospheric Interactions, concerns a study of the processes in the euphotic zone.

More directly related to COMAR was the discussion on the importance of studying the estuarine and coastal zones and land-sea interaction. No further action has been taken in this regard.

Through the co-ordinating mechanism existing with ICSU, Unesco (and its COMAR project) intends to follow closely and to participate in the planning and implementation stages of IGBP.

## **2.2 Co-operation with SCOR** (Documents 6.1, 6.1.1, 6.1.2 refer)

The chairman reported on the 18th General Meeting of SCOR which took place in Hobart, Tasmania, November 26-28, 1986. A number of Working Group studies are related to coastal systems.

### **2.2.1 River Inputs into Ocean Systems**

The final report of Working Group 46 will be finished in the near future and published by Unesco. A new Working Group, No 80, on phase transfer processes in estuarine trace metal cycling, continues to explore a more narrow aspect of river input. They are evaluating the state of knowledge of particle water reactions of key metals and metalloids under the range of conditions encountered in estuarine waters and sediments.

### **2.2.2 Coastal-offshore ecosystems relationships (with IABO)**

The interim report of Working Group No. 65 highlights some main points as follows:

It is generally understood that ecosystems are "open systems" (allowing the exchange of materials and energy with their surroundings). The full implications of this fact have been considered in the design of field experiments and interpretation of field data. However, it became clear during the SCOR Working Group Meetings that a major difficulty in conducting research in natural ecosystems is the definition of their boundaries. Scientists of different disciplines have different ways of defining the boundaries of a system.

One reason for forming the Working Group 65 was to synthesize information from many different adjoint coastal-offshore system pairs and see if there are any general principles that govern their relationships. What became clear from the various presentations is not the emergence of unifying general principles, but the appearance of uniqueness in each. This has important implications as the findings, generalizations, conclusions, and, in fact, management decisions about one ecosystem, (e.g. an estuary), may not be exactly true or applicable to another estuary.

A clear message arising from the Working Group results is the necessity of directly measuring the total fluxes of water, dissolved nutrients, and particulate living and non-living matter across the boundaries of any ecosystem under investigation.



Export was considered important locally but not believed to be significant on a global basis. It was considered that inshore areas could play an essential part in the maintenance of offshore populations by providing nursery grounds or feeding areas.

The Working Group produced their final report and organized a symposium on the subject in San Francisco (7-11 April 1986). A main conclusion was that mass balances of exchange between estuarine,

nearshore and offshore systems are still scarce; therefore comparisons with internal cycles are difficult. This holds for nutrients as well as for organic matter. The report will be published by Unesco and the symposium papers by Springer Verlag. No new Working Group on the subject was proposed.

**2.2.3 Working Group 73 on Ecological Theory in Relation to Biological Oceanography** (with IABO) held a final Meeting and a Workshop on "flow analysis" in December 1986. Negotiations continue with various publishing houses for the publication of the workshop proceedings.

**2.2.4 Working Group 78 - Determination of Photosynthesis Pigments in Seawater** held its First Meeting in March 1986. This Group is chiefly concerned with open ocean conditions but also discussed the specific difficulties of pigment analyses in often turbid coastal waters and of their application to the measurement of productivity.

**2.2.5 A IABO proposal for a new Working Group on experimental ecosystems** was accepted by SCOR. This Group will examine previous studies involving experimental ecosystems and make recommendations for more complete systems ("mesocosms") for estuarine, coastal and open-sea conditions.

**2.2.6 Co-operation between SCOR and SCOPE** will, in the near future, result in a programme on estuaries and deltas which will specifically be directed towards the study of the effects of an accelerated rise of sea level on these coastal systems. Such a rise would not only have geographical, but also ecological consequences.

**2.2.7** Finally, the chairman reported that SCOR has decided to organize the next Joint Oceanographic Assembly in Acapulco, Mexico, 23-31 August 1988. This assembly will be supported by Unesco and other bodies. The programme was not yet available, but the panel expressed the wish that appropriate attention be given to coastal oceanography.

**2.3 Co-operation with IABO.**  
(Document 6.2 refers)

**2.3.1 High Diversity Marine Ecosystems**

Document 6.2.1 refers to the request made by IOC. SCOR established the Working Group 67 on "Oceanography, marine ecology and living resources" (see SCOR Proceedings 1982, vol. 18, pp. 57-67). The Working Group had difficulty in deciding how useful the recruitment concept was for the understanding of stock variability in high diversity, multi-species fisheries (by recruitment is meant the replenishment each year of young fish or shellfish to the adult or the fished stock), and recommended that a Second Working Group be formed to evaluate the specific problems of high-diversity ecosystems.

In reply to the IOC Resolution XII.1, the Unesco Division of Marine Sciences requested IABO to organize such a Working Group. In response to this request, IABO organized an ad hoc Meeting of experts "to examine the special problem of recruitment in high diversity systems" (IABO Report, Roscoff, 6-9 September 1983). The Meeting concluded that the problem of recruitment was not appropriate at that time. Instead, in order to provide a basic understanding of the functioning of high diversity systems, it recommended a programme which

emphasized an experimental approach to the biological oceanography of these systems, with particular reference to those supporting multi-species fisheries. The Meeting addressed the important question of biological interactions and environmental variability and the role they play in determining the abundance of individual species in the community structure. As a follow-up, IABO established, in co-operation with Unesco, a Working Group to examine concepts of high diversity in marine ecosystems with the following terms of reference:

1. To examine spectra of species diversity as they change with different regimes of sampling and perturbations.
2. To review and to develop general concepts of biological diversity and variability in marine ecosystems and their links with: -
  - evolutionary genetics,
  - physiological mechanisms underlying nutrient cycling, and
  - global climate changes.
3. To review the role of special interactions such as symbiosis, commensalism and parasitism and the influence of toxic substances.

The Working Group may consider the following possibilities:

4. To investigate large-scale variability in high diversity marine systems by using satellite data to identify key processes that influence the distribution and abundance of nearshore biota.
5. To discuss the interest in, and feasibility of, an international programme of comparative field studies.

The First Meeting of the Working Group on "High Diversity Marine Ecosystems" took place in Syracuse, USA, in conjunction with the International Congress of Ecology (INTECOL, August 1986).

The Meeting was chaired by Prof. Lasserre and attended by Prof. Levinton, Prof. McIntyre, Prof. Parsons and Dr. Sanders. Prof. Margalef, who was a member of the ad hoc Group, attended and contributed to one of the sessions on 13 August. A detailed report of the Meeting is in preparation. A summary of the discussion is provided below.

The Working Group began by reviewing the background to its creation and examining its terms of reference. Acknowledging the value of focusing attention on high diversity ecosystems, the Group noted that it was the ecosystems that were important, rather than the property of diversity per se. However, it recognized that a clear definition of diversity was required as a prerequisite to further

studies. It therefore agreed, partly in the context of the first and second terms of reference, that the initial step must be to review what is generally understood by "diversity", and proceeded to do this.

The fifth term of reference was considered to be the most important, and it was felt that a significant part of the working group's effort should be devoted to the question of an international scientific programme which would highlight the relevance a basic understanding of high diversity ecosystems would have in relation to practical management problems such as those of fisheries and pollution. It was suggested that the next meeting of the Working Group should be largely devoted to the designing of a programme, of which a training element would be a useful component. At that time it would be appropriate to deal with the remaining terms of reference (numbers 3 and 4) which had so far been only briefly discussed. It would then be important to take full account of other relevant work (either completed, underway or planned), particularly some Unesco projects.

2.3.2 Seagrass: A manual of research methods.  
(Document 6.2.2 refers).

The manual was prepared by an editorial board composed of Dr. C.P. McRoy and Dr. R.C. Phillips under the scientific supervision of IABO.

The manuscript is being revised following the peer review comments, and manual will be published in 1988 or 1989 as the latest issue in the Unesco series of Monographs on Oceanographic Methodology.

2.3.3 Traditional knowledge and management of coastal systems.  
(Documents 6.2.3/6.2.6 refers).

The Working Group, which was established on the recommendation of an ad hoc Steering Committee (1983), met in Cotonou, Benin, in 1985.

The Working Group saw as its priority task an attempt to synthesis available literature.

Planned publications include: (a) proceedings of seminars (b) a popular book on traditional systems (c) a synthesis and a conceptualization of the literature, and (d) audio-visual material.

The Working Group will also attempt to establish relations with bodies such as FAO, IUCN, UNDP, etc.

A series of seminars were planned to promote the collection and consolidation of existing knowledge on the subject in the various regions. With the budget available, three seminars were planned.

The Asian seminar was held in Jakarta in December 1983 (proceedings published in 1985).

The West African seminar was held in Cotonou, Benin, in conjunction with the meeting of the Working Group mentioned above (proceedings in preparation).

The organization of a seminar for Latin America and the Caribbean is envisaged for 1987. Depending on the results of negotiations with institutions in Canada and in the USA, this seminar may also cover North America.

### 3. COMAR REGIONAL ACTIVITIES

#### 3.1 Asia and the Pacific

##### 3.1.1 Research and training on mangrove ecosystems. (Documents 7.1 to 7.1.10 refer).

During its phase I (1983-1986) the UNDP/Unesco project on mangrove ecosystems of Asia and the Pacific organized some twenty workshops, ten training courses, editorial and co-ordinating meetings and awarded about 30 research grants. Among the topics considered were: productivity, geology, sedimentation, erosion/accretion; ecophysiology of mangrove animal and plant species; life history of selected species; afforestation; microbial aspects of mangrove soil and waters; remote sensing applications; mangrove ecosystem dynamics; conversion of mangrove areas for paddy cultivation and aquaculture; human-induced stress; ichthyoplankton and mangrove ecosystem relations to nearshore waters. Eighteen workshop and training course reports, as well as a manual on research methods concerning productivity of the mangrove have been published. Three other manuals are being prepared on hydrodynamics, microbiology and palynology. A major publication entitled "Mangroves of Asia and the Pacific: status and use" and concluding phase I was presented at the Regional Symposium on New Perspectives in Research and Management of Mangrove Ecosystems, November 1986, Colombo, Sri Lanka.

Various countries have engaged in the following activities:

- . afforestation (India, Pakistan, Thailand, Fiji),
- . issue of postage stamps on mangrove conservation (Sri Lanka),
- . and study and conservation of mangroves at secondary schools (Sri Lanka).

In line with the recommendations made by the evaluation mission (Prof. F. Blasco, of France, and Prof. C. Field, of Australia) in 1985 and following the decision taken by the participating countries, a major multidisciplinary research programme will be carried out in the Ranong area on the west coast of Thailand adjoining the Adaman Sea.

Some of the important questions to be addressed as part of the research programme during 1987-1988 include:

- the role of physical, chemical and microbiological activity factors in the productivity of the ecosystem,
- pathways of energy transfer through the ecosystems,
- the role of mangrove primary production as an energy source,
- the degree of dependance of the fauna on the mangrove environment, and
- the physical role of mangroves in influencing the environment.

It is envisaged that during the last three years (1989-1991) of phase II, the project will expand and focus more on the interactions of the mangrove with other systems, such as seagrasses, coral reefs, estuarine benthic and neritic environments, etc,

In co-operation with the International Development Research Centre (IDRC), Canada, a Regional Mangrove Information Network (REMIN) has been formally established. BAKAWAN (published in the Philippines by the National Mangrove Committee) is the official newsletter of the project.

UNDP budget allocated to phase I (1983-1986): US\$ 1,839,068 "  
" " the first two years (1987-1988) of phase II: US\$ 1,000,000 IDRC  
budget allocated to REMIN: US\$ 250,000 Requested of UNDP for the last  
three years (1989-1991) of phase II: US\$ 1,989,400.

The research programme will comprise three main interrelated components:

(A) HYDROGRAPHY, OCEANOGRAPHY AND CLIMATOLOGY

(i) Coastal-regional investigations. The study will be of the Kra Buri River Delta, in particular:-

- monthly water discharge rates,
- monthly sediment input rates, -
- geology, geomorphology (and mapping),
- construction of a tidal chart,
- remote sensing.

(ii) Hydrography of Ngao Canal:

- water circulation,
- dispersion characteristics,
- stratification, and
- residence times and material fluxes.

(iii) Modelling of circulation/dispersion of the mangrove systems.

(B) EDAPHIC FACTORS IN RELATION TO MANGROVE ECOLOGY AND PRODUCTIVITY

This programme will investigate the manner in which soil character varies according to topography, locations and disturbance, and how the varying soil character influences microbial infauna and plant species distribution.

(C) FISHERIES AND FAUNAL STUDIES

The objective of this programme is to undertake a comprehensive and quantitative study of the associated fauna of a mangrove system in South-East Asia.

Mangrove waterways are of both immense and traditional importance for fisheries including shellfish, oysters, and crabs. There have been very few quantitative studies on this aspect. The main groups to be studied include:

- shrimps,
- fish,
- invertebrated fauna,
- zooplankton, ichthyoplankton, and
- meiofauna.

3.1.2 Research and training on coral reefs..  
(Document 7.3 refers).

Three workshops, training courses (86 participants) and a conference (35 participants) were organized or co-sponsored during the last two years. Additionally, under Unesco patronage, 13 participants (funded by COMAR) and 7 participants (funded by IGC) attended the Fifth International Coral Reef Congress (May/June 1985).

- (i) Unesco (COMAR)/UNEP Workshop and Training Course on coral taxonomy (10-25 February 1984, Phuket, Thailand, with the support of DANIDA/Denmark).

A total of 18 scientists from 10 countries participated in the workshop. Recommendations made during the course include the following:

- to update the checklist of Scleractinian corals indicating "stable" and "unstable" species names for each country of the region, and update the coral reference collections to include ecomorphs as well as corals of the entire Asia-Pacific region.
- to exchange research publications and other information on coral taxonomy, and use the existing communication facilities in the region such as:
  - . the Coral Reef Newsletter published by the Pacific Science Association's Scientific Committee on Coral Reefs and the Marine Laboratory, University of Guam;
  - . the University of Guam Marine Laboratory which has agreed to act as a depository for coral reef literature of the Asia-Pacific region and supply copies at cost to scientists in the region;
  - . the Australian Institute of Marine Science (AIMS), Queensland, Australia which keeps a computer record of species distribution of corals.

- (ii) Unesco (COMAR) Workshop with Advanced Training on Human-Induced Damage to Coral Reefs (1-22 May 1985, Japara and Pulau Seribu, Indonesia). See Unesco reports in marine sciences No. 40, 1987.

The preparation for this workshop included a preliminary survey of the Jakarta Bay-Pulau Seribu area by the Indonesian Institute of Oceanography (LON) and Unesco. A total of 30 scientists from 12 countries in the Asian and the Pacific region participated in the field workshop together with 5 experts from Australia, Indonesia, the Netherlands, New Zealand and the United Kingdom.

The workshop gathered approximately 550 man-days of data concerning coral reef structure in the Pulau Seribu region. This information will be used to establish a comprehensive coral reef data base for future reference.

The workshop recommended that the Government of Indonesia proceed with plans to develop a marine park in the Northern Pulau Seribu area and that, in particular, the exceptional state of Belanda Island warrants consideration for inclusion in a protected zone.

(iii) Regional Seminar on Coral Reef Ecosystems: Their Management Practices and Corresponding Research/Training Needs, Ciloto, Indonesia, 4-7 March 1986 (report in preparation).

The regional seminar on coral reef ecosystems was convened in the Lembah Hijau Hotel, Ciloto, West Java, 4-7 March 1986.

The seminar was the second in the series "Man's Impact on Coastal and Estuarine Ecosystems (MICE)" supported by a "funds-in-trust" contribution from the Japanese Government as well as by the COMAR Project and MAB (Man and the Biosphere) Programme of the Unesco Divisions of Marine Sciences and Ecological Sciences respectively.

The activity was attended by participants from 9 countries including Australia (1), Indonesia (26), Japan (4), Malaysia (2), New Zealand (1), Philippines (1), Papua New Guinea (1), Republic of Korea (1), Thailand (2), plus members of Unesco's staff who deal with COMAR and MAB activities.

Problems of coral reef management discussed during the seminar included: man-induced stresses; regulations and enforcement; and socio-economic conditions. Special emphasis was put on man-induced stresses.

Among other things, the Meeting made the following recommendations:

(a) Coral Reef Data Base

Researchers should acquire copies of the Pulau Seribu data, concerning coral reef structure and environmental factors, from Unesco/ROSTSEA and conduct specific analyses using the information so far recorded.

- . The Palau Seribu data base should be used as the basis for expanding documented information relating to coral reefs. Data sets, constructed in the same or expanded format, should be produced for other areas in Southeast Asia and the Pacific.
- . A small regional Meeting should be convened to discuss the applicability of the data base format, its use and improvement.

(b) Workshop and Training

- . A regional workshop/training course on coral reef management should be convened at the University of Ryukyus in September-October 1987.
- . A regional workshop/training course on coastal management, including vegetation and rehabilitation of tropical eroded coastal areas, should be held in Zhing Jao, South China in 1989.

- . A regional workshop/training course on coastal zone management and environmental cost-benefit analysis should be conducted, perhaps in Riau Province, Indonesia.

- . A training course on microcomputer-based methods of analysis for environmental data should be implemented.

(iv) The Second Unesco/UNEP Workshop with Advanced Training on Coral Taxonomy and Environmental Variation (12-22 May 1986, Bolinao, Pangasinan, the Philippines) (report in preparation).

A total of 23 participants attended from: American Samoa (1), Fiji (2), French Polynesia (1), India (1), Indonesia (2), Kenya (1), Malaysia (3), Mozambique (1), China (1), Philippines (4), Sri Lanka (1), Thailand (3), and Vietnam (1). One representative from each of: SPC (South Pacific Commission), Unesco and UNEP also attended as well as 9 observers from the Philippines.

As with the previous coral taxonomy training course held in Phuket, Thailand, two resource people, Dr. C. Vernon and Dr. C. Wallace participated in the course.

Participants were exposed to theory and given a good foundation in recognized procedures used for reporting observations in the scientific literature. The course involved an intensive programme of SCUBA diving which was used to expose participants to the appearance of different corals under varying environmental conditions and to develop their field recognition techniques.

The combined effect of the training course at the Phuket Marine Biological Centre, Thailand, (10-26 February 1984) together with this one at Bolinao will, it is anticipated, provide sufficient coral taxonomy expertise in the region of Southeast Asia to enable field workers to more accurately assess the effects of different policy options that may be introduced.

(v) Unesco/UNEP Workshop with Advanced Training on Methods of Visual Census of Coral Reef Fishes (22-25 May 1986, Pangasinan, the Philippines), (report in preparation).

The advanced training course was organized as a "follow-on" activity to the coral taxonomy workshop and training course (above). Several participants stayed on to gain experience in taking census of fish population.

Attending the course were a total of 10 participants from: Fiji (1), Indonesia (2), Malaysia (1), Philippines (4), Thailand (1), Sri Lanka (1), as well as 7 observers from: American Samoa (1), French Polynesia (1), Kenya (1), South Pacific Commission (1), and the Philippines (3). The training activities were directed by one resource person from Australia, Dr. Gary Russ (Australian Institute of Marine Science) together with a Unesco programme specialist in Marine Sciences.

Among recommendations made by participants were the following:

- . a further training course of longer duration should be held on coral reef fish census.



- . a location be chosen with accessible populations of commercial "target" species, and
- . the amount of time to be spent on data analysis using microcomputers should be equivalent to that allocated to data acquisitions in the field.

The activity gathered several data sets relating to fish population density. The results were recorded in Data-Base II files using software developed by the Australian Institute of Marine Science. It is anticipated that this information will constitute an actively used part of the marine science data base being developed in Southeast Asia and the Pacific.

(vi) Fifth International Coral Reef Congress (27 May to 1 June 1985, Tahiti).

Unesco granted patronage to the above Congress and, under the COMAR project, funded the attendance of 13 scientists from countries in Africa, Asia and the Pacific, Europe and Latin America for the purpose of developing their expertise in coral reef studies. In addition, 7 scientists were sponsored by the International Geological Correlation Programme.

Unesco organized two meetings at the congress. These were:

- Unesco Workshop on coral reef network activities. The Meeting recommended the formation of a Regional Coral Reef Research Information Service which would be co-ordinated by Unesco (ROSTSEA) and patterned after the AMRIP (Australian Marine Research in Progress) service.
- Unesco/UNEP Planning Meeting for reviewing further coral taxonomy training and assessment training in other reef-related organisms.

The Meeting recommended a further training course in hard coral taxonomy. In addition, it was agreed that training in taxonomy and assessment procedures should proceed, where possible, for such important groups as reef fish, soft corals, gorgonians, gastropods and echinoderms.

(vii) The potential of determining past records of coastal events from coral cores. (Document 7.4 refers).

The development of a new underwater drilling apparatus at the Australian Institute of Marine Science has enabled the acquisition of long (>6.0 metres) solid cores. These were extracted from the enormous living colonies of the massive coral *Porites* in the Great Barrier Reef Province. These fine-grained corals may live to be a thousand years old, and a densitometric analysis of the cores by a new X-radiographic method enables events in the life of each colony to be dated with great accuracy (to about a ten-day resolution).

The air-powered underwater drilling apparatus is anchored to the giant colonies and 100 mm cores of up to 10 metres in length are extracted. This diver-operated system, designed and built at the Institute is unique, simple and fast.

Superimposed on a seasonal density cycle are interannual changes in density. The most recent changes in density in Great Barrier Reef corals correlate well with Darwin atmospheric pressure movements, which are regarded as an index to the Southern Oscillation. The corals thus contain analogues of ENSO events for many centuries.

Several long cores (50 mm diam) have been retrieved from very large living colonies of Porites at Pandora Reef. The first of these, about 1800 mm in length, has been X-rayed and analysed. It shows clearly the effect of long term climatic cycles, (such as the Southern or Walker Oscillation of the Western Pacific), on skeletal density patterns. This core records seasonal, annual and supra-annual cycles in calcification rates for the period back to 1866. A manuscript on the topic is being prepared. This core was the first of many to be taken and at present more than 120 long coral cores have been obtained from many locations between the Swain Reefs and Darwin. These cores each contain several hundred years of environmental record, and are presently being prepared for analysis.

Long (>6.0m) cores, taken from massive Porites corals growing in inshore areas on the Great Barrier Reef, contain bands which exhibit bright yellow-green fluorescence when irradiated with long wave (360 nm) ultraviolet light. The bands occur in the high density part of the skeleton which is deposited in the summer or monsoon season. They occur almost every year, and vary in intensity from very bright to dull. All other parts of the coral show a dull blue fluorescence under the same ultraviolet light.

The yellow-green bands are only found in corals growing in the inshore regions of the Great Barrier Reef Province. Cores taken from colonies growing more than about 30 nautical miles from shore exhibit only the blue background fluorescence. Analysis of the yellow-green bands shows that they are highly correlated in intensity and timing with adjacent river runoff. Corals from inner shelf regions have only a few, widely separated fluorescent bands, and these record the seaward extension of river plumes from major flood events.

The chemical compounds, which are introduced into the marine environment and uptaken by the corals during skeletogenesis, are ubiquitous organic compounds derived from decaying plant matter. They are absorbed onto the aragonite crystals in the skeleton, and therefore have an extremely long life-span. These factors, and the wide distribution of these huge Porites colonies throughout the tropical oceans, mean that an enormous repository of climatic and hydrologic history stretching back for centuries, is available to most Indo-Pacific countries.

The discovery in December 1983 of very bright yellow-green bands in cores from Pandora and Magnetic Island corals led to the correlation between these and the runoff figures for the Burdekin River. The squared correlation co-efficient for fluorescence intensity (measured with a "lashed-up" instrument) and runoff is 0.80. Since the timing of the fluor bands is based on the scanning position of the light collector relative to the density bands in the coral, it is necessary for these to be measured in conjunction. An instrument has been designed to measure both density and fluorescence simultaneously. Initial tests of the instruments fluoro-analytical ability have given a 20-day interval record of Burdekin River runoff back to 1860.

Long cores have now been obtained and the fluorescent benching is again obvious.

AIMS is investigating the use of stable isotope thermometry in corals, with a view to collaborating with someone on reconstructing monthly sea surface temperatures for the past 500-1000 years at various locations useful to the TOGA programme. The use of stable isotope thermometry to measure historical monthly sea surface temperatures is not a current practice. There are several Australian laboratories with high-resolution mass spectrometry capabilities who are interested in testing some methods. The project would be labour-intensive and time-consuming, but, if successful, of inestimable value to oceanography and climatology. Some core samples will be provided to the CSIRO Division of Atmospheric Research, Aspendale, as part of an attempt to establish the validity of the technique.

The red bands evident in the outer reef cores remain a mystery. Correlations with historical records of atmospheric/geological events would indicate likely causality. Work will commence on their origin when the instrument referred to above is completed. It is anticipated that a pilot investigation will be possible using the Analytical Services Division of the Institute.

The multi-annual yellow-orange fluorescent bands, evident in the most recent years of the Myrmidon cores, will be studied to determine whether they are linked to upwelling events.

• It is the interannual variability of the proxy record in corals that provides the really useful information.

The cycles, trends, reversals and reinforcements in the various recordings may provide the statistical bases for future planning of a great deal of human activity in the Indo-Pacific region.

#### 3.1.3 Pacific Coastal Productivity (PACICOMP). (Document 7.2 refers).

The attention devoted in the Caribbean since 1982 to three ecosystems - coral reefs, seagrasses and mangroves - and to their interactions, has led to the establishing of the CARICOMP project there. (section 11.2 below). This project has raised similar interest in the Pacific and has led to a proposal to examine the similarities and differences of conditions influencing coastal marine systems productivity (see document 11.1.2). This proposal was discussed at a workshop on "comparison of Atlantic and Pacific Tropical Coastal Ecosystems", in March 1986, Suva, Fiji. (see 4.1).

Besides considering the subject at the interregional level, the workshop recommended that a project be examined for the Pacific with its own specificity. This project was submitted to the consideration of the Panel as the Working Document 7.2.

#### 3.1.4 Coastal systems: Research, training and management

- (1) First Unesco/Japan Regional Seminar: Man's Impact on Coastal Ecosystems (MICE I), (13-16 November 1984, Tokyo, Japan).

This was the first of a series of seminars supported by Japan through the Unesco COMAR and MAB Programmes. Papers were presented in the following areas: inventory of coastal and estuarine ecosystems; problems of mangrove ecosystems, management of coastal systems, ecological and socio-economic aspects of coastal zone management.

An administrative meeting followed the conclusion of the seminar and resolved that multilateral, interdisciplinary, co-operative scientific research, information exchange, training and sustainable management projects on coastal ecosystems be designed within the framework of COMAR and MAB. It was indicated that particular emphasis should be placed on coral reef ecosystems and also brackish water ecosystems. Projects for ecosystems in selected countries of the region should be implemented utilizing available local expertise.

(ii) National Workshop on Development of the Coastal Zone. (8-11 April 1985, Jakarta, Indonesia)

The workshop covered a wide range of topics including resources assessment and problems associated with design of equitable multiple use strategies for coastal development.

Recommendations referred to the following needs:

- to restore positive cultural orientation towards the ocean;
- to establish a law governing the administration and utilization of ocean and coastal resources;
- to set up monitoring stations in regions considered sensitive along the coastal line and designate private institutions to be involved in such monitoring.

It was considered that private institutions could have an important role in supplying inputs for the development, utilization and management of coastal resources, particularly in matters relating to environmental conservation.

(iii) In-service Training Programme in Coastal Development Planning and Management (1 April - 31 May 1985, Bangkok, Thailand).

This course organized by the Thailand Institute of Scientific and Technological Research (TISTR) was jointly sponsored by COMAR/MAB, US-AID, the British Council and the Asian Foundation. As a product of the course COMAR/MAB funded the preparation and printing of a "Manual of Coastal Development Planning and Management, for Thailand", for use by government agencies and university departments (see document 7.3.1).

(iv) Unesco/COMAR workshop on the Application of Digital Remote Sensing Techniques in Coastal Studies, Australian Institute of Marine Science (AIMS), Townsville, Australia, 19-26 August 1985. (See Unesco reports in marine sciences No. 42, 1987).

This course was originally planned as part of the "Unesco-COMAR Coral Reef and Coastal Analysis Programme", however, the subject matter was viewed by the Australian authorities as being of such importance that a joint programme was supported by Unesco and Australia as part of an activity currently concerned with upgrading coastal resource analysis and assessment techniques in Southeast Asia.

A total of 15 participants attended the course together with 14 speakers. Participants came from New Zealand (1), Papua New Guinea (3), Republic of Korea (1), Indonesia (3), Thailand (2), Singapore (1), Philippines (2) and Malaysia. The speakers were from Australia (13) and Philippines (1).

The following topics were covered: history of remote sensing and coral reef surveys; review of remote sensing data sources in Australia and Southeast Asia; the physical basis of remote sensing; data integration and project specifications; introduction to "Micro BRIAN" (Barrier Reef Image Analysis System); field trip to John Brewer Reef.

Laboratory analysis focused on five different enhanced image plotter print-outs of John Brewer reef (a reef 70 kms from Townsville in the great Barrier Reef complex).

In handling image processing procedures, using "Micro BRIAN", the set of analytical routines were written in FORTRAN and configured to run on an IBM 8088 microcomputer. Participants were presented with relevant statistical summaries (co-occurrence matrices etc.) and required to manage the resulting classes as they saw fit.

(v) A tertiary-level course in coastal zone management (Australia). (Document 7.5 refers).

The College Council at the Northern Rivers College of Advanced Education, at Lismore, accepted the recommendation to develop a course on Coastal Zone Management. The rationale for the course was the need to prepare graduates for professional positions with organisations involved in management of the resources of the Australian coastal zone by providing a theoretical framework as well as practical experience in a range of relevant disciplines. A broad interdisciplinary approach was seen to be necessary, in which the individual disciplines would be integrated wherever practicable, and an appreciation of the interrelationship of factors affecting the coastal zone would be fostered. By integrating course activities with management projects in the local region of Lismore, it aims at promoting a positive attitude to the importance of applying scientific principles and skills to the management of coastal resources, both among graduates of the course and in the local community.

For the purposes of the course, the coastal zone was given the broadest possible definition, viz. "the land/ sea interface extending from the upper limits of catchment areas of coastal rivers to the seaward limits of terrestrial influences".

Table 1 gives the qualifying course units.

Table 2 shows the different skill development schemes.

### **3.2 Latin America and the Caribbean.** (Document 8.1 refers).

The COMAR component for Latin America and the Caribbean is entitled "Regional Project for Research and Training on Coastal Systems of Latin America and the Caribbean and their relations with the Continental Shelf (COSALC)".

Four of the seven pilot projects of COSALC are being implemented, COSALC I, II, III and VII.

3.2.1 COSALC-I - Pilot project on coastal and beach stability.  
(Documents 8.3.1, 8.3.2, 8.3.3 refer).

This pilot project has concentrated until now on six countries of the smaller Antilles: Antigua, Dominica, Grenada, St. Kitts, St. Lucia and St. Vincent.

It developed into the following three phases:

PHASE I. An overview of coastal zone management in six East Caribbean islands, April 1985.

The brief survey of coastal management policies and problems in these six islands has shown that there are certain problems common to all the islands. However, individual islands have different ways of approaching these problems, and it is believed that the exchange of ideas and techniques might lead to some new approaches.

The three main problems common to all the islands are the mining of beach sand (and, in some cases, aggregate also); the need for proper coastal development policies including setback provisions, sewage treatment etc.; and finally the need to have one ministry or department with overall responsibility for the coastal zone.

The mining of sand and/or aggregate has been previously identified as a coastal problem in the islands of the East Caribbean. In all the islands sand mining is controlled by legislation, however, in many cases it is the Ministry of Public Works who has to implement this legislation and all too often the sand mining laws are not respected. In addition, monitoring and implementation of the law are always problems and, in some cases, this is carried out by the local village councils. Obviously beach sand mining should be stopped, but unless an alternative can be offered at a reasonable cost, this is not practicable. Nevertheless, viable alternatives for beach sand should be actively sought.

The second major problem concerns coastal development. This has to be well planned, incorporating knowledge of possible coastal changes. A coastline is not a static feature. In some islands there is no coastal setback policy, in other islands the setback is not sufficient for the extent of coastal changes. Natural erosion trends, in addition to man-caused erosion, demand the implementation of setback policies which will both conserve the coastal zone and remain in harmony with the developments. A setback policy of 100 m on lowland coasts is recommended. Changes in the beach zone are closely linked to changes in the offshore zone. Other aspects of development, especially waste disposal, have to be carefully monitored and controlled.

Concerning the third and perhaps the most important problem, it is felt that one ministry or department should have overall responsibility for the coastal zone. The actual ministry in charge varies from island to island, but unless one body has responsibility for the coastal zone, it is impossible to successfully implement a coastal policy. In most islands it is easy to distinguish which particular ministry should have this responsibility.

PHASE II - Seminars on coastal management (six seminars held in August 1985 on six East Caribbean Islands).

The second phase consisted in a series of awareness seminars in the six island countries already mentioned in Phase I, above.

Response to the seminar was very good in all six islands. Education about coastal management was perceived as an important requirement in all the islands.

Several recommendations were made and some action has followed:

- (1) Audio-visual material should be prepared for each island comprising a selection of slides, a tape recording of the slide presentation and a typescript of the presentation. Each presentation should be specially designed for a particular island and should consist of slides and examples related to the island.

This material has been assembled by a consultant, Dr. G. Cambers and is now with Unesco for reproduction and distribution to the six islands. It consists of about 50 slides for each island (total of 300 slides).

- (2) The film "The Beach, a River of Sand", published by the Encyclopedia Britannica, has been provided by Unesco to each of the six island countries.
- (3) Assistance should be given to each island to set up coastal monitoring programmes, to include, but not necessarily to be limited to, beach profiles, waves measurements, and current studies.
- (4) Further training, up to at least the M.Sc. level, should be required of selected individuals. To this end tuition scholarships have been offered at the Western Washington University.
- (5) A minimum of two tide gauges should be installed off each island.

PHASE III - Training of specialists

The main difficulty in this respect is to locate suitable candidates from the islands to undertake such training.

This year Unesco has provided for a student to be trained at the Barbados Coastal Conservation Project. It is envisaged that at least one scholarship could be awarded in 1987 to benefit from the offer made by the Western Washington University.

3.2.2 COSALC II - Pilot project on coastal lagoons of Latin America.  
(Documents 8.4, 8.4.1, 8.4.2, 8.4.3, 8.4.4 refer).

Three countries so far are participating in this activity: Brazil (Lagoa dos Patos), Mexico (Laguna de Terminos) and Venezuela (Lagunas de Tacarigua, Unare and Piritu).

The objectives of this project are essentially to establish co-operative relationships between relevant laboratories of the participating countries for:

- the exchange of information on their respective knowledge and on-going research programmes on the subject;
- the definition of specific fields and research topics for which joint programmes of research and training and the exchange of competences will be beneficial for all participating bodies; and
- the comparison of various types of lagoons at different latitudes.

In line with the recommendations of the planning meeting in Mexico, June 1984:

- a bibliography on the subject, as provided by the participating countries, was reproduced by Unesco and distributed to each country;
- training on coastal geology was organized in Porto Alegre, Brazil, in May 1986. It is hoped that in the near future there will be co-operation in an advanced training (M.Sc.) in geology at the Centro do Estudos Costeiros (CECO) Porto Alegre, Brazil,
- a sub-regional workshop on environmental processes in coastal lagoons was scheduled to be held in Mexico, in November 1986, but was cancelled.
- a sub-regional workshop on biological processes (Venezuela, June 1985) was attended by 70 scientists; the following objectives were established:
  - . to identify those biological processes in coastal lagoons that could be investigated by local workers;
  - . to emphasize appropriate and standardized methodologies; and
  - . to seek ways to develop increased efficiency of the proposed research.

The 70 participants were divided into 7 Working Groups. Each Group identified their respective objectives and defined the methodologies to be used.

The seven proposed Working Groups are on the following subjects:

- (1) organic material,
- (2) microbiology,
- (3) plankton,
- (4) fish ecology,
- (5) benthic ecology,
- (6) production, degradation and transport of organic material derived from mangroves, and
- (7) contamination of the waters of the lagoons.



As soon as funds become available, the groups will pursue their work.

The following specific recommendations arose:

- . that a programme of exchange of research workers be established between Mexico, Venezuela and Brazil;
- . that COMAR/COSALC pilot project on coastal lagoons should include Cananeia (state of Sao Paulo) as a research area;
- . that a practical manual for microbiology be produced for coastal lagoons;
- . to organize a workshop on new methodologies of analysis using continuous flow technology;
- . to consider the shortage of hard currency in Venezuela and other countries in the region for subscription to specialized publications;
- . that equipment required to study these lagoons such be shared between the three countries.

It was observed that an application to IDRC, Canada, for continuous flow equipment may be successful.

It was also considered that an approach should be made at the national level to UNDP for support for subscriptions to publications.

3.2.3 COSALC III - Pilot project: "Caribbean Coastal Productivity (CARICOMP). (Documents 8.2, 8.2.1 refers).

CARICOMP began with a workshop in 1982 held at the West Indies Laboratory (WIL) in St. Croix. Coastal marine scientists from 12 Caribbean nations gathered to consider the factors controlling the distribution, abundance and interactions of the three major Caribbean ecosystems: coral reefs, seagrasses and mangroves. A principal recommendation of this workshop was the design and implementation of a pilot research project in the Caribbean marine coastal zone (Unesco Report in Marine Sciences No. 23).

In November 1985 a Second workshop ("Factors influencing Organic Productivity in the Caribbean Marine Coastal Zone") was held at the Discovery Bay Marine Laboratory of the University of the West Indies in Jamaica. This workshop, sponsored by Unesco and the National Science Foundation (USA) and attended by 35 scientists from the Caribbean and the USA, drafted the scientific framework for CARICOMP. An international Steering Committee (chairman: J.C. Ogden, USA; co-chairman: E. Jordan, Mexico, was established to direct the project. The Steering Committee met at WIL in May 1986 in conjunction with the annual meeting of the Association of Island Marine Laboratories of the Caribbean (AIMLC) to write the final draft of the CARICOMP "framework" document and to discuss the strategy for implementation of the project.

The report of the planning workshop at Discovery Bay is currently "in press". It includes the "framework" document covering project goals, project strategy, project implementation, and project logistics. Contributed papers at the workshop included those from:

- CHR. F. D'ELIA : "Gradients in Factors Limiting Primary Productivity"
- J.W. PORTER : "Pattern of Primary Productivity"
- P.R. BACON : "Mangrove Ecosystems Responses to Gradients in Factors limiting Primary Productivity in the Caribbean"
- J.C. ZIEMAN : "Gradients in Caribbean Seagrass Ecosystems"
- R.P.M. BAK : "Variations in Coral Reefs in Response to Gradients limiting Primary Productivity"
- B. KJERFVE : "Physical Flow Processes in Caribbean waters over a Range of Scales"
- V. KLEMAS & M.A. HARDISKY : "Remote Sensing of Tropical Coastal Ecosystems"

The goal of the CARICOMP project is to understand the factors controlling biological productivity in the Caribbean coastal zone and to facilitate the rational exploitation of its resources. It is thought that the productivity of the ecosystems of the Caribbean coastal zone is enhanced by (1) interactions between adjacent systems, and (2) by the nature and quantity of terrestrial runoff. These multiple interactions and inputs vary widely throughout the Caribbean and create large scale gradients which strongly influence the distribution, structure, and productivity of coastal ecosystems.

A Drafting Group of the Steering Committee is currently working on the preparation of a "core programme" document focusing on research themes.

CARICOMP will establish a co-operating regional network of marine laboratories in the Caribbean and institute a long-term monitoring program with centralized data analysis. It will assist in training and technology transfer, and solicit research projects within the overall project design.

Activities of CARICOMP to date have been funded by Unesco and NSF (USA). In addition to the two workshops which established the framework for the project, there are presently two sub-projects in progress funded by Unesco. One sub-project (at the University of the West Indies in Jamaica and chaired by P. Bacon) is beginning to compile the basic monitoring methods for CARICOMP in a form that will make them easily applicable to the diverse locations of the Caribbean. A second sub-project (at the University of Virginia, USA, and chaired by J. Zieman) is collecting the critical reference material on coral reefs, seagrasses, and mangroves. Unesco will publish these collected papers and they will be available to all participating laboratories.

3.2.4 COMAR-COSALC VII - "Seminar/workshop on the Physical and Biological Processes of Temperate Coastal Marine Systems of Latin America". 3-7 November 1986, Montevideo, Uruguay. (Document 8.5 refers).

The Meeting was held to launch the COMAR/COSALC pilot project No. VII. Forty scientists attended, among whom a majority of senior marine scientists knowledgeable of the subject, from Argentina, the South of Brazil, Chile, Peru and Uruguay it.

The Seminar/workshop:

- . recognized that the coastal marine areas of the region correspond to similar ecological systems which must be studied using the same methodologies and following common objectives;
- . further recognized common problems to the countries which have their origin in the always increasing intensive use of the marine littoral. The development of the coastal zone has not been planned and there is a lack of prior evaluation of environmental impacts caused by the utilization of the various resources;
- . noted a very small integration between countries, institutions and research teams. It recognized an heterogeneity in the level of development of various areas and disciplines of the coastal marine sciences and noted the different levels of the academic training of the marine scientists of the "cono sur";
- . agreed with the statement of the problems and processes as defined for the COMAR/COSALC project during the Caracas Meeting (1982) (Unesco reports in marine sciences No. 24);
- . realized the urgent need to undertake basic interdisciplinary and interregional studies in order to interpret the phenomena occurring in the temperate coastal marine region of Latin America;
- . finally recognized that the potential of the existing human and material resources in the countries of the region are not maximised. The implementation of mechanisms would assure a continuity in the investigation, and the opening of better opportunities for research should permit an improvement of the present situation.

The seminar/workshop recommended:

1. The establishment of a scientific technical committee composed of specialists, representing the region and various themes, to be in charge of co-ordinating the activities of the project.
2. The training of young scientists through short and medium term fellowships using the human and material resources of the region.
3. The implementation of the above point 2 by facilitating the exchange of specialists, and the organization of courses to be given in places having the necessary infrastructure. Meetings should also be organized to discuss and evaluate the results obtained by scientists working on specific themes (Working Groups or Workshops).

4. The creation of a network of information exchange which should assure the distribution of the results obtained within the framework of the COMAR/COSALC project. Each country should prepare an annotated bibliography on the selected research themes.
5. Noting with interest the initiative taken by Brazil and Peru to establish respectively the reserve and the ecological station of TAIM and PARACAS; and in view of the strong impact affecting the coastal systems of Temperate South America and the perspective for its rational management, the seminar recommended the following:  
  
to further expand these reserves, maintain them in appropriate conditions and to establish similar reserves in other areas of the region.
6. That the countries which have not yet constituted their COMAR/COSALC committee do it, in order to promote the development of science at the regional level.
7. In view of completing the elaboration of the pilot projects, the holding of two meetings tentatively in October 1987 in Concepcion (Chile) and June 1988 in Bahia Blanca (Argentina), coinciding with the "Conference Chapman on sediments transport processes in estuaries".
8. That national workshops be organized by the above COMAR/ COSALC committees in addition to and in order to prepare the regional workshop and above all in order to execute the present pilot project.
9. The establishment of a Working Group on "systems of coastal upwellings and their processes" to review at the regional level the status of knowledge on their systems and formulate recommendations in order to improve this knowledge.

**Research proposals (in order of priority):**

1. Geographical-economical assessment of the coastal marine zone of temperate Southern America.
2. Dynamics and stability of the sandy coasts and their relations with the Continental Shelf.

This research proposal includes the following topics:

- a) local regional tendency of the sediment's transport,
- b) balance of sediments natural processes and man action,
- c) dynamics of the low coasts and a definition of the zone which is at risk,
- d) influence of the quaternary processes in coastal dynamics and stability,
- e) the interrelations between the living organisms and the substratum,

- f) biochemical cycles and their relations with the physical processes.
3. The dynamics of the sandy beach communities, basically of the intertidal populations and its socio-economic impact on the fisheries industries, especially concerning the economy of subsistence.
  4. Improve the basic knowledge on the structure and dynamics of the (total) infralitoral community by studying the structure and dynamics of the sandy bottom portion of this community.

The improvement of this knowledge should allow a rational utilization of local common resources such as: vieriras, corvina, pejerrey, lenguado, pescadilla, etc.

5. Structure and dynamic of the coastal dune communities.
6. Structure and dynamic of the intertidal and subtidal communities of hard bottoms and the influence of man. Emphasis will be put on research topics of the inter-tidal ecosystems of Chile and Peru, having similar faunal and algological components. Emphasis will be as well given to ecological problems of the rocky inter-tidal of the Atlantic and Pacific coasts, which also exhibit ecologically equivalent living organisms (ex: users or primary substratum such as mussels and other invertebrates species)

Concerning rocky sub-tidal ecosystems, special reference is made to the fields of Macrocystis pyrifora at the extreme south of the continent which exist both in Chile and Argentina as well as to the fields of Lessonia, the distribution of which encompasses both the sub-tidal zone of Chile and Peru.

7. Recognizing the problems and processes proper to the estuarine systems (Unesco reports in Marine Science No. 24), it is proposed to plan the following projects integrating the following systems of the temperate Latin America:
  - a) temperate/subtropical coastal lagoons,
  - b) complexes of coastal lagoons in the temperate zone,
  - c) the Patagonian rivers' systems
  - d) the canals and fjords' systems of Chilean and Argentinian seas,
  - e) the non-deltaic rivers' systems of the South Central Chile

To start implementing the above recommendations, it was seen to be possibly beneficial for Unesco to provide some "seed money" to facilitate and stimulate interactions between scientists and research institutions of participating countries.

3.2.5 Third (1985) and Fourth (1986) courses on coastal geology for Latin America and the Caribbean, May 19-31, 1986, Porto Alegre, Brazil. (Document 8.6 refers).

Among the main activities of the COMAR/COSALC project in South America and the Caribbean during the period 85/86 were the third and fourth editions of the course on coastal geology taught by the Centro de Estudos de Geologia Costeira e Oceanica - CECO, Porto Alegre, Brazil, with the support of Unesco (COMAR/COSALC).

For the Third course (March 18-30, 1985) 10 geologists out of 28 candidates were selected from the following countries: Argentina (1), Chile (2), Colombia (1), Costa Rica (1), El Salvador (1), Ecuador (1), Mexico (1), and Venezuela (2).

In the Fourth course (May 19-31, 1986) 10 geologists selected from 18 candidates participated: Argentina (1), Chile (1), Colombia (1), Cuba (1), Ecuador (2), Mexico (1), Peru (1) and Uruguay (1).

The course programme comprised 48 hours of class and laboratory work at CECO and 36 hours of field work along the coast of Rio Grande do Sul province (including the Patos- Mirim lagoon system).

A seminar to review the state of knowledge concerning coastal geology of the region was held during the last day's course with students attending it.

Course programme

1. STUDY METHODS IN COASTAL GEOLOGY

- 1.1 Remote sensing and aerophotogeology
- 1.2 Field work, mapping and sampling
- 1.3 Sedimentology
- 1.4 Paleontology and Biostratigraphy
- 1.5 Geochronology

2. COASTAL GEOMORPHOLOGY

- 2.1 Processes
- 2.2 Features
- 2.3 Coast classification

3. COASTAL TERRIGENOUS SEDIMENTATION

- 3.1 Alluvial fans
- 3.2 Braided and meandriform channels
- 3.3 Deltas
- 3.4 Estuaries and lagoons
- 3.5 Beaches, dunes and barriers

4. GEOLOGICAL EVOLUTION OF COASTAL AREAS

- 4.1 Sea level fluctuations
- 4.2 Transgressions and regressions
- 4.3 Core examples

5. MINERAL RESOURCES OF COASTAL AREAS

6. GEOLOGY OF RIO GRANDE DO SUL COASTAL PROVINCE
7. MINERAL RESOURCES OF RIO GRANDE DO SUL PROVINCE
  - 7.1 Peat
  - 7.2 Beach and eolian placers
  - 7.3 Carbonate shells
8. GEOLOGICAL MAPPING OF THE RIO GRANDE DO SUL COASTAL PROVINCE
9. FIELD TRIP
10. SEMINAR "ASPECTS OF COASTAL GEOLOGY IN LATIN AMERICA AND THE CARIBBEAN"

**Results:**

In addition to providing training on coastal geology to a selected number of geologists of the region, the main objectives of the course were the contact and exchange of ideas between them concerning research in the region.

The COMAR/COSALC training programmes on coastal geology have been of great importance to the countries of the region in need of improving their knowledge and policies for the management of the coastal systems.

It was suggested that it may now be appropriate to cease these courses and invest in the advanced training of selected persons to higher degrees, (up to Ph.D.). However it was noted that the courses had extended to several South American countries and were proving popular there.

**3.2.6 The Progress of the COMAR/COSALC Brazilian Commission.**  
(Document 8.7 refers).

The Brazilian COMAR/COSALC Committee is mainly interested in general and specific topics concerning the coastal environments. Activities include training courses, scientific meetings, and research projects, and involve the participation of both national and invited scientists.

Scientific and technical exchanges are important elements for a country like Brazil which has an extended coastline and many problems requiring a solution.

Integrated research projects concerning several important regions of the coastal zone, were established through a co-operative research network between Universities and Federal/State Governments-organizations.

These projects are financially supported by Federal and State Governments agencies, principally by the Interministerial Commission for Marine Resources-CIRM. Other agencies at federal level, like the National Research Council, also contribute funds for specific works, while State Government agencies furnish help for local studies. During the period under consideration the COMAR/COSALC related activities were funded to an amount of US\$ 360,000 (85) and US\$ 480,000 (86).

Several activities mainly related to training courses, meetings and publications received a Unesco aid.

**Research activities:**

Coastal ecosystems are included as one of the priorities of the First and Second Sectorial Plan for Marine Resources developed by CIRM.

Several integrated projects have developed along the Brazilian coast, concerning geological processes, features and evolution, physical, chemical and biological aspects, living and non-living resources, environmental impact, uses and degradation of the ecosystems.

The following main projects can be mentioned:

- Sao Marcos Bay (Maranhao)
- Todos os Santos Bay (Bahia)
- Fluminense Lagoon System (Rio de Janeiro)
- Cananeia-Paranagua Systems (Sao Paulo and Parana)
- Rational Utilization of the Brazilian Tropical Coastal Ecosystems (Sao Paulo)
- Lagoa dos Patos System (Rio Grande do Sul) 30
- Brazilian Marine Programme (studies on morphology, structure and sedimentation of the entire continental shelf).

A great number of small on-going projects researching some specific aspects of the coastal environments are sponsored either by CIRM, CNPq or by a State Government research council.

The Lagoa dos Patos project is part of the pilot project COMAR/COSALC on coastal lagoons. It is a very active programme with 8 meetings in 1985, 10 meetings in 1986, 12 training courses in 1985, and 8 training courses in 1986.

The strategy of the II Sectorial Plan for Marine Resources establishes the main goals for the Coastal studies in Brazil, from the period 1986-1989.

These are the following:

- a) study of coastal ecosystems
- b) identification of new fishing resources
- c) administration of fishing resources
- d) handling and stocking on board and on land
- e) better use of the captured biomass
- f) mariculture
- g) fishing technology
- h) socio-economic aspects of fishing
- i) mineral resources of the continental shelf
- j) dynamics of the physical and chemical processes
- k) instrumentation
- l) human resources



**Proposed meetings:**

The Brazilian COMAR/COSALC commission would like to propose the following regional and interregional meetings to be held in Brazil:

1987 - "Regional workshop on mangroves: to discuss research methods and development planning, comprehensive management techniques and conservation strategies". To be held at the Instituto Oceanografico, University of Sao Paulo, Sao Paulo.

"Workshop on coastal and marine geology research methods" during the First Brazilian Quaternary Congress. Sponsored by ABEQUA, CECO/UFRGS, Porto Alegre.

1988 - "The Fifth Meeting of the Unesco/SCOR/IABO Consultative Panel on coastal ecosystems" at the Federal University of Maranhao Sao Luiz, State of Maranhao.

**3.2.7 The Venezuelan COMAR/COSALC programme.**  
(Document 8.7.2 refers).

Since 1984 the task of the Venezuelan COMAR/COSALC Commission has been to co-ordinate the activities and the internal functioning of the Commission. Good liaison has been established and monthly meetings have been held with relevant Ministries. The COMAR/COSALC Commission has :

- undertaken an inventory of the scientific personnel, equipment and institutions
- developed a total of 52 projects in Venezuela.

It has had 4 meetings since 1985 and has created the conditions for the establishment of the National Commission of Oceanology.

The National Commission of Oceanology is consulted by the government on matters relating to the development of marine sciences. It has initiated the purchase of an Oceanographic vessel, and has established a data bank of oceanographic information.

Venezuela is now developing aquaculture industries, potentially along all the coasts, including in the lagoons. Conservation issues are not always considered. A new Ministry for Ocean and coastal affairs has been established.

**3.3 Africa**

**3.3.1 Regional project on coastal marine systems of Africa (COMARAF).**  
(Documents 9.1., 9.1.1 refer).

The COMAR programme in Africa was started in 1979 in Dakar with a first phase consisting of a series of field training workshops on the estuarine and mangrove environment (1983), coastal lagoons (1985), geology of the coast and of the continental shelf (1987) and productivity of coastal marine systems (1987). To this list can be added the coastal erosion project in West and Central Africa, jointly sponsored by Unesco and UNEP (see 3.3.4 below).

In 1986 the programme was expanded with the preparation of a regional project on coastal marine systems in Africa (COMARAF). COMARAF was submitted for funding to the United Nations Development Programme (UNDP) at the level of US\$ 3,300,000 for the period of 1987 to 1991. UNDP has selected the project and has allocated a sum of US\$ 1,000,000.

COMARAF is proposing the implementation of five pilot projects as follows:

- I. mangroves and estuaries
- II. coastal lagoons
- III. systems interactions and productivity
- IV. coastal dynamics and shelf geology
- V. relation between land and coastal marine desertification

It is envisaged that the project will comprise research activities with a strong advanced training component. A regional Experts Meeting was scheduled to be held as a follow-up to the present Meeting, from 18 to 24 December 1986, in order to review the objectives, priorities and activities of the COMARAF project whilst taking into consideration funds actually allocated by UNDP.

3.3.2 Research methods on coastal lagoons.  
(Document 9.2 refers).

A field training workshop (6-11 May 1985, Abidjan, Cote d'Ivoire), was attended by 47 participants from 11 countries.

It concentrated on the following topics:

- hydrology of lagoon
- sedimentology
- chemical pollution
- microbiology and pollution from bacterial origin
- secondary production
- fishery biology.

3.3.3 Productivity of coastal marine systems.  
(Document 9.2 refers).

A field workshop on the above subject will be organized in the estuary of the Wouri, in Cameroon, in November or December 1987.

The workshop will make a synthetic review of the concepts and methodologies used for studying the productivity of coastal marine systems.

The programme will consist of the following:

- review of the main biogeographic characteristics of the coastal ecosystems
- plankton and pelagic/neretic productivity
- benthos and benthic production
- productivity at the interfaces
- methodologies

The workshop should be a first step activity and lead to an African coastal marine productivity (AFRICOMP) pilot project.

3.3.4 Coastal erosion in West and Central Africa.  
(Documents 9.4, 9.4.1, 9.4.2 and 9.4.3 refer).

The project "control of coastal erosion in West and Central Africa" (WACAF/3) was co-sponsored by Unesco, the UN Department of International Economic Affairs (DIESA), and UNEP. It benefited also from the participation of the Bureau de "Recherche Geologique et Miniere (BRGM)" of France and from the "Organisation des Recherches Scientifiques d'Outre Mer (ORSTOM)"

During the period of 1984-1986 the following activities were realized:

- two training workshops and one final seminar/field workshop were organised in Togo, Nigeria and Senegal, respectively.
- two reports on coastal erosion in West and Central Africa and one "bibliography on coastal erosion of West and Central Africa" were published - site surveys have been carried out in Togo and Senegal.
- fact finding missions have visited about 15 countries participating in WACAF/3.

Recommendations arising from this project are:

Scientific research

To develop research activities at national and regional levels for the:

- evaluation of sediment input to the shore and its dispersal by currents and wave movement;
- measurements and analysis of shoreline evolution, beach profiling and bathymetry;
- measurements of hydrodynamic factors, especially the coastal currents;
- study of onshore/offshore sediment transport and longshore drift;
- study of the role of canyons in trapping sediments and the consequences due to the instability of underwater slopes.

Monitoring

- To develop, test and carry out, as far as possible, technical procedures adapted to local conditions which would allow the participation of local population.
- To prepare, in each country, catalogues on coastal sedimentary processes and maps of erosion and nourishment. These maps should be periodically updated.

- to establish techniques for monitoring the morphological evolution of the coastal zone in the areas at risk, such as those presented during the seminars in Lome (September 1984) and Lagos (February 1985).

#### Laws and regulations

- To promote the exchange of information existing in Africa and elsewhere on rules and regulations concerning use and management of the coastline.
- To prepare by country, or group of countries, texts on rules and regulations for each country or group of countries.
- To enact and reinforce regulations, made on the basis of follow-up studies and concerning impact and the long and short terms risks to the coastline caused by human intervention.

#### Training and co-operation

- To seek financial support from the United Nations enabling courses in Africa to be held at several levels (for technicians, scientists and managers), to provide grants for study abroad and to support the production of reference manuals adapted to specific problems.

#### Documentation

- To create a documentation centre in Africa for existing documentation on the various multidisciplinary aspects of the management and of the protection of the coastline of Africa. This documentation may be assembled by means of regional co-operation under the guidance of a technical committee of experts. Governmental agencies and oil companies are particularly invited to co-operate with requests for data on physical processes, collected directly or through external consultants.
- To request the United Nations to provide both provisional storage for documentation already collected during the project and support for the continuation of documentation collection and updating.

Remarks: WACAF/1 - "Contingencing Planning" and WACAF/2 - "Pollution monitoring" are two other on-going projects of UNEP with no involvement of COMAR.

### **3.4 In the Mediterranean, the Red Sea and the Gulf**

#### **3.4.1 Coastal lagoons of Northern Africa.** (Documents 10.1 and 10.2 refer).

- A bibliography of the scientific literature on the coastal lagoons of Algeria, Egypt, Lybia, Morocco, and Tunisia has been published. The document includes a description of the various coastal lagoons encountered in the countries given.
- A co-operative research programme between Egypt and Tunisia is under consideration. Possible themes for research and advanced training were defined as follows:

In Tunisia: study of oysters and mussels population dynamics of exploited species; benthic fauna; geochemistry and sedimentology.

In Egypt: Plankton; primary production; hydrology; chemistry of water and sediments; nutrients, heavy metals and pesticides.

There is a crucial need for US\$ 300,000 over 3 years to maintain the good interaction between Tunisia and Egypt for this programme. It was noted that 3 countries would need to be involved in order to qualify for support from UNDP at regional level.

#### 3.4.2 Monitoring and management of the coastal zone.

A training course on this subject was organized from November 15 to December 6, 1986 in Alexandria, Egypt.

The programme of the course was :

- Physical, chemical and biological processes in the coastal zone;
- data-base, statistical treatment, graphics;
- time series analysis, introduction to modelling and case-studies;
- Analytical methods;

- . base line parameters, standard parameters for waste waters;
- . oil, chlorinated hydrocarbons, PCBS and heavy metals.

### 3.5 **Europe**

#### International Research Project on the Lagoon of Venice

The Italian Government in its 1986 budget assigned a fund for the study of the lagoon of Venice. Negotiations continue with the Italian authorities on the utilization of this fund (or part of this fund) for the implementation of the International Research Project, prepared by a Group of Experts from Italy and Unesco.

In the meantime an Italian Consortium has been put in charge of the preliminary studies and to direct construction of the engineering works at the three entrances of the Lagoon.

## 4. **COMAR INTERREGIONAL ACTIVITIES**

### 4.1 **Workshop on comparison of Atlantic and Pacific Tropical Coastal Ecosystems, March 1986, Suva, Fiji.** (Documents 11.1.2 and 11.1.3 refer).

The Meeting concluded that the Caribbean and probably the region of Southeast Asia were very productive presumably due mainly to run-off from adjacent land masses. The intermittent bursts of productivity throughout the Eastern Pacific was seen as somewhat different from the norm. Productivity was seen to decline from the Western Pacific - Southeast Asia region towards the centre of the Pacific and to increase again reaching the West coast of America.

The Meeting was able to generate a list of principles relating to the ecological structure of the two oceans and the underlying productivity.

Among the several generalizations recognized was the proposition that societies which had developed in relatively oligotrophic areas, such as the central Pacific, appeared to have generated a rich background of traditional management practices which put restrictions on the utilization of coastal marine resources. Others, such as those from the western parts of Southeast Asia where productivity appeared to be higher due to the land mass proximity, tended not to develop such restrictions but instead relied to a greater extent on free access to resources.

This difference was considered to have management implications for the present day. A list of policy considerations was elaborated with respect to most of the identified conditions mentioned above, and a number of suggestions made for Unesco to use in the development of inter- and intra-ocean studies.

The following three suggestions are particularly important:

- 1) That a set of measurements be gathered from dispersed areas, particularly in Southeast Asia, to verify productivity levels and expected biological responses.
- 2) That a network of marine laboratories be set up to engage in this work.
- 3) That Unesco take the initiative in co-ordinating international marine research activities, establishing - and testing as necessary - the presumed relationship between local productivity and necessary resource management strategies.

Because significant biological responses were seen to be related to productivity levels, it was proposed that a thematic approach based on this relationship should be used to link research on living resources to the elaboration of management strategies both on a global and regional basis.

The Meeting was attended by 11 participants from 4 countries: Australia (3), Fiji (2), Thailand (1), U.S.A. (5) as well as the Unesco Programme specialist in Marine Sciences.

Taking into consideration the CARICOMP (see 3.2.3) and the proposed PACICOMP (see 3.1.3), the workshop held in March 1986 at the University of the South Pacific in Suva, Fiji, proposed to expand the two projects into an inter-regional project which would compare structure and mechanisms underlying productivity in tropical coastal marine systems.

Although the consultative panel recognized the validity of the proposal, it was considered somewhat premature. They believed that, for the time being, the various regional coastal marine productivity projects should be co-ordinated and should exchange information.

## 5. RECOMMENDATIONS

### 5.1 Co-operation with Scientific NGO's

#### 5.1.1 The ICSU-International Geosphere-Biosphere Programme (IGBP)

The Consultative Panel noted that:

- The IGBP will focus on a restricted set of specific problems within a broad intellectual framework;
- The purpose of IGBP is to "describe and understand the interactive physical, chemical and biological processes that regulate the total earth system and how they are influenced by human activity; the unique environment this system provides for life, and the changes that are occurring in it".
- The proposed IGBP will have terrestrial, marine and global projects and that under the two latter projects there are subsections on "estuarine and coastal zone studies" and "studies of land-sea interactions";

Recognized that:

- If the proposed ICSU/IGBP takes place, COMAR can play an active part in supporting the studies mentioned above, both through its scientific and regional programmes
- COMAR scientific programmes particularly those involved with the study of the flux of material between mangroves, seagrasses, coral reefs and estuarine environments are intimately related to the purpose of IGBP
- Changes in sea level and freshwater flow, as recorded by mangrove communities and from cores obtained from large coral heads, are an important paleo-oceanographic record of land/sea interactions
- Sites of regional co-operation between COMAR participants could be used for these and other studies on the high energy zone between the land and the sea.

Recommended:

That Unesco both informs ICSU of its COMAR programmes and indicates that COMAR is prepared to participate in the International Geosphere-Biosphere Programme. This participation of COMAR in IGBP should also involve the Advisory Bodies of Unesco, such as SCOR and IABO.

### 5.1.2 SCOR

The Consultative Panel,

#### Noting:

- that the forthcoming SCOR/SCOPE programme on estuaries and deltas will specifically be directed to the effects of an accelerated rise of sea level on these coastal systems and that such a rise would not only have geographical, but also ecological consequences,
- that SCOR has decided to organize the next Joint Oceanographic Assembly (JOA) in Acapulco, Mexico, in 1988 with, among others the support of Unesco;

#### Recommends that:

- a. COMAR gives its full attention in the future to the effects the accelerated rise of sea level has on the coastal systems, in particular in estuaries and deltas;
- b. appropriate attention be given to coastal oceanography at the JOA and that, in particular, COMAR supports the organization of a special symposium within JOA on the interrelationships between coastal lagoons, mangroves, seagrasses and coral reefs noting that such a symposium would also be of special interest to the host country.

### 5.1.3 IABO

The Consultative Panel,

- A. Noting the fruitful co-operation between IABO and the Unesco-COMAR project,

Recognizing the appropriateness of the activities jointly undertaken both in the "core" project and in the "regional activities" of COMAR.

Welcoming the fact that IABO envisages the possibility of developing relevant parts of its on-going activities in co-operation with Unesco contributory to the the IGBP ,

#### Recommends

1. that IABO continues to provide advice to Unesco in the field of coastal oceanography and that it continues to help evaluating and commenting on the scientific publications issued from COMAR activities.

B. Noting with great interest

- the past activities of the IABO/Unesco Working Group on traditional knowledge and management of coastal systems, in particular the efforts concerning the organization of two regional seminars organized in Jakarta (1983) and Benin (1986), and the editing of the corresponding proceedings.



- new archeological discoveries of endemic civilisations made in 1 the Orinoco delta and in the Rogues archipelago, in Venezuela.

Noting further with appreciation:

- the offer made by the COMAR/COSALC National Committee of Venezuela to act as local organizer for a regional seminar on traditional knowledge and management of coastal systems in Latin America and the Caribbean,
- the initiatives taken in Canada and U.S.A. to co-sponsor the above regional seminar.

2. Strongly supports the recommendations made by the IABO/Unesco Working Group; to continue planning the regional seminars and editing the corresponding proceedings, and, in particular, to organize the Third regional seminar for North and Latin America in 1987.

C. Noting that the Working Group on "experimental ecosystems" with the following terms of reference:

- a) Examine previous studies involving experimental ecosystems; critically evaluate the results and the application of such techniques to estuarine, coastal and open sea problems;
- b) Make recommendations for complete system (mesocosms, field, laboratory and simulation modelling) approaches to current problems in biological oceanography;
- c) Specific design criteria pertinent to studies in the range of estuarine, coastal and open sea conditions;

as proposed by IABO has been established by SCOR.

- Recognizing that the "mesocosm" technique is one of the most useful approaches for studying fate, effects and transformations of matter in coastal systems.

Recommends

3. That the COMAR project be associated with the future activities of the Working Group.

D. Noting the activities of the IABO Working Group on high diversity marine ecosystems (see item 2.3.1 on page 8. of this report),

Further noting with appreciation the enthusiastic reaction of many scientists in the world for such a timely topic,

Recognizing that the deliberations of the Working Group will be important for the understanding of basic ecology of coastal systems and in particular that it is important to look at high diversity in coastal systems like coral reefs, coastal lagoons, mangroves and soft bottom communities, etc, from the point of view of "niche" change and of developing theories in line with the information theory and other ecological concepts.

Noting the importance of the diversity concept for the management of the coastal systems and that stress on coastal marine systems should be considered in the light of the diversity concept.

Strongly supports the Working Group proposal

4. to draw up a scientific international programme using the COMAR regional network and to link training activities to this scientific programme in order to encourage the participation of developing countries.

## **5.2 COMAR regional programmes**

### **5.2.1 Asia and the Pacific**

The Consultative Panel,

Noting that within the framework of the COMAR project co-ordination of training and research of some aspects of tropical coasts and coastal oceanography of Asia and the Pacific is well underway; notably those projects related to the mangrove ecosystem, coral reefs and atolls, seagrass beds. They recognized to some extent the interrelationships among these systems,

Aiming at further improving the methodologies of study and information input, increasing the quality and quantity of scientific research, encouraging the transfer of appropriate information to decision makers, planners and managers,

Recommends that:

- 1) a continuing support to the UNDP/Unesco Regional Mangrove projects (RAS/79/002 and RAS/86/120) be provided and, in time, expanded to include all the countries in Asia and the Pacific that have intertidal tropical forests (mangroves) . It was also recommended that the above programme be extended to consider related ecosystems.
- 2) A sub-project be prepared within the general framework of the RAS/86/120. This Project should include the Pacific Ocean States as well as the Maldives in the Indian Ocean that have peculiar problems of their own;
- 3) Research and training by research be strengthened by:
  - supporting the inter, and multidisciplinary integrated programme Ranong, Thailand;
  - supporting the national mangrove programmes of each country.
- 4) Research should be strengthened in the following fields:
  - hydrology, coastal oceanography and nutrient transport
  - application of remote sensing (including aerial photography) to mangrove studies in space and time (dynamics and productivity),
  - microbiology, particularly as related to nutrient cycling and leaching of metals,

- polynology especially as related to the history, evolution and prediction of mangrove ecosystems' adjustments to sea level changes,
  - phenology, seasonal and life cycles of plant and animal species, food webs, ecophysiology,
  - structure and dynamics of the land-water intertidal tropical interface,
  - nutrient phases, traditional uses
  - conversion of mangrove areas to other uses.
- 5) REMIN (Regional Mangrove Information Network) should be strengthened by providing more communication power;
- 6) Audio-visual education material at different levels should be prepared.
- 7) New areas of research be considered as opportune, such as:
- identification, collection and preservation of genoplasm from intertidal plants,
  - mechanism and significance of N fixation in intertidal sediments and waters, including the measurement of available Nitrogen,
  - modelling of biotic and abiotic factors leading to establishing a basis for ration management,
  - developing scientific and technologically sound practices for the conversion of mangrove ecosystems to alternative uses and for rehabilitation of degraded intertidal areas,
  - role of epiphytic microflora and epibenthic microflora and meiobenthic animals and microbes (bacteria and fungi), in shaping the structure, function, nutritional status and nutrient cycling in the sediments,
  - ways and means for raising productivity of intertidal and near offshore areas by changing their nutritional status.
- 8) Unesco initiate a programme in the Pacific (PACICOMP) complementary to the Caribbean programme (CARICOMP) and keep the flow of communication between the two programmes constant. Towards this objective, a workshop should be held in the Pacific, attended by representatives of marine laboratories from different nations in the tropical Pacific region and Eastern Indian Ocean. At this workshop, a programme will be outlined by which participating marine laboratories can provide, in a standardized form, the knowledge necessary for an understanding of:
- (i) Processes influencing productivity in tropical marine nearshore ecosystems of the Pacific

(a) Natural sources and distribution of nutrients

- mechanisms contributing to the "island mass effects"
- nutrient and productivity characteristics of coastal habitats of different types of land masses (i.e. atoll, oceanic high island, continental shelf island, continental coast)
- interactions, especially nutrient flow, among eco- systems perpendicular to the coast (i.e. terrestrial to coastal marine to offshore pelagic)
- interactions among tropical coastal ecosystems (i.e. coral reefs, mangroves, and seagrass beds)

(b) connections between geographic regions of the Pacific; major routes of dispersion of nutrients and larvae across geographic and national boundaries.

- (ii) Influences of human activities on coastal marine productivity and nutrient input (e.g. land-use patterns, damming of rivers, land-reclamation from mangroves, clear-cut forestry, etc.)
- (iii) Whether or not major broad-scale changes have been occurring over the past decade or two in levels of nutrient input and productivity in coastal marine ecosystems of the tropical Pacific. For example, are increased amounts of nutrient input, (a result of terrestrial runoff caused by increased coastal forest logging), bringing about increased frequencies of phytoplankton blooms and the concomitant occurrences of Paralytic Shellfish Poisoning (PSP) and outbreaks of *Acanthaster planci*?

The ultimate objectives of these comparative studies are to: provide the theoretical framework upon which rational adaptable resource management plans can be constructed, to develop an understanding of the differences in regional ecological processes that lead to variations in the best resource management strategies for each region, and to provide a basis for making decisions on coastal land-use priorities that take into account the effects of different activities on coastal marine ecosystems.

- 9) Information be obtained on the traditional methods of resource management that have developed under different regional environmental conditions. The adaptive benefits of these traditional practices should be analyzed in order to provide insight into the best method of understanding managing coastal resources under particular environmental conditions. America and the Caribbean.

#### 5.2.2 Latin America and the Caribbean

The Consultative Panel,

Noting that the project for Research and Training on Coastal systems of Latin America and the Caribbean and its relations with the Continental Shelf (COSALC) is designed to promote the development of a comprehensive and rational framework for research related to management of coastal systems.

Acknowledging and encouraging the development of COSALC pilot projects: - No. I : Coast and Beach Stability (erosion/accretion) in the Lesser Antilles - No. II: on the coastal lagoons and No. III: CARICOMP (Caribbean Coastal Marine Productivity).

Recognizing the value of inter-regional comparison of the Caribbean and the Pacific through the CARICOMP and PACICOMP projects.

Further recognizing the increasing integration of the research groups within the COSALC pilot project No II on coastal lagoons in order to maintain continuity of the project.

Noting that within the framework of the COSALC pilot project Nr VII - Temperate coastal systems of Latin America, a "Seminar on physical and biological processes of the temperate coastal and estuarine environment of Latin America" was held in Montevideo, in November 1986.

Acknowledging the programmes developed by the National COMAR committees of Brazil and Venezuela.

#### Recommends

1. that Unesco encourage appropriate steps within participating countries to promote COMAR/COSALC to UNDP.
2. that in accordance with recommendation 5.2.2.1 efforts be made to involve the governments of the Caribbean region in the support of the COSALC project and in particular of the pilot projects No. I, II and III.
3. (a) that concerning CARICOMP, a workshop should be held to train regional representatives in the use of remote sensing: including aerial and satellite imagery, in resource imagery, in resource inventory and more sophisticated uses, such as productivity estimations.  
  
(b) Following the development of the Methods Manual, a training course should be held on the applications of selected methods to the preliminary steps of resource inventory and monitoring at participating laboratories. These methods will then be applied to the participating sites. The results will be processed, centrally collected, distributed and analysed in order to calibrate the methods.
4. that a representative of CARICOMP attend the organizational meeting of PACICOMP.
5. that use of information access systems (such as ASFIS, INFOTERRA, etc.) be encouraged as a basis for interregional comparison.
6. the pilot project No. I be expanded from the Eastern Caribbean islands to the mainland coast of Latin America.

7. that the coastal geology training programme implemented by Brazil and a technology course on continuous flow analysis be supported.
8. that the exchange of investigators between participating laboratories in the COSALC pilot project No. II on coastal lagoons and the publication of materials produced be supported.
9. that the Brazilian coastal area of Cananeia (Sao Paulo) be included as a study area of the coastal lagoon pilot project.
10. and urges the participating countries to implement the recommendations made by the COSALC pilot project No. VII - "Seminar on physical and biological processes of the temperate coastal and estuarine environment of Latin America".
11. to continue to support programmes developed by national COMAR committees such as in Brazil and Venezuela.

### 5.2.3 Africa

Noting and recognizing the importance of the COMAR Regional Project for research and training on coastal marine systems of Africa (COMARAF) and the relevance of its objectives to the ecological systems and to the conditions in Africa, and further noting that a COMAR regional meeting was to be held in Dakar (18-23 December 1986) to review and define objectives, priorities and activities for COMARAF.

Noting that a COMAR regional field training workshop on research methodology in coastal lagoons was held in Abidjan (May 1985) and that a training course, on geology of the coast and of the continental shelf, and another COMAR field training workshop on productivity of coastal marine systems, will be held in 1987 respectively in Guinea (Conakry) and in Cameroon.

Further noting the on-going national and regional activities that have been carried out in Senegal, Ivory Coast, Benin and Tanzania in the last years and recognizing the substantial results obtained so far in the domains of research and training, endorses the recommendations at the Abidjan workshop concerning the COMARAF project.

### Recommends

- 1) and encourages the formation of interdisciplinary teams of specialists to undertake research, management and planning to promote a rational utilization of the coastal marine resources.
- 2) strongly the financing of the COMARAF by Unesco and other international agencies.
- 3) the implementation of a training course on geology of the coast and of the continental shelf in Guinea (Conakry) and a field training workshop on the productivity of coastal marine systems in Cameroon, in 1987.

- 4) that financial support be provided for research and training activities on coastal marine systems undertaken by the African countries at the national and regional levels.

### **5.3 Interregional programmes**

The Consultative Panel,

recommends that:

1. Unesco promote a co-operative effort among existing bilateral and international programmes on coastal marine systems. This co-operation would take the form of each programme integrating their resources to establish rational management programmes that take into account important differences in ecological processes among comparable habitats in different geographic regions.
2. Unesco initiate a broad-scale programme in the Pacific complementary to the Unesco programme in the Caribbean (CARICOMP).
3. Unesco utilize a widely accessible international data base for the compilation of the data for this programme.
4. informations be obtained on the traditional methods of resources management under different regional environmental conditions.

### **5.4 Next Meeting of the Consultative Panel**

The Consultative Panel acknowledges with gratitude the invitation made to Unesco and to the chairman of the Panel by the authorities of the "Universidade Federal do Maranhao" to host the next Meeting of the Panel at the University in Sao Luis, Maranhao, Brazil, in 1988.

The Consultative Panel agreed that the present report should be sent both to the countries and to UNDP, recommending their future support to the COMAR project and to its various general components.

## **ACRONYMS**

WOCE: World Oceans Circulation Experiment  
GOFs: Global Ocean Flux Study  
TOGA: Tropical Oceans and Global Atmosphere  
MIZEX: Marginal Ice Zone Experiment  
SCOR: Scientific Committee on Oceanic Research  
CCCCO: Joint SCOR-IOC Committee on Climatic Changes and the Oceans

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IABO: International Association for Biological Oceanography  
SCOR: Scientific Committee on Oceanic Research  
SCOPE: Special Committee on Problems of the Environment



# ANNEX I

Division of Marine Sciences

COASTAL IV/1

Fourth Meeting of the Unesco/SCOR/IABO  
Consultative Panel on coastal systems

Dakar, Senegal  
15 - 17 December 1986

## Agenda

- Registration
- Opening of the Meeting - Election of the Chairman and the Rapporteur
- I. The Major Interregional project on research and training leading to the integrated management of coastal systems (COMAR)
  - A summary report (M. Steyaert)  
COASTAL IV/5.1  
COASTAL IV/5.2
- II. Co-operation with the Non Governmental Scientific Organizations
  - COASTAL IV/5.1
  - II.1 Co-operation with SCOR
    - a) A Status report (H. Postma)  
COASTAL IV/6.1  
COASTAL IV/6.1.1  
COASTAL IV/6.1.2
    - b) Discussion
  - II.2 Co-operation with IABO
    - a) A status report (P. Lasserre)  
COASTAL IV/6.2
    - b) IABO/Unesco Working Group on high diversity marine ecosystems (P. Lasserre)  
COASTAL IV/6.2.1
    - c) Seagrass : A Manual of research methods (P. Lasserre)  
COASTAL IV/6.2.2
    - d) IABO Working Group on traditional knowledge and management of coastal systems (P. Lasserre)  
COASTAL IV/6.2.3
    - e) Seminars on traditional knowledge and management of coastal systems (P. Lasserre)

- In Asia and the Pacific, December 1983 Proceedings  
COASTAL IV/6.2.4
- In West Africa, November 1985, A report  
COASTAL IV/6.2.5
- In Latin America, 1987, A Provisional Agenda  
COASTAL IV/6.2.6

f) Discussion

II.3 The ICSU International Geosphere - Biosphere Programme (IGBP):

- a) Its implication for the COMAR project (H. Postma,  
M. Steyaert)  
COASTAL IV/6.3

b) Discussion

III. COMAR regional activities

III.1 In Asia and the Pacific

COASTAL IV/5.1

- a) Research and training on mangrove ecosystems: Present achievements and future activities (M. Vannuccci)  
COASTAL IV/7.1
  - " IV/7.1.1
  - " IV/7.1.2
  - " IV/7.1.3
  - " IV/7.1.4
  - " IV/7.1.5
- b) Pacific coastal marine productivity (PACICOMP). A proposed research programme (Ch. Birkeland)  
COASTAL IV/7.2
- c) Research and training on coral reef: Present achievements and future activities (M. Steyaert)  
COASTAL IV/7.3
- d) Climatic and oceanographic records in corals from the Great Barrier reef, Australia (P. Isdale, presented by J. Baker)  
COASTAL IV/7.4
- e) A tertiary level course in coastal zone management (J. Baker)  
COASTAL IV/7.5

III.2 In Latin America and the Caribbean

COASTAL IV/5.1

" IV/8.1

- a) Caribbean Coastal Marine Productivity (CARICOMP) (J. Ogden)  
COASTAL IV/8.2

- b) Coastal and beach stability in the Eastern Caribbean Islands (M. Steyaert)  
 COASTAL IV/8.3.1  
     "      IV/8.3.2  
     "      IV/8.3.3
- c) Co-operative research and training on coastal lagoons of Latin America (F. Pannier)  
 COASTAL IV/8.4  
     " "      IV/8.4.1  
     " "      IV/8.4.2  
     " "      IV/8.4.3  
     " "      IV/8.4.3  
     " "      IV/8.4.4
- d) Temperate coastal and estuarine environments in Latin America: Report of a seminar (M. Steyaert)  
 COASTAL IV/8.5
- e) Fourth course on coastal geology: a report (L. Martins, presented by M. Steyaert)  
 COASTAL IV/8.6
- f) The COMAR National programmes Brazil (L. Martins, presented by M. Steyaert)  
 COASTAL IV/8.7.1  
  
 Venezuela (F. Pannier)  
 COASTAL IV/8.7.2
- g) Discussion

### III.3 In Africa

#### COASTAL IV/5.1

- a) Regional project on coastal marine systems of Africa COMARAF (B. Mwaiseje, presented by S. Diop)  
 COASTAL IV/9.1  
     "      IV/9.1.1
- b) Research Methods on coastal lagoons - A Workshop, 6-11 May 1985, Abidjan, Cote d'Ivoire. (B. Mwaiseje, presented by S. Diop)  
 COASTAL IV/9.2
- c) Productivity of coastal marine systems. A regional field training workshop. August/September 1987, Cameroon. A tentative programme. (P. Lasserre/B. Mwaiseje)  
 COASTAL IV/9.3
- d) Coastal erosion in West and Central Africa (A. Suzyumov/B. Mwaiseje)  
 COASTAL IV/9.4  
     "      IV/9.4.1  
     "      IV/9.4.2  
     "      IV/9.4.3

- e) COMAR National programmes
  - in Senegal (S. Diop)  
COASTAL IV/9.5.1
  - others  
COASTAL IV/9.5.2

c) Discussion

III.4 In the Mediterranean, the Red Sea and the Gulf

COASTAL IV/5.1

- a) Co-operative investigation on coastal lagoons between Egypt and Tunisia (Y. Halim/P. Lasserre)  
COASTAL IV/10.1  
COASTAL IV/10.2
- b) Training course on monitoring and management of the coastal zone. November 15-December 6, 1986, Alexandria, Egypt.  
COASTAL IV/10.3

III.5 In Europe

COASTAL IV/5.1

- a) International Research project on the Lagoon of Venice

IV. COMAR interregional activities

- a) Interregional project comparing community structure and mechanisms underlying productivity in tropical coastal marine systems: A proposal (Ch. Birkeland/J. Ogden)  
COASTAL IV/11.1  
" IV/11.2  
" IV/11.3

b) Discussion

V. Next Meeting of the Consultative Panel

## ANNEX II

Division of Marine Sciences

COASTAL IV/2

### Fourth Meeting of the Unesco/SCOR/IABO Consultative Panel on coastal systems

Dakar, Senegal  
15 - 17 December 1986

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IV/5.1	COMAR: Present achievements and future activities (M. Steyaert)
IV/5.2	Research on coastal marine systems - Report of the Third Meeting of the Unesco/SCOR/IABO consultative panel on coastal systems, October 1984, Unesco Technical Papers, No. 47, 1986
COASTAL IV/6	<u>Co-operation with Non-Governmental Scientific Organizations</u>
IV/6.1	Co-operation with SCOR: A status report (H. Postma)
IV/6.1.	Coastal offshore ecosystems relationships - Meeting of SCOR/Unesco W.G. 65. April 1984, U.S.A. - A report
IV/6.1.2	Coastal offshore ecosystems - Seminar, San Francisco, U.S.A., April 1986 - A summary report
IV/6.2	Co-operation with IABO. A status report.
IV/6.2.1	High diversity marine ecosystems: Report of a IABO/Unesco Working Group, August 1986, Syracuse, U.S.A. (P. Lasserre)
IV/6.2.2	Seagrass research methods; Table of contents and List of contributors
IV/6.2.3	Traditional knowledge and management of coastal Systems: Report of a IABO/Unesco Working Group, November 1985, Cotonou, Benin (P. Lasserre)

- IV/6.2.4 Traditional knowledge management of coastal systems in Asia and the Pacific: Proceedings in preparation.
- IV/6.2.5 Traditional knowledge management of coastal systems in West Africa: Proceedings in preparation.
- IV/6.2.6 Traditional knowledge management of coastal systems in Latin America. Provisional Agenda
- IV/6.3 The ICSU International Geosphere-Biosphere Programme (IGBP): Its implication for the COMAR project

COASTAL IV/7 Asia and the Pacific

- IV/7.1 Research and training on mangrove ecosystems: Present achievements and future activities (M. Vannucci)
  - IV/7.1.1 Project RAS/79/002 : Mangrove ecosystems of Asia and the Pacific, Phase I - Report of an evaluation mission by Prof. F. Blasco and C.D. Field
  - IV/7.1.2 Project RAS/86/120 : Mangrove ecosystems of Asia and the Pacific : Phase II - Project document
  - IV/7.1.3 An interdisciplinary survey and research mangrove programme along the Adaman Sea in the Province of Ranong, Thailand
  - IV/7.1.4 Regional Mangrove Information Network (REMIN)
  - IV/7.1.5 Mangroves of Asia and the Pacific : Status and use (Project RAS/79/002, final document)
- IV/7.2 Pacific coastal marine productivity (PACICOMP). A proposed research programme (Ch. Birkeland)
- IV/7.3 Research and training on coral reefs : Present achievements and future activities (M. Steyaert/D. Troost)
- IV/7.4 Climatic and Oceanographic records in corals from the Great Barrier Reef, Australia (P. Isdale/J. Baker)
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- IV/8.1 Regional project for Research and Training on coastal systems of Latin America and the Caribbean and their relations with the Continental Shelf (COSALC). The project document.
- IV/8.2 COSALC Pilot project III - Caribbean Coastal Marine Productivity (CARICOMP) (J. Ogden) - A status report

- IV/8.2.1 CARICOMP - The framework document. COSALC Pilot project III
- " " addendum
- IV/8.3.1 COSALC Pilot project I - Coasts and beach stability in the Eastern Caribbean islands : Phase I - An overview of coastal zone management in six eastern Caribbean Islands. ROSTLAC, Montevideo, 1985
- IV/8.3.2 COSALC pilot project I - Coasts and sand beaches stability in the Eastern Caribbean islands - Phase II - Awareness seminar in six Eastern Caribbean Islands, August 1985, in press, ROSTLAC Montevideo, 1986
- IV/8.3.3 COSALC Pilot project I - Coasts and beaches stability in the Eastern Caribbean islands - Phase III - Audio visual presentation of erosion, cases in six Eastern Caribbean islands
- IV/8.4 COSALC Pilot project - Co-operative research and training on coastal lagoons of Latin America (F. Pannier)
- IV/8.4.1 COSALC pilot project II - Coastal lagoons of Latin America. Meeting on objectives, methodologies and co-operative programme. December 1983, Brazil. A report.
- IV/8.4.2 COSALC pilot project II - Coastal lagoons of Latin America. Planning Meeting. June 1984, Mexico. A report.
- IV/8.4.3 COSALC pilot project II - Coastal lagoons of Latin America - Bibliography 1985
- IV/8.4.4 COSALC pilot project II - Coastal lagoons of Latin America - Workshop on biological processes, July 1985 Venezuela. A report
- IV/8.5 COSALC pilot project IV - Temperate coastal and estuarine environments in Latin America - Report of a seminar
- IV/8.6 Fourth course on coastal geology (L. Martins)
- IV/8.7.1 The COMAR Brazilian programme (L. Martins)
- IV/8.7.2 The COMAR Venezuelan programme (F. Pannier)
- COASTAL IV/9 Africa
- IV/9.1 Regional Project of coastal marine systems of Africa (COMARAF) (B. Mwaiseje)
- IV/9.1.1 COMARAF - Preparatory implemental phase (B. Mwaiseje)

- IV/9.2 Methodologie d'etude des lagunes cotieres. Rapport d'un atelier regional des lagunes cotieres. 6-11 mai 1985. Abidjan (B. Mwaiseje)
- IV/9.3 Productivity of coastal marine systems. A regional field training workshop, November. 1987, Cameroon (P. Lasserre)
- IV/9.4 UNESCO/UN-DIESA/UNDEP Project "Control of coastal erosion in West and Central Africa" Terminal report, 1986
- IV/9.4.1 Control of coastal erosion in West and Central Africa. A report of a Unesco/UN/DIESA/UNEP seminar workshop, Dakar, 11-18 March 1985. UNEP/IG.58/INF.5. 1985
- IV/9.4.2 Coastal erosion in West and Central Africa UNEP Regional Seas report and Studies, No. 67, 1985
- IV/9.4.3 bibliography on coastal erosion, West and Central Africa prepared by FAO for Unesco/UN-DIESA/UNEP, 1985
- IV/9.5.1 Activities of EPEEC (Equipe pluridisciplinaire d'etude des ecosystemes cotiers) in Senegal (S. Diop)
- IV/9.5.2 Activities of EPEEC in other countries (B. Mwaiseje/S. Diop)
- COASTAL IV/10 Mediterranean, Red Sea and the Gulf
- IV/10.1 Co-operative investigation on coastal lagoons between Egypt and Tunisia (Y. Halim/P. Lasserre)
- IV/10.2 Coastal lagoons along the Southern Mediterranean coast (Algeria, Egypt, Libya, Morocco, Tunisia) Description and bibliography, Unesco reports in marine science No. 34, 1986
- COASTAL IV/11 Interregional Activities
- IV/11.1 Interregional project comparing community structure and mechanisms underlying productivity in tropical coastal marine systems : A proposal (Ch. Birkeland/J. Ogden)
- IV/11.2 Comparison of Atlantic and Pacific coastal ecosystems. Proposal and background document. (Ch. Birkeland/J. Ogden) 1985
- IV/11.3 Inter- and Intraoceanic differences in community structure and ecological processes in tropical ecosystems. Report of a workshop - 24/29 March 1986, Fidji.



## ANNEX III

Division of Marine Sciences

August 1986

### UNESCO/MAJOR INTER-REGIONAL PROJECT ON COASTAL SYSTEMS (COMAR)

#### List of Publications

Availability of these publications varies from title to title. Those followed by 'S' are essentially sales items which can be purchased through Unesco national distributors. Those followed by 'F' are available free of charge from the Marine Information Center.

- Scientific aspects and human impact on the mangrove environment. A Unesco Regional Seminar, 27-30 November 1978, Cali, Colombia. Report and recommendations. Unesco reports in marine science No. 9, 1980. Available in English and Spanish ('F').
- Human uses of mangrove environment and management implications. A Unesco Regional seminar, 4-8 December 1978. Dacca, Bangladesh. Report and recommendations. Unesco reports in marine science No. 8. 1979. Available in English ('F').
- Asian symposium on mangrove environment. Research and management, 25-29 August 1980. Unesco and the University of Malaya, Kuala Lumpur, Malaysia. The Proceedings (published by ROSTSEA). ('S').
- Bibliography on mangrove research, 1600-1975. Unesco, 1981, ('S').
- Mangroves: research methods. Unesco monographs on oceanographic methodology, No. 8. Unesco, 1984.
- Handbook for Mangrove Area Management. Unesco with IUCN and East West Center. ('F'). Available from the East West Center Order Department JAB 1079, 1777 East West road, Honolulu, Hawaii 96848, USA
- Introduccion a la Ecologia del Manglar por G. Cintron y Y Schaeffer-Novelli, 109 pp. 1983. Available in Spanish from Unesco Regional Office for Science and Technology for Latin America and the Caribbean, (ROSTLAC), Montevideo, Uruguay.
- International Symposium on coastal lagoons, 8-12 September 1981. Unesco and the University of Bordeaux, France. The report: Unesco technical papers in marine science, No. 43. Available in French, English and Spanish ('F').
- International Symposium on coastal lagoons, 8-12 September 1981. The Proceedings. Unesco and the University of Bordeaux, France, 1982. Special issue of Oceanologica Acta. Available in French, English and Spanish. ('S'). (Address order to: Centrale des Revues 11, rue Gossin, 92543 Montrouge Cedex, France).
- Coastal lagoon survey (1976-1978). Unesco technical papers in marine sciences No. 31. 1981. (Unesco/SCOR)\* Available in English. ('F').

- Coastal lagoon research, present and future. A Unesco seminar, 28 August - 2 September 1978. Duke University Marine Laboratory, Beaufort, North Carolina, USA. Report and guidelines. Unesco technical papers in marine science No. 32. 1981. (Unesco/IABO\*\*). Available in English. ('F').
- Coastal lagoon research, present and future. A Unesco Seminar, 28 August - 2 September 1978. Duke University Marine Laboratory, Beaufort, North Carolina, USA. Proceedings of a Unesco/IABO seminar. Unesco technical papers in marine science, No. 33, 1981. (Unesco/IABO\*\*). Available in English ('F').
- Les lagunes cotieres de la Mediterranee du Sud (Algerie, Egypte, Lybie Maroc, Tunisie) Description et bibliographie. Rapports de l'Unesco sur les sciences de la mer, No. 34. Unesco 1986. Available in French and English ('F').
- Methodologie d'etude des lagunes cotieres, resultats d'un atelier regional reuni a Abidjan du 6 au 11 mai 1985. Rapports de l'Unesco sur les sciences de la mer, No. 36. Unesco 1986. Available in French. ('F').
- Coral reefs: research methods, Unesco monographs on oceanographic methodology No. 5. 1978. Available in English. ('S').
- Coral reef management in Asia and the Pacific: Some research and training priorities. Report of Unesco workshop held in Manila, Philippines, 21-22 May 1981. Summary and recommendations. Unesco report in marine science No. 18, 1982. Available in English. ('F').
- Coral reef survey methods. Report of a regional Unesco/UNEP workshop hosted by the Phuket Marine Biological Centre, Thailand, 13-17 December 1982. Unesco reports in Marine Science No. 21. Available in English. ('F').
- Coral reef management handbook. Unesco with the Great Barrier Reef Marine Park Authority, Australia. Available in English from ROSTSEA, Jakarta, Indonesia. ('F').
- Coastal zone resource development and conservation in southeast Asia, 1984. Available in English from ROSTSEA.
- Biogeochemistry of estuarine sediments, Unesco, 1978. Available in English. ('S').
- The coastal ecosystems of West Africa. Coastal lagoons, estuaries and mangroves. A Unesco workshop, 11-15 June 1979, Dakar, Senegal. Report and recommendations. Unesco reports in marine science No. 17. 1981. Available in English and French. ('F').
- "L'Estuaire du Sine Saloum" - Resultats d'un atelier regional sur les mangroves et l'estuaire du Saloum, 28 fevrier 5 mars 1983. Dakar et estuaire du Saloum, Senegal. Unesco et equipe pluridisciplinaire d'etude des ecosystemes cotiers (E.P.E.E.C.) du Senegal: Unesco reports in marine science, No. 32. Available in French.

- Coastal ecosystems of the southern Mediterranean. Lagoons, deltas and salt marshes. A Unesco Meeting of Experts, 25-27 September 1978. Tunis. Report and recommendations. Unesco reports in marine science. No. 7. 1979. Available in Arabic, English and French. ('F').
- Coral reefs, seagrass beds and mangroves: Their interactions in the coastal zones of the Caribbean. A Unesco workshop, 24-30 May 1982. West Indies Laboratory, St. Croix, US Virgin Islands. A report. Unesco reports in marine science No. 23. 1983. Available in English. ('F').
- Marine and coastal processes in the Pacific: Ecological aspects of coastal zone management. Papers presented at a Unesco seminar held at Motupore island research center, Univeristy of Papua New Guinea, 14 - 17 July 1980. Available from ROSTSEA.
- Coastal ecosystems of Latin America and the Caribbean. Objectives, priorities and activities of Unesco's COMAR project for the Latin American and Caribbean region. A Regional Review Meeting, Caracas, Venezuela, 15-19 November 1982. Unesco reports in marine science No. 24. Available in English and Spanish. ('F').
- Research on coastal marine systems. Report of the Third Meeting of the Unesco/SCOR/IABO consultative panel on coastal systems. October 1984. Unesco technical papers in marine science No 47. 1986. Available in English. ('F').
- Productivity and processes in island marine ecosystems. Recommendations and scientific papers of the Unesco/IOC sessions on marine science co-operation in the Pacific, at the XVth Pacific Science Congress, Dunedin, New Zealand, February 1983. Unesco reports in marine science No. 27. 1984.
- The Traditional Knowledge and Management of Coastal Systems in Asia and the Pacific, edited by K. Ruddle and R.E. Johannes. 1985. Available from ROSTSEA.

\* SCOR: Scientific Committee on Oceanic Research.

\*\* IABO: International Association of Biological Oceanography.

**PUBLICATIONS ON THE MANGROVE ECOSYSTEMS OF ASIA AND THE PACIFIC**

Available from the UNDP/UNESCO Regional Mangrove Project  
RAS/79/002  
15 Jor Bagh  
New Delhi 11003  
India

- Report on the Regional Remote Sensing Training Course on Mangrove Ecosystems, Bangkok, Thailand, November 23 - December 16, 1983
- Directory of Mangrove Experts
- Report on the Training Seminar on Geology, Sedimentology, Erosion and Accretion in Mangrove Areas; causes and effects, salt balance; Dhaka, Bangladesh, January 14 - February 5, 1984
- Report on the Workshop on Productivity of the Mangrove Ecosystem: management implications; Penang, Malaysia, October 4 - 6, 1983
- Report of the First Introductory Training Course on Mangrove Ecosystems; Bangkok, Thailand, March 2 - 30, 1983
- Productivity of the Mangrove Ecosystems, a manual of methods; Penang, Malaysia, September 18 - October 2, 1983
- Report on the Workshop on the Conversion of Mangroves Areas for Paddy Cultivation; Los Banos, Philippines, April 1 - 13, 1985
- Report on the Second Introductory Training Course on Mangrove Ecosystems; Goa, India, November 1 - 25, 1984
- Report on the workshop on Human Populations; Mangrove Resources; Human Induced Stresses and Human Health; Bogor, Indonesia, October 2 - 7, 1984
- Report on the Special Training Course on Mangrove Species Ecophysiology; Townsville, Australia, May 1 - 14, 1985
- Report on the Workshop on the Dynamics of Mangrove Ecosystems; Motupore, Papua/New Guinea, May 27 - June 2, 1985

Forthcoming

- Report on the Training Course on Life Histories of Mangrove Species; Bangkok, Thailand, October 2 - 16, 1985
- Report on the Third Introductory Training Course on Mangrove Ecosystems, Singapore, October 20 - November 16, 1985
- Report on the Special Training Course on Mangrove Microbiology; Manila, Philippines, October 28 - November 8, 1985
- Report on the workshop on the conversion of mangrove areas to aquaculture, Iloilo, Philippines, 24-26 April 1986.

**Titles currently available in the Division of  
Marine Sciences and other sources**

**HOW TO OBTAIN:**

- a. Sales items may be purchased in Paris, from the Unesco Book store (unless otherwise indicated).

Unesco Headquarters  
7, place de Fontenoy  
75700 Paris  
FRANCE

- b. Titles listed as free of charge may be obtained by contacting:

Mrs. M. Kravetz/Mrs N. Levy  
Marine Information Centre (B.403/402)  
Division of Marine Sciences  
1, rue Miollis  
75015 Paris (France)  
Tel. (1) 45 68 39 61

- c. Titles listed as available in our Regional Offices:

ROSTSEA : Regional Office for Science and Technology  
for Southeast Asia  
Jalan M.H. Thamrin 14  
273/JKT Tromolpos  
Jakarta  
INDONESIA

ROSTLAC : Regional Office for Science and Technology  
for Latin America  
Casilla de correo 859  
Montevideo  
URUGUAY

## ANNEX IV

Division of Marine Sciences

COASTAL IV/4

### Fourth Meeting of the Unesco/SCOR/IABO Consultative Panel on coastal systems

Dakar (Senegal)  
15 - 17 December 1986

#### List of participants

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# UNESCO TECHNICAL PAPERS IN MARINE SCIENCE

Titles of numbers which are out of stock

No.	Year	SCOR WG	No.	Year	SCOR WG
1 Incorporated with Nos. 4, 8 and 14 in No. 27	1965	WG 10	15 Monitoring life in the ocean, sponsored by SCOR, ACMRR, Unesco, IBP-PM	1973	WG 29
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 IAPSO	1965	WG 15	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
3 Report on the intercalibration measurements in Copenhagen, 9-13 June 1965. Organized by ICES	1966	—	17 An intercomparison of some current meters, report on an experiment of Research Vessel Akademik Kurchatov, March-April 1970, by the Working Group on Current Velocity Measurements; sponsored by SCOR, IAPSO, Unesco	1974	WG 21
4 Incorporated with Nos. 1, 8 and 14 in No. 27	1966	WG 10	18 A review of methods used for quantitative phytoplankton studies; sponsored by SCOR, Unesco	1974	WG 33
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, IAPSO	1966	WG 15	20 Ichthyoplankton. Report of the CICAR Ichthyoplankton Workshop-Also published in Spanish	1975	—
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	21 An intercomparison of open sea tidal pressure sensors. Report of SCOR Working Group 27: "Tides of the open sea"	1975	WG 27
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	—	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	—
8 Incorporated with Nos. 1, 4 and 14 in No. 27	1968	WG 10	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
9 Report on intercalibration measurements, Leningrad, 24-28 May 1966 and Copenhagen, September 1966; organized by ICES	1969	—	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
10 Guide to the Indian Ocean Biological Centre (IOBC), Cochin (India), by the Unesco Curator 1967-1969 (Dr. J. Tranter)	1969	—	27 Collected reports of the joint panel on oceanographic tables and standards, 1964-1969	1976	WG 10
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, IAPSO and Unesco	1969	WG 21	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
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	—	29 Committee for the preparation of CLOFETA-Report of the first meeting, Paris, 16-18 January 1978	1979	—
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	30 Ninth report of the joint panel on oceanographic tables and standards, Unesco, Paris, 11-13 September 1978	1979	—
14 Incorporated with Nos. 1, 4 and 8 in No. 27	1970	WG 10			