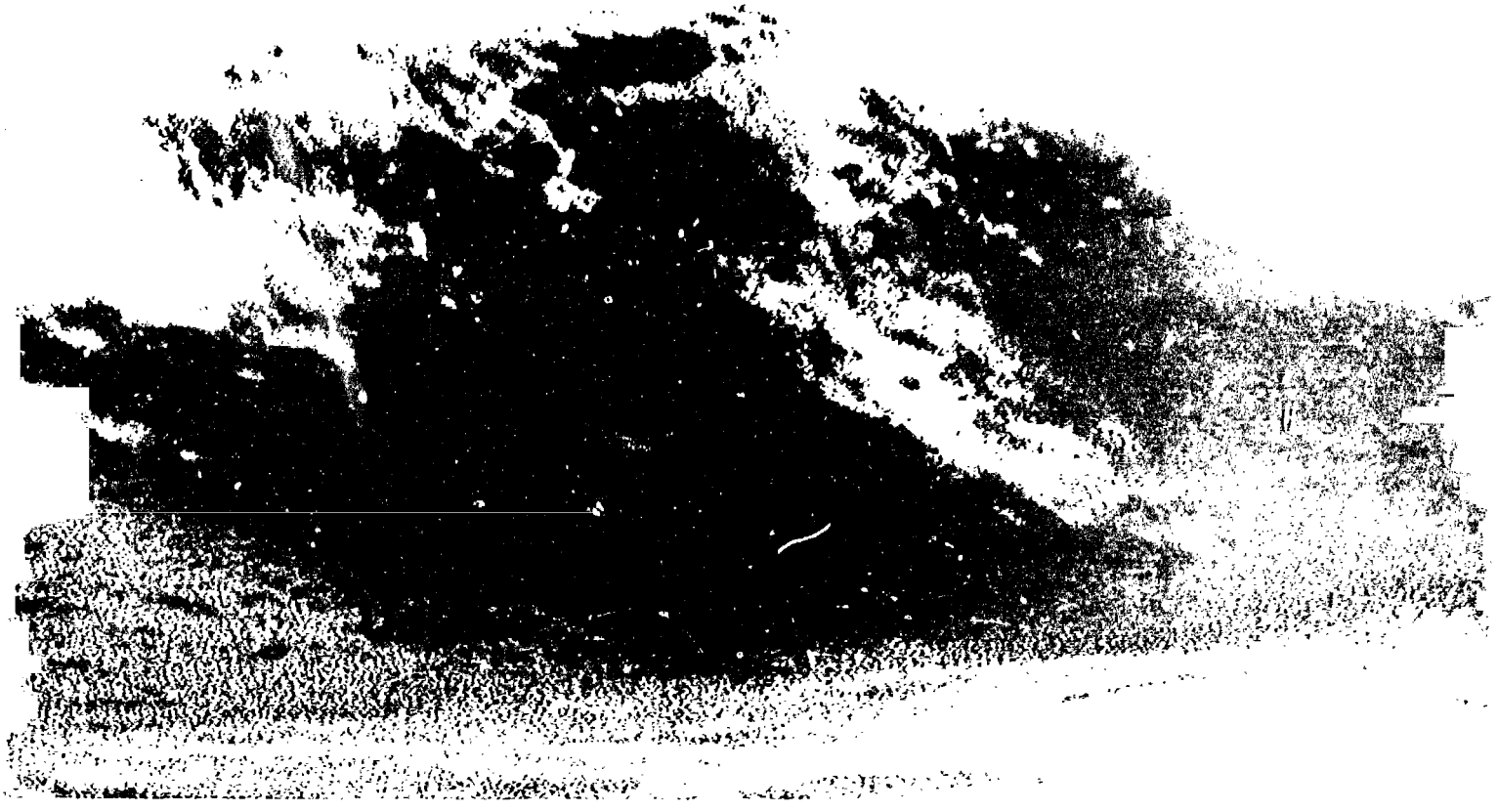
Intergovernmental Oceanographic Commission

Triennial Report 1980-82



Intergovernmental Oceanographic Commission

Triennial Report
1980-82

(Prepared in accordance with IOC Statutes, Article 12)

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INTRODUCTION

For well over 20 years, the Intergovernmental Oceanographic Commission has actively carried out co-operative programmes in pursuit of its basic purpose as laid down in the IOC Statutes:

"to promote the scientific investigation of the ocean through the concerted action of its Member States".

As the Commission moves forward to its 25th anniversary, which will be celebrated in 1985, IOC Member States have paid particular attention to the need to ensure that the IOC can fulfil its responsibilities as the leading UN intergovernmental body in marine scientific affairs and related ocean services, training, education and mutual assistance.

There is no doubt that decisions taken at the Twelfth Session of the IOC Assembly in November 1982 represented a breakthrough in the development and maturation of the Commission which now has 110 Member States, a three-fold growth since its founding in 1960.

The consolidation of regional activities with a view to increasing the involvement of Member States and scientists, especially those of the developing world, coupled with the launching or intensification of the global scientific research programmes and ocean service systems and activities, has prepared the Commission for the continuation and reinforcement of the ocean partnership which has been a hallmark of its activities during the past two decades.

In the coming years, IOC will concentrate its efforts on five major scientific thrusts: ocean dynamics and climate; ocean science in relation to living resources; ocean science in relation to non-living resources, including ocean mapping; and the chemistry and health of the oceans, including the establishment of a global system of monitoring of marine pollutants.

At the same time, the existing regional bodies of the Commission will be further developed so that they can, if so desired by participating Member States, be progressively upgraded to the level of IOC Sub-Commissions (as is already the case in the Caribbean and adjacent regions) and new regional bodies will be established for those oceanic regions not yet covered by regional subsidiary bodies of the Commission, as, for example, the Central Indian Ocean and Central Eastern Atlantic.

Several exciting new developments in the Commission's programme are worthy of particular note, since they demonstrate the commitment of IOC to pave the way towards the year 2000, while building upon the valuable experience already acquired.

Delegates to the Third Session of the IOC Working Committee for Training, Education and Mutual Assistance in the Marine Sciences launched the initial idea for "a Comprehensive Plan for a major assistance programme aimed at strengthening of marine science infrastructures in developing Member States, so as to enable them to achieve their national goals in the field of ocean affairs..." The Comprehensive Plan was subsequently adopted by the Twelfth Session of the IOC Assembly and will form an essential element of the Unesco and IOC response to the concern expressed by the United Nations Conference on the Law of the Sea that "unless urgent measures are taken, the gap in technology between developing and advanced countries will continue to grow....."

Under the IOC marine pollution research and monitoring programme, substantial progress has been made towards establishing the basis for a global network of institutions, structured around regional components, which will progressively lead to continuous monitoring of the marine environment and analysis of the health of the ocean.

In another, closely related, effort to gather in a systematic manner information on the characteristics of the ocean, IOC is gradually building up the structures required to establish a World Ocean Watch. Oceanographic data and information already being processed through the IOC International Oceanographic Data Exchange System will be supplemented by new data management projects related to ocean dynamics and climate, provision of oceanographic data products under IGOSS and a world-wide network of tide gauges for sea-level measurement.

Among the most challenging developments are those linked to implementation of the new ocean regime, following the recent signature of the United Nations Convention on the Law of the Sea by 117 States.

The Convention represents the culmination of an effort, spanning a period of nine years, to contribute to the establishment of a legal order facilitating international maritime communication, the peaceful utilization of the seas and oceans, the fair and rational exploitation of their resources, the study and protection of the marine environment and the conservation of the biological resources it contains.

With this new Charter of the Oceans a promising era of international co-operation will emerge as

States, organizations and individual marine scientists explore the practical implications of the Convention to their traditional ways of interacting with the sea. This new era presents a particular challenge to the IOC and its Member States as work together to strengthen the links of their partnership, which is now entering its third d of marine scientific co-operation.

1. THE LONG-TERM AND EXPANDED PROGRAMME OF OCEANIC EXPLORATION AND RESEARCH (LEPOR)

'designed to assist in a better understanding
of the marine environment through science...'

[UN General Assembly Resolution 2414 (XXIII),
17 December 1968]

Following adoption by the UN General Assembly of Resolution 2414 (XXIII), 17 December 1968, which entrusted the IOC with formulation of a comprehensive outline for LEPOR and with co-ordination of its implementation, the Commission embarked upon what was considered to be the acceleration phase of the long-term programme, the International Decade of Ocean Exploration (IDOE), 1971-80. During the IDOE, considerable advances were made in all branches of oceanography. Research undertaken throughout the decade confirmed earlier preliminary findings that ocean events are closely interrelated and led to the recognition that future studies should concentrate on co-operative, multi-disciplinary endeavours.

As the decade drew to a close, the Commission, aware of the need to establish directions for its programme during the 1980s, set up an ad hoc Working Group on the Future Role and Functions of the Commission (FUROF). The Working Group was asked to "identify possible future objectives and functions of the Commission in the light of its increased membership and the development of the regime for marine scientific research, the exploration and rational exploitation of marine resources and related activities".

Following approval of the FUROF recommendations by the Eleventh Session of the IOC Assembly, the IOC Scientific Review Board studied the implications of these programme directives to future implementation of LEPOR. In considering how the Commission could best respond to its responsibility to ensure the ongoing review of its programmes within the perspective of LEPOR, the Board recommended that the IOC, in collaboration with its scientific Advisory Bodies, undertake a study on Ocean Science for the Year 2000. This view was endorsed by the Executive Council at its Fourteenth Session and an IOC/Unesco/SCOR/ACMRR Expert Consultation on Ocean Science for the Year 2000 was convened by IOC in April 1982, under the chairmanship of Prof. Eugene Seibold, with Prof. Warren Wooster acting as General Rapporteur (Fig.1).

Prior to its submission to the Twelfth Session of the IOC Assembly, the Report was presented to the Joint Oceanographic Assembly (Halifax, August 1982) during a round table devoted to consideration of expected major trends in ocean research through the end of the century. Comments by participants have provided valuable critique from the international scientific community. In his foreword to the Report (doc. IOC/INF-505), Prof. Seibold summarized the challenges confronting marine scientists as follows:

> "To use the ocean wisely, you must first understand it. How to maintain our renewable biological resources? How to conserve the genetic potential of the 180,000 or so animal species know up to now to live in the ocean? How to conserve ecological integrity? What is the ultimate compatibility of the oceans for the many

Fig. 1 - Meeting in Villefranche-sur-Mer, 13 - 17 April 1982. Some of the world leaders in marine scientific research participated in the IOC/Unesco/SCOR/ACMRR ad hoc Expert Consultation on Ocean Science for the Year 2000.

different kinds of pollutants transported from land by rivers and wind? All of these and many more problems need more and better research because at least since Bacon we have learned that 'Nature, to be commanded, must be obeyed' ".

Professor Seiboldt, when informing the Director General of Unesco about the discussions which took place at JOA, noted that:

" This Report will establish the framework for future planning of international research. It defines the most important scientific problems and critical or respresentative regions. It stresses interdisciplinary approaches and the development of new techniques, including data handling and evaluation.

Additionally, it may help to advise IOC and other international orgnizations for future marine science policy, especially in relation to the Law of the Sea - from the planned International Sea Bed Authority to the management of the Exclusive Economic Zones and the coastal management of different countries."

Following review of the Report on Ocean Science for the Year 2000 by the Twelfth Session of the IOC Assembly, it was decided that the Commission should pursue the updating and revision of LEPOR during 1983-84, in consultation with the UN organizations members of ICSPRO and other concerned Specialized Agencies, with a view to submitting their conclusions to ECOSOC and, subsequently, to the UN General Assembly.

Meetings

2-5 February 1981 Paris	First Session of the Scientific Review Board (SRB)
13-17 April 1982 Villefranche-sur-Mer	SCOR/ACMRR/IOC/Unesco Expert Consultation on Ocean Science for the Year 2000 (FORE)

2. GLOBAL OCEAN SCIENCE PROGRAMMES

2.1 OCEAN SCIENCE IN RELATION TO LIVING RESOURCES (OSLR)

In deciding to undertake the formulation of plans for a major programme on oceanographic studies of the marine ecological conditions in relation to living resources, the Eleventh Session of the IOC Assembly, by Resolution XI-17, recognized "the vital need for adequate understanding of the relationships between ocean environmental variability and fish stocks, and ... that IOC activities in ocean science can enhance and complement the study of living resources." It was further decided that the relevant Scientific Advisory Bodies of the Commission would be requested to develop a comprehensive scientific programme plan and project proposals for research.

Subsequently SCOR and ACMRR formed Working Group 67 on Oceanography, Marine Ecology and Living Resources to study the problem. Their report, which was submitted to the Twelfth Session of the IOC Assembly, clearly identified the major issues, as summarized below.

As man's ability to catch fish throughout the ocean has increased, so has the potential to cause irremediable damage to the living resource wealth of the oceans. Although world fish landings have increased three-fold in the last 30 years, fisheries scientists are pessimistic as to the possibility of continued growth at the same rate. While overfishing was an actual or potential problem in only a few limited areas a couple of decades ago, the capabilities for increased harvesting now exist on a broad enough scale for over-fishing to be a problem virtually anywhere in the world ocean.

> "Management techniques must be applied now or in the near future in most fisheries to conserve the resources and maximize the economic and societal benefits. Proper management requires a foundation of research on both the fish and the ocean environment in which they live.... Unfortunately, neither the capability to conduct research in living resources and other ocean sciences nor the scientific infrastructure to do it has kept pace with the ability to catch fish." (doc. IOC-XII/8 Annex 2)

As an initial point of departure towards developing the scientific basis for appropriate management, a matter of special concern to FAO, the Twelfth Session of the Assembly approved the basic proposals of SCOR/ACMRR WG 67 for an International Recruitment Project (IREP) and decided to:

OSLR Meetings

23-27 May 1980 Paris	Ad hoc Planning/Co-ordination Meeting (IOC/FAO) on a programme on Ocean Sciences in Relation to Living Resources (OSLR)
14-17 October 1980 Rome	Meeting of Experts on Ocean Sciences in Relation to Living Resources (OSLR)
23-27 August 1982 Santiago	Workshop on Marine Living Resources: Case Studies in the Southeast Pacific

OSNLR Meeting

19-24 July 1982 Heidelberg	Unesco/IOC/CMG Third Workshop on Marine Geosciences

Establish a Guiding Group of Experts for the programme on Ocean Science in Relation to Living Resources (OSLR), and invite the FAO to co-sponsor the programme;

Accept the offer of Canada to organize a Workshop on the future planning of IREP, to be held in Halifax, 27-30 September 1983;

Organize a Workshop, to be held in Paris, 6-9 September 1983, in collaboration with Unesco, IABO and SCOR, to examine the special problems of high-diversity ecosystems in the context of the OSLR programme.

As an input to this new programme, the IOC published the proceedings and technical contributions of the FAO Workshop on the Effects of Environmental Variation on the Survival of Larval Pelagic Fishes (Lima, 1980), as IOC Workshop Report No. 28.

The Commission supported, through lecturers from outside the region, a Workshop on Marine Living Resources: Case Studies in the Southeast Pacific (Chile, August 1982), and it co-sponsored with FAO a Technical Consultation on Changes in Abundance and Species Composition of Neritic Fish Stocks (Costa Rica, April 1983)

2.2 OCEAN SCIENCE IN RELATION TO NON-LIVING RESOURCES (OSNRL)

The new ocean regime offers promising opportunities to Member States for the rational exploitation of non-living resources found within their continental shelves. Ocean Science in Relation to Non-Living Resources (OSNLR) is another initiative launched by the Commission during the triennial period in order to assist its Member States in acquiring the geological/geophysical knowledge required to locate and explore their non-living marine resources. The Executive Council, through Resolution EC-XIV.19, called upon the UN, through its Ocean Economics and Technology Branch, to co-sponsor the development and implementation of such a programme. The Scientific Committee on Ocean Research (SCOR) and the Commission on Marine Geology of the International Union of Geological Science, assisted the IOC to prepare a proposal for OSNRL, submitted to and approved during the Twelfth IOC Assembly.

The programme proposal was developed at the Third International Workshop on Marine Geoscience (Heidelberg, July 1982), organized by the Commission for Marine Geology of the International Union of Geological Sciences, at the request of and with the support of IOC and the Unesco Division of Marine Sciences. In his introduction to the Workshop section on Ocean Science and Non-Living Resources, Dr. Eric Simpson, President of SCOR, gave an overview of present and future research trends:

"The 1970's were the International Decade of Ocean Exploration. As a result, we have witnessed a decade of intensive exploration of the ocean floor, particularly with respect to the deep oceans. Our knowledge of deep-ocean mineral resources and offshore hydrocarbon deposits is therefore much more comprehensive than before.

In fact, hydrocarbons remain the most important marine mineral resource by far. Very considerable effort has gone into the study of offshore margins with a view to finding sedimentary basins which are prospective for hydrocarbons. Nonetheless, there are large areas of the world's continental shelves where further prospecting is necessary.

Of the inorganic minerals, only comparatively near-shore shelf deposits to depths of about 40 metres have so far been recovered commercially. Sand and gravel remain the most important of these. ...For many maritime nations, such offshore aggregate is likely to remain the principal offshore inorganic mineral recovered over the next decade and substantially more effort needs to be devoted to the location of these deposits and to their potential environmental impact....

In the deep-sea, manganese nodules are the largest and the most interesting type of deposit from a commercial standpoint. Nonetheless, only a relatively small percentage of the nodules (less than 5%) is commercially prospective. From a scientific point of view, the major aspects of nodule genesis are now understood. Future studies must be directed to special types of nodules and specific programmes that will answer critical problems."

Subsequent discussions at the Workshop covered a wide range of topics on research in the marine geosciences. Recommendations for future research (included in IOC Workshop Report No. 31) were endorsed by the Assembly which, through Resolution XII-2, decided to set up a Guiding Group of Experts on Implementation of the Programme of Ocean Sciences in Relation to Non-Living Resources to further develop relevant IOC activities in joint sponsorship with the UN(OETB).The Guiding Group is also expected to provide scientific and technical advice to IOC regional subsidiary bodies involved in implementation of regional components of OSNLR.

The programme approved by the Assembly has also taken into account the considerable previous experience of the Commission gained through its various geological and geophysical activities, notably in the WESTPAC region, through collaboration with CCOP and CCOP(SOPAC).

During the 1980-82 period, close co-operation has continued in the fields of marine geology, geophysics and mineral resources, between the IOC and the Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP), established by ESCAP for the Southeast Asian region, and with the Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas (CCOP/SOPAC), established by ESCAP for the South Pacific region.

The CCOP(SOPAC) IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, held in Noumea, New Caledonia, 9-15 October 1980, was attended by participants from 15 Member States and identified 20 projects for implementation by the Committee for Co-ordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas (CCOP/SOPAC), in collaboration with the IOC through the Programme Group for WESTPAC.

The Seventeenth Session of CCOP in Bangkok (November 1980), was attended by Dr. G. Gierman, then Deputy Secretary IOC, who is a Special Advisor to CCOP.

The Ninth Session of CCOP(SOPAC) was held in Tarawa, Kiribati (October 1980), and was attended by Dr. R. Richmond, from Suva, on behalf of the Commission. CCOP and CCOP (SOPAC), as the lead organizations for joint programmes in marine geology, geophysics and mineral resources within the WESTPAC region, perform an excellent co-ordinating role. Both organizations have expressed their satisfaction with the co-operation with IOC, of which the above-mentioned Workshop in Noumea is a good example.

The Joint CCOP-IOC Working Group on post-IDOE Studies of East Asian Tectonics and Resources (SEATAR) held its Sixth Session in Bangkok (10 November 1980), in conjunction with the Seventeenth Session of the Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP) Bangkok, 4-7 November 1980). It should be noted here that the rate of implementation of the SEATAR programme, in particular through the co-operation of the developing countries of the region, is particularly satisfactory. The Working Group agreed to widen its programme, which is composed of ten transects, and to negotiate an extension to the mainland of China.

The Seventh Session of the CCOP-IOC Working Group on post-IDOE Studies on East Asia Tectonics and Resources (SEATAR) was held in Quezon City, Philippines, on 26 November 1981, in conjunction with a national SEATAR Workshop on the Luzon-Marianas Transect. IOC was represented by Dr. Mario Manasala. In developing its future programmes, SEATAR is seeking a better balance between the tectonics and the resources aspects.

A SEATAR Workshop on Palaeomagnetic Research was held March 1-5, 1982, in Kuala Lumpur, hosted by the University of Malaysia, with the financial support of IOC. Attended by 47 scientists from 13 Member States, the Workshop's main conclusions were that: (i) palaeomagnetic research should be a fundamental part of basic mapping programmes; (ii) magneto-stratigraphic studies of economic deposits including oil-bearing sequences, should be pursued; (iii) provision of training is vital; (iv) sampling programmes of critical formations should be broad enough to result in reliable determination of palaeomagnitic poles; (v) all available analytical techniques should be exploited; (vi) more unified reporting standards were specified.

The Eighth Session of the CCOP-IOC Working Group on SEATAR was held in Tokyo on 3 December 1982; it reviewed the progress in SEATAR's activities.

In preparation for the associated ocean services required by the OSNLR programme, the Working Committee on IODE has formed a Task Team on Data on Non-living Resources in the Ocean.

2.3 CHEMICAL COMPOSITION OF THE MARINE ENVIRONMENT AND STATE OF THE HEALTH OF THE OCEANS

At its Fourth Session (6-12 January 1982), the Working Committee for the Global Investigation of Pollution in the Marine Environment (GIPME) evaluated the research and monitoring needs of IOC Member States, and prepared a detailed five-year plan of work. The Committee also identified the stages of a detailed development plan for marine pollution research, baseline studies and monitoring, with a view to providing a sound scientific basis for regulatory action.

The Working Committee assessed the continued applicability of the Comprehensive Plan for GIPME and the strategy and priorities for current and planned activities within the GIPME Programme. The Comprehensive Plan was published by the IOC in 1976 as IOC Technical Series No. 14. It proposes a systematic scientific approach, or philosophy, to the determination of the extent of marine pollution through a set of discrete, sequential and iterative procedures. Implicit in the Plan is the use of mass-balance assessments to judge the degree of contemporary oceanic contamination. Such assessments may then be combined with knowledge of the biological effects of potential contaminants to define the impact and consequences of marine pollution.

The Working Committee decided that, conceptually, the Comprehensive Plan for GIPME is as valid and applicable today as it was when first published. Indeed it exemplifies a logical and intrinsically scientific approach to the problem of quantifying marine pollution. Neither its philosophical basis nor its approach requires revision at present. Consequently, the Working Committee for GIPME proposed a strategic plan for, and assigned priorities to, future activities within the initial phases of implementation.

All the various components of the Comprehensive Plan for GIPME are depicted schematically in Figure 2. The Plan comprises four major stages, each of which contains a variable number of components: (i) mass-balance (which includes baseline measurements), (ii) contamination assessment,(iii) pollution assessment and (iv) regulatory action. All of these stages are intended to be addressed sequentially for any given potential marine contaminant, but they are also linked by feedback loops that permit iteration of the procedures in individual stages of the Plan.

The proposed activities of the IOC marine pollution research and monitoring programme, including the Marine Pollution and Monitoring System (MARPOLMON) will be presented, in the context of this strategic framework, to the UNEP Governing Council in May 1983, with the aim of providing the Council an opportunity to review the Commission's efforts in this area, and to determine the extent to which UNEP is prepared to join with the IOC in co-sponsoring one or more of the programmes and activities described therein.

2.3.1 Group of Experts on Methods, Standards and Intercalibration (GEMSI)

During 1980-82, the GIPME Group of Experts on Methods, Standards, and Intercalibration (GEMSI), continued to render technical advice, under new terms of reference, as will the newly-formed GIPME Group of Experts on Effects of Pollutants (GEEP). A detailed programme of intersessional activities for these Groups has been drawn up. This includes, inter alia: conducting a world-wide intercalibration exercise on trace metals in biological material; generating detailed plans for

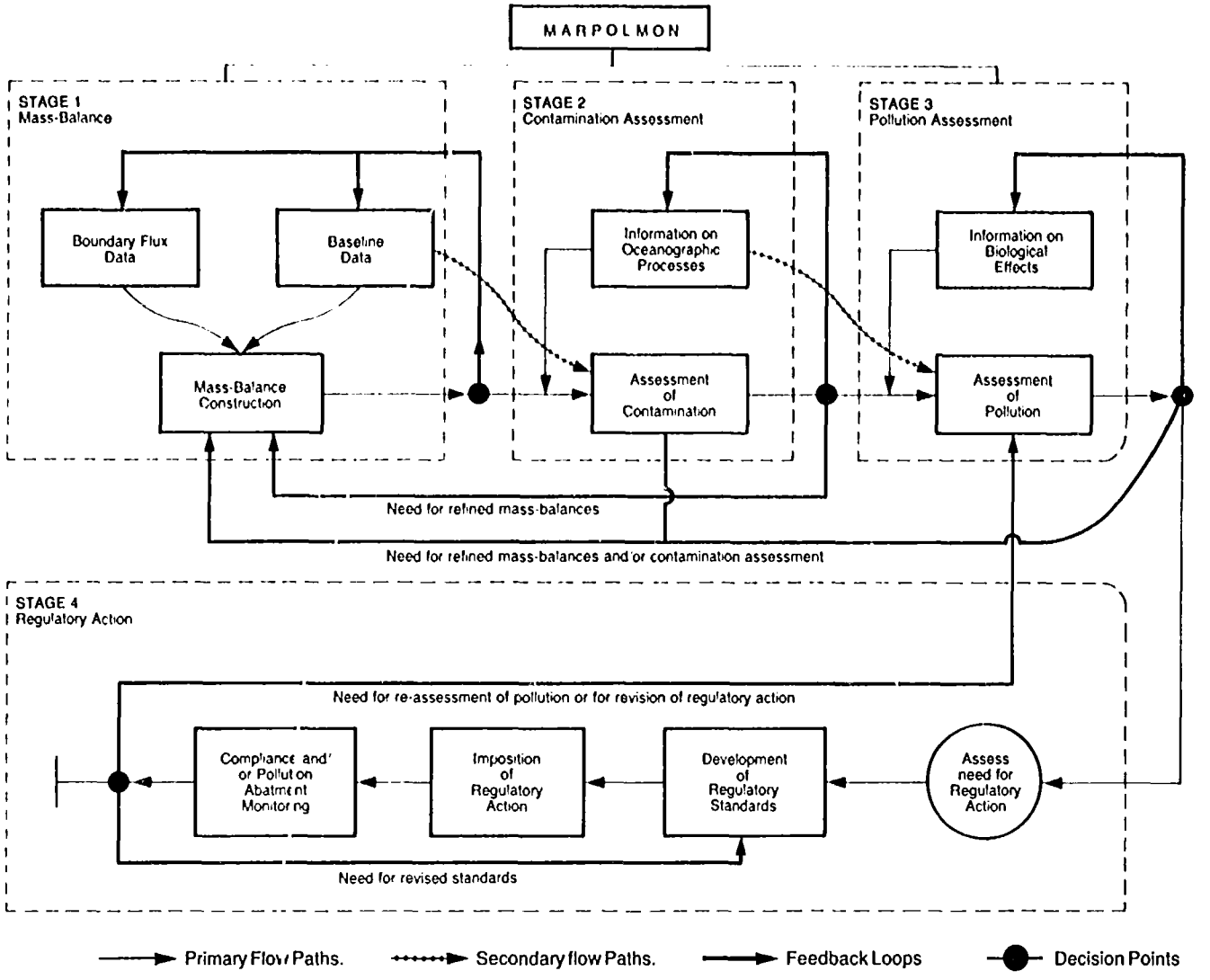


Fig. 2 - A schematic presentation of the four major stages of the Comprensive Plan for GIPME.

an Intercalibration Workshop for the WESTPAC region; preparation of an intercalibration exercise on dissolved/dispersed hydrocarbons and on the analysis of the sea-surface microlayer. In addition, at the request of UNEP, GEMSI is at present reviewing and revising several analytical reference methods.

The results of an intercalibration workshop held in Bermuda (January 1980) (Fig. 3) and of an intercalibration of organochlorine standard solutions were presented at the Third Session of the Group of Experts on Methods, Standards and Intercalibration (GEMSI) (September 1980). GEMSI also considered the feasibility of monitoring pollutants (especially oil, heavy metals and organochlorines trapped in the sea-surface microlayer) in the Pilot Project, and decided that such monitoring is feasible and desirable in the context of MARPOLMON. An intercalibration exercise is planned as the essential first step, and a manual will be prepared on the sampling method.

During the Fourth Session of GEMSI (March 1982), the technical and scientific aspects of implementation, as well as future action, of the Comprehensive Plan for GIPME were discussed. Regional aspects of marine pollution, particularly in the IOCARIBE and WESTPAC regions were considered. Among other items discussed by GEMSI was its relationship with other subsidiary bodies of the Working Committee for GIPME, and the scientific and technical aspects of co-operation with other UN and intergovernmental organizations, especially UNEP and ICES.

As a contribution to the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP) and in the framework of TEMA, the Australian Department of Science and the Environment organized a training course (Perth, 18 February - 1 March 1980). Eight participants from six countries of the WESTPAC region attended the course which covered methods for sampling and analysis.

On the basis of advice from GEMSI, a revised Manual for MARPOLMON - Petroleum is under preparation. The methods and principles for data reporting have been introduced in UNEP Regional Seas Programmes where petroleum pollution is of concern.

Fig. 3 - During the Bermuda Intercalibration Exercise, a Sodmann Bottle is prepared for sampling of sea water to be used for organochlorine analysis.

2.3.2 Health of the Oceans

An assessment of the Health of the Oceans was undertaken by the IMCO/FAO/Unesco/UN/WMO/WHO/IAEA/UNEP Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP). At the request of the Unesco Division of Marine Sciences, an IOC staff member serves as the Technical Secretary for GESAMP. The GESAMP assessment revealed significant gaps in data and understanding of marine pollution, which can be filled by the GIPME programme, after research needs have been determined by the IOC Working Committee for GIPME and specific data sets developed through the Marine Pollution Research Programme and Monitoring System (MARPOLMON). The first review of the Working Group on the Health of the Oceans will be published by Unesco, as the lead agency of the Working Group, in late 1982. The review includes the following topics: basic properties of the ocean system; biogeochemical cycles; pollutants in the marine environment; implication for the use of the marine environment; specific problems of regional significance; methodology for the assessment and control of marine pollution and conclusions.

2.3.3 Regional Activities in GIPME

Although global in scope, GIPME is implemented through regional activities which include a strong training, education and mutual assistance component, aimed particularly at the developing countries. Marine pollution research and monitoring are implemented through the regional subsidiary bodies of the Commission and in relation with the UNEP Regional Seas Programme Action Plans to which the IOC contributes by providing technical backstopping for projects under these Action Plans.

2.3.3.1 The Western Pacific (WESTPAC)

GEMSI, and especially its ad hoc Group on the Use of Marine Organisms in MARPOLMON, has identified the WESTPAC region as one of the first areas where training and intercalibration exercises will be conducted, and a consultant has visited (December 1982) some of interested laboratories in the region to finalize details for a regional intercalibration exercise to be held in 1983 in Australia.

The WESTPAC Task Team on Marine Pollution Research and Monitoring Using Commercially Exploited Shellfish as Determinants has developed a sound programme, as an important regional component of GIPME, and of which the above-mentioned intercalibration exercise is a specific follow-up.

A Workshop on the Coastal Transport of Pollutants was held in Tokyo (March 1980), with the support of Japan, from which emanated recommendations concerning future studies relating to marine pollution research and monitoring within the region. The report was issued as IOC Workshop Report No.24.

Under the UNEP Action Plan for East Asian Waters and the Western Pacific, the IOC has collaborated with FAO and UNEP in the assessment of the origin, magnitude and effects of oil pollution in Southeast Asian waters.

2.3.3.2 Southwest Atlantic

The IOC International Workshop on Marine Pollution in the Southwest Atlantic took place in Montevideo (10-14 November 1980). Seventeen experts from the three Member States of the region (Argentina, Brazil and Uruguay) participated and four experts from outside the region. The Workshop reviewed marine pollution research and monitoring in the region and made one composite recommendation for future development of regional co-operation. The Workshop did not consider itself in a position to make specific project proposals, but did recommend the formation of a Standing Committee consisting of one expert from each Member State of the region (Argentina, Brazil and Uruguay) and one expert nominated by IOC. Participants also proposed the establishment of a Regional Marine Pollution Intercalibration Centre. The Workshop emphasized the need for consolidated national plans as a basis for regional co-operation and co-ordination. It also called upon the countries of the region to determine their needs for training and technical assistance.

2.3.3.3 Caribbean and adjacent regions

The regional marine pollution monitoring proramme (CARIPOL) of the IOC Association for the Caribbean and adjacent regions (IOCARIBE) includes measurements of oil in its various forms and derivatives in the marine environment, and is a regional component of MARPOLMON. CARIPOL will provide inputs to the Action Plan for the wider

Caribbean which has been d[illegible]ped by UNEP and the Economic Commission for Latin America (ECLA), and for which UNEP has organized three planning meetings: (Caracas 28 January - 2 February, 1980, Montego Bay, 6-8 April 1981, and Cartagena, 14-25 April 1983).

Marine chemists from the region, as members of the Steering Committee for CARIPOL, met to define a programme of future regional activities which will be expanded to include other types of marine pollutant such as pesticides and heavy metals (Veracruz, October 1982).

In the framework of CARIPOL, a Training Course on Marine Pollution Monitoring was held in San Jose (8 September - 2 October 1980), in English and Spanish, with the financial support of IOC and through contributions from Venezuela to the IOC Trust Fund. Ten trainees from seven Member States participated in the course given in English, and thirteen trainees from eight Member States took part in the Spanish course.

2.3.3.4 Gulf of Guinea and adjacent areas

With the collaboration of IOC and other organizations of the UN system, an Action Plan for the region was prepared by UNEP, and considered by a UNEP Meeting of Experts to Review the Draft Action Plan for the West African Region (Libreville, Gabon, 5-9 November 1979). It was further developed and adopted by a Conference of Plenipotentiaries on Co-operation in the Protection and Development of the Marine and Coastal Environment of the West African Region (Abidjan, 16-23 March 1981).

2.3.3.5 Kuwait Action Plan Region

A Draft Action Plan for the region was approved by a UNEP Meeting of Governmental Experts on the Co-operative Projects of the Kuwait Action Plan, held in Kuwait, 19-23 November 1979. The Plan contains a proposal for the assessment of the origin and magnitude of oil pollution in the region, as well as of industrial organisms. However, the evaluation of some preliminary information-gathering projects, the creation of the Interim Secretariat under the Kuwait Regional Convention on the Protection and Development of the Marine Environment and the Coastal Areas, and the unsettled situation in the region, have led to a delay in implementation.

The resulting need to re-evaluate the Action Plan was discussed at a First Government Experts' Review Meeting on Co-operative Projects of the Kuwait Action Plan in Kuwait (11-15 April 1981), convened by the Interim Secretariat. Out of this grew a proposal to form two Task Forces, one to deal with physical, chemical, biological, and geological oceanography, and the other to deal with oil and non-oil pollution. The IOC participates in both Task Forces, but the meeting did not assign specific tasks to the collaborating organizations of the UN system. The role of IOC and other organizations of the UN system was worked out at an inter-agency meeting (kuwait, 9-11 January 1982). The Commission was represented at two meetings of the KAP Task Forces on Oceanography and on Baseline Studies of Oil and Non-oil Pollutants (Kuwait, 9-13 January 1982).

A mission was conducted in the region by two consultants who developed plans for two training courses which IOC and Unesco are organizing on behalf of UNEP. One, to be held at the University of Qatar, will be on oceanographic measurements and the maintenance of equipment; the second, convened in Basrah, Iraq, will be on the fate of petroleum in the environment. Both will be held end of 1983.

2.3.3.6 Mediterranean

Phase I of the UNEP Co-ordinated Pollution Monitoring and Research Programme (MED POL) formally ended on 31 March 1981. The results of Phase I were evaluated at a Meeting of Experts to Evaluate the Pilot Phase of MED POL and to Develop a Long-Term Monitoring and Research Programme for the Merditerranean Action Plan (Geneva, 12-16 January 1981).

The two projects formally co-ordinated by IOC (MED-I, Baseline Studies and Monitoring of Oil and Petroleum Hydrocarbons in Marine Waters, and MED-VI, Problems of Coastal Transport of Pollutants), in common with the other five basic projects, were judged to have provided considerable experience to Member States and their participating research centres in regional co-operation in marine scientific and technical programmes.

Results were not as numerous as was originally hoped, and various reasons for this were evaluated. In most cases it had not been possible to make realistic assessments of the state of marine pollution in the region as a whole. Intercalibration exercises were not as successful as anticipated and many participating research centres, for various reasons, did not follow closely enough the methods agreed upon. The proposal for Phase II developed by the Expert Meeting was submitted to a UNEP Meeting of Financial and Programming Experts of the Mediterranean Coastal States (Geneva, 26-30 January 1981), at which IOC was not represented, owing to the heavy workload of the Secretariat. The proposal was then submitted to the Second Meeting of the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution, and its Related Protocols, and to the Intergovernmental Review Meeting of Mediterranean Coastal States on the Action Plan (Cannes, 2-7 March 1981). This meeting approved Phase II of the Action Plan, the costs of which have been estimated at US$12 million for the three-year period, 1981-83.

It is expected that the IOC will be called upon to co-ordinate, with the collaboration of the International Laboratory of Marine Radioactivity (of IAEA) in Monaco, the marine pollution monitoring of reference (open-sea) areas, and, with the collaboration of the Unesco Division of Marine Sciences, relevant oceanographic studies.

The IOC is preparing documentation describing reference methods for some trace metals in seawater and in sediments, for use in MED POL Phase II.

In co-operation with ICSEM and UNEP, the IOC co-sponsored the VIth Workshop on Pollution in the Mediterranean (Cannes, 6-10 December 1982); this Workshop reviewed the state of knowledge of marine pollution of the Mediterranean.The Proceedings of the Workshop will be published by the IOC in 1983.

2.3.3.7 Southeast Pacific

In this region IOC collaborates with the CPPS (Comision Permanente del Pacifico Sur) in the

Meetings

11-26 January 1980 Bermuda	Intercalibration Exercise of the IOC/WMO/UNEP Pilot Project on Monitoring of Background Levels of Selected Pollutants in Open-Ocean Waters
11-15 February 1980 New Delhi	Third IOC/WMO Workshop on Marine Pollution (Petroleum) Monitoring
18 February - 2 March1980 Perth	Training Course on Petroleum Monitoring
8-12 September 1980 Monterey	Third Session of the Group of Experts on Methods, Standards and Intercalibration (GEMSI)
10-14 November 1980 Montevideo	IOC International Workshop on Marine Pollution in the Southwest Atlantic
3-5 March 1981 Miami	Consultation of the GEMSI ad hoc Group on Sampling of Sea-surface Microlayer
19-23 May 1981 Woods Hole	Consultation of the GEMSI ad hoc Group on Analysis of Dissolved/Dispersed Petroleum Hydrocarbons in Seawater
19-23 May 1981 Bermuda	GEMSI ad hoc Group on the Future Action under the IOC/WMO/UNEP Pilot Project on Monitoring Background Level of Selected Pollutants in Open-Ocean Waters
6-12 January 1982 New York	Fourth Session of the Working Committee for the Global Investigation of Pollution in the Marine Environment (GIPME)
8-12 February 1982 Paris	GEMSI ad hoc Group on the Use of Marine Organisms in MARPOLMON
25-31 March 1982 Curacao	Fourth Session of the Group of Experts on Methods, Standards and Intercalibration (GEMSI)
17-19 May 1982 Texel	Consultations on the IOC/WMO/UNEP Pilot Projects on Monitoring of Selected Pollutants in Open-Ocean Waters
15-21 August 1982 Texel	Meeting on IOC/WMO/UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters
4-5 October 1982 Paris	Working Group on the GIPME Programme Development
11-13 October 1982 Veracruz	IOCARIBE/CARIPOL Steering Committee workshop
6-10 December 1982 Cannes	Sixth UNEP/ICSEM/IOC Workshop on Marine Pollution of the Mediterranean

execution of the marine pollution research and monitoring component of the UNEP Action Plan for the Southeast Pacific. The Commission was represented at two meetings (a UNEP/CPPS Meeting of Government-nominated Experts to Develop an Action Plan for the Southeast Pacific (Quito,29 June - 3 July 1981); and an Interovernmental Meeting to Adopt the Action Plan in the Southeast Pacific (Lima, 31 July - 7 August 1981).

The Working Committee for GIPME agreed to provide technical guidance to the Unesco/UNDP Project "Evaluation of Contaminants that Affect the Living Aquatic Resources of the Countries of the 'Andres Bello' Agreement" on the execution of an intercalibration exercise and in assisting with the required technical training. The IOC Assistant Secretary responsible for Marine Pollution Research and Monitoring gave specialized lectures to a meeting of experts held under this Project in Cartagena, Colombia in 1982. The Working Committee also agreed to assist in a similiar effort for the Gulf of Guayaquil in Ecuador funded by the Organization of American States. The IOC provided support through IEMA in the form of travel grants.

2.3.3.8 North Atlantic, North Sea and Baltic Sea

The IOC and the International Council for the Exploration of the Sea (ICES) have agreed to co-operate specifically in the development and conduct of intercalibration exercises such as that organized in Bermuda in January 1980 (IOC Workshop Report No. 25, superseded by IOC Technical Series No. 22), and of the ICES Intercalibrations of Petroleum Analysis of Mussel Homogenate (1983).

2.3.4 Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-ocean waters

As an input for developing the Marine Pollution Monitoring System (MARPOLMON) under GIPME, a Workshop on Intercalibration of Sampling Procedures of the IOC/WMO/UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in open-ocean Waters was held in Bermuda, January 1980. The intercalibration compared three types of sampling bottles and three types of hydrographic wire. Forty-five scientists from twelve Member States participated in the exercise. A report of the workshop was issued as IOC Workshop Report No. 25, and the detailed report of the analytical results was issued as IOC Technical Series No. 22. It represents a major achievement, being the first operational activity of the Commission in this field.

The Third IOC/WMO Workshop on Marine Pollution Monitoring, which was held in New Delhi (February 1979), reviewed the results of the Marine Pollution (Petroleum) Monitoring Pilot Project (MAPMOPP), which formally ended in June 1980). It was concluded that the objectives of the Pilot Project had been achieved and it recommended that, in most respects, the activities under MAPMOPP should be incorporated into a preliminary phase of the petroleum component of MARPOLMON. The Workshop also considered the feasibility of including new techniques for petroleum monitoring and of eventually incorporating pollutants other than oil into the MARPOLMON programme.

As follow-up action under the Pilot Project, further studies have been proposed to the UNEP Regional Seas Programme Activity Centre on the collection and determination of organochlorine compounds in seawater. The purpose of these studies is to determine background levels of these compounds and selected trace metals in open-ocean waters and to conduct experiments relevant to mechanisms of transport of pollutants in the marine environment. The baseline study will be organized by IOC in co-operation with the Bermuda Biological Station for Research, and research institutions of IOC Member States will be requested to join the exercise.

2.4 OCEAN DYNAMICS AND CLIMATE

Within the last decade it has become clear that human activities can influence the global climate and that, conversely, climate change can seriously affect human activities. To gain greater understanding of the mechanisms that govern climate change, WMO has launched the World Climate Research Programme (WCRP), which concentrates on the physical and dynamical properties of the climate system. The principal objectives of the WCRP are to determine the sensitivity of the climate to possible changes in external influences and to seek ways of making useful predictions of climate change (Fig. 4).

IOC's role in the study of climatic changes and the ocean was set out in Resolution XI-3 of the Eleventh Session of the IOC Assembly; the Member States called upon IOC to plan and undertake the oceanographic component of WCRP. The Assembly requested the IOC/SCOR Committee on Climatic Changes and the Ocean (CCCO) to plan and promote the oceanic component of the World Climate Research Programme (WCRP) for which the Commission is responsible, and, in particular,"to take the lead in recommending and developing the components, programmes and arrangements necessary for the oceanographic portion of climate programmes".

The main focus of the Joint SCOR/IOC Committee on Climatic Changes and the Oceans during the triennium has been to identify the types of research that are required to improve our understanding of the ocean's role in climate change and variability, and to identify the most important climatologically significant processes and means of their incorporation into physical mathematical models. The planning of an ocean observation programme has also begun, including the development of advice regarding its co-ordination.

The Joint SCOR/IOC CCCO and the Joint Scientific Committee for the WCRP, of ICSU and WMO, have, by means of study groups, panels and invited experts, done the overall planning based on the guidance given by two sessions of the Joint SCOR/IOC CCCO (Tokyo, May 1981 and Split, March 1982). National research proposals have been reviewed for their potential contributions, and the scientific community has been invited to evaluate the international proposals and to provide independent research recommendations.

2.4.1 Large-scale oceanographic experiments in the WCRP

Eighty-one oceanographers and meteorologists met in Tokyo at the Japanese Meteorological Agency (May

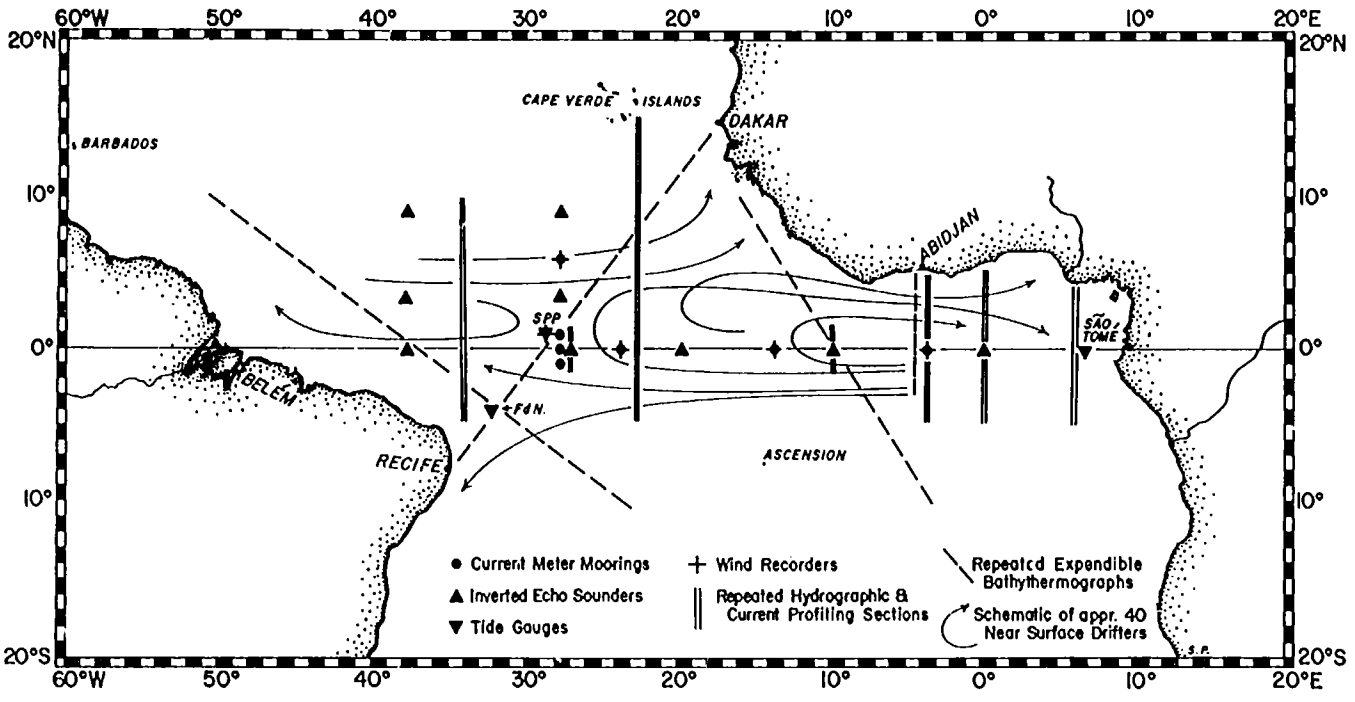


Fig. 4 - Observational systems of the Programme National d'Étude de la Dynamique du Climat (FOCAL-France) and the Seasonal Equatorial Atlantic Experiment (SEQUAL-USA), one of the many national efforts which contribute to the understanding of climate change and the oceans.

1982) for a Study Conference on Large-scale Oceanographic experiments in the World Climate Research Programme (WCRP). Organized by IOC, SCOR, WMO and ICSU, the Conference was convened to determine the scientific basis for an experimental research strategy and to review, assess and identify critical experimental components. As a result, the following programmes are being planned:

2.4.2 A World Ocean Circulation Experiment (WOCE)

The purpose of the WOCE is to understand quantitatively the general circulation of the ocean, in order to assess the sensitivity of the climate system to change in external forcing, whether natural or due to man, on time scales of decades to centuries.

2.4.3 The Tropical Oceans of the Global Atmosphere (TOGA)

The interannual variability of the tropical ocean is known to be one of the largest signals of climate variability on earth. Efforts within TOGA will be aimed at a description of the changes in the tropical ocean in response to atmospheric forcing; identification and description of those changes in the global atmospheric circulation which are related to changes in the tropical ocean; and an identification of the physical causes of relationships between the tropical ocean and the global atmosphere. The activities of TOGA are in an initial stage of development in a large number of national and co-operative observational programmes, in which the regional subsidiary bodies of the IOC are expected to play an active role.

2.4.4 Heat flux studies in the Atlantic and Pacific

The establishment of reliable methods of measuring the meridional transport of heat and salt by the oceans is essential for the WCRP, and these study programmes are designed to achieve that end by intercomparison of different methods.

The oceanographic components of the WCRP will require large-scale observational programmes, to be implemented or co-ordinated by the IOC. An essential element of these programmes will involve satellite systems, requirements for which have been defined, and an outline for a workplan, which addresses technical details has been developed. The main goal of this work would be to create the best possible data set for the establishment and study of climatologies of the important variables, such as wind stress and sea level elevation.

2.4.5 Ocean Monitoring

The IOC intends to develop progressively the basis for a global ocean monitoring system as a starting point for a World Ocean Watch which will include data gathered from all monitoring systems co-ordinated by the Commission. An ocean observation programme for climate research has been addressed within the Joint SCOR/IOC CCCO in the context of the Pilot Ocean Monitoring Study (POMS). The JSC and CCCO jointly organized a POMS planning meeting (Miami, October 1979) and a meeting on Time Series of Ocean Measurements (Tokyo, May 1981), with the support of the IOC. Studies recommended by these meetings are under way and the requirements for an ocean observing system, to be developed in the framework of IOC, are emerging. Such a world-wide ocean monitoring programme, to be

co-ordinated by IOC, will integrate national and international marine-oriented observational programmes, as well as incorporate new observational techniques. An Action Plan for an Ocean Observing System which has been submitted to IOC and WMO includes implementation guidelines for a wide variety of demands. The design of the observation system is being undertaken in close collaboration with the IOC/WMO Working Committee for the Integrated Global Ocean Services System (IGOSS), the IOC Working Committee for International Oceanographic Data Exchange (IODE) and with the advice of the Scientific Committee on Oceanic Research (SCOR).

Meetings

26-27 September 1980 Boston	First Meeting of the Cage Feasibility Working Group
26-31 January 1981 Chilton (UK)	Joint CCCO/JSC Meeting on the Co-ordination of Plans for Future Satellite Observing Systems and Ocean Experiments to be organized within the World Climate Research Programme (WCRP)
11-15 May 1981 Tokyo	Joint CCCO/JSC Meeting on Time Series of Oceanographic Measurements
18-22 May 1981 Tokyo	Second Session of the Joint SCOR/IOC Committee for Climatic Changes and the Oceans (CCCO)
4-5 November 1981 London	First Joint SCOR/IOC CCCO World Ocean Circulation Experiment (WOCE) Design Options Study Group
18-20 January 1982 Boulder	Second Meeting of the Cage Feasibility Working Group
1-3 February 1982 Paris	Meeting of the Joint SCOR/IOC CCCO ad hoc Group on Ocean Observational Systems
25-26 February 1982 Paris	Second Joint SCOR/IOC CCCO World Ocean Circulation Experiment (WOCE) Design Options Study Group
1-5 May 1982 Split	Third Session of the Joint SCOR/IOC Committee for Climatic Changes and the Oceans (CCCO)
10-21 May 1982 Tokyo	Joint CCCO/JSC Study Conference on Large-Scale Oceanographic Measurements in the World Climate Research Programme (WCRP)
21-23 June 1982 Yalta	Joint SCOR/IOC CCCO Tropical Atlantic Climate Studies Panel Meeting
24-29 June 1982 Geneva	Joint WMO/CAS/JSC-CCCO Meeting of Experts on the Role of Ice in Climatic Variations
31 July 1982 Bedford (Canada)	Joint SCOR/IOC CCCO workshop on Sea Level Data Requirements for Climatic Studies
27 September - 1 October 1982 Sidney (Canada)	Joint SCOR/IOC CCCO Pacific Heat Flux Study Group
13-16 October 1982 Princeton	CCCO/JSC Study Group on Inter-annual Variability of the Tropical Oceans and Global Atmosphere (TOGA)

2.4.6 The WMO-ICSU Global Atmospheric Research Programme (GARP)

The Global Atmospheric Research Programme is a joint undertaking of the World Meteorological Organization (WMO) and the International Council of Scientific Unions (ICSU); it is one of the most ambitious and complex co-operative international geophysical studies ever undertaken. During the First GARP Global Experiment (FGGE) Operational Year (1 December 1978 to 30 November 1979), which provided unprecedented data for the study of the many oceanic processes linked to atmospheric forcing and feedback, the IOC played a major role in oceanographic data management and in documenting and planning all oceanographic aspects of the experiment.

As an input of IOC to the FGGE Data Management plan of WMO, two parts of the Global Ocean Data Inventory of planned and/or completed oceanographic work were issued in 1979 and 1981 by the Environmental Data and Information Service (EDIS) of NOAA (National Ocean and Atmospheric Administration of the United States of America).

The Global and Ocean Data Inventory, produced in collaboration with the Bureau National de Donnees Oceaniques (BNDO) of France and under the guidance of IOC, is part of the EDIS commitment to IOC in its capacity as an IOC Responsible National Oceanographic Data Centre (RNODC) for the FGGE Operational Year. More than 1300 principal investigators from 33 countries provided inventory information on 6300 planned or existing oceanographic data sets. The dates spanned by the Inventory are September 1978 to March 1980. Also as part of the FGGE data management plan, EDIS is compiling, in collaboration with IOC and BNDO, a Global Ocean Data Base, targeted for completion by December 1983.

The IOC has co-ordinated the oceanographic component of another GARP Regional Experiment, namely ALPEX (Alpine Experiment). The goal of the marine scientific investigations during the Mediterranean Alpine Experiment (MEDALPEX) was to understand the effect of wind forcing on the dynamics of the western part of the Mediterranean and Adriatic Seas. A promising example of a co-ordinated oceanographic experiment resulting from a strong expression of interest by the Commission and the willingness of several national oceanographic institutions (Belgium, France, Italy, Spain, Turkey, the USSR and Yugoslavia), MEDALPEX began on 1 September 1980 and continued until 30 September 1982, with a special period of intense observations in March/April 1982. The IOC funded the post of the MEDALPEX Technical Co-ordinator for oceanography, which was located at WMO headquarters during the experiment.

Measurements of sea and air parameters were made possible through the support of seven countries which provided a total of eleven ships, three meteorological buoys and about twenty-five subsurface moorings with current meters, several platforms and seventeen highly instrumented aircraft. The scientific results of MEDALPEX will be issued by IOC in the near future. Two national data centres assumed responsibility for MEDALPEX data management and exchange, the USSR for oceanographic data and the UK for sea level data.

MEDALPEX training opportunities were offered by Member States, with the support of IOC, to two students from a Mediterranean developing country. The purpose of this training component was to enable young scientists to gain experience in certain observational techniques, including the launching of expandable bathythermographs, and in the use of the resultant data.

Meetings

25-28 February 1980 Paris	Ad hoc Planning Meeting on GARP/ALPEX Oceanography
24-25 September 1980 Paris	Second Planning Meeting for Oceanographic Programmes during MEDALPEX
24-25 February 1981 Paris	Third MEDALPEX Meeting
19-20 October 1981 Paris	Fourth MEDALPEX Meeting

3. GLOBAL OCEAN SERVICES

3.1 THE INTEGRATED GLOBAL OCEAN SERVICES SYSTEM (IGOSS) (formerly the Integrated Global Ocean Station System)

The Integrated Global Ocean Services System (IGOSS) is a Joint IOC/WMO, world-wide, operational service system providing, in real time, data on the state of the oceans for various marine users. The primary purpose of IGOSS is to make available to Member States of IOC and WMO oceanic products required by them for the provision of efficient and effective ocean services, whether for operational applications or research (Fig. 5).

To achieve this purpose IGOSS is designed to promote, develop and co-ordinate the international arrangements necessary for the timely global acquisition and exchange of oceanic data, the provision of ocean services and the dissemination to various user groups of oceanic products including observations, analyses and predictions of important ocean features. These users are concerned with exploration and exploitation of biological and mineral resources of the ocean, shipping, weather and climate, recreation, search and rescue operations, oceanic and offshore engineering, harbour control and pollution abatement and control. The products are also used in support of meteorological and oceanographic research (Fig. 6).

The Second Session of the Joint IOC/WMO Working Committee for IGOSS was held in October 1980. It prepared the General Plan and Implementation Programme for 1982-85 which was subsequently endorsed by the executive bodies of the IOC and WMO.

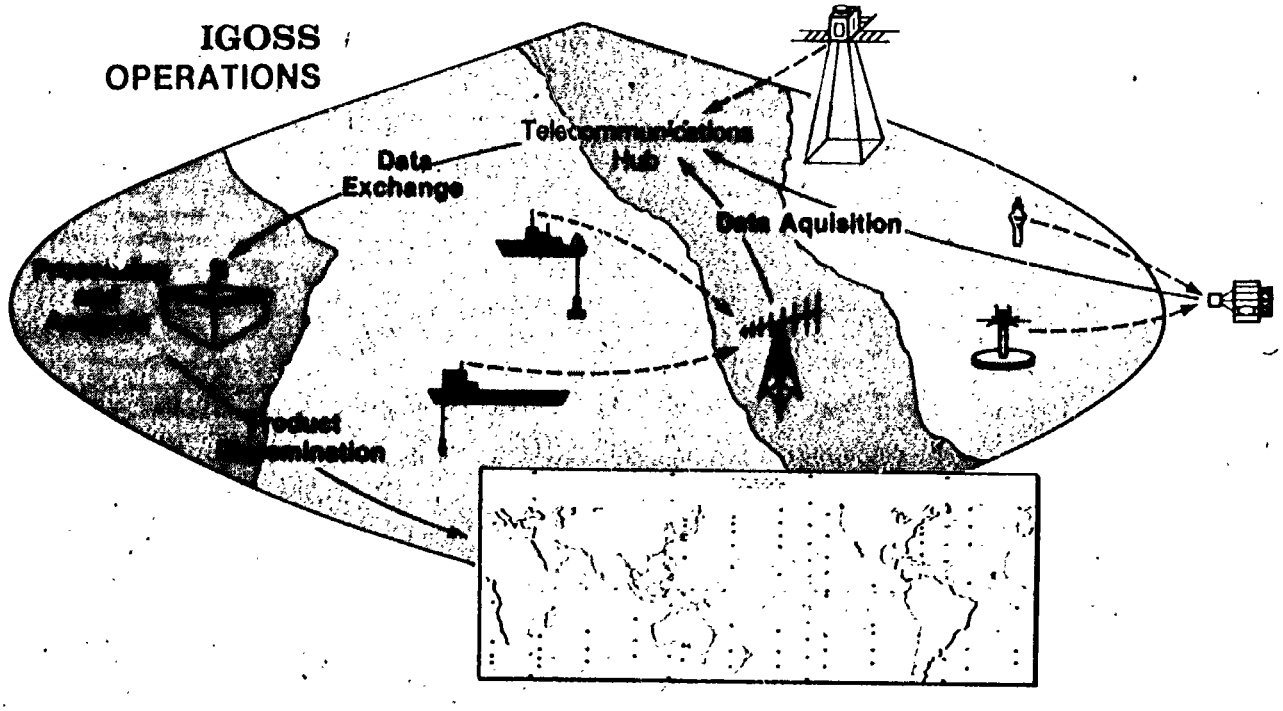


Fig. 6 - IGOSS in operation serving the world community.

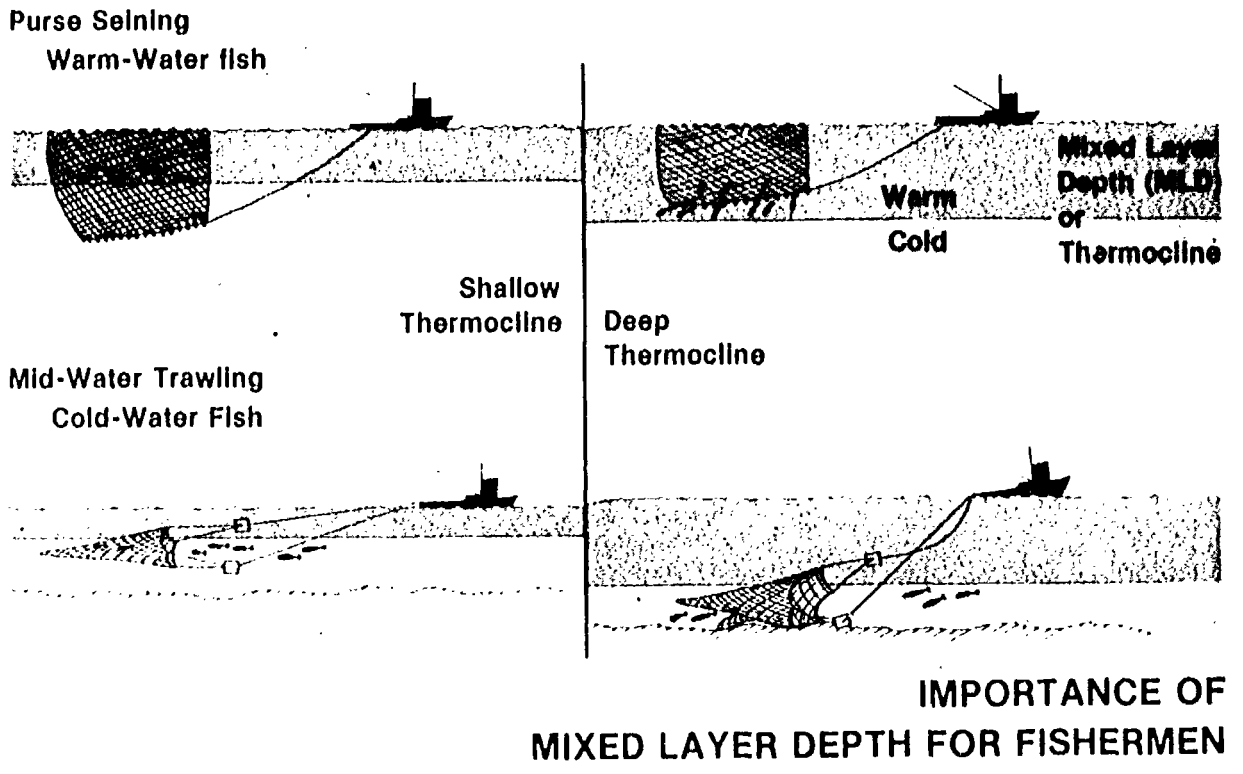


Fig. 6 - Subsurface temperature data in most ocean areas show a well-mixed surface layer overlying the main body colder water in the oceans. The boundary between these layers is called the thermocline. Because many fish species will not cross this temperature barrier, relevant data can be of great use in the setting of fishing gear.

In accordance with Resolution XI-6, the Working Committee transferred its marine pollution monitoring responsibilities to the IOC Working Committee on Global Investigation of Pollution in the Marine Environment (GIPME) and, therefore, disbanded its Sub-group of Experts on Marine Pollution Monitoring.

The Sub-groups of Experts on Operations and Technical Applications and Scientific Matters Related to IGOSS were maintained and a new Task Team of governmental experts was established to be responsible for implementation aspects of the IGOSS observing system.

The IGOSS General Plan and Implementation Programme for 1982-1985 (WMO Publication No. 582) is a guide for the further development of IGOSS in the manner desired by participating nations. It contains guidelines for the development of the following basic components of IGOSS: Observing System, Data Processing and Services System; telecommunications; research in support of the development of the system and training and education related to IGOSS. A general brochure on IGOSS was published in November 1979 by IOC and WMO with co-operation from the United States, and an update on this brochure is under active consideration.

Member participation in the IGOSS programme has grown from a few in the early seventies to over forty in 1982, who contribute to some or all aspects of IGOSS. 21 members now provide data within the IGOSS framework; 24 have designated coastal radio stations which receive BATHY/TESAC reports free of charge; 8 have processing centres which directly utilize these reports; and 30 prepare and regularly issue ocean services products. This member participation in the IGOSS programme is significant and provides a substantial resources base which can already, in part, satisfy global, regional and national requirements for timely oceanic data and information.

In 1980-82 major efforts were concentrated on the implementation of the activities described below.

3.1.1 The IGOSS Observing System

The first co-ordinated global observing system established by IGOSS was the Bathythermographic/ Temperature-Salinity-Currents (BATHY/TESAC) Operational Programme. This programme continues to be the major observational programme within IGOSS providing over 30,000 BATHY/TESAC reports per year.

The BATHY/TESAC programme comprises the world-wide collection, exchange and processing of BATHY data (profiles of ocean temperature with depth) and TESAC data (temperature/salinity/ current profiles with depth). Instructions and forms are available for recording standardized observation, message coding, and data transmission, so that data from each participating nation can be exchanged rapidly and accurately around the globe (Fig. 7).

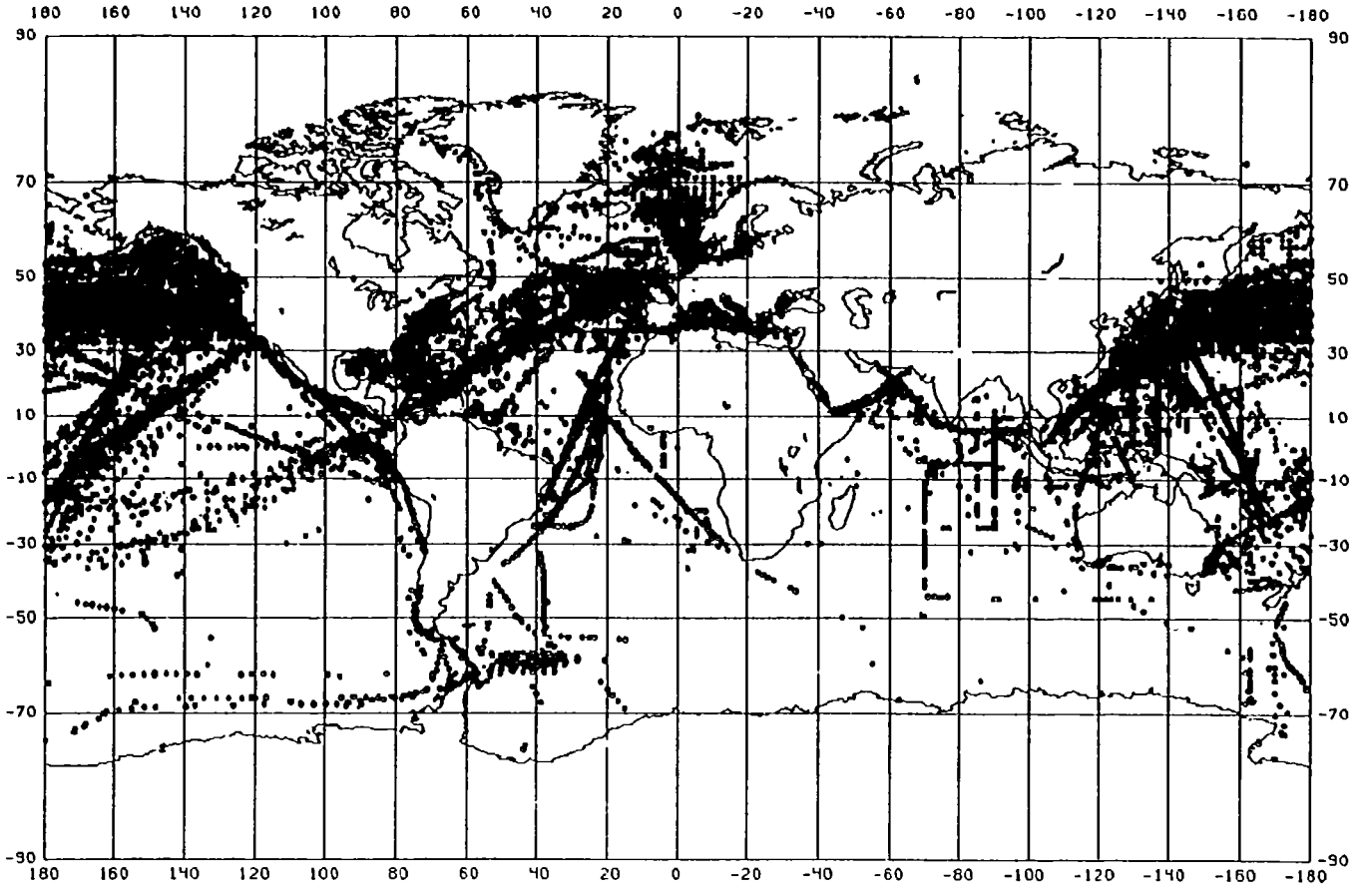


Fig. 7 - Distribution of BATHY and TESAC reports during 1982, showing wide global coverage by ships from many co-operating nations which contribute subsurface ocean temperature data to the IGOSS programme.

Ships and moored and drifting buoys from many co-operating nations contribute data to the system. The number of voluntary observing ships (ships-of-opportunity) submitting IGOSS reports has doubled since 1978. Global, regional and national groups use the BATHY/TESAC Operational Programme as a basis for their monitoring requirements.

For example, during the FGGE Operational Year Member States assigned ships, buoys, airplanes and satellites to collect oceanographic data through the IGOSS system for use in SCOR WG-47 scientific investigations, for the FGGE global oceanographic data set and regional data requirements for programmes such as MONEX, WAMEX, El Nino and NORPAX. A critical review of IGOSS activities in support of FGGE was held in April 1980, and the report, including recommendations for the further strenghtening of IGOSS in the decade of the 1980's was published as IOC-WMO/IGOSS- FE/Doc.13.

Other activities in support of the BATHY/TESAC operational programme include:A Joint IOC/WMO Meeting of Experts on Quality Control of IGOSS Data, held in March 1982. A Joint IOC/WMO Meeting on Code Requirements and Data Exchange Formats, held in March 1982.

3.1.2 The IGOSS Data Processing and Services System (IDPSS)

The organizational structure of the IGOSS Data Processing and Services System consists of National, Specialized and World Oceanographic Centres (NOC's, SOC's and WOC's, respectively; See Figure 1, IGOSS Plan and Implementation Programme 1982-85). The NOC's are responsible for the application of quality control procedures and the compilation of bulletins for insertion onto the GTS. The SOC's prepare quality controlled operational data sets and products for designated requirements or regions. These data sets are provided to Responsible National Oceanographic Data Centres (RNODC's) on a regular basis. The WOC's prepare global products on the basis of available data on the GTS.

Other activities related to IDPSS include the preparation of a draft Guide to the IDPSS, and the publication of an IGOSS poster.

3.1.3 IGOSS Regional Development

Following the endorsement of the concept of strengthening IGOSS through the development of regional implementation, Resolution 6 (JWC-IGOSS-I), the Second Session of the Joint Working Committee developed a set of Guidelines for Implementing IGOSS on a Regional Basis.

This initiative was followed by a Joint WMO/IOC Regional IGOSS Implementation Co-ordination Meeting in WESTPAC and NORPAX Regions, Tokyo, November 1981. In addition, preliminary assessments of the feasibility of the regional implementation of IGOSS were developed for the Caribbean and Eastern Central Atlantic regions, on the basis of staff missions to these two regions.

The highly successful WMO/IOC Implementation Co-ordination Meeting for the WESTPAC and NORPAX Areas (Tokyo, November 1981) generated a series of operational proposals for strengthening the data collection and exchange system in the Northern Pacific and recommended that the proposals be extended to cover the total Pacific basin. A meeting to include the South American Member States is being organized for 1983. Experience obtained from this region will be invaluable in the setting-up of co-operative programmes in other areas. A pilot project to establish a regional tide-gauge network and a coastal ocean observing system, was also agreed at the First Session of the IOC Programme Group for the Co-operative Investigation in the North and Central Western Indian Ocean (CINCWIO).

The Chairman of the IGOSS Task Team on regional development, together with a scientist from the WESTPAC region visited Australia, China, and the Philippines as a follow-up to the regional meeting and established a strong link between those countries and IGOSS.

3.1.4 Ocean Monitoring Requirements for Climate Research

The on-going and planned research activities relating to the climatic changes and the oceans and the the interaction of such changes with the world's atmospheric climate are of great importance to IGOSS. To quote from a 1982 World Climate Research Programme (WCRP) document:

> "The design of a comprehensive monitoring system over and in the oceans remains a crucial activity within the WCRP and that the development of a realistic plan for an ocean observing system be treated as an urgent task".

Meetings

14-18 April 1980 Paris	Joint IOC/WMO Meeting on the Evaluation of IGOSS Support to FGGE and Future Activities
21-25 April 1980 Geneva	Joint WMO/IOC Meeting on the Preparation of the Draft IGOSS Plan and Implementation Programme 1982-85
28-30 April 1980 Geneva	Joint WMO/IOC Meeting to Prepare a Draft Guide to IGOSS Data Processing and Services Syteem (IDPSS)
20-29 October 1980 Geneva	Second Session of the IOC/WMO Working Committee for IGOSS
2-3 February 1981 Paris	IGOSS Officers' Meeting
6-7 April 1981 London	IOC/SCOR/ECOR Consultative Meeting on Drifting Buoy Programmes
9-13 November 1981 Tokyo	Joint WMO/IOC Regional IGOSS Implementation Co-ordination Meeting in WESTPAC and NORPAX Regions
1-5 March 1982 Washington, D.C.	Joint IOC/WMO Meeting of Experts on Quality Control of IGOSS Data
15-20 March 1982 Geneva	Joint IOC/WMO Intersecretariat Consultations on the Future Monitoring Efforts and Work Plan for IGOSS
22-26 March 1982 Geneva	Joint WMO/IOC Meeting on IGOSS Code Requirements and Exchange Formats
20-22 April 1982 Paris	ARGOS Users Conference
28-30 June 1982 Paris	Second IGOSS Officers Meeting
13-17 September 1982 Sidney (Canada)	Second Joint IOC/SCOR/ECOR Informal Consultative Meeting on Drifting Buoy Programmes
29 November - 3 December 1982 Hamburg	Meeting of the Editing Group for the World Version of the IOC/WMO Guide to Operational Procedures for the Collection and Exchange of IGOSS Data (BATHY and TESAC)

IGOSS is working closely with the SCOR/IOC Committee on Climatic Changes and the Oceans (CCCO) to develop the systems basis for adequate ocean monitoring.

The required programme entails not only the present BATHY/TESAC data but also additional data such as mean sea level, currents, waves and surface salinity. In order to achieve the necessary data quantity and quality for the experiments, new techniques and instrumentation will likely be necessary. The ocean climate experiments presently under study are concerned with the heat flux and transport of energy by the oceans. The requirements for data are large and will require advance planning and study to which IGOSS will make a substantial contribution.

3.2 INTERNATIONAL OCEANOGRAPHIC DATA EXCHANGE (IODE)

An efficient world-wide system of oceanographic data exchange is essential to the success of any marine science programme, and it was to meet this need that the IOC Working Committee on IODE was established in 1961.

The major objective of the IODE is to collect, process, archive, retrieve and exchange oceanographic data and information on a world-wide basis with the aim to render services to the scientific community, to the off-shore industry and to the governments of Member States. These services are needed to be able to minimize the hazards of ocean and atmosphere, protect and develop coastal areas, improve weather forecasting and marine transport, safeguard the marine environment and make proper use of oceanic living and non-living resources.

To achieve this goal a global network of oceanographic data centres, co-ordinated by the the Commission, has been established and is gradually expanding (Fig. 8-9). At present, the IODE network consists of : two World Data Centres (Oceanography); 38 National Oceanographic Data Centres (NODCs) and Designated National Agencies (DNA); and 12 Responsible National Oceanographic Data Centres (RNODCs). Complementary arrangements for the management of information have been developed within the framework of ASFIS and MEDI, as described in the following section.

In the mid-1970's, the Committee enlarged its purvue when the Commission decided that the joint IOC/FAO/UN(OETB) Panel of Experts on the Aquatic Sciences and Fisheries Information System (ASFIS)

Fig. 8 - Total number of observations exchanged (all types).

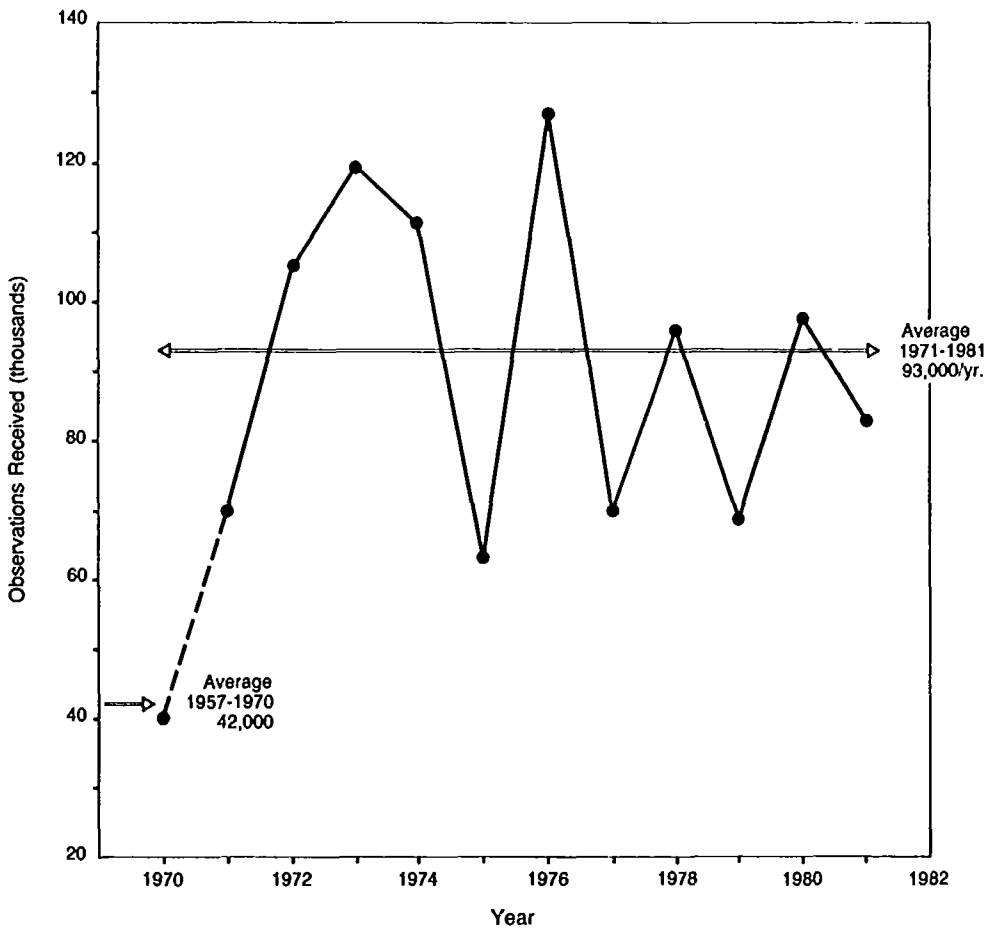
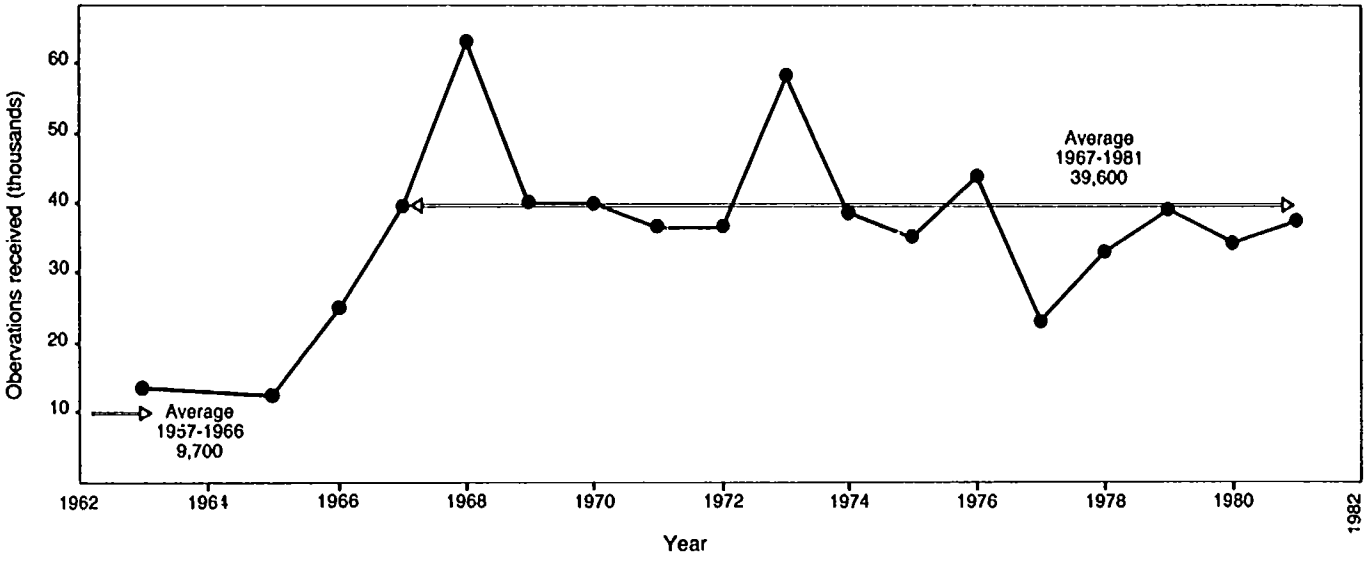


Fig. 9 - Number of oceanographic serial stations data exchanged



should report to the governing bodies through the Working Committee on IODE.

This trend towards increased responsibility for marine information management was reinforced during the Tenth Session of the Working Committee (Hamburg, August 1981) which decided, by Resolution IODE-X.6, that:

(i) a survey of available information resources and exchange mechanisms for marine scientific and technical information be undertaken in order to allow the formulation of IOC future policy on information dissemination and exchange, with particular reference to improving the present international exchange mechanisms for all types of marine-related information;

(ii) a result of the survey on information resources, in collaboration with interested agencies (FAO, UNEP, WMO, Unesco and UN(OETB)), a Handbook on Marine Scientific and Technological Information Resources be published and distributed;

(iii) a "Task Team on IODE's Role in Information Management" be established to examine the implications of additional responsibilities for information management on the structure, functions and budget of the Working Committee on IODE and to guide and carry out the recommended survey of information resources.

During the Tenth Session of the Working Committee on IODE, several other major initiatives were identified:

development of IODE's capability to render service and data products,

data management support to major new scientific programmes, especially in connection with the World Climate Research Programme,

development of strategies for coping with data from anticipated automated data collection systems,

establishment of an IOC structure for information management, with special emphasis on document delivery.

To meet these goals, various Task Teams have been established under the Working Committee to deal with specific kinds of data, i.e., remotely-sensed oceanographic data, IGOSS data archiving, marine pollution, marine biology, marine information management, measured waves, marine geology and geophysics, and to meet the ever-growing requirements for international management of marine data generated by international organizations.

Groups of Experts advise the Committee on the development of standard data formats, and on the improvement of the RNODC System, the Marine Environmental Data Information Referral System (MEDI) and the Joint IOC/FAO/UN(OETB) Aquatic Sciences and Fisheries Information System (ASFIS). Significant progress has been made during the triennial period, as reported below.

3.2.1 Format Development

A standard international exchange format for marine scientific data, GF-3, has been endorsed by the international scientific community, and by oceanographic data centres of other international organizations, and has already started to be used by NODCs around the world. The detailed specification of GF-3 and supplementary tables have been published in Annex I, parts 1 and 2 of the IOC Manuals and Guides No.9. Part 3 has been planned as a non-technical document on the use of GF-3, which will demonstrate the simplicity and effectiveness of the format for various types of data sets.

3.2.2 Responsible National Oceanographic Data Centres (RNODCs)

The pilot programme on Responsible National Oceanographic Data Centres (RNODCs), has been converted to an operation level, with twelve RNODCs in operation in different regions and for different types of data. Active participation of RNODCs has been a positive contribution to a number of large-scale international oceanographic programmes, such as the Mediterranean Alpine Experiment (MEDALPEX). A Guide on RNODCs was issued as Annex I to the IOC Manual and Guides No. 9.

3.2.3 The FAO/IOC/UN (OETB) Aquatic Sciences and Fisheries Information System (ASFIS)

The FAO/IOC/UN(OETB) Aquatic Sciences and Fisheries Information System (ASFIS) has reached the planned point of development in scope, coverage and products envisaged in the early stages of its design.

These include the monthly abstract journal and computer searchable database Aquatic Sciences and Fisheries Abstracts (ASFA); monthly

Meetings

8-11 April 1980 Paris	Third Session of the Joint Panel of Experts on ASFIS
26-30 May 1980 Rome	ASFA Editorial Staff Meeting
8-12 September 1980 Washington, D.C.	First Session of the IODE Group of Experts on IOC Format Development
15-17 September 1980 Washington, D.C.	IODE Intersessional Consultations
27-31 October 1980 Hamburg	ASFA Advisory Board Meeting
20-23 January 1981 Paris	Third Session of the Group of Experts on RNODCs
26-29 January 1981 Paris	Third Session of the Group of Experts on MEDI
24-26 March 1981 Wormley, UK	SCOR/IAPSO and RNODC-FOY Expert Meeting
18-22 May 1981 Lisbon	ASFA Editorial Staff Meeting
3-14 August 1981 Hamburg	Tenth Session of the Working Committee on International Oceanographic Data Exchange (IODE)
9-13 November 1981 Rome	ASFA Advisory Board Meeting
30 November - 2 December 1981 Paris	IODE Consultative Meeting
7-9 September 1982 Washington, D.C.	Fourth Session of the Group of Experts on RNODCs
11-15 October 1982 Washington, D.C.	ASFA Advisory Board
29 March - 9 April 1982 Tokyo	Unesco/IOC Short Term Training Course in Oceanographic Data and Management

current-awareness services reproducing contents pages of important journals, Marine Science Contents Tables (MSCT) and Freshwater and Aquaculture Contents Tables (FACT); and the World List of Aquatic Sciences and Fisheries Serial Titles providing bibliographic information on relevant publications. To increase user awareness of the services available through ASFIS, a travelling exhibit was developed by Canada, with the support of Unesco and IOC, and was set up for the first time at the Joint Oceanographic Assembly (Fig. 10).

Fig. 10 - An on-line demonstration of ASFIS gave participants at the Joint Oceanographic Assembly (August 1982) an opportunity to learn more about the system and its information products.

Computerized registers are maintained and used to prepare a variety of printed directories - of experts, institutions, and projects. The International Directory of Marine Scientists has been produced from this register and will be issued by the Unesco Division of Marine Science in 1984.

The Joint FAO/IOC/UN(OETB) Panel of Experts on ASFIS has directed its action towards ensuring that ASFIS, it products and services, have a greater impact on an enlarged user community through a network of eight national institutions. Input for the ASFIS bibliographic database, ASFA, has been increased by extending the systems network to a total of eighteen institutions in eight Member States (Canada, France, Fed. Rep. of Germany, Mexico, Portugal, United Kingdom, USA, USSR). It is expected that Japan will soon resume full participation. The Southeast Asian Fisheries Development (SEAFDEC) is expected to provide input to ASFA (hitherto its input has been to another FAO system, AGRIS). Plans are being made to assist Member States in meeting their new information requirements emanating from implementation of the UN Convention on the Law of the Sea and an ad hoc meeting on the subject of ASFIS development will be held in June 1983.

3.2.4 The Marine Environmental Data Information Referral System (MEDI)

The Marine Environmental Data Information Referral System (MEDI) which is operated and maintained by IOC was developed to provide information on the availability, characteristics and location of marine environmental data. MEDI has entered a phase of development marked by an orderly increase of data input from centres and a steady growth of the system. International co-operation with the UN, FAO, IAEA, ICES, IHO, WMO and UNEP has resulted in the maintenance of inventories of environmental data: IOC for IODE purposes; FAO for ASFIS; WMO for meteoreological data under the World Climate Programme; UNEP for the Regional Seas Programme; and joint programmes such as IGOSS. MEDI is the marine science sectoral focal point of UNEP's international referral system INFOTERRA. New MEDI data file descriptions, mainly concerning satellite data files, have been received and processed on a continuing basis by the MEDI Co-ordination Centre for input to the MEDI Referral System.

3.3 THE TSUNAMI WARNING SYSTEM

Twenty-two nations are now members of the IOC International Co-ordination Group for the Tsunami Warning System in the Pacific. The Group was invited by the Governments of Chile and Fiji to hold its 1980 and 1982 meetings, respectively.

During the reporting period educational and publicity materials (in the form of booklets, posters, T-shirts etc.) were prepared and published, and a slide show on Tsunamis and Tsunami preparedness will be available shortly.

To improve the warning capabilities, several new seismic and tidal stations have been brought into the system. In addition the U.S. National Weather Service increased the application of computer techniques at its Pacific Tsunami Warning Center, thus improving the quality and rapidity of transmission of watch and warning messages.

A start has been made to receive real-time sea-level information via the GOES Satellite. Tidal stations equipped with instruments to transmit sea level changes via the GOES Satellite are located at Antofagasta and Easter Island, Chile, at la Punta, Peru and at Baltra Island, Ecuador. After the initial operating problems are solved, this approach could open several new avenues in the tsunami warning procedures. In many fields of oceanography and meteorology where sea level changes are a prerequisite, real time data availability could be very beneficial.

An "Annotated Tsunami Bibliography" covering the period 1962-1976 was prepared by the International Tsunami Information Center and issued in 1982. Plans are underway to make the 3,000 bibliographic citations available throug a computerized data retrieval system for rapid access. In addition a catalogue of gauging stations which describes the type of equipment, location, etc., is almost compiled. This data is required for a better understanding of the information supplied by these stations in the warning process.

New and additional Tsunami Wave Travel Time charts have to be computed and drafted and a master plan is required outlining a Pacific-wide International Tsunami Warning System which is most beneficial and effective. A mission is being arranged in September 1983 to assess the necessity and requirements for the establishment of new regional warning centres, particularly along the Southern American coast and within the South Pacific Islands and to prepare a project proposal for submission to UNDP and other extra-budgetary sources of funding.

Meetings

3-7 March 1980 Vina del Mar	Seventh Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ITSU)
13-17 April 1982 Suva	Eighth Session of the International Co-ordination Group for the Tsunami Warning System in the Pacific (ITSU)

A project proposal on Tsunami preparedness was submitted to UNDP in 1980. It was put on the waiting list; further negotiations have been undertaken to raise the priority assigned by UNDP to this project. The project includes proposals for several missions to the Pacific region to establish regional tsunami warning systems.

Dr. Gerry Dohler of Canada was appointed to the position of Assistant Director of ITIC, following his secondment by his Government to the IOC and took up his post on 1 July 1982 for a one-year period.

Co-operation with the UN Disaster Relief Organization was maintained through regular exchange of information and inter-secretariat discussions.

3.4 OCEAN MAPPING

The remaining sheets of the fifth edition of the General Bathymetric Chart of the Oceans (GEBCO) have been published by the Canadian Hydrographic Office during the triennial period and the complete series is now on sale. The series, which consist of 16 sheets on Mercator projection at a scale of 1:10 million at the equator, covering the world's oceans from 72 degree S., and two polar sheets on stereographic projection at a scale of 1:6 million at 75 degree latitude, was completed in 1982; it was displayed at the International Hydrographic Conference (April 1982), and the Joint Oceanographic Assembly (August 1982) and the Unesco General Conference (December 1982) (Fig. 11).

A 'World' sheet on a scale of 1:35 million will be published in early 1983. These 19 GEBCO sheets (folded), together with a supporting volume, will then be sold in boxed sets. These series form the best and most up-to-date set of charts of the world's oceans available at the present time and constitute a major advancement in the field of ocean mapping.

Preparation of the series has been supervised by a joint IOC/IHO Guiding Committee for the GEBCO, which now has the task of planning a 6th Edition, to be based on a system of digitized contours held in a bathymetric data bank. By this means it will be possible to produce simply and quickly contour sheets of any part of the world's oceans on any desired scale and projection. The International Hydrographic Bureau has published, on behalf of the Commission and the IHO, a volume entitled 'Standardization of Undersea Feature Names' (bilingual English/French; English/Russian and English/Spanish texts are in preparation).

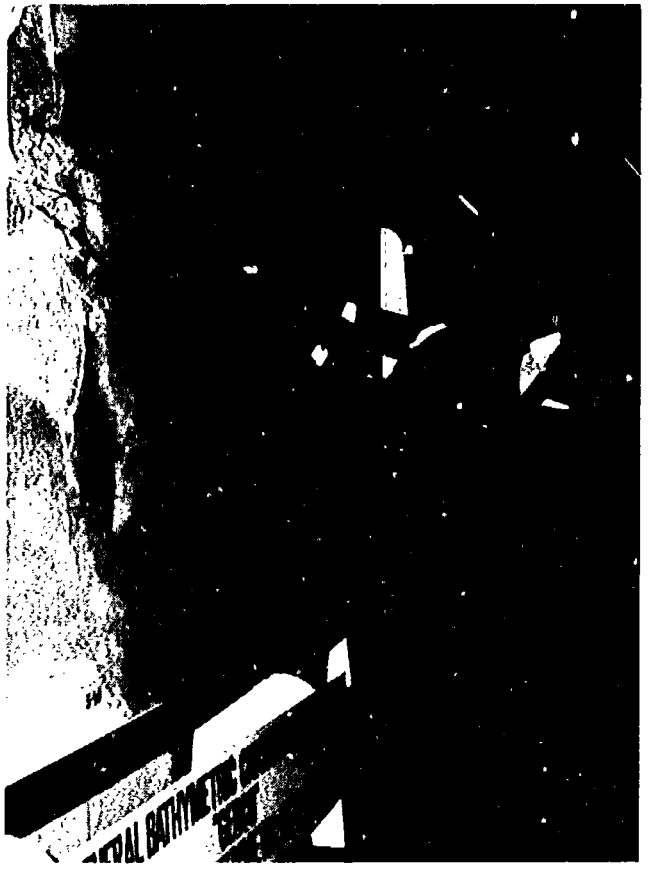


Fig. 11 - During the Twelfth Session of the IOC Assembly (November 1982), Amadou Mahtar M'Bow, Director-General of Unesco, and Mario Ruivo, Secretary, IOC, study the recently issued 5th edition of GEBCO.

Scientists contributing to the work of the Joint IOC/IHO Guiding Committee for GEBCO offer a specific scientific and technical expertise in the field of marine geology and geophysics and hydrographic surveying which is unique within the United Nations system. This expertise is highly relevant to the scientific needs of Member States in connection with the new ocean regime. It is planned, subject to the necessary extra-budgetary funds being found, to develop a system whereby this expertise is used to provide training and education facilities needed by coastal States in order to build up a cadre of marine geologists, geophysicists and hydrographic surveyors, so essential for their exploration of the oceans.

The International Bathymetric Chart of the Mediterranean (IBCM) was completed and printed by the USSR Hydrographic Office in 1981, and work has begun on the preparation of six geophysical overlay sheets. The IBCM was displayed during the Unesco General Conference (December 1982). The IBCM Group of Specialists on Overlay Sheets in Geology and Geophysics met in Pau, France (22-24 June 1982) to plan this work. The International Bathymetric Chart of the Mediterranean was displayed at the International Hydrographic Conference (April 1982), and the Joint Oceanographic Assembly (August 1982) and the Unesco General Conference (December 1982).

The Central Editorial Board for the Geological and Geophysical Atlases of the Pacific and Atlantic met in Sochi, USSR (18-20 May 1982) to review the status of preparation of these Atlases. A second meeting of the Board will be held in Tallinn, USSR, in May 1983 to review the status of data compilation in anticipation of publication of the Atlas in 1984-85.

The Executive Council, at its Fifteenth Session, agreed on the need to consolidate the Commission's activities in the field of geomorphological, geological and geophysical mapping, especially in view of the initiatives of concerned Member States to prepare such maps in, for example, the Caribbean and Pacific region of Central America, in Western Africa and in East Africa, with the possible support of Mexico, France and the Federal Republic of Germany, respectively.

Negotiations are underway with the Commission for the Geological Map of the World (CGMW) for the co-sponsorship of their recently-established Sub-Commission on Sea-Floor Geological Mapping to co-operate with IOC in geological/geophysical mapping of features at scales suitable for non-living resources.

Meetings

6-8 October 1980 Monaco	Seventh Session of the Joint IOC/IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO)
12-14 May 1980 Monaco	Second Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean (IBCM)
13-16 October 1980 Cagliari	First Session of the IBCM Disciplinary Group on Overlay Sheets in Marine Geology and Geophysics
6-8 May 1981 Yalta	Ad hoc Meeting on the Preparation of Atlases of the Atlantic and Pacific Oceans (GAPA)
10-11 June 1981 Leningrad	Second Session of the IBCM Disciplinary Group on Overlay Sheets in Marine Geology and Geophysics
9-10 June 1981 Leningrad	Third Session of the Editorial Board of the International Bathymetric Chart of the Mediterranean (IBCM)
8-10 March 1982 Paris	Eighth Session of the Joint IOC/IHO Guiding Committee for the General Bathymetric Chart of the Oceans
12-18 May 1982 Sochi	Second Session of the Central Editorial Board for the Geological-Geophysical Atlases of the Atlantic and Pacific Oceans (GAPA)
22-24 June 1982 Pau, France	Third Session of the IBCM Disciplinary Group on Overlay Sheets in Marine Geology and Geophysics

4. STRENGTHENING OF NATIONAL AND REGIONAL MARINE SCIENTIFIC AND TECHNICAL CAPABILITIES

One of the responsibilities of the Commission as a joint specialized mechanism for the UN Organizations Members of ICSPRO is to assist in the evaluation of national needs in training, education and mutual assistance in the marine sciences and related activities. In carrying out this function, the IOC develops, recommends, and co-ordinates activities to satisfy those needs through the concerted action of its Member States and other international organizations. The Commission also assists Member States in establishing or strengthening national/regional organizational structures for marine science and technology, and encourages the formulation of comprehensive national marine science policies and related institutional arrangements.

During the triennium significant progress was made in the TEMA activities, from both a conceptual and operative point of view. In light of the discussions at UNCLOS and the expressed wishes of Member States, the IOC has adjusted the focus of its TEMA programme with a view to increasing its potential to respond to the new challenges confronting developing nations, in particular, those resulting from the United Nations Convention on the Law of the Sea.

The adoption, and recent signature, of this Convention has created favourable conditions for Member States, within an enlarged area of national jurisdiction, to explore and exploit marine resources and an obligation to manage living and non-living resources and to ensure the preservation and protection of the marine environment.

This, above all, entails on the part of those States the adoption of urgent measures to formulate marine science policies and to strengthen their marine science organizational infrastructure and manpower so as to optimize their capabilities to undertake the required marine scientific research and to achieve national goals in marine affairs. At the same time, these factors place considerable responsibility on the Commission to meet the expanding requirements of its Member States and of the international marine scientific community as a whole.

As UNCLOS drew to a close, the Conference unanimously adopted a resolution alerting the international community to the implications of the Convention in terms of development. The resolution, entitled "Development of National Marine Science, Technology and Ocean Service Infrastructures", was transmitted to the 37th session of the United Nations General Assembly and states, in part:

> The Third United Nations Conference on the Law of the Sea,
>
> "Convinced that, unless urgent measures are taken, the marine scientific and technological gap between the developed and developing countries will widen further and thus endanger the very foundations of the new regime,"...
>
> "Noting that present efforts undertaken within the United Nations system in training, education and assistance in the field of marine science and technology and ocean services are far below current requirements and would be particularly inade quate to meet the demands generated through operation of the Convention on the Law of the Sea."...
>
> "Recommends that all competent international organizations within the United Nations system expand programmes within their respective fields of competence for assistance to developing countries in the field of marine science, technology and ocean services and co-ordinate their efforts on a system-wide basis in the implementation of such progammes, paying particular attention to the special needs of the developing countries, whether coastal, land-locked or geographically disadvantaged;"...

4.1 AN IOC PLAN FOR A MAJOR ASSISTANCE PROGRAMME TO ENHANCE THE MARINE SCIENCE CAPABILITIES OF DEVELOPING COUNTRIES

Having followed with great attention the evolution of discussions during UNCLOS, the IOC has been well aware of the rationale leading to the resolution referred to above. Already, as early as 1980, at the Third Session of the Working Committee for TEMA (Buenos Aires, April 1980) Member States addressed the issue. Delegates to the meeting recommended that the IOC prepare a Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries.

Implementation of the Recommendation (TEMA-III.1) was given high priority and the Executive Council at its Thirteenth Session, by Resolution EC-XIII.15, instructed the Secretary of the Commission to develop such a Plan. In pursuance of this, the Secretary, with the assistance of two consultants and TEMA ad hoc Group for Co-ordination and Implementation, prepared a proposal for a Comprehensive Plan which was adopted by the Twelfth Session of the IOC Assembly (Resolution XII-8).

In approving the Comprehensive Plan (Doc.IOC/EC-XV/8 Annex 5 rev), along with a

companion document on Modalities for its Implementation, the Assembly has developed a framework for the Commission's endeavours in this decade to respond to the aspirations of developing countries so that they can acquire the marine science and technology capability needed to achieve their national goals in ocean affairs.

Also developed to enable Member States to participate more fully in global, regional and sub-regional oceanographic research programmes of the IOC, the Plan is designed to play a catalytic role in mobilizing international support and extra-budgetary funding and other forms of assistance.

The general objective of the Comprehensive Plan is to bring about collective action at the national, regional and global levels with a view to ensuring that, by the year 2000, the majority of coastal States will have acquired the necessary capability to enable them to undertake marine scientific research and ocean services activities.

As an initial step in implementing the first phase of the Comprehensive Plan, a pilot project is underway to develop Marine Science Country Profiles (MSCP), with the active involvement of the authorities and local institutions of each country. The purpose of the profiles, as recommended by the Third Session of the Working Committee for TEMA, is to identify national needs based on the compilation and analysis of information in the field of marine science, ocean services and related fields, including the general scientific, administrative, industrial, and institutional framework within which marine scientific activities are conducted.

The basic model for the MSCP has been tried out experimentally in Australia and India to assess its feasibility and other countries will be invited to contribute information in the near future as the model is refined. Such profiles will provide a basis for self-evaluation by interested Member States who wish to strengthen the assessment of their specific needs in function of their national goals in marine affairs.

Important inputs to the Marine Science Country Profiles will be drawn from the existing registers which are maintained within the joint FAO/IOC/UN(OETB) Aquatic Sciences and Fisheries Information System (ASFIS). These registers contain information on marine scientists and institutions, research vessels, serial titles and other publications, statistics, and an extensive bibliographic information component. Information derived from the MSCP data base will be used also to assist in developing sub-regional and regional projects, with their national components, as proposals for the extrabudgetary assistance which is essential to implementation of the Comprehensive Plan.

4.2 TRAINING ACTIVITIES

Another significant development worthy of mention is the increased mutual assistance between the developed and developing countries. In this context a number of IOC Member States have provided assistance through contributions to the IOC Trust Fund and other forms of support, such as the IOC Voluntary Assistance Programme. Seven IOC Member States contributed $555,000 to the IOC Trust Fund during 1980-82, bringing to almost $1,700,000 the total amount contributed since the fund was established in 1972. A detailed listing of the types of training offered through co-operative arrangements is found below, preceded by a brief overview which demonstrates the scope of interest and support provided by IOC Member States to the programme.

The Government of Japan provided assistance for well-defined training projects relating to WESTPAC activities. With this support the IOC was able to provide training for a number of scientists from the region on board of Japanese research vessels, and others received training in data processing at the NODC in Tokyo.

The Government of Australia provided assistance by hosting training courses for marine science technicians and in marine pollution monitoring to a number of scientists from WESTPAC (see below).

Assistance provided by the Federal Republic of Germany supported training of scientists in the WESTPAC region.

The contribution from Venezuela enabled the IOC to organize a training course within IOCARIBE in support of CARIPOL.

The USSR provided shipboard training for a number of scientists from Latin America during cruises in the Caribbean region, as well as off the east coast of the Pacific Ocean.

The USA provided training of scientists in data processing to a number of scientists at the US NODC.

The Government of France has offered to host in November 1983 a training course in marine science information and documentation services for the French-speaking countries of Africa.

Similarly, the Governments of Spain and Mexico have agreed to provide training fellowships to scientists from Western African and Latin American countries, respectively.

During the three years covered by this report, 130 scientists and technicians from 42 countries received support under the regular programme and with the assistance of donor countries. As noted below, this training has taken many forms, and has included both short- and long-term fellowships, study grants, shipboard training, and support for attendance to workshops, symposia and training courses.

In support of ongoing scientific programmes and other relevant activities of the Commission, five Training Courses were held:

Training Course on Petroleum Monitoring (Perth, 18 February - 2 March 1980): 8 participants from 6 WESTPAC countries.

Regional Training Course for Marine Technicians (Townsville, 1-28 June 1980): 10 participants from 8 countries of the WESTPAC region.

Caribbean Marine Pollution Programme (CARIPOL) Training Course in Marine Petroleum Pollution Monitoring, (San Jose, 8 September - 2 October 1980): 23 participants from 15 IOCARIBE countries.

Advanced Training Course in Biological Oceanography for the Western Pacific (WESTPAC) (Mactan Island, Philippines, 22 March-16 April 1981); 20 participants from 9 countries in the region.

IOC Short-term Training Course in Oceanographic Data and Information Management (Tokyo, 29 March-9 April 1982); 3 participants from 3 WESTPAC countries.

In addition, scientists from developing countries were supported to attend seminars, training courses or workshops, organized by Member States or non-governmental organizations, in areas which complement the Commission's work:

Seminar on Estuaries - their Physics, Chemistry, Biology, Geology, Geophysics and Engineering Aspects, held at the National Institute of Oceanography in Goa (16-20 November 1981);

SEATAR Workshop on Palaeomagnetic Research held under the sponsorship of CCOP, Kuala Lumpur 1-6 March 1982);

IOI Training Programme in the Management and Conservation of Marine Resources organised by the International Ocean Institute, Malta (12 April - 18 June 1982);

SCOR/SCAR Workshop on the Enhancement of Interaction between Physical, Chemical and Biological Oceanography in the Southern Oceans, Tokyo (24-26 May 1982);

IOI Training Programme on Marine Resource Management and Conservation in the Indian Ocean Basin and Adjacent Seas, Goa (4 October-10 December 1982);

Training Course on Analysis of Marine Pollution Bermuda Biological Station, 10-28 August 1982).

4.3 WORKSHOPS ON PROGRAMME PLANNING

The IOC, jointly with the United Nations University and the Division of Marine Soiences of Unesco organized a Workshop on "International Co-operation in the Development of Marine Soience and the Transfer of Marine Technology in the Context of New Ocean Regime" (October 1982). Partioipants in the Workshop were drawn from 11 countries, in addition to representatives from the sponsoring organizations.

The Workshop analysed the implications of the agreed text of the Convention on the Law of the Sea to coastal States and competent international organizations as related to the conduct of marine scientific research, transfer of marine science and technology and the means required to assist developing countries, particularly through the

Meetings

18 February - 2 March 1980 Perth	Training Course on Petroleum Monitoring
21-26 April 1980 Buenos Aires	Third Session of the Working Committee for Training, Education and Mutual Assistance (TEMA)
1-28 June 1980 Townsville	Regional Training Course for Marine Technicians from Countries of the WESTPAC Region
8 September - 2 October 1980 San Jose	Caribbean Marine Polution Programme (CARIPOL) Training Course in Marine Petroleum Pollution Monitoring
22 March - 16 April 1981 Mactan Island, Philippines	Advanced Training Course in Bioloical Oceanography for the Western Pacific (WESTPAC)
16-18 November 1981 Paris	First Session of the TEMA ad hoc Group for Co-ordination and Implementation
29 March - 9 April 1982 Tokyo	Unesco/IOC Short Term Training Course in Oceanographic Data and Management
27 September - 1 October 1982 Paris	UNU/IOC/Unesco Expert Consultation Workshop on International Co-operation in Development and Transfer of Marine Science and Technology
11-16 October 1982 Paris	Unesco/IOC/ECOR Workshop on Advanced University Curricula in Ocean Engineering and Related Fields

establishment of regional centres and co-operative networks.

Deliberations were structures around the following themes: the new ocean regime and its implications for co-operation in marine science and technology; recent trends in marine science and technology; analysis of the problem; implementation of requirements for international co-operation.

Under this last topic, attention was given to such subjects as the acquisition of competence; creating favourable conditions for research; international co-operation in marine science education and training; international transfer of information; planning and conduct of research activities; development and creation of institutions and the role of existing international organizations.

The Workshop offered some general suggestions regarding the overall roles of "competent international organizations", with special regard for those of IOC and Unesco. It was proposed that two main lines of action should be followed in devising a strategy for promoting marine science and technology in developing countries:

i) countries should be assisted in developing the awareness that a sound scientific basis is essential to their attaining the maximum benefits offered by the opportunities arising from the new ocean regime and that for this sufficient and stable support for marine science is needed;

ii) efforts should be made to encourage the development of endogenous capabilities and intellectual creativity in relation to marine science and technology so as to lead to a stronger ocean partnership between developing and developed countries on a more equal footing.

Based on the conclusions of the Workshop, the IOC, jointly with UNU, plans to organize Workshops on Regional Centres for Marine Scientific Research to determine the means by which co-operative mechanisms could be strengthened, for example through networks of national institutions within a regional framework. The first of these workshops is being organized in early 1984.

A Unesco/IOC/ECOR Workshop on Advanced University Curricula in Ocean Engineering and Related Fields (Paris, 11-16 October 1982) brought together fourteen specialists in the field of ocean engineering teaching at the university level, with the aim of identifying the various subfields of ocean engineering and to design sample curricula. The outcome of the workshop, which is being issued as Unesco Reports in Marine Science No. 25, will serve as guidance for developing and developed countries alike, as they move forward in the strengthening of their own human resources in connection with the utilization and management of the oceans.

4.4 PROPOSALS FOR EXTRA-BUDGETARY ASSISTANCE

As part of present development strategy the IOC has developed several project proposals for extrabudgetary assistance. These include (i) programme of training, education, research and monitoring connected with the "El Niño" phenomenon in the Southeast Pacific; (ii) Tsunami Warning System in the Pacific; (iii) strenthening of the Sri Lanka National Aquatic Resources Agency (NARA) through the Development of Capabilities in Aquatic Sciences and Technologies and (iv) WESTPAC sub-regional project on marine science for development. The projects on "El Niño" and NARA are under active consideration by UNDP.

5. IOC REGIONAL SUBSIDIARY BODIES

Development of the global programmes of the IOC has been marked by an active implementation of their marine science components and the related ocean services at the regional level. This has been accompanied by related training, education and mutual assistance support aimed at enhancing Member States' capabilities, and especially those of developing countries, to participate in these programmes.

In recognition of the need to strengthen its regional structures, the IOC, at the Twelfth Session of the Assembly, decided to create a new category of regional subsidiary bodies known as Sub-Commissions, to serve as a mechanism for the Commission's regional activities in the future.

The concept of regional sub-commissions had first arisen within the IOC Association for the Caribbean and Adacent Regions (IOCARIBE), which was set up in 1975 for a six-year experimental period. In discussing the future status of the Association, following the end of the experimental period, IOCARIBE Member States proposed (Resolution IOCARIBE-III.7) that the Association become a Sub-Commission so as to ensure the regional infrastructure required for the proper implementation of IOC programmes in the Caribbean region, and for the assumption of possible new responsabilities arising out of the adoption of the UN Conference on the Law of the Sea.

Subsequent debate at the Fifteenth Session of the IOC Executive Council led to the conclusion that "circumstances may arise where the regional activities of the Commission may need a status and continuity not provided for by any of the existing arrangements available to the Commission, and that it would be useful to agree upon the concept". The Council established certain basic conditions and circumstances that should be taken into account when a decision to establish a Sub-Commission was to be taken:

"(i) the countries of the region are already actively engaged in co-operative investigations or have demonstrated their interest in doing so;

(ii) an existing regional subsidiary body of the Commission formally requests the assembly to recognize it as being in this new category of subsidiary body;

(iii) the budget and secretariat services required for the effective functioning of a Sub-Commission can be made available"

In approving the concept of, and general terms of reference for, Regional Sub-Commissions of IOC, the Twelfth Session of the Assembly endorsed the basic conditions found above and approved a set of guidelines which will govern the establishment of such bodies by the Commission in the future.

The basic Terms of Reference, as approved by the Assembly, read as follows:

"Regional Sub-Commissions shall:

(i) Define regional problems the solution of which calls for international co-operation, and promote, develop and co-ordinate the required marine scientific research programmes and related activities;

(ii) Implement and co-ordinate the regional components of global marine scientific research programmes and activities of the Commission;

(iii) Promote the development and use, at regional level, of ocean services and related supporting activities, co-ordinated or maintained by the Commission;

(iv) Facilitate the exchange of scientific data and information and the transfer of knowledge resulting from marine scientific research, especially to developing countries in the region;

(v) Assist with the identification of training, education and mutual assistance needs in the region, particularly those relating to the programmes of the regional Sub-Commission, and promote the required TEMA activities;

(vi) Make recommendations to the governing bodies of the Commission on policy matters, and submit proposals on the budgetary and other forms of support required for the programme of work of the regional subcommission; co-operate with other subsidiary bodies of the Commission on technical matters of common interest;

(vii) Provide general guidance and serve as a mechanism for Member States, for the formulation, evaluation and follow-up of proposals for extrabudgetary projects aimed at strengthening national capabilities in marine scientific research and the establishment of common institutions, services and facilities (e.g., centres, networks);

(viii) Co-operate with the regional subsidiary bodies of the UN Organizations members of ICSPRO and of other UN organizations as well as regional bodies collaborating with the Commission;

(ix) Regional Sub-Commissions have the right, provided that no costs fall on the Commission or have been approved by a governing body, to: (a) form Task Teams to carry out specific assignments; (b) establish Groups of Experts; and (c) organize technical meetings (e.g., workshops), provided costs fall within the budget allocated to them or extra-budgetary funding is available for that purpose; otherwise recommendations to that effect shall be submitted

to the governing bodies of the Commission for their consideration and approval.

The concept was applied to IOCARIBE which is now formally established as the IOC Sub-Commission for the Caribbean and Adjacent Regions. Further application of the concept will be kept under continuing review by the Commission with respect to the various ocean regions in which the IOC is active, e.g., WESTPAC and CINCWIO.

New arrangements, under which the Marine Science Officers of the Unesco Regional Offices for Science and Technology (ROSTs) have been designated as IOC Assistant Secretaries for the IOC regional subsidiary bodies in their respective areas, represent a step forward in the servicing of such bodies.

These staff, in addition to their responsibility to ensure effective implementation of the Unesco marine science programme, will assist the IOC Secretariat in discharging certain of its functions at the regional level.

The Unesco Regional Office for Science and Technology for South East Asia (ROSTSEA) in Djakarta has already lent its support to a number of projects in the Western Pacific region (WESTPAC) and this mode of co-operation with the ROSTs will be strengthened in the future: the Regional Office for Science and Technology for Africa (ROSTA), for CINCWIO; that for South and Central Asia (ROSTSCA), for the central Indian Ocean; that for the Arab States (ROSTAS), for the Gulf; and that for Latin America and the Caribbean (ROSTLAC), for the Central and South-western Atlantic and the South-east Pacific.

5.1 THE IOC SUB-COMMISSION FOR THE CARIBBEAN AND ADJACENT REGIONS

The first regional association of the IOC, the IOC Association for the Caribbean and Adjacent Regions (IOCARIBE), became operational in July 1976. Launched as a successor mechanism to CICAR (Co-operative Investigation of the Caribbean and Adjacent Regions), the fundamental purpose of IOCARIBE is to oversee all of the Commission's activities in the region and, in response to the needs of its Member States, to develop a programme of regional activities based on international collaboration and mutual assistance.

The Third Session of IOCARIBE (Cancun, December 1980) recommended the formal constitution of an IOC Sub-Commission for the region, with the same name and acronym, but with functions that would enable IOCARIBE to provide improved services to its Member States. To facilitate consideration of the proposal by the IOC Assembly, an evaluation of the Association's work was made (doc. IOC/INF-495).

During its Third Session, the Association recommended further development of regional programmes on ocean dynamics, marine biology and living resources, marine pollution research and monitoring, marine geology, and the associated oceanographic data and information services. IOCARIBE, as a subsidiary body of the IOC, has also been given responsibilities for the implementation of the regional component of IOC's major global programmes on marine pollution research and monitoring, ocean science and living and non-living resources, and ocean services, and will be a regional focus for initial development of the Unesco/IOC Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries.

Of the regional scientific programmes adopted by IOCARIBE, two have made particularly rapid progress in the past three years: marine petroleum pollution monitoring and research (CARIPOL), the first regional contribution to IOC's global Marine Pollution Monitoring System; and scientific programmes in support of fisheries projets recommended by a Workshop on this subject in Martinique (November/December 1977) and approved by IOCARIBE at its First Session; these scientific programmes constitute a precursor of IOC's proposed global programme on Ocean Science in Relation to Living Resources (OSLR).

In the case of IOCARIBE's marine pollution programme, CARIPOL, the Action Plan adopted in 1978 has been actively pursued under the leadership of a Scientific Co-ordinator and a Steering Committee consisting of active marine pollution research scientists from the region. One of the first concerns was to ensure that the necessary local scientific and technical skills were available and, to meet this goal, a Training Course in Marine Pollution Monitoring, took place in Costa Rica from 8-18 September 1980, (course given in English), and from 22 September - 2 October, (course given in Spanish). Ten trainees from seven Member States attended the English course, and thirteen trainees from eight Member States attended the Spanish course. Support for this course was provided from the IOC Trust Fund contributions of Mexico and Venezuela. Subsequent provision of analytical equipment to selected Member States has enabled the trainees to apply their knowledge and participate in regional marine pollution monitoring and research. CARIPOL data from participating countries are routinely entered in machine-readable format in the Responsible National Oceanographic Data Center for IOCARIBE (U.S. National Oceanographic Data Center and in the World Data Centre (Oceanography) A.

The IOCARIBE oceanographic research programme in support of fisheries projects contains three projects in the planning phase: oceanographic and environmental dynamics in the Lesser Antilles; biology and distribution of spiny lobsters; and the Western Atlantic Turtle Symposium (Costa Rica, 17-22 July 1983).

Two Steering Committees, one for Antillean oceanography and one for the Western Atlantic Turtle Symposium have been formed to develop and implement the general plans recommended by an IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects, held in Martinique in 1977. The Steering Committee for the Antillean Oceanography Programme oversees the spiny lobster project, in which the close collaboration of FAO will be sought.

Recommendations of the interdisciplinary workshop called for a region-wide investigation of sea turtles to provide the necessary data upon which sound management practices could be based for the rational use of this valuable living resource. The Western Atlantic Turtle Symposium (WATS) will be convened in Costa Rica in July 1983 in collaboration with the FAO Western Central Atlantic Fishery Commission (WECAFC), with the funds provided by the United States.

Meetings

8 September - 2 October 1980 San Jose	Caribbean Marine Pollution Programme (CARIPOL) Training Course in Marine Petroleum Pollution Monitoring
1-5 December 1980 Cancun	Third Session of the IOC Association for the Caribbean and adjacent regions (IOCARIBE)
24-30 May 1982 St. Croix	Workshop on Interconnections between Coral Reefs, Seagrass Beds and Mangroves

Preparation for the symposium has included extensive collaboration with participating experts in the preparation of National Reports, the compilation of which will constitute the major Working Document for the meeting. Annotated English and Spanish versions of the "National Report Format" and the "Manual of Sea Turtle Research and Conservation Techniques" have been distributed to national focal points in the thirty countries that have indicated an interest in participating in the Symposium. Papers presented at the Symposium will represent a significant contribution to the scientific research being carried out within the region.

In a related area of research, following a recommendation of a Symposium on Unusual Mass Fish Mortalities in the Caribbean and Gulf of Mexico (Mayaguez, November 1981), IOCARIBE decided to convene an ad hoc Panel of Experts to prepare a Fish Kill Response Manual describing 'on-the-scene' emergency measures to be taken, including methods, techniques and follow-up procedures to be applied when mass mortality of marine species is detected. The Manual, although to be prepared primarily for use in the region, could be useful elsewhere. It is expected to be published in 1983.

A third scientific programme recommended by IOCARIBE is "Environmental Geology of the Coastal Area". Owing to the nature of environmental geological research, and particularly the map scale requirements, relatively small "pilot areas" were selected for initial research and for the development of appropriate techniques and methods. Trinidad and Tobago and Venezuela have begun planning their contribution to the pilot project for the Gulf of Paria. Other Member States of the region that wish to carry out local projects will be able to benefit from this experience. A Training Course on Environmental Geological Methods and Techniques is being developed as a supporting component of this project.

In collaboration with the Unesco Division of Marine Sciences, a project on research and training in the management of the coastal ecosystem in the Caribbean is being implemented. A Unesco/UWI/IOC Workshop on the Interconnections between Mangroves, Sea-grass Beds and Coral Reefs, was held in St. Croix, U.S. Virgin Islands,(24 to 29 May 1982). The Workshop called on Unesco and the IOC to assign high priority to research aimed at providing basic inventories of these three ecosystems and their inter-relationships.

Two marine scientists from Venezuela and Costa Rica participated in a shipboard training exercise (February 1982), aboard the USSR R.V. AKADEMIK VERNADSKY in the eastern Caribbean, in the framework of TEMA.

5.2 PROGRAMME GROUP FOR THE WESTERN PACIFIC (WESTPAC)

The basic programmes formally adopted by the Programme Group for the Western Pacific at its First Session (Tokyo, 21-24 February 1979) were: (i) physical oceanography; (ii) marine biology and pollution; and (iii) marine geology and geophysics.

The physical oceanography programme proved to be too complex for immediate implementation and only two projects were formally retained when the Programme Group reviewed the situation at its Second Session (Jakarta, 19-24 October 1981): (i) a survey of currents and tides in the coastal and nearshore waters of the WESTPAC region: and (ii) exchange processes and water circulation around coral reefs. Although some Member States have been active in these two fields, in the context of their national activities, there remains a need to promote common methods and approaches, so that national results can be pooled and analyzed in a regional context. Also, because of the lack of a staff member (until September 1982) in the Ocean Science Unit of the IOC Secretariat, it has not been feasible to convene a meeting of the ad hoc Task Team created to oversee these projects.

The Programme Group for WESTPAC, at its Second Session, separated the pollution programme from the marine biology programme (these were combined originally). The marine biology programme was stimulated by the WESTPAC Workshop on Marine Biological Methodology (Tokyo, 9-14 February 1981), the Advanced Training Course in Biological Oceanography (Mactan Is., 22 March - 16 April 1981)

Meetings

11-13 February 1980 Noumea	Planning Meeting of the Joint CCOP-IOC Geological Workshop
18 February - 2 March 1980 Perth	Training Course on Petroleum Monitoring
27-31 March 1980 Tokyo	WESTPAC Workshop on the Marine Geology and Geophysics of the Northwest Pacific
27-31 March 1980 Tokyo	WESTPAC Workshop on Coastal Transport of Pollutants
19 April - 9 May 1980 Hong Kong	International Marine Biological Workshop on the Marine Flora and Fauna of Southern China
1-28 June 1980 Townsville	Regional Training Course for Marine Technicians from Countries of the WESTPAC Region
9-15 October 1980 Noumea	Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific
10 November 1980 Bangkok	Sixth Session of SEATAR
26-30 January 1981 Manila	Meeting of the WESTPAC Task Team on Marine Pollution Research and Monitoring Using Commercially Exploited Shellfish as Determinants
9-14 February 1981 Tokyo	WESTPAC Workshop on Marine Biological Methodology
22 March - 16 April 1981 Cebu	Advanced Training Course in Biological Oceanography for the Western Pacific (WESTPAC)
21 September - 2 October 1981 Seoul	Eighteenth Session of the Committee for CCOP
19-24 October 1981 Jakarta	Second Session of the Programme Group for WESTPAC

and the Unesco Workshop on Coral Reef Management (Manila, May 1981).

The ad hoc Task Team on Marine Pollution Research and Monitoring Using Commercially Exploited Shellfish as Determinants developed (March 1981) a sound programme, as an important regional component of GIPME. A consultant visited some of the interested laboratories in the region (December 1982) to make arrangements for a regional intercalibration exercise to be held in Australia in 1983, as a basis for the implementation of the IOC Marine Pollution Monitoring System (MARPOLMON) in the region.

The Programme Group at its Second Session adopted a programme of Ocean Dynamics and Climate which, besides the physical oceanography activities mentioned above, includes the development of the regional basis for an ocean monitoring system. This WESTPAC programme is supervised by an ad hoc Task Team on Ocean Dynamics in the Western Pacific.

The Government of Japan has made three research vessels available for oceanographic and geophysical work in 1982. On the occassion of these cruises, a total of ten scientists from five countries have participated in cruises in the WESTPAC region.

The IOC has continued to co-operate closely with the Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP) in the field of marine geology and geophysics, through the Joint CCOP-IOC Working Group on South-east Asian Tectonics and Resources (SEATAR). Appreciable progress was made on the seven geophysical transects that constitute the major part of the SEATAR programme (see the Summary Report of the Seventh Session of SEATAR, Manila, 26-28 November 1981).

The Programme Group for WESTPAC, also at its Second Session, received a request from CCOP(SOPAC) (South Pacific) that IOC co-sponsor a Joint CCOP(SOPAC)/IOC Working Group on South Pacific

Tectonics and Resources (STAR), along the lines of SEATAR. This proposal was taken up at the Twelfth Session of the Assembly, but a final decision is pending further elaboration of the Terms of Reference.

Several workshops and training courses have been held in the region for the implementation of the WESTPAC programme:

(i) the WESTPAC Workshop on the Marine Geology and Geophysics in the Northwest Pacific (Tokyo, 27-31 March 1980), which was attended by 31 scientists from nine Member States, identified 15 projects for implementation;

(ii) the WESTPAC Workshop on Coastal Transport of Pollutants (Tokyo, 27-31 March 1980), which was attended by 26 participants and six observers from nine Member States of the region, identified seven research projects for implementation;

(iii) the Regional Training Course for Marine Science Technicians from countries of the WESTPAC Region (Townsville, 1-28 June 1980), which provided training for ten participants from eight regional countries, was organised by the Australian Institute of Marine Science on behalf of the IOC;

(iv) the CCOP (SOPAC)/IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific (Noumea, 9-15 October 1980), which was attended by participants from 15 Member States, identified 20 projects for implementation by CCOP (SOPAC) and IOC;

(v) the WESTPAC Workshop on Marine Biological Methodology (Tokyo, 9-14 February 1981), which was attended by 41 participants and 18 observers from 12 Member States, which recommended two core projects (on major biological communities and on zones of high pelagic and planktonic productivity) for implementation by all Member States of WESTPAC; and

(vi) the Advanced Training Course in Biological Oceanography for WESTPAC (Mactan Island, 22 March-16 April 1981), which was attended by 20 participants from nine regional countries.

5.3 PROGRAMME GROUP FOR SCIENTIFIC INVESTIGATIONS IN NORTH AND CENTRAL WESTERN INDIAN OCEAN (CINCWIO)

Most of the activities reported here concern implementation of Resolution XI-9 (Scientific Investigations in the North and Central Western Indian Ocean) by which the IOC, at the Eleventh Session of its Assembly (October/November 1979), decided to establish a Programme Group for CINCWIO.

The Programme Group held its First Session at the Unesco Regional Office of Science and Technology for Africa in Nairobi (4-8 October 1982) and at Unesco, Paris (4 November 1982) (Fig. 12). It approved and adopted four programmes: (i) ocean dynamics; (ii) marine biology and living resources; (iii) marine pollution research and monitoring; (iv) ocean mapping.

It agreed to establish, as part of a global network being promoted by IOC, a regional system of tide gauges and coastal oceanographic stations to generate essential data, including data needed for the Indian Ocean Experiment recommended by the SCOR/IOC Committee on Climatic Changes and the Oceans.

Fig. 12 - Participants at the First Session of the Programme Group for the Cooperative Investigation in the North and Central Western Indian Ocean (CINCWIO) in Nairobi, October 1982.

Meetings

AFRICA	
8-13 June 1981 Addis Ababa	ECA/Unesco/IOC Workshop on Marine Science and Technology in Africa
25 September - 3 October 1982 Mahe (Seychelles)	Unesco/IOC/UNEP Workshop on the Marine and Coastal Environment of the East African Region
CINCWIO	
4-9 October 1982 Nairobi	First Session of the Programme Group for the Co-operative Investigations of the North and Central Western Indian Ocean (CINCWIO)

The programme on marine biology and living resources was designed to serve two purposes: (i) to assist the Member States in evaluating the effects of environmental factors on important fish stocks, especially major migrating species; and (ii) to determine the effects of such factors on the distribution of eggs and larvae of some important fish species, as a preparation for eventual regional participation in the IOC programme of Ocean Science in Relation to Living Resources.

In support of this programme, the Federal Republic of Germany has offered to fund a training course in 1983 on marine living resources of the CINCWIO region, to be held in Mombasa in November 1983.

The Programme Group agreed that there was a need to rationalize the use of national research vessels in the region, and to make co-operative arrangements to make available one or two research vessels based in the countries of the region for use in marine scientific research undertaken by CINCWIO Member States, on a regional or sub-regional basis.

The marine pollution research and monitoring programme is comparatively modest and aimed at the implementation of MARPOLMON in the region. The Member States agreed to undertake the preparation of a bathymetric chart of the region, as a basis for the development of an eventual programme of marine geology. The Federal Republic of Germany informed the Twelfth Session of the IOC Assembly of the possibility of providing assistance in the preparation of such a bathymetric chart.

5.4 MARINE SCIENCE CO-OPERATION ON THE ATLANTIC COAST OF AFRICA

The Secretariat, in responding to Resolution XI-18, which called for a workshop on marine science co-operation for countries of the Atlantic coast of Africa, co-operated in the organization of the Joint ECA/Unesco Workshop on the Present State and Future Development of Marine Science and Technology in Africa (Addis Ababa, 8-13 June 1981). IOC sponsored the participation of three experts (from Africa and outside the region).

The Workshop discussed machinery for regional co-operation in marine sciences. It recognized that there is an urgent need to develop the capabilities of African coastal states to enable them to carry out national, regional and international oceanographic programmes, and to prepare for the evaluation, exploitation and management of their resources.

The greatest need was to enhance the human resources already available at universities and institutes, or to create a basic infrastructure where none at present existed. There was unanimity that regional co-operation is essential, and IOC was called upon to study the establishment of a co-ordinating body to promote such co-operation in marine science and related services. To support this development, the Workshop urged Member States to form, where necessary, National Oceanographic Commissions. IOC was called upon to promote data and information exchange as a basis for research and training programmes. In the longer term, IOC was asked to mount a comprehensive assistance programme to enhance the marine science capabilities of African countries.

In response to the above-mentioned recommendations of the ECA/Unesco Workshop on the Present State and Future Development of Marine Science and Technology in Africa, the Executive Council, at its Fourteenth Session (Tenerife, Spain, 22-27 June 1981), by Resolution EC-XIV.7, instructed the Secretary to arrange for the preparation of proposals for sub-regional projects to be developed in the general context of the Major Plan referred to in Resolution EC-XIII.15 (A Comprehensive Plan to Enhance the Marine Science Capabilities of Developing Member States), and implemented as a follow-up of the ECA/Unesco Project.

The Executive Council at its Fourteenth and Fifteenth Sessions gave special attention to the development of marine science co-operation in Africa. Spain has offered five fellowships in the

field of oceanography to scientists from IOC Member States of western Africa. France expressed its willingness to assist these countries with the production of sea-bed maps, and with training courses in ocean data and information management, the first of which will be held in late 1983 at the Centre Oceanologique de Brest.

A Workshop on Regional Co-operation in Marine Sciences in the Central Eastern Atlantic (Western Africa) is being organized by the Commission. The Government of Spain has offered to host the meeting in Tenerife during the last quarter of 1983.

A mission was undertaken in September 1983 to four countries of West Africa (Ghana, Ivory Coast, Nigeria and Senegal) to gather information regarding national priorities for marine scientific research and associated requirements for assistance, which will be used as background material for the aforementioned Workshop. The possibility of implementing IGOSS on a regional basis was also studies. The resulting proposals were considered by the Twelfth Session of the IOC Assembly, which adopted a general policy for the regional implementation of IGOSS.

5.5 PROGRAMME GROUP FOR THE SOUTHERN OCEANS (SOC)

The Fourth Session of the Programme Group was originally scheduled to be held in 1982, but has been postponed to 7-12 March 1983. Co-operation has continued with the Scientific Committee on Oceanic Research (SCOR) and the Scientific Committee on Antarctic Research (SCAR) regarding studies and research of common interest.

Fig. 13 - Flood damage arising during 'El Niño' conditions.

Fig. 14 - The 'El Niño' phenomenon has drawn wide public interest, as seen from this collage of newspaper articles.

5.6 SCIENTIFIC INVESTIGATIONS OF EL NIÑO

The Regional Study of "El Niño" Phenomenon (ERFEN) is a multidisciplinary investigation sponsored by the Comision Permanente del Pacifico Sur (CCPS) and supported by the IOC. It is becoming increasingly recognized by scientists that the central problem for ERFEN is an understanding of "El Niño" as a local manifestation of a global variation of oceanic and atmospheric conditions (Figs. 13-14).

The Joint IOC/WMO/CPPS Working Group on Investigations of "El Niño" held its Second Session in Guayaquil, Ecuador, in November 1980. The Group has developed the necessary links with global programmes, such as the IOC/WMO Integrated Global Services System (IGOSS), the IOC International Oceanographic Data Exchange (IODE), and the WMO/ICSU World Climate Research Programme (WCRP) through the joint SCOR/IOC Committee on Climatic Changes and the Oceans. A project on training, education, research and monitoring relevant to the "El Niño" phenomenon in the south-east Pacific, aimed at strengthening the scientific research capacities of the

institutions in the ERFEN countries (Chile, Colombia, Ecuador, Peru), was prepared by IOC and submitted to UNDP through the Comision Permanente del Pacifico Sur (CPPS). In spite of repeated efforts by the Secretariat of CPPS and IOC and the strong support by Member States concerned, UNDP has not yet assigned funds for this project.

Within the TEMA programme, six short-term fellowships for data management training were awarded to individuals from participating institutions and support was provided through the IOC Trust Fund for the attendence of three scientists from the region to the El Niño Rapid-Response Planning Meeting held in Miami, September 1982.

The co-operation between the IOC and CPPS in the development of the "El Niño" programme and other activities is an excellent example of concerted regional effort on matters of mutual interest to both organizations. CPPS produces for itself and the Commission an El Niño Newsletter, in Spanish and English, with support from the IOC.

Meetings

10-14 November 1980 Guayaquil	Second Session of the Joint IOC/SMO/CPPS Working Group on the Investigations of "El Niño"
23-26 November 1981 Lima	Second Session of the Scientific Committee for the Regional Study of the Phenomenon known as "El Niño" (ERFEN)

6. CO-OPERATION WITH OTHER ORGANIZATIONS

6.1 INTER-SECRETARIAT COMMITTEE ON SCIENTIFIC PROGRAMMES RELATING TO OCEANOGRAPHY (ICSPRO)

The Twentieth Session of ICSPRO (Paris, 23-28 June 1980) reviewed the outcome of the Eleventh Session of the IOC Assembly, particularly the development of MEDI, funding for IOC programmes and activities, including the 1981-82 programme and budget exercise, and the development of the TEMA aspects of activities of major concern to ICSPRO. The work of the Logistics Committee for the Joint Oceanographic Assembly was also worked out in detail.

The Twenty-first Session of ICSPRO (Paris, 1-3 June 1981) laid a foundation for detail discussion of the implementation and evaluation of the ICSPRO Agreement at the next Session.

Regarding the evaluation of the function of ICSPRO and enahcement of its work, the Committee felt a need to make itself more effective and define better its relation to the IOC and to IOC programmes, as well as joint programmes amongst its own Members.

The idea of a need for increased co-operation was particularly stressed with regard, at this stage, to information services, and the Committee decided to convene soon a meeting of ICSPRO Data and Information Management Officers to prepare proposals for consideration at ICSPRO-XXII. This meeting took place in Rome, 24-29 January 1982.

In evaluating progress at UNCLOS, the Committee agreed that the preparation of "Country Profiles" in the field of marine sciences and related aspects would provide a good factual background for the identification of priorities and for facilitating co-ordinated action by the Members of ICSPRO.

6.2 CROSS-ORGANIZATIONAL PROGRAMME ANALYSIS (COPA) IN MARINE AFFAIRS

Increasing international involvement with marine affairs over the last several decades has been reflected in the development of programmes in specific fields by many international organizations. Being aware of the multiplicity of activities of the United Nations system in the marine area, the Committee for Programme and Co-ordination decided to include this subject for a Cross-organizational Programme Analysis (COPA) which would take into account the needs of Member States.

The COPA in marine affairs, which has been prepared in consultation with all concerned UN agencies, is intended to describe the current state of work in marine affairs by the UN system in terms which will also permit governments to determine the degree to which these meet the new requirements for action in the light of the new legal ocean regime. The COPA, which will be completed in 1983, includes a description of the mandates for action and division of responsibilities among the organizations of the system; an assessment on whether the activities being undertaken are responsive to identified needs and priorities; an identification of duplication and overlap, if any; and an assessment of the effectiveness of co-ordinating mechanisms and suggestion for measures for improvement.

The analysis, which will be presented to the Twenty-third Session of the CPC in May 1983, "indicates that the activities of the system generally constitute a well-organized response to the current needs of Membesr States and that there is a high degree of co-operation among organizations".

Several points of particular interest were raised in the analysis and are pertinent not only to the work of Unesco and the IOC, but to the UN System as a whole. For example, the analysis showed that during the 1982-83 biennium, 17 major organizational units of the United Nations and 11 Specialized Agencies are undertaking 456 distinct marine affairs activities, whose total cost is estimated at $371.3 million.

Of the issues addressed in the analysis, 'Enhancement of knowledge about the oceans' accounts for $57.5 million in commitments for 1982-83, and thus ranks third, following 'Living marine resources' and 'Use of ocean space'. The COPA states that "clearly the major organization is Unesco/IOC with anticipated spending of $15.5 million and 42 out of 113 activities".

In view of the large number of organizations involved in some aspect of marine affairs, the need for appropriate co-ordination is obvious. The report clearly indicates that this co-ordination requirement appears to have been met so far by various mechanisms, including ICSPRO in the field of marine science. As a joint co-ordinating mechanism of the ICSPRO agencies, the IOC is in a strong position to work towards the increased co-operation necessary for the future and the IOC Assembly has been kept informed of developments in this regard.

6.3 THIRD UN CONFERENCE ON THE LAW OF THE SEA

6.3.1 Analysis of the Implications to IOC of the UN Convention on the Law of the Sea

The IOC ad hoc Task Team to study the Draft Convention on the Law of the Sea and Any Future Texts Developed by UNCLOS, and the Implications to the Commission held two sessions (Tenerife, 18-20 June 1981 and New York 18-22 July 1982). Work has been completed on the review of the Articles of the Convention which have a clear bearing on IOC programmes and activities. At its Second Session the Task Team dealt with the relevant articles under five groupings: Ocean Science (conduct and promotion; basis for management, conservation, exploration and exploitation of marine resources), Ocean Services and Products (marine scientific data and information; Ocean Mapping; ODAS), Enhancing National Marine Scientific Capabilities (transfer of science and technology; TEMA), Provision of Scientific and Technical Advisory Services to other Organizations and Member States (including the Commissions to be set-up under the Convention) and Organizational and Legal Aspects. The implications to the IOC have been addressed in terms of programme, structure, budget, staff and statutes. This task was substantially advanced at the Second Session, but much work remains, and the Task Team (renamed Task Team to Study the Implications, to the Commission, of the UN Convention on the Law of the Sea and the New Ocean Regime) will meet in Paris in December 1983.

The regime and the Convention bring into sharp relief, on the one hand, the obligations and responsibilities falling on Unesco's Member States, and the possibilities for the rational exploitation of the living and non-living resources of the sea and the sea bed, and, on the other hand, the capabilities of the Member States to undertake such rational exploitation, to meet new national obligations and responsibilities, and to determine effective national policies in marine affairs.

It was with this concept in mind that the UN Conference on the Law of the Sea adopted a Resolution submitted by the Group of 77, entitled "Development of National Marine Science, Technology and Ocean Service Infrastructures", which was endorsed by the UN General Assembly. The Resolution constituted the recognition of an extraordinary need to develop the means to achieve these ends. One of the basic needs is to develop a marine scientific and technological capability as a basis for rational exploitation of marine resources and for their protection with a view to sustaining the yield, in respect of living resources, and to programming, over the long term, the exploitation of non-living resources.

The participation of the Member States in the benefits, accruing from the use of ocean space and its resources, offered by the Convention on the Law of the Sea can only be fully realized if all Member States, and particularly developing ones, have the requisite marine scientific and technological capabilities, as a basis for achieving national goals and participating fully in international co-operative activities of interest to them.

6.4 JOINT OCEANOGRAPHIC ASSEMBLY

The Fifth Joint Oceanographic Assembly (JOA) was convened 2-13 August (Halifax), with the participation of some eight hundred marine scientists from thirty-six countries. The Assembly, which meets every six years, provides the opportunity for scientists to present the main developments in oceanographic research and trends of interdisciplinary interest as well as allowing for meetings of the various scientific bodies of the International Council of Scientific Unions (ICSU), with the lead being provided by the Scientific Committee on Oceanic Research, in co-operation with the IOC and Unesco.

IOC provided substantial travel support for speakers and participants from developing countries, as did other ICSPRO agencies. Over one hundred requests for support were received, and Unesco and the IOC were able to meet the needs of eighteen scientists. The selection of these participants was a good example of co-ordination between SCOR, ICSPRO agencies, the Logistics Committee for JOA, chaired by the Secretary of IOC, and Member States.

Meetings

18-20 June 1981 Tenerife	First Session of the ad hoc Task Team to Study the Draft Convention on the Law of the Sea and Any Future Text Developed by UNCLOS, and the Implications to the Commission
26-30 July 1982 New York	Second Session of the ad hoc Task Team to Study the Draft Convention on the Law of the Sea and Any Future Text Developed by UNCLOS, and the Implications to the Commission

6.5 WORKING AGREEMENTS WITH OTHER ORGANIZATIONS

The Commission shares a number of objectives in common with various intergovernmental and non-governmental global and regional organizations dealing with marine sciences. The degree of co-operation has changed with time and circumstances and to promote complementary activities, the IOC has negotiated working agreements with certain organizations with a view to enhancing co-operation and co-ordination of actions. These agreements define areas in which joint activities could produce practical and tangible results of direct benefit to the respective Member States.

A Memorandum of Understanding was signed in May 1982 by the International Atomic Energy Agency (IAEA) and the IOC.

Other Memoranda under negotiation include ones with: the United Nations Environment Programme (UNEP), to ensure co-operation among the UNEP Regional Seas Programme and relevant IOC programmes, especially GIPME and MARPOLMON; the International Council for the Exploration of the Sea (ICES), to undertake joint activities in the North Atlantic Ocean and adjacent seas, particularly in connection with the programme on OSLR and marine pollution research; the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM), to expedite the development of joint programmes, including the promotion through ICSEM of global research programmes and ocean services of the IOC in the Mediterranean, and the provision by IOC of support to developing countries of the region.

7. GOVERNING BODIES

The IOC Assembly held its Twelfth Session (IOC-XII) in Paris from 3-20 November 1982; the Commission's Executive Council met in four sessions (EC-XIII, Paris, 23-28 June 1980, EC-XIV, Tenerife, 22-27 June 1981, EC-XV, Paris 1-6 March 1982, and EC-XVI, Paris, 2 November 1982) (Fig. 15).

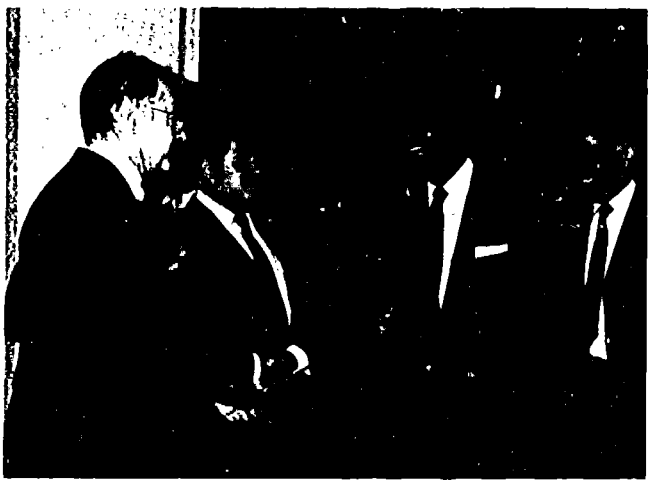


Fig. 15 - Dr. Mario Ruivo, in the company of the Chairman of IOC, Dr. Agustin Ayala Castañares, welcomes the Director-General of Unesco, Mr. Amadou Mahtar M'Bow, and the Assistant Director-General for Science, Professor Abdul-Razzak Kaddoura.

The Thirteenth Session of the Executive Council (Paris, 22-28 June 1980) endorsed a number of important programmes on which the work of the Commission was focused during the triennial period.

Endorsement was provided for the IOC's then new initiative on the study of the ocean's impact on climate and a mandate was given to continue, in co-operation with the FAO, development of a new programme on ocean science relating to living resources.

Terms of reference were approved by the Council for the new Programme Group for the Co-operative Investigations in the North and Central Western Indian Ocean (CINCWIO). In connection with the UN Conference on the Law of the Sea, the Council decided to continue to provide assistance in the identification of the outer limits of the continental shelf, and in the examination of the scientific terminology used in the various articles of the text. In addition, an ad hoc Task Team was created to analyze the implications of the Convention to the IOC.

The Executive Council at its Fourteenth Session continued in its review of the Commission's scientific programmes and identified the programme thrusts for which there was a need for increased resources.

During the Fifteenth Session of the Executive Council, considerable attention was given to the marine science component of the Unesco Medium-Term Plan for 1984-89, and the Council formally recommended that the marine science programme of Unesco and its IOC be identified as a major thrust within the Medium-Term Plan. The Council stressed the need to deal with the oceans as a global entity and to maintain an integrated approach to programme development by the Commission and the Unesco Division of Marine Sciences.

The importance of a scientific programme on ocean science related to non-living resources was identified, and the Commission requested SCOR, together with the Commission on Marine Geology (CMG) to develop such a plan and project proposals. The framework for a Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of the Developing Countries was studied and endorsed.

The Sixteenth Session of the Executive Council, in its capacity of Steering Committee for the Twelfth Session of the IOC Assembly, concentrated on arrangements for IOC-XII.

Several major policy decisions affecting the future of many of the IOC's programmes were taken at the Twelfth Assembly of the IOC. The opening address given by the Director-General of Unesco, Mr. Amadou-Mahtar M'Bow, emphasized the importance of the Assembly's deliberations upon the future of international co-operation in marine scientific research and related activities, especially in light of the new ocean regime as codified under the United Nations Convention on the Law of the Sea.

In the field of ocean science, the Assembly considered a report on "Ocean Science for the Year 2000". This statement of future ocean research will be used not only as a basis for IOC programme development, but also for updating the Long-term and Expanded Programme of Oceanic Exploration and Research (LEPOR).

Two major scientific programmes of the Commission, in the fields of the oceans and climate and marine pollution research and monitoring, were endorsed as being of great importance to Member States. Accordingly, Action Plans were adopted for implementation of an Ocean Observing System, as developed by the Joint SCOR/IOC Committee on Climatic Changes and the Ocean (CCCO); and the

Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment (GIPME), and its major operational component, the Marine Pollution Monitoring Programme (MARPOLMON).

To aid Member States in the management of the marine resources within their zones of national jurisdiction, two new scientific programmes were approved. Various lines of investigation were envisaged for the programme on Ocean Science in Relation to Non-Living Resources (OSNLR), and the United Nations, through its Ocean Economics and Technology Branch (UN/OETB) was invited to co-sponsor it. As a crucial companion activity to OSNLR, work will continue with the preparation of bathymetric charts and overlay sheets, especially in those ocean regions where no adequate charts exist. Ocean Science in Relation to Living Resources (OSLR), a programme aimed at a better understanding of the relationship between fish stock abundance and ocean environmental variability, was also approved and FAO was invited to co-sponsor it.

In support of the IOC ocean service activities, the Assembly decided to charge the Working Committee on International Oceanographic Data Exchange (IODE) with new responsibilities for information exchange. The Programme and Implementation Plan for the IOC/WMO (World Meteorological Organization) Integrated Global Ocean Services System (IGOSS) for the period 1982-1985 was also approved.

To provide a basis for the regional development of the science and services programmes, the Assembly approved the IOC Comprehensive Plan for a Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Member States, as well as the guidelines on modalities for its implementation, so that the Commission can respond to the needs of its Member States within the context of the new ocean regime.

A number of structural changes were adopted. The Assembly decided to create a new category of subsidiary body known as Regional Sub-Commissions, and the concept was immediately applied to the Caribbean and adjacent regions. The extension of the concept will be studied by the Commission in due course, with respect to the various ocean regions in which IOC is now active (such as the Western Pacific and the Western Indian Ocean). With a view to the eventual creation of a sub-commission, a Programme Group for the Central India Ocean (CINDIO) was created and plans for strengthening regional co-operation for the Central Eastern Atlantic (West Africa) were endorsed.

The size of the Executive Council was increased to 32 seats, in order to improve geographical representation, and to facilitate the participation of Member States in the work of the Commission. The frequency of Council meetings was reduced from three to two between consecutive ordinary sessions of the Assembly.

During the elections which are held at each session of the Assembly (Fig. 16), the Commission selected its Officers for the period 1982-84, as follows:

Chairman:	I.A.	Ronquillo (Philippines)
1st Vice-Chairman:	M.-A.	Martin-Sane (France)
2nd Vice-Chairman:	A.R.	Bayoumi (Egypt)
3rd Vice-Chairman:	J.A.	Galavis-Seidel (Venezuela)
4th Vice-Chairman:	K.	Voigt (German Democratic Republic)

Fig. 16 - The newly elected Chairman of the IOC, Professor Inocencio Ronquillo, of the Philippines, in the company of the outgoing Chairman, Dr. Agustin Ayala Castañares.

The following Member States were elected to designate representatives to sit on the IOC Executive Council:

Algeria	Jordan
Angola	Kenya
Argentina	Mexico
Australia	Netherlands
Brazil	Nigeria
Canada	Peru
China	Senegal
Costa Rica	Spain
Germany, Federal Republic of	Sweden
India	Turkey
Indonesia	United Kingdom
Iraq	Union of Soviet Socialist Republics
Italy	United States of America
Japan	

A good deal of attention was paid to the oceanographic component of the Unesco Draft Medium-Term Plan (1984-1989). Stress was also placed on maintaining the integrity of the marine sciences programme, which includes those of the IOC and of the Division of Marine Sciences. The Commission reiterated the view of the Executive Council, at its Fourteenth Session, that an increase in the Commission's budget of about 50 per cent is essential if the IOC is to respond effectively to the increasing needs of Member States, and to undertake the new scientific programmes approved by its Member States.

Attention was given to enhancing co-operation with other international organizations, notably with the United Nations Environmental Programme, the International Atomic Energy Agency, the International Council for the Exploration of the Sea, and the International Commission for the Scientific Exploration of the Mediterranean Sea, as well as with FAO and UN/OETB, in conjunction with two new programmes on living and non-living resources.

The implications for the Commission of the new ocean regime arising from the adoption and signature of the Convention on the Law of the Sea, have been analysed by an ad hoc Task Team, and the Assembly asked the Team to continue its analysis in terms of possible structural, statutory, budgetary and programmatic consequences to the Commission.

8. MISSIONS OF THE SECRETARY

In addition to ad hoc consultations with officials and scientists from Member States, as well as with officers from intergovernmental and non-governmental organizations, during their visits to the IOC Secretariat in Paris, the Secretary undertook a number of official visits to Member States during 1980-82, as well as to the Headquarters of UN Organizations Members of ICSPRO (Fig. 17).

The major purpose of these visits was to discuss with local authorities and senior officials concerned with IOC affairs how to enhance Member State participation in the Commission's activities and in what ways the IOC programme could be strengthened. The role of IOC in the light of present trends in ocean affairs, in particular the expected demands devolving on the Commission as a result of the emerging new ocean regime, was discussed.

These visits also offered a good opportunity for the Secretary to become directly acquainted with national policies in the field of marine science and related aspects, to visit universities and other educational and research institutions, and to contact national funding agencies.

Consultations also included the marine science component of the Unesco Medium-Term Plan (1984-89), the requirements of the Commission and proposals for the 1984-85 programme of work and budget as well as

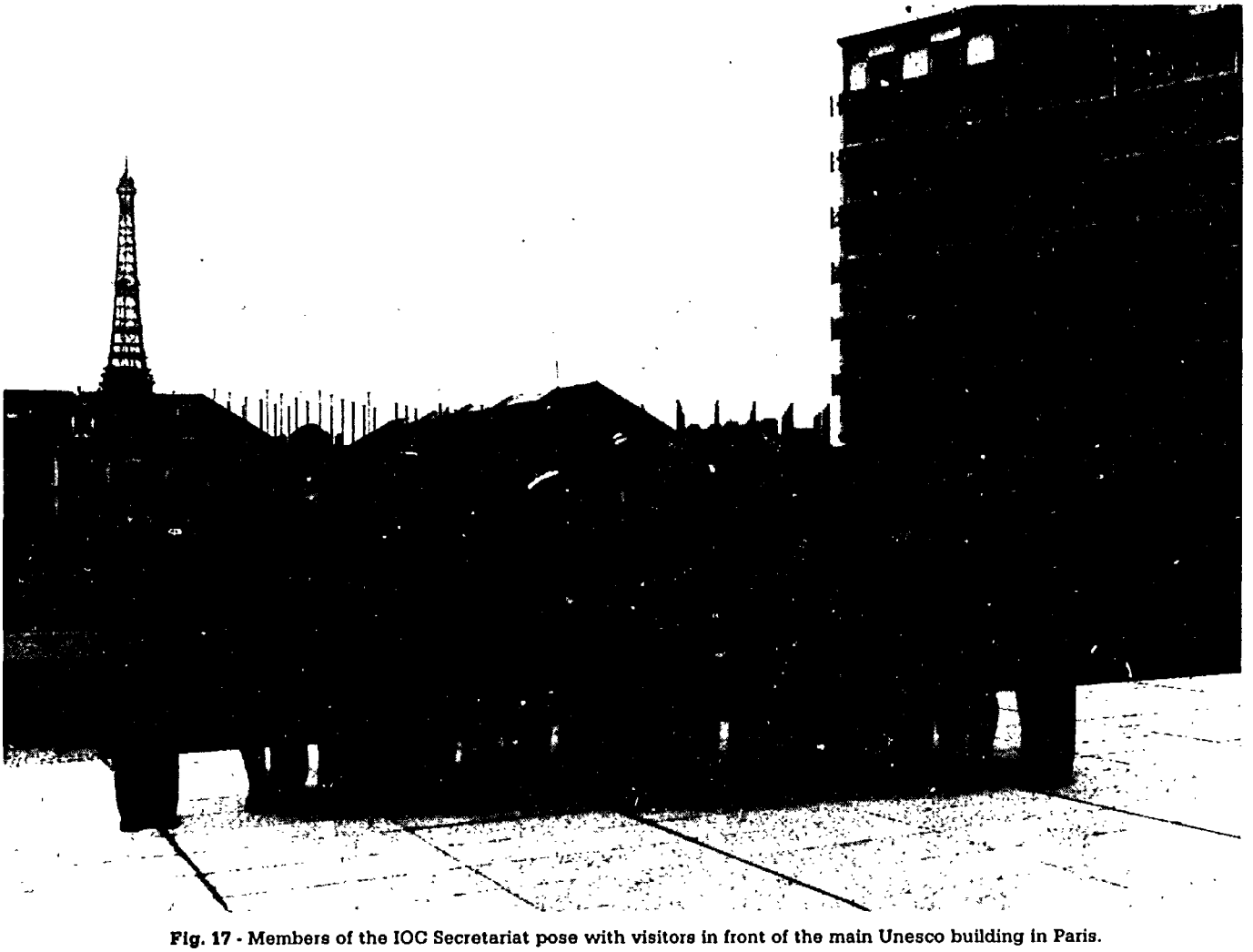


Fig. 17 - Members of the IOC Secretariat pose with visitors in front of the main Unesco building in Paris.

direct and indirect financial and in-kind support to the Commission, including contributions to the IOC Trust Fund.

Within this context, the Secretary undertook a two-week mission to Japan (Tokyo, Kyota, Shimizu) from 3-2 July 1980. On his return from Cancun, Mexico, where he attended the Third Session of the IOC Association for the Caribbean and Adjacent Regions (1- December 1980), the Secretary made a stop-over in Madrid to discuss with Spanish authorities the preparations for the Fourteenth Session of the IOC Executive Council.

He visited the USSR (Moscow, Leningrad) for one week, from 15-21 February 1981, and, while in the United States, accompanied the Chairman on a two-day visit to Washington, D.C., from 23-25 March 1981, in conjunction with attendance at the Tenth Session of UNCLOS in New York.

From 6-17 July 1981, the Secretary undertook a two-week mission to the People's Republic of China (Beijing, Guangzhou and Tsientsin) for discussion s with senior officials of the National Bureau of Oceanography, the National Commission for Unesco and with the staff of various laboratories and research institutions. Special attention was paid to the participation of China in TEMA and WESTPAC activities.

After leaving China, the Secretary visited Sri Lanka from 16-23 July to participate in a joint UN(OETB)/FAO/IOC mision to advise the Government on their plans to establish a National Aquatic Resources Agency and to draft a project on development and strengthening of national capabilities in marine affairs to be submitted to UNDP for financing. The Secretary availed himself of this opportunity to discuss IOC affairs with the Minister of Fisheries and senior officials of the Ministries of Foreign Affairs, of Industry and Scientific Affairs, of Finance and Planning, of Education as well as with the staff of the Universities.

In conjunction with his participation in the Sixteenth Session of the Comision Permanente del Pacifico Sur (CPPS), Lima, the Secretary undertook a mission to the Member States of the region. In Colombia he visited the Colombian Oceanographic Committee and senior officials of the Ministry of Foreign Affairs, of the Navy and of the National Agency for Science and Technology Research (COSIENCIAS).

In Ecuador, from 26-28 November, the Secretary had the honour of being received by the President of the Republic, which testifies to the importance attached by Ecuador to international co-operation in marine affairs. The Secretary also had interviews with the Minister of Foreign Affairs and senior officials of the Department of State, of the Navy and of the Universities.

While in Chile (29 November-1 December), he met with the Secretary of State for Fisheries, senior officials of the Ministry of Foreign Affairs, of the Navy and of the Catholic University of Chile.

In Peru, from 1-8 December, he had the honour of being received by the President of the Republic and senior officials of the Ministries of Foreign Affairs, of Fisheries, and senior staff of the Universities and research institutions, which again was a testimony to Peru's interest in international co-operation in marine science.

During the mission to Ecuador and Peru, the Secretary-General of CPPS kindly agreed to join the Secretary for the discussions on matters concerning the promotion of the project proposal on "El Nino" to be submitted to UNDP. While in Lima, the Secretary had the opportunity to discuss with the Secretary- General and other staff of CPPS how best to develop co-operation between CPPS and IOC on matters of common interest, particularly on the scientific investigations of "El Nino".

The Secretary also accompanied the Chairman during his official visit to France (4-8 December 1981) at which time they had an interview with the Minister of the Navy, with senior officials of the Ministry of Foreign Affairs and those of CNEXO.

The Secretary met with the Secretary-General of ICSEM, Commandant J. Y. Cousteau to discuss development of co-operation between the two organizatio ns in the Mediterranean. This was followed by discussions with Mr. C. Solamito, Minister Plenipotentiary of Monaco, in conjunction with the Secretary's attndance at the International Hydrographic Conference in Monaco, April 1982.

In addition to these missions, the Secretary visited the Executive Heads and senior officials of the UN Organizations Members of ICSPRO for consultation on matters of common interest, especially related to enhancing the role of IOC as a joint specialized co-ordination mechanism.

At the time of the Thirteenth Session of the IMO Marine Environmental Protection Committee (8-14 June 1980), he met with Mr. C. P. Srivastava, Secretary-General of IMO. In July 1980, he visited the Secretary-General of WMO, Dr. A. A. Winn-Nielsen and also met with the Executive Director of UNEP, Dr. M. Tolba, in Geneva. He accompanied the Chairman of IOC on his visit to the Secretary-General of IAEA, Dr. S. Eklund, in Vienna on 6 February 1981, and to the UN Under-Secretary-General of UNCLOS, Mr. Bernardo Zuleta, in New York, in conjunction with the Tenth Session of UNCLOS in April 1981.

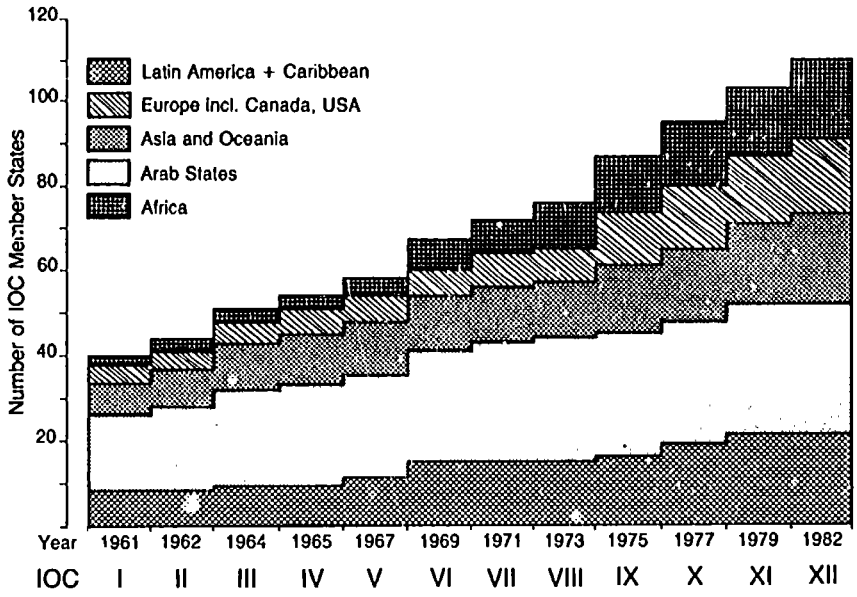
While attending the Tenth Session of the Advisory Committee on Marine Resources and Research (ACMRR) in Rome during November 1982, the Secretary had discussions with the Acting Assistant Director-General of FAO for Fisheries regarding the development of co-operation between FAO and IOC in the framework of the ICSPRO Agreement, particularly in relation to the programme on Ocean Science in relation to Living Resources.

The Secretary participated in an inter-agency meeting (Geneva, 3-5 July 1982) called by the UN Under-Secretary-General and Representative of the Secretary General to UNCLOS, to exchange views on future co-operation aimed at facilitating the implementation of the Convention on the Law of the Sea and to assist Member States in that regard.

In conjunction with the consultations mentionned above, the Secretary had discussions with the Director of the UNEP Regional Seas Programme regarding co-operation between the two organizations on matters concerning GIPME, MARPOLMON, execution of field projects and other subjects of mutual interest.

In connexion with part-time participation in the 34th Session of the WMO Executive Committee (Geneva, 7-26 June 1982), the Secretary had the opportunity to exchange ideas with the Secretary-General of WMO on the continued development between the two organizations of matters of common interest, particularly IGOSS and the oceanographic component of the World Climate Research Programme.

Fig. 18 - Growth in IOC Membership, 1961-1982



ANNEX I

Programme and Budget of the biennium, 1981-1982

Breakdown of the Unesco Regular Programme funds made available to the Commission

I.	Secretariat Services (Assembly, Executive Council meetings, advisory services to the Commission)	308,100
II.	Global and Regional Science Activities (GIPME/ MARPOLMON, OSLR, OSNLR, Ocean Dynamics and Climate, Ocean Mapping)	557,800
III.	Global and regional components of Ocean Services (IGOSS, Data Management, Tsunami Warning)	274,300
IV.	Training, Education and Mutual Assistance in the marine sciences (TEMA)	383,000
	TOTAL (Operational funds)	1,523,200
V.	Staff costs approved under the Unesco Regular Programme	1,150,600
	TOTAL	2,673,800

Breakdown of the 1980-1982 total income (in US$)[1]

	In the form of funding	In Kind(2)	SALARIES	TOTAL
Unesco	1,523,200	-	1,150,600	2,673,800
United Nations	-	60,000	-	60,000
FAO	-	-	150,000 (4)	150,000
WMO	-	-	130,000 (4)	130,000
IMO	-	-	130,000 (4)	130,000
Member States et al. through IOC Trust Fund	382,000	(3)	302,000 (5)	684,000
TOTAL	1,905,200	60,000	1,862,600	3,827,800
Extra-budgetary funds from UNEP for projects for which IOC is executing agency	220,900	-	-	220,900

(1) It should be noted that the above financial statement is based on information available to the IOC Secretariat, and is not an official actuarial record.
(2) e.g. for hosting meetings under the ICSPRO agreement.
(3) No estimate attempted.
(4) Staff seconded to IOC by ICSPRO Agencies
(5) Including salaries for staff seconded by Member States through contributions to the IOC Trust Fund and direct secondment.

ANNEX II

State-Member representatives on the Executive Council (4 November 1979 to 19 November 1982 and from 20 November 1982)

State-Member representatives on the Executive Council (4 November 1979-19 November 1982)

A. Ayala-Castañares	Mexico (Chairman)
N.J. Campbell	Canada (First Vice-Chairman)
C. Druet	Poland (Second Vice-Chairman)
I.A. Ronquillo	Philippines (Third Vice-Chairman)
A.R. Bayoumi	Egypt (Fourth Vice-Chairman)
F. Vila	Argentina
L.C. De Freitas (1)	Brazil
Luo Yuru	China
G. Angel Mejia (2)	Colombia
M.-A. Martin-Sané	France
H.U. Roll	Germany (Federal Republic of)
S.Z. Qasim (3)	India
N. Nasu	Japan
S.O. Allela	Kenya
T.F. Groustra-de-Kat	Netherlands
J.G. Tobor (4)	Nigeria
Sogui Diouf	Senegal
J.M. Turnay Turnay (5)	Spain
J.-O. Stromberg	Sweden
Salem Hadj Ali	Tunisia
E.I. Tolstikov	Union of Soviet Socialist Republics
P.F.G. Twinn (6)	United Kingdom
F. Webster (7)	United States of America
J.A. Galavis Seidel	Venezuela
R. Stijelja	Yugoslavia

(1) Replaced by V. Lisieux Medeiros de Figueiredo
(2) Replaced firstly by A. Martinez Barbosa, then by J. Sanchez Cortes
(3) Replaced by V.V.R. Varadachari
(4) Replaced by E.O. Bayagbona
(5) Replaced by H. Oliver Massuti
(6) Replaced by R.J.H. Beverton
(7) Replaced by J.V. Byrne

State-Member representatives on the Executive Council (from 20 November 1982)

I.A. Ronquillo	Philippines (Chairman)
M.-A. Martin-Sané	France (First Vice-Chairman)
A.R. Bayoumi	Egypt (Second Vice-Chairman)
J.A. Galavis-Seidel	Venezuela (Third Vice-Chairman)
K. Voigt	German Democratic Republic (Fourth Vice-Chairman)
A. Chouikhi	Algeria
D. Van-Dunem	Angola
F. Vila	Argentina
D.G. Keeley	Australia
V. Lisieux Medeiros de Figueiredo	Brazil
N.J. Campbell	Canada
Luo Yuru	China
M.M. Murillo	Costa Rica
G. Hempel	Germany, Federal Republic of
V.V.R. Varadachari	India
A. Soegiarto	Indonesia
N.A. Hussain	Iraq
C. Morelli	Italy
N. Nasu	Japan
A. Badran	Jordan
S. O'Allela	Kenya
A. Ayala-Castañares	Mexico
T.F. Groustra-de-Kat	Netherlands
J.G. Tobor	Nigeria
J.M. Bakula	Peru
D.Y. Kane	Senegal
M. Oliver Massuti	Spain
J.-O. Stromberg	Sweden
T.I. Balkas	Turkey
R.J.H. Beverton	United Kingdom
E.I. Tolstikov	Union of Soviet Socialist Republics
J.V. Byrne	United States of America

ANNEX III

Member States of the Commission

At the time of the Twelfth Session of the Assembly, 110 countries were Member States of the Commission (*):

ALGERIA
ANGOLA (PEOPLE'S REP.)
ARGENTINA
AUSTRALIA
Austria
Bahamas
Bangladesh (People's Rep.)
Belgium
BRAZIL
Bulgaria
Cameroon
CANADA
Chile
CHINA
Colombia
Congo
COSTA RICA
Cuba
Cyprus
Denmark
Dominican Republic
Ecuador
EGYPT, ARAB REPUBLIC OF
Ethiopia
Fiji
Finland
FRANCE
Gabon
GERMAN DEMOCRATIC REPUBLIC
GERMANY,FEDERAL REPUBLIC OF
Ghana
Greece
Guatemala
Guinea
Guyana
Haiti
Iceland
INDIA
INDONESIA
Iran
IRAQ
Ireland
Israel
ITALY
Ivory Coast
Jamaica
JAPAN
JORDAN
KENYA
Korea, Democratic People's Republic of
Korea, Republic of
Kuwait
Lebanon
Libyan Arab Jamahiriya
Madagascar
Malaysia
Malta
Mauritania, Islamic Republic of
Mauritius
MEXICO
Monaco
Morocco
Mozambique
NETHERLANDS
New Zealand
Nicaragua
NIGERIA
Norway
Oman
Pakistan
Panama
PERU
PHILIPPINES
Poland
Portugal
Qatar
Romania
Saudi Arabia
SENEGAL
Seychelles
Sierra Leone
Singapore
Solomon Islands
Somalia
South Africa, Republic of (suspended)
SPAIN
Sri Lanka
Sudan
Surinam
SWEDEN
Switzerland
Syrian Arab Republic
Tanzania, United Republic of
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
TURKEY
Ukrainian SSR
UNION OF SOVIET SOCIALIST REPUBLICS
United Arab Emirates
UNITED KINGDOM
UNITED STATES OF AMERICA
Uruguay
VENEZUELA
Vietnam, Socialist Republic of
Western Samoa
Yemen, Republic of
Yugoslavia

(*) Members of the Executive Council appear in capital letters

ANNEX IV

List of publications issued 1980-1982

1. Intergovernmental Oceanographic Commission (IOC)

(a) IOC Technical Series

No. 21 Bruun memorial lectures, 1979: Marine environment and ocean resources. 1980. 40 pp. (English, French, Spanish, Russian)

No. 22 Scientific report on the intercalibration exercise of the IOC/WMO/UNEP pilot project on monitoring background levels of selected pollutants in open ocean waters. 1982. 91 pp. (English)

No. 23 Operational sea-level stations (in preparation)

(b) IOC Manuals and Guides

No. 9 Annex I The IOC General Magnetic Tape format for the International Exchange of Oceanographic Data.
Part 1. Technical Specification. 1980, 64 pp. (English, French, Spanish and Russian)

No. 9 Annex I, Part 2. Code Tables. 1982, 41 pp. (English, French, Spanish and Russian)

No. 9 Annex II Guide for Responsible National Oceanographic Data Centres. 1982. 30 pp. (English, French, Spanish and Russian)

No.10 Marine Environmental Data Information Referral Catalogue (MEDI Catalogue) Second Edition 1979. 214 pp. (Quadrilingual)

No.11 The determination of petroleum hydrocarbons in sediments. 1982. 38 pp. (English, French, Spanish, Russian)

No.12 Chemical Methods for use in Marine Environmental Monitoring (in preparation)

(c) IOC Workshop Series

No.

22 Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980. 38 pp. (English, French, Spanish, Russian)

23 WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific Tokyo, 27-31 March 1980. 30 pp. (English, Russian)

24 WESTPAC Workshop on Coastal Transport of Pollutants. Tokyo, 27-31 March 1980. 25 pp. (English)

25 Workshop on the Intercalibration of Sampling Procedures of the IOC/WMO/ UNEP Pilot Project on Monitoring Back- ground levels of Selected Pollutants in Open-Ocean Waters. Bermuda, 11-26 January 1980. 92 pp. (English)

26 IOC Workshop on Coastal Area Management in the Caribbean Region, Mexico City, 24 September - 5 October 1979. 42 pp. (English, Spanish)

27 CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific. Noumea, New Caledonia, 9-15 October 1980. 63 pp. (English)

28 FAO/IOC Workshop on the effects of envir- onmental variation on the survival of larval pelagic fishes. Lima, 20 April - 5 May 1980. 328 pp. (English)

29 WESTPAC Workshop on marine biological methodology. Tokyo, 9-14 February 1981. 37 pp. (English)

30 International Workshop on Marine Pollution in the South-west Atlantic Montevideo,10-14 November 1980. 20 pp. (English, Spanish)

31 Third International Workshop on Marine Geoscience. Heidelberg. 19-24 July 1982. 37 pp. (English, French, Spanish, Russian).

32 UNU/IOC/Unesco Workshop on International Cooperation in the Development of Marine Science and the transfer of Technology in the Context of the New Ocean Regime. Paris, 27 September - 1 October 1982 (in preparation)

(d) Bathymetric Charts

- General Bathymetric Chart of the Oceans (GEBCO) - Fifth Edition (18 Charts)
- International Bathymetric Chart of the Mediterranean

2. Unesco - Division of Marine Sciences (OCE)

Unesco Technical Papers in Marine Science

No.

31 Coastal lagoon survey (1976-1978) 1980. 280 pp. (English)

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. 97 pp. (English)

33 Coastal lagoon research, present and future. Proceedings of a seminar, Duke University, August 1978. (Unesco, IABO) 1981. 348 pp. (English)

34 The carbon budget of the oceans. Report of a meeting, Paris, 12-13 November 1979. 1980. 16 pp. (English)

35 Determination of chlorophyll in sea- water. 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. 20 pp. (English)

36 Tenth report of the joint panel on ocean- ographic tables and standards, Sidney, B.C., Canada, 1-5 September 1980. sponsored by Unesco, ICES, SCOR, IAPSO 1981.25 pp. (English)

37 Background papers and supporting data on the Practical Salinity Scale 1978. 1981. 144 pp. (English)

38 Background papers and supporting data on the International Equation of State of Seawater. 1981. 192 pp. (English)

39 International Oceanographic Tables, Vol. 3. 1981. 111 pp. (English/French/ Spanish/Russian/Arabic)

41 Ocean Atmosphere Materials Exchange (OAMEX). 1982. 27 pp. (English)

43 International Symposium on Coastal Lagoons, 1982. 53 pp. (English, French, Spanish)

Unesco Reports in Marine Science

No.

10 Development of marine science and technology in Africa. 1980. 58 pp. (English, French)

11 Programa de investigacion sobre el plancton de la costa oeste de Sudame- rica. 1981. 46 pp.(Spanish)

12 Geologia y geoquimica del margen continental del Atlantico sudoccidental. 1981. 40 pp.(Spanish)

13 Ensenanza de la oceanografia en Latinoamerica. 1981. 40 pp. (Spanish)

14 Marine science and technology in Africa: present state and future development. 1981. 125 pp. (English,French)

15 Fishery science teaching at the university level. 1981. 71 pp. (Arabic, English, French, Russian,Spanish.)

16 Marine and coastal processes in the Pacific: ecological aspects of coastal zone management. 1981. 20 pp. (English)

17 The coastal ecosystems of West Africa: coastal lagoons, estuaries and man- groves. 1981. 60 pp. (English,French.)

18 Coral reef management in Asia and the Pacific: some research and training priorities. 1981. 22.pp. (English)

19 Mareas Rojas en el Plancton del Pacifico Oriental - ROSTLAC 1982 - 47 pp. (Spanish)

Gesamp Reports and Studies

No.

10 Report of the Eleventh Session - Dubrovnik, Yugoslavia, 25-29 February 1980. (English, Spanish)

11 Marine Pollution Implications of Coastal Area Development. 1980. 114 pp. (English)

12 Monitoring biological variables related to marine pollution. 1980. 22 pp. (English)

13 Interchange of Pollutants between the Atmosphere and the Oceans. 1980. 55 pp. (English)

14 Report of the twelfth session - Geneva, 22-29 October 1981. 1981. 64 pp. (English)

15 The Review of the Health of the Oceans. 1982. 122 pp. (English)

16 Scientific Criteria for the Selection of Waste Disposal Sites at Sea. 1982. 60 pp. (English)

17 The evaluation of the hazards of harmful substances carried by ships. 1982. 110 pp. (English)

Monographs on Oceanographic Methodology

7 Mathematical models in biological oceanography. 1981. 176 pp. (English)

NON-SERIAL TITLES

Directorio de Ciencias del Mar de America del Sur. Published by the Regional office in Montevideo, Uruguay. 1980. 258 pp. (Spanish)

Directorio de Ciencias del Mar de America del Sur - Suplemento: Indice de Especialistas. Published by the Regional Office in Montevideo, Uruguay. 1980. 258 pp. (Spanish)

Memorias del seminario sobre el estudio cientifico e impacto humano en el ecosistema de manglares. Published by the Regional Office in Montevideo, Uruguay. 1980. 405 pp. (Spanish)

Memorias del seminario sobre indicadores biologicos del plancton. Published by The Regional Office in Montevideo, Uruguay. 1981. 116 pp.(Spanish)

River inputs to ocean systems. Published by UNEP and IOC. 1981. 384 pp. (English)

Assault on the largest unknown - The International Indian Ocean Expedition by Daniel Behrman. 1981. 96 pp. (English)

Bibliography on mangrove research - 1600 - 1975. Compiled by B. Rollet 1981. 479 pp. (English)

Harvesting Ocean Energy 1981. 171 pp. (English)