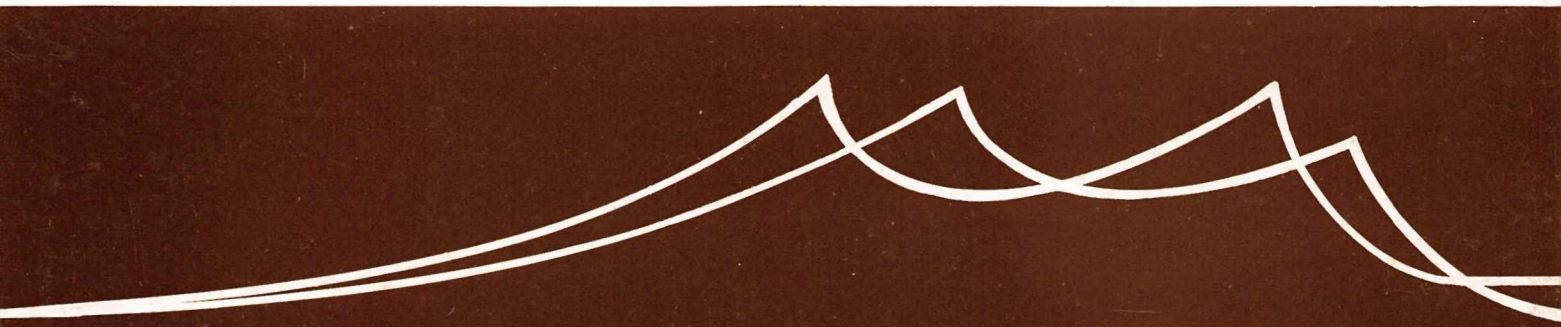
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



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SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

PROCEEDINGS

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SCOR PROCEEDINGS, Vol. 21

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REPORT OF THE TWENTY-SEVENTH MEETING OF THE SCOR EXECUTIVE COMMITTEE

Seattle, USA

September 10 to 12, 1985

The twenty-seventh meeting of the Executive Committee of SCOR was held at the Applied Physics Laboratory of the University of Washington in Seattle from 10 to 12 September 1985. The President of SCOR, Professor Gerold Siedler, chaired the meeting. A list of participants is given in Annex I.

Professor G. Ross Heath, Vice-President of SCOR, welcomed the participants on behalf of the Ocean Studies Board of the U.S. National Academy of Sciences, which is the U.S. Committee for SCOR. He also transmitted messages of good wishes from the Provost of the University of Washington, Dr. George M. Beckmann, and the Director of the Applied Physics Laboratory, Dr. Stanley R. Murphy.

The President opened the meeting by thanking Professor Heath for his hospitality as Dean of the College of Ocean and Fishery Sciences of which the Applied Physics Laboratory is part. He welcomed several participants and observers who are not members of the Executive Committee.

Professor Siedler reminded the meeting of the death, in November 1984, of Sir George Deacon, who had been a founding member of SCOR and its first Vice-President. His many contributions to international marine science included service as President of IAPO, the forerunner of IAPSO. Sir George was instrumental in founding the National Institute of Oceanography, now the Institute of Oceanographic Sciences at Wormley (U.K.). He received many awards, especially in recognition of his work in Antarctic oceanography. Professor Siedler recalled that Sir George remained a modest man who never failed to encourage young scientists. The meeting observed a moment of silence to honour Sir George Deacon.

1.0 ORGANIZATION AND FINANCE

1.1 Membership

The President reported that in June 1985, he and the Past-President and Executive Secretary of SCOR visited a number of Chinese oceanographic institutions at the invitation of the newly-formed Chinese Committee on Oceanic Research. The purpose of this visit was to complete the final discussions related to the membership of China in SCOR and to speak to as many Chinese oceanographers as possible about SCOR activities. It was hoped that by doing this, the integration of Chinese scientists into current and future SCOR activities could proceed smoothly and relatively quickly.

The visit to China concluded with a three day stay in Beijing. The SCOR delegation met with the Chinese Committee on Oceanic Research whose members had travelled to Beijing for the occasion. The Co-Chairmen of the Committee are Dr. Luo Yuru who is Director of the National Bureau of Oceanography and President of the Chinese Society of Oceanography, and Dr. Tseng Chengkui who is Director Emeritus of the Institute of Oceanology of the Academia Sinica and President of the Chinese Society of Oceanology and Limnology. The Co-Chairmen presented the President of SCOR with a formal letter of application for Category II membership in SCOR. Since he had been given a mandate by the XVII General Meeting to accept such an application, Professor Siedler welcomed the Chinese Committee on Oceanic Research to SCOR with great pleasure.

Professor Siedler explained the rights and duties of members of SCOR - to cooperate in working group activities, to initiate proposals for new activities and so on. He mentioned the most recently-formed working groups, those for which membership suggestions were still being considered, and the proposals which would be discussed at the Executive Committee meeting in Seattle. It was suggested that the Chinese Committee might wish to consider appointing Corresponding Members to existing working groups in which China has specific interests.

In response to an enquiry received from the Committee for SCOR in Taipei, the Executive Committee confirmed the decision of the XVII General Meeting regarding the designation of the two committees which represent Chinese oceanographers in SCOR. They are the Chinese Committee on Oceanic Research, and the Committee on Oceanic Research located in Taipei, China.

The meeting reviewed recent correspondence with the Consejo Superior de Investigaciones Cientificas of Spain regarding the re-establishment of Spanish membership in SCOR. This membership had lapsed due to the non-payment of membership contributions. The Executive Committee wished to encourage the formation of a new Committee for SCOR in Spain and expressed the hope that it would be representative of all oceanographers in the country.

The Executive Secretary informed the meeting of a number of changes in SCOR membership since the XVII General Meeting.

Dr. J.H. Middleton has replaced Professor J.S. Turner as an Australian Nominated Member. Dr. A.D. McEwan is the new Chairman of this Committee.

Captain H. Garcia is now the third Nominated Member from the Chilean SCOR Committee.

The three Nominated Members from the newly formed Chinese Committee for Oceanic Research are Professor Tseng Chengkui, Professor Ren Mei-e and Dr. Luo Yuru.

Drs. A. Nielsen and V. Hansen have replaced Dr. G. Kullenberg and Dr. J. Bondam as Danish members of SCOR.

The Italian Committee has added Dr. C. Morelli as one of its Nominated Members of SCOR.

The Committee on Oceanic Research in New Zealand has reported that its Nominated Members are now Drs. J.M. Bradford, R.M. Heath and K.A. Hunter.

The Polish SCOR Committee has added two Nominated Members; Professor C. Druet and Professor A. Zielinski.

Professor I. Hessland has replaced Professor K. Gunderson as a Nominated Member of the Swedish Committee for SCOR.

Dr. D. Imboden is the new Chairman of the Swiss Commission d'Oceanographie et de Limnologie and has replaced Professor L. Hottinger as a Swiss Nominated Member of SCOR.

The Nominated Members from Thailand are now Dr. S. Sudara, Dr. C. Swasdiyakorn and Captain P. Vejjanukroh.

Dr. J. Capuzzo and Dr. R. Gammon have replaced Dr. J. Baker and Dr. J. Steele as U.S. Nominated Members of SCOR.

ICSU has notified SCOR that its Liaison Officer with SCOR is now Professor D. Lal. Academician Brekhovskikh continues to act as ICSU's Representative Member in SCOR.

Dr. G.R. Valenzuela is the new Representative Member for URSI.

1.2 Publications

The Publications Officer, Professor Charnock noted the SCOR Proceedings Volume 20 was published in March 1985 and contains the report of the XVII General Meeting of SCOR. A new SCOR Handbook was published in July 1985. He presented the following list of publications which have appeared since the XVII General Meeting and which arise from SCOR activities.

UNESCO Monographs on Oceanographic Methodology

No. 4 "Zooplankton Fixation and Preservation" has been reprinted.

No. 7 "Mathematical Models in Biological Oceanography" was published in Russian in February 1985.

UNESCO Technical Papers in Marine Science

No. 45 "The International System of Units (SI) in Oceanography" Report of IAPSO Working Group on Symbols, Units and Nomenclature in Physical Oceanography (SUN).

BIOMASS Publications

BIOMASS Report Series

No. 39 Meeting of the BIOMASS Executive, Bremerhaven, FRG. 2-3 October 1984.

No. 40 Post-FIBEX Acoustic Workshop, Frankfurt/Main, FRG. 3-14 September 1984 (in press).

No. 41 Meeting of BIOMASS Working Party on Bird Ecology, Hamburg, FRG. 20-22 September 1984.

No. 42 Meeting of BIOMASS Working Party on Fish Ecology Dammarie-les-Lys, France. 25-29 August 1984.

No. 43 Meeting of the Group of Specialists on Southern Ocean Ecosystems and Their Living Resources. Dammarie-les-Lys, France. 26-28 June 1985.

No. 44 FIBEX Seabird Data Interpretation Workshop. Cape Town, South Africa. 10-18 April 1985.

BIOMASS Scientific Series

Volume 4 Distribution and Abundance of Antarctic Penguins: A Synthesis of Current Knowledge. Edited by G.K. Wilson.

Volume 5 Illustrated Guide to Fish Larvae of the Southern Ocean. Edited by V.N. Efremenko.

Volume 6 Review of the Biology and Present Status of Exploited Antarctic Fish Stock. Edited by K.H. Kock, G. Duhamel and J.C. Hureau.

Atlas of Biological Oceanographic Results of the Southern Part of the Drake Passage and the Bransfield Strait During FIBEX.

CCCO Publications

Summary Report of the Sixth Session of CCCO, Washington, D.C. 27 November - 4 December 1984.

Report of the Second Session of the JSC/CCCO TOGA Scientific Steering Group, University of Liege. 2-5 May 1984. WCP-89.

Report of the Second Session of the JSC/CCCO Working Group on Satellite Observing Systems for Climate Research, Vienna, 29 June - 3 July 1984. WCP-91.

Time Series of Ocean Measurements: An Annual Review. Vol. II. IOC Technical Series No. 30.

TOGA Scientific Plan. WCRP Publication Series No. 3.

Miscellaneous Publications

WG 42 Report of a meeting of the ICES/SCOR Working Group on the Study of the Pollution of the Baltic. Helsinki, 1-3 April 1985. ICES Paper C.M. 1985/E:9.

WG 73 Ecosystem Theory for Biological Oceanography. R. Ulanowicz and T. Platt (eds). Can. Bull. Fish and Aquat. Sci. No. 213. 260 pp. 1985.

The Publications Officer regretted the delay in the preparation by some working groups of manuscripts which had been promised for publication by UNESCO (c.f. 2.1).

1.3 Finance

The Executive Secretary presented a series of financial documents which included a final statement for the 1984 fiscal year, the budget for 1985 as approved by the XVII General Meeting, and an interim statement for the period January 1 to August 31 1985. The 1984 financial statement appears as Annex II to this report.

In general, these documents showed SCOR's financial position to be healthy. SCOR finished the 1984 fiscal year with an unusually large amount of cash on hand. This was due, in part, to the cancellation or postponement of several activities in 1984. The Executive Secretary was of the opinion that this cash balance would be approximately equal in size at the end of the 1985 because a relatively small number of working group meetings had taken place this year. The Executive Committee asked Professor Charnock to consult with the Executive Secretary in drawing up a budget for 1986 based on the requests for financial support which were before the meeting for consideration. He was also asked to make recommendations to the meeting as to appropriate levels of membership contributions for 1986 and 1987. The meeting was reminded that the XVII General Meeting had agreed that contributions should increase by not more than 5% in 1986 and that SCOR Committees had been informed of this decision in late 1984.

In making his report later in the meeting, Professor Charnock noted that the Executive Committee had considered a large number of requests for financial support of subsidiary bodies in 1986. Fourteen activities had been approved. In addition, it was expected that considerable expense might be involved in holding the XVIII General Meeting in the southern hemisphere. He presented a budget for 1986, which included a starting balance of $120,000.00 U.S. It projected a year-end balance of $49,000.00 if all activities approved by the Executive Committee take place in 1986 as planned. This closing balance would be much closer to traditional levels and to the amount which is considered desirable to have on hand for the support of activities in the early portion of a new fiscal year. In view of SCOR's present ability to adequately meet the needs of its subsidiary bodies, Professor Charnock recommended that there should be no increase in membership contributions in 1986, but that it would be necessary to increase them by 10% for 1987 since the cash balance was expected to be reduced by that time. The Executive Committee concurred with these recommendations.

In considering SCOR's present financial situation, some members of the Executive Committee made suggestions as to ways to inject some flexibility into the management of SCOR's financial resources. At times, when a large cash balance is on hand, it may be desirable to adjust budgetary allocations approved by an Executive Committee Meeting. For example, under these circumstances, a request from a working group Chairman to expand a meeting of his group by inviting two or three additional experts could be accommodated if the budget could be adjusted. The Constitution of SCOR assigns responsibility for budgetary control to the President and Secretary. The Executive Secretary was instructed, therefore, to draw up financial statements on a quarterly basis and to consider amendments to the budget approved by the Executive Committee. Such changes are to be made in consultation with the President and Secretary.

Concern was expressed by the Executive Committee about the effect on SCOR of current financial problems at UNESCO. Dr. Morcos, the representative of UNESCO, stated that the Division of Marine Sciences is making every effort to preserve funds for non-governmental organizations in the face of budget cuts.

Mr. L.B. Brown of the National Science Foundation (U.S.A.) informed the meeting of steps being taken within the U.S. to ensure continued American support of international scientific activities in spite of the U.S. withdrawal from UNESCO. He stated that the U.S. Department of State had included in its budget being considered by Congress a request for $2.7 million to permit continued support of UNESCO scientific programmes of

high priority to the U.S. He noted that it appeared likely that the major part of this budget request, possibly $2 to 2.2 million, would be approved. Mr. Brown indicated that roughly $500,000 of this amount might be allocated to continued U.S. support of the IOC programme, with part of these funds going to the IOC Fund-in-Trust earmarked for the support of specific IOC programmes, and part going to U.S. institutions for their support of specific IOC activities.

Mr. Brown stressed that the U.S., in considering which IOC activities should receive continued funding from the above allocations, had assigned a very high priority to the IOC's continued support of SCOR in order that the IOC could continue to receive the excellent scientific guidance it has always received from SCOR. He indicated that the U.S. National Science Foundation is similarly considering additional funding of ICSU to redress any shortfalls in UNESCO overall support of ICSU. He expected that, should the IOC and/or ICSU reduce their support for SCOR as a result of reduced UNESCO budgets, the U.S. would very likely assure that overall financial support continued at least at the present level. Accordingly, he suggested that it would not be necessary for SCOR to consider curtailing its planned programme work. [Note: It has since been reported that the U.S. contribution to UNESCO in the 1986 fiscal year will be approximately $1.2 million of which about one-sixth will be allocated to the IOC.]

1.4 Preparation for Election of Officers in 1986

The President noted that at the XVIII General Meeting it will be necessary to hold elections for the positions of the three Vice-Presidents and the Secretary of SCOR. The current Vice-Presidents are all eligible for re-election, however, Dr. Longhurst will have served as Secretary for three terms, the maximum allowed by the Constitution of SCOR. It was agreed that Professor Siedler and Dr. Torben Wolff (Denmark) should act as a Nominations Committee during the period leading up to the XVIII General Meeting. If necessary, they may co-opt one other member to serve on the committee. SCOR Committees will be invited to submit nominations of candidates for the relevant positions.

2.0 SUBSIDIARY BODIES

2.1 Arising from Former Working Groups

WG 46 River Inputs to Ocean Systems

The Publications Officer reported that he had received a draft of the final report of WG 46. This document is an expanded version of the report of the final meeting of the group and is intended for publication by UNESCO. Most of the recommendations of the working group have been dealt with by SCOR or have been passed to other organizations for consideration. Dr. Chesselet agreed to review the draft report before it is submitted to UNESCO.

WG 51 Evaluation of CTD Data

The continuing delay in the preparation of a "Guide to the Acquisition and Analysis of High Quality CTD Data" was noted with regret. The Chairman of WG 51 has agreed to give the manuscript to Professor Charnock who will serve as co-editor of the volume which, it was hoped, could be completed in the near future.

WG 61 Sedimentation Processes at Continental Margins

The Executive Committee agreed that it is unlikely that the papers presented by the WG 61 members at the JOA in 1982 can now be published as a single volume. The decision of the XVII General Meeting to disband WG 61 was, therefore, confirmed.

2.2 Existing Working Groups

WG 42 Pollution of the Baltic

The Executive Committee Reporter for WG 42 noted that the cooperation between SCOR and ICES in this group continues to be very positive. The major plans of WG 42 for the immediate future include the Patchiness Experiment (PEX '86) which will be carried out in late April and early May 1986 and will involve ten to thirteen ships from the Baltic countries. A pilot study involving four vessels was carried out in April 1985. The first part of PEX will be an intercalibration exercise followed by detailed investigations in polygons of varying sizes of a large range of physical, chemical and biological parameters.

The Executive Committee agreed with the recommendation of WG 42 that it meet for three days in the first half of 1986 in Sweden to consider:

- progress in the study of contaminants in sediments, and the preparation of the critical review on sediments;
- developments with regard to the Patchiness Experiment;
- recommendations for revised guidelines for monitoring contaminants in fish and shellfish in the Baltic;
- results obtained in the work on monitoring sections from the coastal zone to the open sea and from coastal monitoring studies; and
- papers on new harmful substances in the Baltic Sea and inputs to the Baltic.

Professor Kullenberg had informed SCOR and ICES that he wished to resign as Chairman of WG 42 since he has taken up a position at IOC. The Executive Committee agreed to submit his nomination of Dr. L. Brugmann (GDR) as his replacement to ICES for consideration.

WG 54 Southern Ocean Ecosystems and Their Living Resources

The Chairman of WG 54, Professor El-Sayed, reviewed the report which he had submitted to SCOR and which is given in Annex III. In his presentation, Professor El-Sayed discussed recent BIOMASS activities, especially the completion of SIBEX Phase 2 and the establishment of the BIOMASS Data Centre at the British Antarctic Survey, Cambridge, UK. He reported that at its meeting in June 1985 the group, noting that the BIOMASS programme is now in its final stages, reviewed the existing organizational framework for BIOMASS. While the field investigations have been completed, a great deal of data analysis and synthesis of information remains to be carried out. It will also be necessary to ensure effective use of the BIOMASS Data Centre.

His report, therefore, proposed the establishment of a SCAR/SCOR Programme Group for Southern Ocean Ecosystem Studies with terms of reference as given in Annex III. The terms of reference proposed for the Programme Group would have charged it with the design of a new phase of BIOMASS investigations. There was a consensus among the

participants, which was supported by the representative of SCAR, Mr. G.E. Hemmen, that efforts in the near future should concentrate on the analysis and synthesis of the enormous amount of data already collected during the BIOMASS programme. The SCAR Executive Committee had suggested that WG 54 be disbanded by the next SCOR General Meeting and that the existing BIOMASS Executive Committee be retained to oversee this period of data analysis which would culminate in a final BIOMASS Evaluation Meeting in 1989. The SCOR Executive Committee endorsed this recommendation and approved the proposals of WG 54 for a series of data evaluation workshops leading up to the 1989 meeting. While the main responsibility for these activities will rest with SCAR, SCOR will continue to provide financial support for BIOMASS activities in 1986.

The Executive Committee proceeded to discuss the report of WG 74, General Circulation of the Southern Ocean (see page 13), and then to consider the future needs for SCOR and SCAR involvement in oceanographic studies in the antarctic. There was a detailed discussion of the means by which appropriate physical and chemical oceanographers and marine meteorologists could best be involved in the planning and convening of the various BIOMASS data workshops referred to above. In SCOR's view, this involvement of oceanographers from various disciplines is essential if the analysis and synthesis of the many types of BIOMASS data is to be effectively carried out. The Executive Committee requested SCAR to ensure that whenever the BIOMASS Executive establishes a workshop planning group, it seek advice from SCOR regarding appropriate nominees from the oceanographic community.

WG 54 had identified three significant new projects that would be undertaken in the near future (i.e. krill target strength, international krill physiology project and International Weddell Sea Winter Studies). The SCOR Executive Committee felt that there is a great need for research on long term ecosystems monitoring to study seasonal and inter-annual variability of the biological, chemical and physical oceanographic parameters and processes at selected sites. SCOR invited the chairmen of WG 54 and WG 74 to continue their informal consultations and discussions of problems of mutual interest and to keep SCAR and SCOR informed as appropriate. A proposal might emerge from such discussions for a small meeting between a few members of the BIOMASS Executive and a few key physical and chemical oceanographers and meteorologists to formulate a plan for a monitoring project. In view of this, SCOR did not feel that it was necessary to call an ad hoc meeting to prepare reports for the 1986 meetings of SCAR and SCOR, as had been proposed by SCAR.

WG 56 Equatorial Upwelling Processes

Dr. Longhurst gave an account of a symposium which was organized by members of WG 56 and took place at UNESCO in May 1985. It was entitled "Vertical Motion in the Equatorial Upper Ocean its Effects upon Living Resources and the Atmosphere" and successfully brought together oceanographers in various disciplines to discuss the effects of upwelling, primarily along the west coasts of the African and South American continents. The symposium attracted a large number of participants from developing countries. The organizers of the symposium had hoped to have the papers which were presented published as a special issue of Oceanologica Acta. It appeared that this would not be possible due to lack of funds. At the Executive Committee meeting, however, financial support for the publication was offered from several sources. These were gratefully accepted since it was agreed that a single symposium volume would have much greater scientific impact than if the papers were to appear individually in the journal. The Convenor of the symposium, Dr. David Halpern, and its Chairman, Dr. Richard Barber, will work with the publishers of Oceanologica Acta on scientific aspects of the publication, while the Executive Secretary was instructed to contact the agencies which had committed financial support and to coordinate the mobilization of these funds.

Since several members of WG 56 did not attend the symposium in Paris, the group did not hold its final meeting as planned. The Executive Committee agreed to ask the Chairman of WG 56 for a brief final report summarizing the activities of the working group.

WG 65 Coastal Offshore Ecosystems Relationships

Dr. Stromberg reminded the meeting that, at the XVII General Meeting, SCOR had recommended revisions to a proposed programme for a workshop to be organized by WG 65. The Convenor of this workshop, Dr. B.-O. Jansson, submitted a revised programme and detailed plans for the workshop which, it is hoped, will take place in San Francisco in April 1986 at the Tiburon Center for Environmental Studies. These were approved by the Executive Committee. While the budget submitted by Dr. Jansson indicated a shortage of adequate funds, the Executive Committee felt that participants in the workshop should be encouraged to seek travel funds from all possible sources rather than all travel costs being provided by the organizers. The representative of UNESCO noted that his organization will contribute some funds to SCOR in support of the WG 65 workshop. He also expressed the interests of IOC in this workshop because of the IREP and with respect to GEMSI and GIPME interests in mass balance studies.

WG 66 Oceanographic Applications of Drifting Buoys

WG 66 had planned to hold a meeting in 1985, however, most members of the group had an opportunity to meet in March at the Scripps Institution of Oceanography. On this occasion, which was a meeting on drifting buoys for TOGA, they discussed some definitions and standards for four types of drifting buoys: meteorological drifters, current drifters, heat content drifters and flux drifters. It was agreed that this ad hoc meeting satisfied the need for a full meeting of WG 66. It is expected that the report of the TOGA drifters meeting will be available for review in late 1985. A brief report from the Chairman of WG 66 indicated that the group would monitor developments in drifting buoy technology and that it may seek approval for a formal meeting in 1987.

The representative of WMO, Dr. S. Mizuno, reminded the meeting that SCOR and WMO have mutual interests in the topic of drifting buoys and that the two organizations had agreed to cosponsor a meeting of experts on the technical aspects of drifting buoys. However, WMO and IOC had recently established an International Drifting Buoy Co-operation Panel which was to hold its first meeting in October. SCOR will be invited to participate in the activities of this Panel and Dr. Mizuno suggested, therefore, that the proposed meeting of experts could best be organized by the Panel which would consider the matter at its meeting.

Dr. Mizuno noted that the drifting buoys associated with the TOGA project are providing about one thousand reports to the GTS daily; this is comparable with the numbers provided by the buoy set for FGGE in the Southern Ocean. Dr. Stewart commented that the present design of buoy networks is very different from the extensive FGGE network which had been designed for wide meteorological coverage. The arrays now in use are intended to study specific problems in restricted areas and it seemed unlikely that a global network would be recommended in the foreseeable future.

In reply to a question, Dr. Stewart added that these drifting buoys were not necessarily designed to act as Lagrangian tracers - it was desirable in many cases to conduct temperature and salinity observations rather than measurements of ocean currents. The need for careful specification remains, however, and the report of WG 66 will be received with interest when it is available.

It was agreed that Dr. John Garrett (Canada), a member of WG 66, would represent SCOR at the first meeting of the Drifting Buoy Co-operation Panel in Toulouse in

October.

WG 68 North Atlantic Circulation

The President received a brief report from the Chairman of WG 68. He noted that the group has met formally three times and that there have been many informal meetings between members of WG 68.

The group has worked towards two major objectives:

- Discussion and coordination of ongoing and planned field work: requirements of an observational programme for the mean circulation and for its annual and interannual variability were discussed, and it is hoped that a more detailed programme can be proposed at the October meeting.

- A cooperative model intercomparison was carried out jointly with WOCE-NEG, where different model types were used with similar geometry, topography and resolution. The same surface forcing data were applied. Cases for wind only and wind plus thermohaline forcing were done on mean, seasonal and interannual time scales.

The final meeting of WG 68 will be held during 29-31 October, jointly with the WOCE Numerical Experimentation Group, at the Royal Society in London. A final report, possibly suitable for publication in the WCRP Report Series or the ICES Cooperative Research Series, will be sought from WG 68.

WG 69 Small-Scale Turbulence and Mixing in the Ocean

WG 69 had been given approval by the XVII General Meeting to hold a full meeting in 1986, possibly in Sofia, Bulgaria. An alternative location was also under consideration and the Executive Committee agreed to leave the final decision on the dates and location of the meeting to the Chairman of WG 69. The group is beginning to make plans for the second Liege Colloquium on Oceanic Turbulence to be held in 1987.

WG 70 Remote Sensing of the Oceans from Satellites

The Chairman of WG 70, Dr. J.F.R. Gower, presented the final report of his working group, entitled "Opportunities and Problems in Satellite Measurements of the Sea", which was ready for submission to UNESCO for publication in the series UNESCO Technical Papers in Marine Science.

This report had been prepared for SCOR as a reasonably authoritative yet concise statement of requirements, capabilities and present plans for acquiring and using ocean data from satellites. The various requirements for ocean data that can be addressed by satellites are summarized in section 2 and the capabilities of different sensors are discussed in section 3. Various aspects of exploiting these capabilities to satisfy the requirements are discussed in section 4. This also includes general background information on satellites and their sensors. Section 5 highlights the problems faced by developing countries in acquiring and exploiting this data. Conclusions and recommendations are given in section 6.

The Executive Committee wished to encourage the publication of the WG 70 report as quickly as possible. It was agreed that this final report adequately satisfied the terms of reference assigned to WG 70 and that the group should be disbanded at the XVIII General Meeting in 1986.

WG 71 Particulate Biogeochemical Processes

The first meeting of WG 71 took place in 1984 and several major issues were identified which need to be addressed if particulate biogeochemical processes in the oceans are to be understood in detail. The report submitted by the Chairman, Dr. Krishnaswami, sought approval for a second meeting of WG 71 in 1986 at which he proposed to discuss the following topics:

- primary production rates in the ocean, the accuracy of their measurements and the relationship between surface productivity and particle transport below the euphotic zone.

- the factors controlling particle sedimentation through the water column, such as interaction between fine suspended particles and large settling particles, particle aggregation mechanisms etc.

- measurement of settling fluxes, assessment of sediment trap efficiencies, horizontal vs vertical components in the trapped material.

The Executive Committee agreed that this meeting could be held as planned at Cambridge University in April 1986.

The Executive Committee Reporter for WG 71, Dr. Chesselet, reiterated the view expressed by Dr. Krishnaswami in his report that the meeting of the working group would be very timely in view of the plans of the U.S. National Academy of Sciences for a Global Ocean Flux Study which is being designed in part to assess the biogeochemical cycles of reactive elements and their relation to ocean circulation and climatic trends. Dr. Chesselet was of the opinion that WG 71 could serve as an appropriate mechanism for international coordination within the Global Ocean Flux programme. This was seen as a suitable role for a SCOR subsidiary body, especially in view of the complementary nature of the Global Ocean Flux and WOCE programmes. Several participants in the Executive Committee meeting reiterated this view. The representative of UNESCO and IOC noted that a new GESAMP working group has been proposed which will investigate problems related to the particle flux of pollutants to the deep sea.

WG 72 The Ocean as a Source and Sink for Atmospheric Constituents

The President reviewed the report submitted by the Chairman of WG 72 which noted that the working group is organizing a symposium entitled "Influence of marine and terrestrial biosphere on the chemical composition of the troposphere". This symposium was originally scheduled for September 1985 in Mainz, FRG, but has been postponed until 16-22 March 1986 due to conflicts with other international meetings on related topics. It is expected that the symposium will provide an ideal opportunity for the presentation of recently obtained results on air-sea exchange and for an interdisciplinary discussion of the influence of oceans on the biogeochemical cycles of trace substances in the troposphere. It will have two major sessions: one on air-soil exchange and another on air-sea exchange. The latter will be divided into several smaller sessions:

- Measurements of dissolved gases and particulates in the upper ocean layer.
- Estimates of oceanic source and sink strengths of atmospheric trace constituents.
- Influence of man's activities on exchange rates through the air-sea interface.
- Biological and chemical production and destruction processes in water and air.
- Transport mechanisms through the air-sea interface.

WG 72 planned to hold an *ad hoc* meeting in Bombannes in order to prepare a document, as required by the terms of reference of the group, describing the present

state of knowledge in this field .

The Secretary General of IAMAP, Dr. Ruttenberg, noted the strong interest of his organization in the symposium being organized by WG 72. He also informed the meeting that the IAMAP Commission on Atmospheric Chemistry and Global Pollution will meet in September 1986 to plan an international workshop on the organization of a Global Tropospheric Programme which will take place following the IUGG Assembly in 1987. He emphasized the need for close coordination between these two groups.

Dr. Chesselet expressed the opinion that the WG 72 symposium in Mainz could provide an excellent opportunity to establish this liaison since many of the same individuals will be involved in this meeting and in the IAMAP Commission planning meeting in September. He expected to be present in Bombannes shortly after the Executive Committee meeting and agreed to raise this issue with the Chairman and members of WG 72.

Dr. Stewart, the Chairman of CCCO, noted that the geochemists involved in WOCE are very interested in the use of substances such as freons and fluorocarbons as tracers of oceanic circulation. There is a regrettable lack of information on the atmospheric input of these compounds to the oceans. The Executive Committee agreed that this is an important topic which should probably be addressed by a new working group which would focus on tracers, their uses and their potential, especially in relation to climate studies.

WG 73 Ecological Theory in Relation to Biological Oceanography

Dr. Longhurst reviewed the report outlining the current activities of WG 73 which had been submitted by the Chairman, Dr. Ken Mann. The group had organized a very successful workshop on "Ecosystem Theory in Relation to Biological Oceanography" held near Quebec City, Canada in March 1984. The Proceedings have now appeared as Canadian Bulletin of Fisheries and Aquatic Sciences No. 213. Dr. Mann's report highlighted the two activities of WG 73 which were approved by the XVII General Meeting:

- Testing of Various Ecosystem Models Against Existing Data Sets:
  This activity, led by Dr. John Field (South Africa), assisted by Drs. M. Fasham (UK), R. Ulanowicz (USA) and F. Wulff (Sweden), has led to the assembly of a number of computer programs for flow analysis of existing data sets from a range of marine ecosystems. Techniques include loop analysis, input-output analysis, and dynamic network analysis. Those named will meet in Asko, Sweden in November 1985 to test programs. A Flow Analysis Workshop, to which a larger group of participants will be invited, is planned to be held in conjunction with the next meeting of WG 73.

- Stimulation of Cooperative Work Between Biological and Physical Oceanographers:
  As reported to the last SCOR General Meeting, WG 73 has focussed attention on well-defined energetic interfaces such as fronts, ice-water interfaces, and sediment-water interfaces which appear to be associated with enhanced biological productivity. This activity is led by Dr. L. Legendre (Canada) who convened a workshop in Liege, Belgium, in May 1985, following the Liege Colloquium on "Dynamic Biological Processes at Marine Physical Interfaces". A great deal of interest was expressed by oceanographers from many parts of the world in mounting a coordinated study of marine interfaces. WG 73 now proposes to examine the problem at its next meeting by holding a session on "Physical Mechanisms Supporting Biological Productivity at Interfaces in the Oceans". Three questions will be considered:

(i) Is there good evidence that biological productivity is normally enhanced at interfaces?
(ii) If so, what are the physical mechanisms leading to this enhancement at the various types of interface?
(iii) Are these mechanisms reducible to a single generalization, and if so, what are the implications for the design of field programmes?

For this session to be effective it would be desirable to invite two or three physical oceanographers to the meeting.

The working group had been given approval for a meeting in late 1986 in conjunction with the International Symposium on the Benguela Upwelling System being held in Cape Town. The Chairman recommended that the meeting be held instead in San Francisco in conjunction with the joint AGU/ASLO meetings (December 1986) in order to increase the likelihood of participation by all members of the group and in order to facilitate the attendance of physical oceanographers at little expense. This suggestion was supported in a written statement from Professor Lasserre, Executive Committee Reporter for WG 73.

He also noted, that at the last meeting of SCOR, a note of caution had been expressed that the activities of WG 73 should not become too diverse for adequate supervision by a single group. He felt that the activities described in Dr. Mann's report take this point into consideration.

The Executive Committee agreed that the 1986 meeting of WG 73 should be its final meeting. The terms of reference will have been satisfied by the flow analysis workshop and the special session on physical mechanisms and productivity at interfaces which are planned for this occasion. The actual implementation of the coordinated physical-biological experiments is not within the mandate of the working group and must depend upon the enthusiasm and resources of those oceanographers who have expressed interest in the concept of such a programme. WG 73 will be urged to complete its activities with its final meeting in December 1986.

The representative of IOC noted that a number of the proposals for interface studies being considered by Dr. Legendre's sub-group are of direct relevance to problems of variability in upwelling and tropical demersal environments. These are important in two recruitment projects (SARP and TRODERP) which are components of the OSLR programme of IOC. He reiterated the interest of his organization in the accomplishments of WG 73.

WG 74 General Circulation of the Southern Ocean

The Chairman of WG 74, Professor Worth Nowlin, presented the final report of his group which summarizes questions and recommendations regarding research dealing with the general circulation of the Southern Ocean. This report, which was written on the basis of discussions at two meetings of WG 74 in 1983 and 1984, fulfills the responsibilities of the group under its original terms of reference. The XVII General Meeting of SCOR had agreed to keep WG 74 in existence to provide, as appropriate, during the period 1984-1986, advice and representation on behalf of SCOR regarding physical and chemical oceanography of the Southern Ocean. Recent activities have included: correspondence with Dr. D. Sahrhage and discussions with Dr. S. El-Sayed regarding the proposed "Scientific Symposium on Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill"; discussions and correspondence with several scientists regarding the future of Antarctic marine ecosystem research; and discussions and correspondence with Dr. S. El-Sayed regarding future approaches by SCOR and SCAR to providing advice on physical, chemical and

biological studies in the Southern Ocean.

In introducing his report, Professor Nowlin mentioned several significant developments in the field of physical oceanography of the Southern Ocean during the last decade. Specifically, he mentioned a "Southern Ocean Atlas" published by Gordon and Baker (1982) which presented quality-controlled data. SEASAT altimetry has given scientists new information on antarctic current systems and on the extent of the variability of surface geostrophic flow. Altimetry has also revealed an unexpectedly high degree of large-scale variability in the Antarctic Circumpolar Current (ACC). Strong variation in surface speeds in the ACC (as much as 25%) may persist for several weeks and be spatially coherent over as much as two-thirds of the extent of the ACC. Heat flux estimates across the ACC have shown that oceanic poleward heat flux required to match heat loss to the atmosphere over the Southern Ocean cannot be accounted for by mean geostrophic flow. Eddies and/or deep boundary currents are assumed to play a role in the balance of heat loss. Estimates of eddy heat flux at Drake Passage are known to be large enough to account for heat flux, if that region is typical of the Southern Ocean. Transport by the ACC has been monitored at Drake Passage for a full year. This time series has been extrapolated to four years using deep pressure recorders and further extrapolation is underway using tide gauge and sea level atmospheric pressure measurements. These recent advances formed the background for WG 74's discussions of gaps in our present knowledge of the general circulation patterns of the Southern Ocean and of research programmes which might serve to fill these gaps.

It was agreed that the WG 74 report deserved a wide circulation and that publication in the WCP Report Series would be most appropriate and would ensure that the report reaches both oceanographers and meteorologists. The Executive Secretary was instructed to investigate this suggestion further.

The Chairman of WG 74 was of the opinion that his group could now be discharged except that there continues to be a need for input from physical oceanographers to the design of Southern Ocean ecosystem experiments. Mechanisms for enhancing interdisciplinary collaboration in Southern Ocean studies were discussed by the Executive Committee in the context of its consideration of future SCOR and SCAR involvement in this field (see page 8 of this report).

WG 75 Methodology for Oceanic Carbon Dioxide Measurements

Dr. Chesselet noted that WG 75 was meeting in France at the same time as the Executive Committee meeting was taking place. A brief report from the Chairman of WG 75 outlined the agenda for this meeting which included:

- Introductory review on terms of reference, membership, communication from the SCOR Executive Committee, interface with CCCO through the CO_2 Panel and report of the 2nd committee meeting at Lake Arrowhead, California in May, 1984.
- Discussion on the topics of (a) the roles of C-13 and C-14 in the global oceanic CO_2 cycle, (b) the role of calcium in the global oceanic CO_2 cycle, (c) strategies for optimizing ocean sampling, including orientation of tracks and station spacing, (d) Atlantic, Indian and Antarctic Oceans with respect to oceanic CO_2 measurements and processes affecting programme designs and (e) other relevant oceanic measurements related to the oceanic CO_2 cycle.
- Reviews of progress on standards and intercalibration, interface with other SCOR WGs and other international bodies, progress on Pacific studies, time-table for reports on specific topics, e.g. standards, methodology of oceanic CO_2 measurements, and an integrated international programme on oceanic CO_2 measurements.
- Future activities.

Dr. Chesselet recalled that WG 75 had been asked to take a fairly narrow approach to CO_2 studies, restricting itself to methodological questions. The meeting agreed that the agenda planned for the Les Heuches meeting adequately reflected this direction for WG 75. He also stated that a well identified need exists for work to be carried out on intercalibration and standards for various CO_2 measurements. Some of this could well be undertaken by JPOTS, and Dr. Chesselet suggested that WG 75 should invite JPOTS to consider this topic as appropriate. The representative of UNESCO, Dr. Morcos, noted that the French government and UNESCO will provide some financial support to Dr. F. Culkin (UK) and Dr. A. Poisson (France) who are members of JPOTS, for preliminary work on certain CO_2 standards. Dr Morcos will consult with the Chairman of JPOTS to consider the role of the Panel in the study of problems related to standards for CO_2 studies and will report to the cosponsoring bodies.

Dr. Wong, in an informal report to SCOR, had proposed two membership changes for WG 75 involving the replacement of current members who have recently been inactive. While the Executive Committee agreed that the proposed changes were suitable, it felt that they should be discussed between Dr. Wong and these two members in case they wished to participate more fully in future WG 75 activities.

WG 76 Ecology of the Deep Sea Floor

A report of the first meeting of WG 76, which took place in June 1985, prior to the Deep-Sea Biology Symposium in Hamburg, is given in Annex IV. The Executive Committee Reporter for WG 76, Dr. Stromberg, noted that in its meeting the working group had addressed questions relating to the methodology for estimating biomass of various groups of benthic organisms. It concluded that for most groups except the megafauna serious gaps exist in our current knowledge and sampling abilities which make quantitative data extremely difficult to obtain. The group identified an urgent need for multidisciplinary studies of the deep-sea if the impact of human activities on this environment is to be assessed. The lack of information on the deep-sea ecosystem led WG 76 to suggest that prediction of the impact of human activities such as mining is virtually impossible at present. Instead, it recommended that the only practical approach is for scientists to study actual impact events, perhaps by designing and controlling these events specifically for such studies. The group learned of a joint French/FRG pilot manganese nodule mining project planned for 1987 which might have provided an ideal opportunity for impact studies had an early involvement of the scientific community been incorporated into the planning for the project.

The report of WG 76 did not present any positive conclusions or definite plans for future activities. The Executive Committee felt that it would be useful for WG 76 to consider a general framework for impact studies even if the 1987 project referred to above is not possible. It might also wish to consider questions of methodology in more detail and carry out a more intensive evaluation of the gaps in our present knowledge of deep-sea communities.

Some regret was expressed by members of the Executive Committee who felt that WG 76 had not been given sufficiently well defined terms of reference. It was agreed that the group should be encouraged to formulate more precise tasks which would satisfy a specific need in benthic biology which could be met in a relatively short time.

WG 77 Laboratory Tests Related to Basic Physical Measurements at Sea

A brief report from Dr. Striggow, Chairman of WG 77, was reviewed by the President. The group has begun its work in correspondence and this is expected to continue. In particular, the members are considering:

- the priorities for sensors to be investigated
- the accuracy of the sensors
- the physical and technical problems limiting this accuracy
- possibilities for an intercomparison of sensors

The meeting approved Dr. Striggow's request for a full meeting of WG 77 in 1986. Since this will be the first meeting of the group, Dr. Striggow's proposal for a brief meeting considering theoretical questions was considered to be preferable to his second option which was a lengthier meeting to undertake some of the practical intercomparison work.

Dr. Morcos of the Division of Marine Sciences of UNESCO stated that his organization wishes to cosponsor WG 77.

WG 78 Determination of Photosynthetic Pigments in Seawater

Dr. Longhurst noted that the establishment of this working group had been approved by the XVII General Meeting (see SCOR Proceedings, Vol. 20 for terms of reference). Dr. F. Mantoura (UK) had accepted SCOR's invitation to chair WG 78 after a rather lengthy, but unavoidable, delay. The Executive Committee reviewed Dr. Mantoura's proposed membership list for WG 78 and agreed that invitations should be sent immediately to the individuals on the list. The Executive Secretary was instructed to invite the USSR Committee for SCOR to nominate an appropriate Soviet scientist to WG 78. At the time of writing this report, the following individuals had accepted invitations to join WG 78:

R. Dawson	(USA)	W. Gieskes	(Netherlands)
R. Gagosian	(USA)	Clarice Yentsch	(USA)
C.J. Lorenzen	(USA)	S. Liaaen-Jensen	(Norway)
S.W. Jeffrey	(Australia)	Y. Halim	(Egypt)

Dr. Mantoura plans to hold the first meeting of WG 78 in Plymouth in early 1986. Each member will present a state-of-the-art review in his/her area of specialization and the group will review advances in pigment chemistry and will plan an experimental workshop. This workshop, which will take place in 1987, will be part of the methodological work related to pigment measurements to be accomplished by WG 78.

WG 79 Geological Variations in Carbon Dioxide and the Carbon Cycle

Dr. K. Hsu, The Executive Committee Reporter for WG 79, reviewed a report from the Chairman of this group which was established by the XVII General Meeting. Dr. Sundquist reported that the membership of WG 79 was complete except that no formal responses have been received from the two Russian scientists who have been invited to join the group. It is expected that the following individuals will be members of WG 79:

E. Barron	(USA)	D. Lal	(India)
E. Borisenkov	(USSR)	M. Oeschger	(Switzerland)
M. Budyko	(USSR)	N. Shackleton	(UK)
E. E. Degens	(FRG)		

Approval was given for WG 79 to hold its first meeting in 1986. The most convenient time for this initial meeting would appear to be in September 1986 at the Second International Conference on Paleoceanography. The Woods Hole location of this meeting will minimize travel costs, and the occasion will provide an opportunity for joint discussion with WG 81 which will be meeting at the same conference.

The Chairman of WG 79 has tentatively agreed to cosponsor a symposium in 1987 on "The Global Carbon Cycle: Palaeoclimatic Perspectives". This meeting is being organized

for the INQUA Congress in Ottawa, Canada, by Dr. Alan Hecht, Director of the U.S. National Climate Program Office. Speakers at the symposium would include many members of WG 79, and the papers would be published as a group in the new AGU journal Paleoclimatology, to be edited by Dr. Hecht.

Dr. Sundquist's report noted that the activities of WG 79 should be coordinated as much as possible with other SCOR activities that have overlapping interests. In particular, WG 79 would benefit from regular communication with WG 75, WG 81, and the CCCO. The overlapping purviews of these groups are a natural consequence of the interdisciplinary nature of the CO_2 problem and regular interaction will enhance exchange across disciplinary boundaries as well as efficiency in planning and organizing activities. The Chairman of WG 81 is a member of WG 79, and the meeting mentioned above will assure that these groups will work closely together. The Chairmen of these groups (in addition to others) are Corresponding Members of CCCO, and it was agreed that Drs. Hsu and Chesselet, as Executive Committee Reporters for WG 79 and WG 75 respectively, should be responsible for liaison between these groups.

WG 80 Effects of Hydrothermal Processes in the Ocean

The establishment of this group was approved by the XVII General Meeting on the basis of a proposal from the Canadian SCOR Committee. It had not been possible, however, to identify a Chairman for the working group. Dr. Heath suggested that there is only a very small scientific community which is occupied in the study of hydrothermal processes. He felt that this group of scientists is actively studying ridge-crest systems and may not yet be prepared to approach this relatively new topic on the global scale demanded by the terms of reference for WG 80. It was agreed by the Executive Committee that insufficient interest had been shown in WG 80 to warrant proceeding further with its establishment. The Executive Committee will recommend to the next General Meeting that it be dropped from the list of active working groups.

WG 81 Deep Water Palaeoceanography

Professor Heath presented a report from the Chairman of WG 81, Dr. N. Shackleton (UK). He noted that the group held its first meeting during the AGU annual congress in Baltimore in May 1985. While the group had only been formally established for a short time (since the XVII General Meeting), there was an urgent need for this early meeting since the terms of reference of WG 81 call upon it to organize a session for the Second International Paleoceanography conference which will take place in Woods Hole in 1986. The members of WG 81, as it is now constituted, had also organized a scientific session at the Baltimore AGU meeting, although much of the planning for this session had taken place before the WG had been formally established.

The following individuals have agreed to join WG 81:

E. Boyle	(USA)	J. Reid	(USA)
J.C. Duplessy	(France)	M. Sarnthein	(FRG)
A.D. Lisitzin	(USSR)	J. Sundermann	(FRG)
G.P. Lohmann	(USA)		

The main business of the first meeting of WG 81 was to discuss the programme for the 1986 paleoceanography conference. A tentative programme was developed which includes papers on the following topics:

- A review of deep water circulation processes
- Modelling ocean deep water circulation
- The impact of surface productivity on the ocean deep waters
- Deep ocean palaeochemistry

- Evidence for deep water temperature changes
- Carbon isotope palaeoceanography
- Evaluation of palaeo-sources of deep water
- The use of palaeo-tracers to evaluate deep water flow
- The use of benthic foraminifera in palaeoceanography

The speakers would be asked to produce substantial review manuscripts for publication in the AGU journal Paleoceanography; many will be collaborative reviews. Members of the working group also agreed to stimulate submissions for a poster session on the subject.

The Chairman's report noted that the first meeting of WG 81 is already bearing fruit by enhancing collaboration between scientists with different types of expertise and by encouraging the exchange of deep-sea sediment samples between laboratories. The Executive Committee agreed that funds should be allocated for a second meeting of the group in Woods Hole in conjunction with the conference on palaeoceanography.

Dr. Shackleton also proposed to organize a workshop with the primary objective of getting interest from the physical oceanography community. He noted that a number of good scientists in this area are capable of contributing to the work of palaeoceanographers but are profoundly skeptical of the kind of palaeoceanographic reconstructions that they see in the geological literature. He suggested that WG 81 organize a two day workshop at which members of the group, with their knowledge of the kinds of geological data which might be obtainable, could hold discussions with oceanographers who have given considerable thought as to how the ocean works. He wished to hold this workshop early enough for it to have an impact on the reviews that would be prepared for the Woods Hole meeting in September 1986.

The Executive Committee did not approve this proposal for several reasons. It did not feel that there is a really urgent need for such a workshop in the immediate future and could not commit financial support to WG 81 for three meetings in the 1985-86 period. In addition, the physical oceanographers who were suggested as participants in the workshop were all from the U.S.A. and it was felt that a broader international participation is desirable. In summary, the Executive Committee wished to encourage the working group to complete its tasks related to the 1986 conference and then to submit a more detailed proposal to SCOR for a workshop which might bring together representatives of the palaeoceanographic and physical oceanographic communities.

A nomination of an additional candidate for membership in WG 81 which was received from the Canadian SCOR Committee will be forwarded to the Chairman of the group for consideration.

WG 82 Polar Deep-Sea Palaeoenvironments

The Executive Committee Reporter for WG 82, Dr. Hsu, noted that the membership of the group was in the process of being finalized. Dr. Jorn Thiede (FRG) had accepted SCOR's invitation to serve as Chairman of WG 81. The terms of reference approved at the XVII General Meeting had been circulated for comments and nominations had been sought from Committees from SCOR. Since the Executive Committee meeting, invitations have been sent, inviting the following individuals to join WG 82:

D. Clark	(USA)	F. Gradstein	(Canada)
A. Foldvik	(Norway)	J. Kennett	(USA)
D. Futterer	(FRG)	H.-P. Sejrup	(Norway)
L. Frakes	(Australia)	H.N. Siddiquie	(India)

In addition, the Chairman wishes to include a scientist from the USSR in WG 82.

Dr. Thiede's proposal that WG 82 hold its first meeting in conjunction with the Second International Congress on Paleoceanography in Woods Hole (September 1986) was approved by the Executive Committee. The congress will include a special session entitled "Polar Seas Geological Record" which is being convened by the Dr. Thiede and which will involve the participation of members of WG 82.

Dr. Hsu noted that the formation of WG 82 is very timely in view of the current emphasis of the Ocean Drilling Programme on Arctic (1985-86) and Antarctic (1986-87) palaeoenvironments.

2.3 Committees and Panels

Committee on Climatic Changes and the Ocean

The report of CCCO was presented by the Chairman, Dr. R.W. Stewart, and is given in Annex V. Dr. Stewart gave brief accounts of the status of the three main foci of the CCCO programme: TOGA, WOCE and the Ocean Observing System Development Plan (OOSDP). [Readers are referred to various CCCO reports listed in the SCOR Handbook, and to previous issues of SCOR Proceedings for background information on the CCCO programme.]

TOGA (the Study of the Interannual Variability of the Tropical Oceans and the Global Atmosphere) has been underway since January 1, 1985. While TOGA is now being implemented, its development continues. The scientists involved in this project hope to capture a full El-Nino event within the decade of TOGA activity; therefore, the organization of the programme must be designed so that operations can be intensified if a new significant El-Nino event should develop. Dr. Stewart emphasized the urgent need for rapid transmission of TOGA data from the collectors to the users if CCCO is to be successful in its efforts to encourage modellers to do actual forecasting rather than hindcasting.

A WOCE International Planning Office has been established at the Institute of Oceanographic Sciences, Wormley (UK), under the Directorship of Dr. G. Needler (Canada). The first draft of the WOCE Scientific Plan has been completed and, at the time of the Executive Committee meeting, was being circulated for review prior to the fifth session of WOCE which was to take place in October.

Major documents related to both the TOGA and WOCE programmes were expected to be available for distribution to the scientific community in the very near future. The "TOGA Scientific Plan" was in press at WMO and the International TOGA Project Office (Boulder, U.S.A.) was in the final stages of preparing the "TOGA Implementation Plan". The "WOCE Scientific Plan" will be published and distributed in January 1986. Information on these documents may be obtained from the SCOR or CCCO Secretariats.

In his presentation to the Executive Committee, Dr. Stewart made special mention of CCCO's efforts to increase the speed of transmission of data from scientists to IODE and the World Data Centres. He emphasized that the oceanographic data which are needed in near real-time, are those which can be handled relatively easily by these systems, but which are needed quickly for forecasting in TOGA. In WOCE, the urgency is somewhat less. Real-time predictions on a time scale of months do not figure in the planning for WOCE as they do for TOGA. Nevertheless, timeliness remains important in order that the data may be included in composite data sets and thereby contribute to analyses, and so that they may provide guidance in the design of later observing programmes. Dr. Stewart pointed out that data taken from research ships are frequently the longest delayed before their submission. He urged scientists to submit their data promptly to the international exchange systems. Reference was made to a new policy of NSF (USA) which will also be adopted by the participants in the U.S. TOGA Programme. It requires that

data sets likely to be useful to TOGA must be submitted to IGOSS in near real-time (48 hours to 2 weeks). Other data must be archived in "appropriate institutions" within two years.

Professor Siedler noted that the XVII General Meeting had recommended that SCOR play a more significant role in the selection of members of CCCO. He and the Chairman of CCCO have had the opportunity to consult on this matter in the period since the General Meeting.

The President also informed the Executive Committee that he has agreed that SCOR should cosponsor with IOC and WMO the International WOCE Conference which will take place in 1987. This decision was accepted by the 13th Session of the IOC Assembly in early 1985 (Resolution IOC XIII-4).

In closing the discussion on CCCO, Professor Siedler mentioned the considerable scientific excitement associated with this important activity. He thanked Dr. Stewart for attending the meeting and for his continuing leadership as Chairman of CCCO.

Joint Panel on Oceanographic Tables and Standards

The Chairman of JPOTS, Dr. J. Gieskes, submitted a report to SCOR which described two major topics discussed by members of the Panel at a meeting held in December 1984 at the Scripps Institution of Oceanography. The structure and composition of Volume 4 of the Oceanographic Tables, constituting a compilation of properties derived from the equation of state of seawater (EOS-80), was discussed in detail by a subpanel of JPOTS consisting of Drs. S. Morcos, J.M. Gieskes (Chairman), F.T. Millero and A. Poisson, as well as by Drs. R. Millard, R. Perkin, J. Reid and E. LaFond as invited experts. The Table is principally based on the Algorithms for Computations of Fundamental Properties of Seawater published by UNESCO in 1983. As a result of the discussions a more concise outlay of Table 4 was designed, and publication of Table 4 was expected in early 1986.

The production of an Oceanographic Manual by UNESCO was discussed by the subpanel, and, although the usefulness of such a manual was generally agreed on, it was decided that this was not the immediate task of JPOTS, but would best be accomplished under the auspices of JPOTS. In the meantime, a panel has been appointed for this purpose by SCOR with representatives of IAPSO, ICES and UNESCO and has begun its work in correspondence. The members of this panel, which will meet in late 1986, are Drs. Millard (SCOR) Taira (IAPSO), Dooley (ICES) and Mamayev (UNESCO).

An important point of concern to JPOTS is the production of standard seawater in various countries, especially those requiring large volumes and wishing to avoid purchasing the IAPSO Standard Seawater prepared at IOS (UK). The principal concern is the calibration of these standards. This issue has become particularly important following the introduction of the Practical Salinity Scale and the subsequent changing of the standardization procedure of standard seawater. It is recommended that these standards be considered as secondary standards and be calibrated only against standard seawater, which in turn is calibrated against the primary KCl standard.

Dr. Morcos reported that useful contacts have been established between UNESCO, the National Bureau of Oceanography (NBO) of China and the Standard Seawater Service of the Institute of Oceanographic Sciences. It is expected that Dr. F. Culkin, Director of the Standard Seawater Service, will visit China early in 1986. His visit, which will be supported by UNESCO and NBO, is aimed at discussing this issue with the Chinese scientists and authorities, and agreeing on the best way of preserving the universality of standard seawater. He reported that UNESCO welcomes similar contacts with other countries producing standard seawater and intends to pursue its efforts in this direction.

A meeting of the CO_2 subpanel of JPOTS was convened in La Jolla at Scripps Institution of Oceanography on December 11 and 12, 1984. Particular topics for discussion were the pooling of the thermodynamic information on the carbonic acid dissociation constants, and also the information on the boric acid dissociation constants. Various pH scales were discussed and agreement was reached to recommend the use of one scale only. Knowledge of carbonate solubilities was still felt to be somewhat ambiguous. However, the subpanel is of the opinion that a consistent picture on the thermodynamics of the carbon dioxide system in seawater is now possible. A detailed report on the thermodynamics of CO_2 in seawater, based on several sources of reliable data sets, is presently in preparation by the Chairman, Dr. J. Gieskes, in consultation with Dr. A. Dickson and Dr. A. Poisson and other sub-panel members. This report is expected to be circulated to the JPOTS Sub-Panel in 1985 before being published in the series UNESCO Technical Papers in Marine Science.

Dr. Morcos also wished to bring to the attention of SCOR that several instrument makers have contacted the UNESCO Division of Marine Sciences requesting copies of the publications resulting from the work of JPOTS, in order to follow its recommendations regarding the application of the Practical Salinity Scale, 1978 and the International Equation of State of Seawater, 1980.

The President informed the meeting that the report of IAPSO Working Group on Symbols, Units and Nomenclature in Physical Oceanography (SUN) had just been published as UNESCO Technical Paper in Marine Science No. 45/IAPSO Publication Scientifique No. 32, 1985. By its resolution No. 6 - 1983 - IAPSO urged the scientific community to study the report and consider its use by scientists, publishers and editors of oceanographic journals, hopefully by 1st January 1986. In addition, UNESCO has sought SCOR's endorsement of the recommendations given in this report in time to have it adopted at the next meeting of the IOC. Professor Siedler had discussed this matter with the Director of the Division of Marine Sciences of UNESCO and the President of IAPSO. He had then asked the Chairman of JPOTS to advise the SCOR Executive Committee whether the use of the report's recommendations should be endorsed by SCOR. While his response was not available at the time of the meeting, when this report was ready for publication, Dr. Gieskes had indicated that JPOTS had given its approval, following consultation among the members by correspondence.

Editorial Panel for the Ocean Modelling Newsletter

The Ocean Modelling Newsletter enjoys continued success. Dr. A. Gill, Chairman of the Editorial Panel, had informed the Executive Secretary that ONR has renewed its financial support of the Newsletter for an additional three years, and that the sixty-fourth issue had recently been published.

2.4 Proposals for New Working Groups

Role of Phase Transfer Processes in the Cycling of Trace Metals in Estuaries

Dr. Chesselet introduced this proposal which had been considered in a preliminary form at the XVII General Meeting. The report of the meeting of SCOR WG 46 (RIOS) held in Lisbon in December 1982 recommended that consideration should be given by SCOR to establishing a Working Group to address specifically the question of the cycling of material in estuaries.

The marked gradients in basic physicochemical parameters (pH, pE, ionic strength) and the strong coupling of processes in bottom sediments and in the water column lead to important transfers of material within estuaries between solution and solid phases. Because fractions of the particulate material are trapped and recycled on a variety of

time scales within the estuary before eventual export, particle/water interactions can lead to intensive redistribution of trace constituents. Such redistribution is an important factor contributing to the variations in concentration and chemical speciation which characterize estuarine systems and is relevant in terms of biological availability.

These estuarine processes are important in modifying fluxes between rivers and coastal seas. Mass balance studies on individual estuaries provide little capacity to predict modifications of fluxes in other estuaries, since the extent to which particle/water reactions operate depends on a complex interaction between the rates of phase transfer processes and the rates of physical processes, such as mixing and transport of water and sediments, and turbulent resuspension of bottom sediments.

Because of the resulting variability, physicochemical processes which are common to all estuaries can have very different consequences in terms of their effects on fluxes in individual systems. To provide predictive capacity, it is necessary to define those characteristics of solutions and particles which determine the rates and extents of phase transfer processes, taking account of the range of hydrographic conditions, contrasting with water compositions, sediment loads and seasonal variability, in estuaries in different latitudes.

The proposal was circulated to SCOR Committees and various comments and membership suggestions were received at the SCOR Secretariat. The Canadian SCOR Committee wished to ensure that the membership of the group includes at least one scientist familiar with tropical estuaries in order to permit considerations of the latitudinal variability of estuaries. The establishment of the working group was approved by the Executive Committee. It will be WG 80 and will have the following terms of reference:

- To define the most useful properties for the characterisation of the geochemical reactivity of estuarine particulates, especially the surface properties of solids, such as surface area, electrical charge and properties of binding sites, and to recommend methods to measure these properties.

- To evaluate the state of knowledge of particle/water reactions for key metals under the range of conditions encountered in estuarine waters and sediments.

- To recommend appropriate experimental and theoretical research needed to further develop models of particle/water interactions able to predict the behaviour of trace metals in different regimes.

With respect to the first task, WG 80 will be invited to take account of the effects of coatings of organic material and oxyhydroxides of iron and manganese and the role of micro-organisms in mediating reactions at particle surfaces. The proposal mentioned that the processes involved in particle/water reactions in estuaries include production of new solid phases from dissolved and colloidal constituents, exchanges between material in solution and at particle surfaces, and redox reactions, especially within the sediments where large fluctuations of pE occur. The working group should confine its consideration to the most reactive trace constituents. It was suggested that transition metals receive particular attention because of their geochemical and biological importance, and that special consideration be given to metals which undergo changes in oxidation state during cycling in aquatic environments.

The Executive Committee agreed that Dr. M. Whitfield (UK) should be invited to chair WG 80 and that he should be invited to select the membership from the sixteen suggestions received.

Experimental Estuarine and Coastal Ecosystems

The Secretary of IABO, Dr. McIntyre, in introducing this item, noted that experimental enclosed ecosystems have become a very useful tool in the field of marine ecological research, but that a critical and authoritative evaluation of their use would be very timely. Again, this proposal had been written at the XVII General Meeting and circulated to Committees for Oceanic Research for review. While a small number of membership suggestions had been received, no comments were made about the terms of reference proposed for this working group.

At the Executive Committee meeting, Professor Siedler, speaking on behalf of the FRG Committee for Oceanic Research, recommended that SCOR should take into account the results of a forthcoming ICES meeting on this topic before proceeding further with the proposal. Other participants expressed conern that the membership proposed for the group included only proponents of the use of the systems and that an unbiased evaluation of the technique might not be achieved.

Dr. McIntyre agreed with members of the Executive Committee who suggested that no urgent need for such a working group had yet been demonstrated. The meeting concurred with his suggestion that IABO should review the results of the ICES symposium, and invite a few experts to comment on the needs in this field and whether the establishment of a SCOR working group might satisfy these needs. IABO may then wish to revise the proposal for terms of reference and membership of such a group and re-submit it to SCOR for consideration well in advance of the XVIII General Meeting in 1986.

The Importance of the Island Mass Effect on Tropical Coastal Zone Productivity

This proposal was submitted for initial consideration by the XVII General Meeting which recommended that it be revised. No further information was available for the Executive Committee meeting.

Data Assimilation in Ocean Models

The President reported that, in accordance with the recommendation of the XVII General Meeting, this proposal had been submitted to the CCCO Modelling Panel for consideration. The Panel did not feel that there was a need for such a working group. However, the Chairman of former WG 34, on whose recommendation the proposal had been developed, had indicated that while the CCCO Panel deals primarily with very large scale models, a need does exist for work on data assimilation in relation to real-time mesoscale eddy resolving type models. Professor Charnock supported this point of view and agreed to consider the proposal further in consultaton with appropriate modellers. He hoped to submit a definite proposal to the next SCOR meeting.

2.5 SCOR Scientific Rapporteurs

Marine Pollution

The Scientific Rapporteur for the field of marine pollution, Dr. B. Dybern, had submitted a report to the XVII General Meeting of SCOR which recommended that SCOR should give some consideration to its role in this field and to its interactions with other organizations with related interests, both non-governmental (e.g., SCOPE) and intergovernmental (e.g., GESAMP, GIPME, etc.). The Executive Committee agreed to establish a small group to consider this question and to make recommendations to the next General Meeting of SCOR. Dr. McIntyre, who is familiar with GESAMP activities, observed that this organization is initiating a Second Review of the Health of the Oceans. For this reason he felt a review by SCOR of its role in studies of marine

pollution would be especially timely. The group may also consider the question of SCOR's role as an advisory body to IOC and UNESCO in matters relating to marine pollution and the activities in which the interests of SCOR and SCOPE may overlap. Dr. Postma (Netherlands) will be invited to assume the lead role in this exercise and Drs. Dybern, Chesselet and McIntyre will be asked to contribute because of their knowledge of other organizations active in this field.

Coastal Research

There was no report available from the Rapporteur for Coastal Research, however, discussion of a number of other items had touched upon this field.

Law of the Sea

Professor W. Wooster, the Rapporteur on the Law of the Sea, submitted a report to SCOR in 1983, which recommended that an assessment be carried out of the impact of the U.N. Convention on the Law of the Sea on the conduct of oceanographic research. The full report is given in SCOR Proceedings Volume 19, and it was circulated to all Committees for Oceanic Research for consideration. The responses received are summarized in Annex VI. Several of these suggested that the proposed assessment was premature since national policies and regulations are still being developed in some countries. Professor Wooster reported that ICES is preparing a manual of relevant procedures and practices for its member states and that SCOR may wish to consider this document before proceeding further on this matter.

3.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

3.1 Intergovernmental Oceanographic Commission

Following the recommendations of the XVII General Meeting, the Executive Committee invited Dr. K. Denman (Canada) to serve as SCOR's representative to the IOC Guiding Group of Experts for its programme on Ocean Science in Relation to Living Resources (OSLR). Dr. Denman was nominated to replace SCOR's former representative, Dr. A. Bakun, who had been elected Chairman of the Guiding Group at its first session . Recruitment studies (IREP) have formed the main component of the OSLR programme to date. A component of the Sardine/Anchovy Recruitment Project (SARP) is underway in the Eastern Pacific and other such studies are being planned for other regions. A second type of recruitment study, entitled Tropical Demersal Recruitment Project (TRODERP), will also be considered during a workshop which will take place in Mexico in 1986.

In response to a request from IOC, SCOR nominated Dr. S. Calvert (Canada) as its representative to the IOC Guiding Group of Experts for the programme on Ocean Science in Relation to Non-Living Resources (OSNLR). This group held its first session in January 1985 and developed a general framework for the OSNLR programme. The IOC Assembly accepted the recommendations of the Guiding Group, including the suggestion that a high priority be placed on studies of the non-living resources of coastal zones in view of the importance of these resources to many coastal states. Studies within the OSNLR programme will, initially, focus on the need for more scientific information about the mechanisms leading to the formation of certain non-living resources.

The Chairman of CMG, Dr. K. Hsu, expressed regret that the first meeting of the Guiding Group of Experts for OSNLR was arranged at such late notice. Neither the CMG nor the SCOR representative was able to attend due to teaching and other commitments which could not be rearranged. A workshop on OSNLR, which had been discussed between representatives of IOC, CMG and SCOR, had been postponed for financial reasons. Dr. Hsu foresaw little chance that such a workshop could now be arranged before 1989.

The IOC Programme Group for the Southern Ocean has decided to arrange an international seminar on "Antarctic Ocean Variability and its Influence on Marine Living Resources, Particularly Krill". SCOR and SCAR have agreed to cosponsor this seminar with IOC and CCAMLR. The Chairman of WG 74 has been contributing to the development of an interdisciplinary programme for the seminar in collaboration with the Chairman of the IOC PG/SOC. The seminar was to have been held in 1986 but has been postponed to June 1987 when it will be held in conjunction with the Fifth Session of PG/SOC.

The Thirteenth Session of the IOC Assembly discussed the revision of the Long-term and Expanded Programme of Oceanic Exploration and Research (LEPOR). The IOC is the organization responsible for the preparation and implementation of LEPOR within the UN system. As a first step in updating LEPOR, IOC had requested its advisory bodies, under SCOR's leadership, to prepare a report which was entitled "Ocean Science for the Year 2000" and was presented to the IOC Assembly in 1982. This document was intended, in part, to be used in the updating of LEPOR. IOC Resolution XIII-19 calls upon SCOR to assist IOC in convening a group of scientific experts to review a draft of an updated version of LEPOR, probably in the second half of 1986.

The Executive Committee agreed to ask Dr. D. Burton (UK) to represent SCOR at a meeting of GEMSI which was to take place in November 1985. Dr. Morcos stated that IOC wishes to improve liaison with those SCOR working groups which are undertaking activities relevant to marine pollution studies (see also item 2.5).

3.2 UNESCO Division of Marine Sciences

The representative of UNESCO, Dr. S. Morcos, remarked that many matters of interest to his organization had been dealt with under other agenda items. He stated that, in spite of current financial constraints, both IOC and the Division have placed a high priority on funding in support of SCOR activities. Every attempt would be made to defend these funds from budget cuts.

3.3 International Council for the Exploration of the Sea

The President of ICES, Professor Warren Wooster, expressed his appreciation of the continued collaboration with SCOR in joint activities such as WG's 42 and 68 and JPOTS.

3.4 World Meteorological Organization

Dr. S. Mizuno, who represented WMO, presented his report in connection with the discussion of WG 66, Oceanographic Applications of Drifting Buoys, since this is the main issue of mutual interest to SCOR and WMO.

4.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

4.1 Affiliated Organizations

Commission for Marine Geology

The Chairman of CMG, Dr. K. Hsu, in presenting his report, expressed concern over the growing difference in the levels of expertise in the field of marine geosciences between the developed and developing countries. This is especially obvious in the context of the Ocean Drilling Programme . He urged IOC and the UNESCO Division of

Marine Sciences to explore ways of involving scientists from developing countries in ODP and of communicating the results of the programme to these countries.

Dr. Hsu reported that CMG is involved in discussions within IUGG and IUGS as to how these organizations might contribute to ICSU's proposed International Geosphere - Biosphere Programme (see item 4.3). In particular, CMG may be able to provide expertise in connection with long-lived radioactive wastes and long-term and rare event prediction.

International Association for Biological Oceanography

The Secretary of IABO, Dr. A. McIntyre, reviewed the history of his organization from its formation by Anton Brunn in 1964 to its current period of revitalization. He stated that many of IABO's most productive activities in recent years have been carried out through its affiliated bodies such as the Coral Reef Committee, and the International Associations for Mangroves, Seaweeds, Cephalopods and Meiobenthology. He noted the interest of IABO in SCOR WG's 65 and 73.

Several members of the Executive Committee mentioned the overlapping interests of biologists and oceanographers in other disciplines in the field of coral reef studies. Reefs are important to geologists as indicators of sea level changes and to chemists because of their involvement in the cycling of CO_2. It was strongly recommended that Dr. Peter Davies (Australia), who is Chairman of the IABO Coral Reef Committee, should establish liaison with the CO_2 Panel of CCCO. This suggestion received very strong support from several participants in the meeting.

In discussing the general operation of IABO, concern was expressed that it had not so far made the impact on the field of biological oceanography which its founders might have expected. SCOR, however, wishes to encourage the further development of IABO and it was recommended that IABO seek information on the structure, organization and constitution of the other three Affiliated Organizations of SCOR.

International Association for the Physical Sciences of the Ocean

The President reported that he had attended the IAPSO Executive Committee Meeting, which was held in conjunction with the IAPSO/IAMAP Assembly in Hawaii in August. An important item of interest to SCOR was the discussion of the scientific programme for the 1987 IUGG Assembly in Vancouver. (see Annex VII). IAPSO is the lead association or cosponsor of ten of the IUGG symposia and is also organizing ten IAPSO symposia. The IUGG/IAPSO General Assembly will take place from 9 to 22 August, 1987. The scientific programme is being developed in consultation with SCOR in order to avoid overlap with the programme for the next Joint Oceanographic Assembly (see item 5.1).

International Association for Meteorology and Atmospheric Physics

The Secretary General of IAMAP, Dr. S. Ruttenberg, presented a brief report. This also highlighted the programme which is being developed for the IUGG General Assembly and the symposia being organized or cosponsored by IAMAP. The programme is outlined in Annex VII.

The IAMAP Executive Committee met during the IAMAP/IAPSO Scientific Assembly in Hawaii in August 1985. It discussed an Estonian SSR proposal for a programme of "Sea-Atmosphere Monitoring above the Baltic Sea as a Representative Basin" (SEAMAB). The proposed programme would investigate the small-scale interaction between the atmosphere and the sea and the modification of air masses over the coastal zone in a region of highly concentrated industrial activity where the atmospheric transport of pollution is a significant contributor to marine pollution. The IAMAP Executive Committee

recommended that the proposal be referred to the Helsinki Commission since it involves governmental questions. IAMAP wished SCOR to consider the scientific content of the proposal. It was agreed that the proposal should be referred to WG 42 (Pollution of the Baltic) for comments.

The next IAMAP Scientific Assembly will be held in Reading, U.K. during the first two weeks of August 1989.

4.2 Corresponding Organizations

Arctic Ocean Sciences Board

In accordance with the recommendations of the XVII General Meeting, a request from the AOSB to become a Corresponding Organization has been approved. This request was received following the Third Meeting of the Arctic Ocean Sciences Board which was held at the National Academy of Sciences, Washington, in conjunction with a scientific session on "Remote Sensing Applications to the Greenland Sea Project". The main topic of discussion was the Greenland Sea Project which is being designed to study the exchange of water between the Arctic and Atlantic Oceans through the Greenland Sea. The final plan for the project is to be submitted to the Board before its next meeting in January 1986.

Engineering Committee on Oceanic Resources

ECOR Officers have recently drawn up a proposed programme of activities for ECOR for the period late 1985 to 1988. This was in response to the request by ECOR members, made at the General Assembly held in Buenos Aires in October 1984, that a programme of work, aimed at securing a successful future for ECOR, be developed within twelve months.

The proposal recommends that international technical activity of ECOR will continue to be carried out through international Working Groups, but with strengthened member involvement and support. Six projects have been proposed, based on ideas from members, as a basis for such Working Groups in the period 1985 to 1988 as follows:

Ocean Engineering Education: To assist in the development of training and education rrcourses for ocean engineers throughout the world.

Ocean Energy Systems: To provide guidance for the developing nations of the world in exploiting their indigenous ocean energy resources.

Reliability Methods for Design and Operation of Offshore Installations: To draw up a state-of-the-art report on the application of reliability methods in offshore engineering; to carry out joint research work on some aspects of reliability methods.

Research Directory - Offshore Collisions: To update and expand the list of R & D projects in offshore collisions.

Data Exchange from Full-scale Offshore Experiments: To ensure maximum exchange of detailed information from full-scale offshore experiments; to encourage further similar experiments.

Codes of Practice: To provide guidance to countries considering the introduction of regulations covering marine affairs.

During development of this programme, current activity has centred on the Working

Group on Ocean Energy, coordinated by Japanese ECOR. A report by the Working Group was discussed comprehensively at the General Assembly and the report, together with edited discussion of it and papers from the technical session on Ocean Energy, is currently being published. Further international activity was commenced on the subject of "Reliability Methods for Design and Operation of Offshore Installations" on an initiative by Dutch ECOR.

4.3 International Council of Scientific Unions

Professor Siedler provided the meeting with background information on the development of ICSU's proposed "International Geosphere Biosphere Programme (IGBP): A Study of Global Change". This programme, first suggested in 1982, would be an interdisciplinary examination of the natural and man made changes that are taking place on and around the Earth. ICSU believes that such a study will improve the basis for a more rational management of the world's resources and will improve our ability to forecast significant global change. ICSU held an interdisciplinary symposium on Global Change at its General Assembly in 1984. The Assembly established an ad hoc planning group on global change to review the relevant ongoing activities of organizations within and outside ICSU and to develop the proposal further. This group produced a detailed draft outline document for an IGBP which was sent to all ICSU bodies for comments. These replies were to be examined by the ICSU General Committee at its meeting in October 1985, and a decision on whether or not to launch such a programme will be taken at the 21st General Assembly of ICSU in September 1986. The outline document was discussed by the Executive Committee and the response which was sent to ICSU following the meeting was based on this discussion.

The proposal for IGBP was felt by the SCOR Executive Committee to be timely for a number of reasons. In particular, a well conceived programme on Global Change could be complementary to the World Climate Research Programme (WCRP). These two international efforts would be carried out within a virtually identical time frame and each might well contribute to the breadth and impact of the other. IGBP might also be expected to stimulate support (both national and international) for the environmental and life sciences in the same way as WCRP has done for meteorology, oceanography and other physical sciences. In order to do this, the overall programme must be well focussed with clearly defined components. One participant in the SCOR meeting was pleased to note that the additional needs for terrestrial remote sensing involved with IGBP will stress the need for satellite instrumentation so urgently required by oceanographers and meteorologists in support of the WCRP. In summary, the SCOR Executive Committee viewed IGBP as providing a very useful "umbrella" under which many necessary and desirable programmes could be developed.

There were, however, quite serious reservations expressed about the process of the development of the IGBP to date and about the involvement of members of the ICSU family in this process. They concerned the potential for duplication of effort in IGBP and the possibilities for dilution or weakening of ongoing scientific activities. It was felt that the need for a completely new global programme had not been demonstrated. The apparent rejection by the ad hoc planning group of a programme plan involving coordination of ongoing activities plus new additional components and the proposal for a new independent entity was not viewed as desirable. Such an approach, it was felt, might weaken successful programmes which are already underway and which may have a great deal to contribute to a study of Global Change. Many existing projects might be valuable components of IGBP with only slight modifications. A number of SCOR activities were identified in this context.

The SCOR Executive Committee wished to suggest to ICSU that, before planning for IGBP proceeds much further, a careful evaluation of existing activities should be

undertaken. This could be carried out by a group which includes representatives of organizations such as SCOR and of ongoing international programmes such as the WCRP and major national programmes such as the Global Ocean Flux Study (of the U.S.A.). The meeting stressed that much of value is already being done and that great strides could be made by identifying these efforts and coordinating them in such a way as to allow their original goals to be achieved while at the same time ensuring that the maximum benefits can be derived from them for the IGBP. Concurrently, ICSU should identify those goals of IGBP which are not met by existing ICSU activities and should initiate programmes to satisfy them in cooperation with the appropriate ICSU organizations.

A second major initiative of ICSU in 1985 was a three day conference to be held in October in order to examine ICSU's contemporary and future role in international scientific cooperation. The meeting was to make a critical examination of the future orientation needed to enable ICSU to respond to the needs of researchers, national institutions and other international organizations. Again, the views of all members of the ICSU family were sought, and the Executive Committee had before it a background document from ICSU for consideration.

The members of the Executive Committee of SCOR discussed various activities of ICSU in this context. The following general items were considered most important:

ICSU has played a major role in providing active scientists with a forum where they can discuss current research problems and develop ideas for future investigations. In this way, ICSU has ensured the quality of international programmes, especially those which are undertaken by intergovernmental agencies. The members of the Executive Committee wished to encourage a continuation and possibly strengthening of ICSU's role in this respect. One of the most important benefits deriving from such a role would be the increased likelihood that good scientists will have a greater commitment to programmes over which they can exert some "quality control". A good example of this was felt to be the World Climate Research Programme (WCRP) and in particular the work of the joint SCOR/IOC Committee on Climatic Changes and the Ocean (CCCO). The involvement of ICSU, and of SCOR, has ensured the contributions of first-rate individual scientists to the design of a major interdisciplinary programme, with the participation of both non-governmental and intergovernmental organizations.

The Executive Committee felt that these activities also help scientists to recognize that the intergovernmental agencies can contribute to many international scientific programmes because they are able to mobilize resources which are not available to individual scientists, even when they are working through organizations such as ICSU. The scientists, however, also have a responsibility to ensure that the intergovernmental organizations deal with matters of scientific substance when developing their programmes.

In discussing ICSU's present and future role, the members of the Executive Committee emphasized that they view the advisory role of ICSU as a most valuable one and encourage ICSU to further develop its potential in this area. It was felt that ICSU and its constituent organizations can be indispensable advocates of quality in international scientific activities, especially those conducted under the auspices of agencies like UNESCO, UNEP, FAO and WMO. Most importantly, such an advisory role should be active rather than passive. It was suggested that ICSU should consider where it can appropriately provide advice and should formulate and contribute it, rather than waiting for advice to be sought. The only caution expressed about such an involvement with intergovernmental agencies is that ICSU should be rigorous in avoiding any politicization, although this was not felt to be a real danger in view of ICSU's tradition of scientific independence.

Finally, in considering matters relating to ICSU, the Executive Committee agreed that SCOR should be represented at the forthcoming ICSU General Committee meeting by Professor Ken Hsu.

4.4 ICSU Unions and Committees

Committee on Space Research

At the 20th General Assembly of ICSU in 1984, a resolution was adopted which called upon COSPAR to create an interdisciplinary ad-hoc Group on Remote Sensing for Global Change. The group is expected to act as a focus for remote sensing activities within ICSU, particularly those related to monitoring global changes on a decadal time scale. Dr. J.F.R. Gower (Canada) has agreed to serve as SCOR's representative on this group.

A report from COSPAR noted that in response to a request from the Joint Scientific Committee for the WCRP, COSPAR organized an International Workshop on Satellite-Determined Sea-Surface Temperatures for Global Climate Applications. The meeting was cosponsored by JSC and CCCO, hosted by NOAA, Washington, D.C., and held from 27 to 31 May 1985. Some twenty participants from eight countries attended. Financial support was provided by COSPAR, JSC and CCCO. The report of the meeting is now being edited and will be published in the WMO WCRP series.

COSPAR was also recently involved in a JSC sponsored and organized meeting on solar fluxes at the ocean surface, particularly relating to the TOGA experiment. G. Ohring, Chairman of COSPAR Sub-Commission Ia, was one of the co-chairmen of the JSC meeting and was the COSPAR advisor to the programme committee.

At the next COSPAR meeting, at Toulouse, France, 30 June to 12 July, 1986, there will be a topical symposium on Satellite Observations of Ocean Colour for Dynamic and Biological Studies. J.F.R. Gower is Programme Chairman and the meeting will be organized in cooperation with SCOR, CCCO, IAPSO and URSI.

International Union of Pure and Applied Chemistry

At its 25th meeting, the SCOR Executive Committee had agreed to cosponsor CHEMRAWN IV - Chemistry and Resources of the Global Ocean, a conference being organized by IUPAC which was to have taken place in Woods Hole in September 1985. Dr. S. Calvert (Canada) agreed to serve as SCOR's representative on the organizing and programme committees. He had, however, informed SCOR that organizational problems had led to the conference being postponed until 1986 without any consultation with the cosponsors or with the members of these committees. Dr. Heath, who had also been a member of the organizing committee and an invited speaker, reported that his experience had been similar. In his view, the rationale for the conference has not been well defined. The Executive Committee agreed that these difficulties did not augur well for the success of CHEMRAWN - IV and that SCOR sponsorship should be withdrawn.

Union Radio Scientifique Internationale

A written report was received from the URSI representative to SCOR, Dr. G.R. Valenzuela.

As in the past, URSI continues to be most interested and active in remote sensing of the ocean, ice, land and atmosphere with electromagnetic sensors. Presently URSI realizes its aims through nine standing Commissions:

A Electromagnetic Metrology
B Fields and Waves
C Signals and Systems
D Electronic and Optical Devices and Applications
E Electromagnetic Noise and Interference
F Wave Propagation and Remote Sensing
G Ionospheric Radio and Propagation
H Waves in Plasmas
I Radio Astronomy

The remote sensing activities within the Union are coordinated by the Inter-Commission Coordinating Group for Remote Sensing (ICCGRS) established in 1981 and chaired by Dr. J.F.R. Gower. Within the Commissions, most of the remote sensing activities are concentrated in Commission F, with Commission B, C, and G also having interest in remote sensing.

Scientific Committee on Problems of the Environment

A report which was submitted by the Executive Secretary of SCOPE is given in Annex VIII. SCOR had been invited to be represented at the VIth SCOPE General Assembly which took place in Washington, D.C., at the same time as the SCOR Executive Committee meeting. Dr. H. Postma (Netherlands), a former President of SCOR, agreed to represent SCOR in addition to his participation as a member of the Dutch SCOPE Committee. He had expressed his concern at the continuing existence of overlap in certain activities of SCOPE and SCOR, especially in the field of biogeochemical cycling and studies of estuarine and coastal ecosystems. It was agreed that this matter should be considered by the group established by the Executive Committee (see item 2.5) to review SCOR's role in the field of marine pollution.

Scientific Committee on Antarctic Research

The Executive Secretary of SCAR, Mr. G.E. Hemmen, had participated actively in the discussions of the reports of WG's 54 and 74 and of the plans for SCOR and SCAR involvement in the process of the analysis and synthesis of BIOMASS data (c.f. section 2.2.).

He also reported briefly on the proposals being developed by the SCAR Group of Specialists on Antarctic Sea Ice (cosponsored by SCOR) for a ten-year multi-disciplinary programme to study the Antarctic Sea Ice Zone which would include over-wintering and ship observations and would make optimum use of new satellite systems due to be launched in the coming years. A more detailed proposal was being prepared and would be made available to SCOR.

5.0 FUTURE MEETINGS

5.1 Joint Oceanographic Assembly

The President reminded the Executive Committee that, at the XVII General Meeting, SCOR had considered two invitations from Committees for Oceanic Research which were interested in hosting the next JOA in 1988. On that occasion, Dr. Angus McEwan had presented a detailed proposal from the Australian Committee for SCOR to hold a JOA in Hobart, Tasmania. An informal invitation was also received from the Chairman of the Mexican Committee for SCOR and the General Meeting gave the Executive Committee a mandate to pursue this possibility further when more information became available. In July 1985 a formal invitation was received from the Director General of the Consejo

Nacional de Ciencia y Tecnologia of Mexico. It was accompanied by information about facilities and arrangements available for a JOA in Mexico in 1988. Professor Siedler informed the meeting that two important items had not yet been clarified; these related to the financial responsibilities to be assumed by the organizers and the need to ensure that the ICSU regulations on the Free Circulation of Scientists would be applied by the Mexican authorities.

Professor Siedler reported that, in discussing JOA-88 with many members of the oceanographic community, he had found opinion to be strongly in favour of a Mexican site for the Assembly due to reduced travel costs, the likelihood of greater participation by scientists from developing countries, and the increased opportunities for financial support for a conference held in Mexico. A small ad hoc group was established to consider the many questions involved with the two invitations which were before the Executive Committee. This group recommended that SCOR accept the Mexican invitation provided that appropriate assurances are received in the near future regarding financial arrangements and the availability of entry visas to all bona fide scientists. It was hoped that a Mexican JOA would be successful in promoting international interactions in marine science and that it would advance the sharing of knowledge between the developed and the developing countries.

The XVII General Meeting had invited Professor W. Wooster to serve as Chairman of the Scientific Programme Committee for JOA-88. It had also been agreed that SCOR must play a stronger role in the establishment of the Programme Committee and in the development of the programme for the JOA than has sometimes been the case for previous assemblies. The experience of JOA-82 in Halifax had led the Executive Committee to suggest that at least half of the papers presented in 1988 should be contributed. It was decided that the Programme Committee should consist of the Chairman, representatives of each of SCOR's Affiliated Organizations, a representative of the National Organizing Committee (this liaison with the organizers was felt to be most important), and a representative of the International Logistics Committee which is traditionally established by the ICSPRO agencies. SCOR may add one additional member to the Programme Committee in order to ensure an appropriate international or interdisciplinary balance. The Executive Secretary of SCOR and the Secretaries of the four Affiliated Organizations will be invited to serve as Corresponding Members in order to provide liaison and effective communication between the organizations, as well as administrative support to the Committee.

There was a consensus that SCOR must establish and maintain close contacts with the organizers of the next JOA. To this end, it was agreed that Professor Wooster and the Executive Secretary should visit Mexico as soon as the CONACyT invitation can be officially accepted, in order to assist the National Organizing Committee in any way possible based on their experience in organizing past assemblies. A suggestion was also made that SCOR may wish to consider appointing a liaison person to work for a six month period before JOA-88 to ensure that critical aspects of a large assembly like the JOA, such as programme implementation, facilities and the management of registration, are well coordinated.

It was hoped that questions related to the Mexican invitation would be resolved before the end of 1985 and that the Programme Committee would be established and could begin its work in correspondence early in 1986.

5.2 XVIII General Meeting and 28th Executive Committee Meeting

The President proposed to ask the Australian Committee for SCOR if it would be willing to host the XVIII General Meeting in late 1986 or early 1987, depending on the availability of facilities and the need to organize a scientific component for the

General Meeting. The Executive Committee agreed that it would not be necessary for it to meet in full session before the next General Meeting. It would, however, probably be necessary for the Officers and Executive Secretary to meet in order for administrative matters to be dealt with before the end of 1986 if the General Meeting cannot be held until early 1987.

5.3 Other Meetings

The President announced that he had accepted a request for SCOR cosponsorship of the 4th International Congress on the History of Oceanography which will take place in Hamburg, Germany, from 23 to 29 September, 1987.This congress is being organized by Deutsche Gesellschaft fur Meeresforschung and will also be cosponsored by UNESCO, ICES, IAPSO and IABO.

A request for SCOR cosponsorship of the 2nd International Liege Colloquium on Coupled Ocean-Atmosphere Models has also been accepted in view of its relevance to the TOGA and WOCE projects which will be well underway when the colloquium is held in May 1989.

The following meetings of interest to SCOR which had not been discussed under the preceding agenda items were drawn to the attention of the partcipants by the Executive Secretary:

ICSU/WMO Joint Scientific Committee for the WCRP. Lisbon. March 10 to 14, 1986.

Marine Technology Society. Marine Data Systems. New Orleans. April 30 to May 2, 1986.

AOSB 5th Session. Helsinki. June 10 to 11, 1986.

COSPAR Plenary Meeting. Toulouse. June 30 to July 12, 1986. This will include a Symposium on Satellite Observations of Ocean Colour for Dynamic and Biological Studies.

Population and Community Ecology in the Benguela Upwelling Region and Comparable Frontal Systems. Cape Town. September 8 to 12, 1986.

6.0 OTHER BUSINESS

The meeting was informed that Professor Torben Wolff, a former Vice-President of SCOR, has undertaken to produce a history of SCOR. He will present a summary paper on this topic at the 4th International Congress on the History of Oceanography in 1987. Professor Wolff would welcome contributions of photographs of SCOR meetings, activities and of individuals who have been closely connected with SCOR in the past. He would also be grateful to receive anecdotes or notes on memorable events which might add a lighter touch to the historical account. The representative of IOC and UNESCO noted that the archives of these organizations would be made available to Professor Wolff should he wish to make use of them.

In closing the 27th meeting of the SCOR Executive Committee, Professor Siedler expressed his gratitude to Dr. Heath and his staff for their hospitality and for the excellent facilities they had provided for the meeting. He also extended the thanks of the Executive Committee to the US Committee for SCOR for hosting the meeting.

ANNEX I

TWENTY-SEVENTH EXECUTIVE COMMITTEE MEETING OF SCOR

Seattle, USA. September 10 - 12, 1985

LIST OF PARTICIPANTS

Members of the Executive Committee

*	Prof. G. Siedler	Fed. Rep. of Germany	President
*	Dr. A.R. Longhurst	Canada	Secretary
*	Dr. R. Chesselet	France	Vice-President
*	Dr. G.R. Heath	U.S.A.	Vice-President
*	Prof. J.-O. Stromberg	Sweden	Vice-President
*	Prof. H. Charnock	United Kingdom	Co-opted Member
*	Prof. K. Hsu	Switzerland	Ex-Officio / CMG
	E. Tidmarsh		Executive Secretary

Other Participants

	Mr. L.B. Brown	(USA		Dr. S. Mizuno	(WMO)
*	Prof. S. El Sayed	(WG 74)		Dr. S. Morcos	(UNESCO/IOC)
*	Prof. R.O. Fournier	(Canada)	*	Dr. A.D. McIntyre	(IABO)
*	Dr. R. Gammon	(USA)	*	Prof. W. Nowlin	(WG 74)
*	Dr. J.F. Gower	(WG 70)		Mr. L. O'Quinn	(Canada)
	Dr. D. Halpern	(USA)	*	Mr. S. Ruttenberg	(IAMAP)
	Mr. G. Hemmen	(SCAR)	*	Dr. R.W. Stewart	(CCOO)
*	Dr. D. Imboden	(Switz)	*	Prof. W. Wooster	(ICES)

* = SCOR members

ANNEX II

1984 FINANCIAL STATEMENT

BALANCE: January 1, 1984		111,198.24	
INCOME:			
Nat'l. Contr'ns. & Arrears	95,635.03		
IOC Contracts	20,000.00		
UNESCO Contracts	24,999.70		
Grant from ICSU	38,000.00		
NSF Grant	32,418.58		
Can. Gov't. Contr. re CCCO Chrmn's Travel	5,138.01		
French Grant re Roscoff	8,284.02		
Interest	5,829.70		
Misc. and Gain on Exchange	1,093.07		
TOTAL INCOME		231,398.11	
TOTAL CASH PLUS INCOME			342,596.35
EXPENSES:			
WG 42	726.46		
WG 54	10,000.00		
WG 56	1,782.00		
WG 66	5,290.35		
WG 69	10,736.79		
WG 70	181.45		
WG 71	6,227.21		
WG 73	11,979.53		
WG 74	19,202.15		
WG 75	22,356.99		
CCCO	47,882.56		
CCCO Chrmn's. Travel	5,246.14		
JPOTS (credit)	(622.93)		
TOTAL		140,988.70	
EXPENSES RELATED TO SCIENTIFIC ACTIVITIES:			
Officers Meeting	2,902.21		
Gen. & Exec. Meeting	9,434.60		
Representation	11,511.63		
Publications	1,412.74		
Conferences	9,954.55		
NSF Travel Grants	17,166.76		
TOTAL		52,382.49	
TOTAL EXPENSE FOR SCIENTIFIC ACTIVITIES		193,371.19	
ADMINISTRATIVE EXPENSES:		35,700.24	
TOTAL EXPENSES			229,071.43
BALANCE: December 31, 1984			113,524.92
TOTAL BALANCE PLUS EXPENSES			342,596.35

ANNEX III

WORKING GROUP 54

SOUTHERN OCEAN ECOSYSTEMS AND THEIR LIVING RESOURCES

Activities of SCOR WG 54 during the period of September 1984 to August 1985, as covered by this report, include: the completion of Phase 2 of SIBEX (Second International BIOMASS Experiment). The meetings of key BIOMASS Working Parties, the establishment of the BIOMASS Data Centre, the recent meeting of SCOR Working Group 54 at which the future of the BIOMASS Programme and the Working Group was discussed and the planning of future meetings, workshops, and symposia was drawn. Highlights of these activities are detailed below.

1. Completion of SIBEX Phase 2

With the successful completion of SIBEX Phase 2 in April 1985, the field exercise of the International BIOMASS Programme was completed on schedule. Altogether, 11 ships belonging to 10 countries took part in this exercise. A list of the countries, ships, areas of study, and research activities is given in Appendix 1.

2. Results of BIOMASS Meetings since the last Report of SCOR WG 54 (see Appendix 2)

Summaries of the key Workshops/Meetings are given below:

a. Working Party on Acoustics
A workshop was held in Frankfurt, FRG, from 3 to 14 September 1984 to re-analyze the FIBEX acoustic data. The data were analyzed through a modified version of the PASCAL-R database used at the 1981 Post-FIBEX Data Interpretation Workshop in Hamburg. The Report of the meeting is now in the final stages of preparation and will be published in the BIOMASS Report Series.

b. Working Party on Bird Ecology
A workshop on Seabird Data Interpretation was held at the University of Cape Town, South Africa, 10-18 April 1985. The report of the workshop will soon be published in the BIOMASS Report Series.

c. Working Party on Fish Ecology
A meeting of the Fish Ecology Working Party was held in Damarie-les-Lys, France, 25-29 August 1984 to review the progress made regarding the Review of the Biology and Status of Antarctic Fish Stocks, the results of SIBEX Phase 1, and the plans for SIBEX Phase 2. Also discussed were future activities in the field of fish research. The report of the meeting has been issued as BIOMASS Report Series No. 42.

3. Matters Arising from the Meeting of SCOR WG 54 in June 1985

The Working Group met 26-28 June 1985 in Dammarie-les-Lys, France. The meeting was hosted by Dr. J.C. Hureau on behalf of the Comite Nacional Francais des Recherches Antarctiques. The Working Group members discussed the progress made in the BIOMASS Programme since the group met last in 1982. Following is a capsulation of what transpired at the meeting.

a. BIOMASS Data Centre

The BIOMASS Data Centre began to function in early March 1985, when two new staff members joined the British Antarctic Survey to service the Data Centre. The data from FIBEX, previously entered into a database in Hamburg, FRG, are now being loaded into the new database. Data from SIBEX (Phase 1 and 2) cruises are currently being sent to the BIOMASS Data Centre.

A status report on the Data Centre was presented by Dr. R.M. Laws and Mr. D. Vaughan, Data Centre Manager. The group discussed and made recommendations regarding: (i) access to information from the Database, (ii) data exchange with other data centres, (iii) disposition of raw data, (iv) changes to data sets, and (v) data maintained at the Data Centre.

The group also recommended the establishment of a BIOMASS Data Centre Advisory Group with the following terms of reference: (i) to monitor the performance of the BIOMASS Data Centre and ensure that it is efficiently run so as to serve the needs of all participating countries, (ii) to advise the BIOMASS Data Manager on any development within the BIOMASS Programme which may effect the operation of the Data Centre, and (iii) to ensure that the scientific community of BIOMASS and related programmes are aware of the facilities available through the Data Centre so that full advantage is taken of it as a means of educating scientists and stimulating research in Antarctica.

b. Future of the BIOMASS Programme

The Working Group members discussed, at some length, the future of the BIOMASS Programme. The group recognizes that the main success of the BIOMASS Programme has been in fostering and developing interest in research into the Southern Ocean Ecosystem; all nations engaged in marine Antarctic research have developed major programmes directly or indirectly due to BIOMASS initiatives. The BIOMASS Programme has provided an important framework for international collaboration, instituting multi-ship surveys and multi-national efforts in data handlings; it has also contributed greatly to the development, standardization, and intercalibration of methods and instrumentation.

The achievements of the Programme, to date, must be reviewed through the detailed evaluation, analyses, and early publication of results of past activities, in particular, FIBEX and SIBEX. Such evaluation may be aided through a number of specialized workshops, as well as in an overall summing up workshop. This evaluation will also help resolve which of the problems for the future are best tackled through international cooperation and which through national programmes.

c. Future Research

The Working Group realizes that although the field exercise phase of the BIOMASS Programme was completed, much remains to be done. Further evaluation of the existing data is necessary, as is the initiation of new programmes -- at sea, ashore, and in the laboratories -- regarding the quantitative assessment of standing stock, production, and variability of krill, squid, fish, and top predators.

(i) For certain selected areas, ecosystem studies should provide information on fluctuations in recruitment and distribution of the major elements of the pelagic and, possibly, benthic systems.

(ii) Winter biological studies and investigations related to the sea ice zone, as well as to oceanic fronts, rings, and gyres, should receive particular attention in the near future.

(iii) Krill population ecology, particularly early life history, longevity, migration patterns, stock identity, and reproduction, call for concerted action in terms of

field studies and laboratory experiments.

(iv) Methodology for abundance estimates of krill, both by hydroacoustics and by net sampling, remains a field of major concern. There are great uncertainties regarding target strength and net avoidance, which call for concerted international action in these fields.

(v) International shore-based study of krill physiology and biochemistry directed towards a model of krill energetics is needed. The cooperation of specialists during one season, at one Antarctic research station, and working with one krill population would permit a considerable advance in knowledge.

(vi) Further research on other dominant components of the ecosystem, e.g., fish, squid, and key predators, which have, to some extent, been subordinated to krill research, should also be undertaken. In particular, the recently published report of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) ad hoc Working Party on Ecosystem Monitoring indicates that there are great opportunities for BIOMASS to contribute to the solution of problems directly related to the concerns of CCAMLR regarding the use of indicator species.

d. Plans for Future Investigations

(i) International Target Strength

The Working Group recognizes the utmost importance of definitive target strength experiments on E. superba, for making better use of both present and future BIOMASS acoustic data.

(ii) International Krill Physiology Project

Physiological studies of krill growth, energy requirements, and metabolic rates are viewed as extremely important for understanding the ecological relationships in the Southern Ocean. A proposal to hold a workshop focussing on research needs, particularly methodology, to improve the current low degree of comparability of results from different research groups was endorsed by the Working Group. The workshop will be held as soon as practicable in 1986.

(iii) International Weddell Sea Winter Studies

At least three countries (FRG, USA, and Argentina) are planning winter cruises in 1985 and/or 1986 in the Weddell Sea. The objectives of these studies are to provide relevant information on the physical/chemical components of the marine ecosystem of the area, in particular:

to describe the physical/chemical factors governing the distribution, abundance, productivity, and behaviour of marine organisms, especially phytoplankton, zooplankton (including krill), and fishes;

to describe the short and longterm environmental fluctuations governing the biology of organisms under the ice cover; and

to describe the behaviour of the penquins and seals in the pack ice.

e. Future of SCOR WG 54

In general, the BIOMASS organization has proved to be a successful mechanism for promoting international cooperation and communiation in the study of Southern Ocean biology. The acronym BIOMASS has achieved currency in describing a prestigious international programme on the Southern Ocean with both academic and popular appeal. The BIOMASS Data Centre has recently become operational and now can provide the basis for a projected series of international workshops and for the research activities of

individual scientists. Further work along the lines outlined above in item 3.c is called for over the next decade and probably beyond.

Thus, there is a clear case to retain those elements of the organizational structure of the BIOMASS Programme that have contributed to its success. It is recognized that the sponsorship of SCOR makes any SCAR Group of Specialists a regular SCOR Working Group and, by definition, would limit its life to normally six years. In order to provide the necessary continuity within the dual sponsorship, a new designation as SCAR/SCOR Programme Group for Southern Ocean Ecosystem Studies is proposed, with membership of no more than 10 leading scientists in the various fields of Southern Ocean biology. The new terms of reference for the proposed Programme Group are:

(i) to plan, encourage, coordinate, and facilitate the further analysis of FIBEX and SIBEX data and of other BIOMASS activities;

(ii) to develop a further phase of Biological Investigations of Marine Antarctic Systems and Stocks by joining in with the activities of SCAR/SCOR ad hoc Working Groups among others;

(iii) to respond to requests for scientific advice and information from CCAMLR and other international organizations with interests in science, resources, and conservation of the Southern Ocean; and

(iv) to ensure that the BIOMASS Data Centre is efficiently run so as to serve the scientific needs of all contributing programmes.

f. Relationship of SCOR WG 54 to Other Organizations

(i) CCAMLR - It was noted that CCAMLR has already made substantial requests of SCOR WG 54 for the Fish and Krill Reviews. It was felt that the future requests of CCAMLR should be carefully considered because of the large commitment of resources that were dedicated to these past efforts.

(ii) SCOR - The association of SCOR WG 54 with SCOR WG 74 was considered to have been helpful in past activities, and the Group recognizes that it is important to continue that association in the future. In a letter to the Chairman of the Working Group, Dr. S.Z. El-Sayed, Dr. W. Nowlin, Chairman WG 74, expressed some suggestions about future coordination between the two groups, and his suggestions were warmly received. Among these is an offer for advice from the physical oceanographers regarding the Southern Ocean in support of the BIOMASS Program and future studies of the Antarctic marine ecosystem.

g. BIOMASS Publications

The BIOMASS publications which have been published since the last annual report are listed in Section 1.2 of this report. The Working Group believes that it would be both important and useful to compile a BIOMASS Bibliography. Dr. R.M. Laws agreed to receive lists of publications on BIOMASS-related subjects which will be collated and published periodically.

h. BIOMASS Finances

The BIOMASS budgets were reviewed, and priorities for expenditures were discussed. It was proposed that the focus for expenditures be on workshops centred on the use of the BIOMASS Data Centre and on the expenses connected with operation and maintenance of the Data Base.

i. Future Meetings

In an effort to ensure that full advantage is taken of the data collected during FIBEX and SIBEX, as well as of the BIOMASS Data Centre, the Working Group decided that, as

the BIOMASS Program enters its second phase, there will be two major categories of meetings:

(i) evaluation of FIBEX and SIBEX data leading to the BIOMASS Evaluation Meeting (BEM), in 1989, in the FRG, and

(ii) meetings and workshops focusing on future activities, e.g., the International Target Strength Project, the International Krill Physiology Project, and the International Weddell Sea Winter Studies.

With this in mind, the Chairman of the Working Group has recently circulated a memorandum soliciting proposals for holding workshops to the Past Chairmen of the BIOMASS Working Parties on Acoustics; Krill Ecology, Krill physiology/Biochemistry; Fish Ecology; Squid Ecology; and Bird Ecology, as well as to other experts. The proposals should specify objectives, plans for the conduct of the workshops, and potential participants. The proposals should also indicate the potential demands on the Data Centre. These proposals will be reviewed by the BIOMASS Executive at their meeting in November/December 1985. The Executive will then appoint convenors and set dates for these workshops.

APPENDIX 1

SECOND INTERNATIONAL BIOMASS EXPERIMENT (SIBEX) PHASE 2 (1984/85)

Country	Ship	Dates	Area Investigated	Research Activities	Supporting Institute or Organization
Atlantic Ocean Sector					
Argentina	Almirante Irizar	March 1984-Jan. 1985	Scotia Sea Weddell Sea Bransfield Sea Bellingshuasen Sea	Physical, chemical oceanography; phytoplankton, zooplankton and fish studies; population dynamics of fur & elephant seals; bird studies.	Instituto Antartico Argentino Buenos Aires
Brazil	Professor W. Besnard	24 Jan.-15 Feb. 1985	S. Drake Passage, Bransfield Strait	Physical, chemical oceanography, ; phytoplankton, zooplankton and ichthyoplankton studies; krill larvae and krill distribution.	Instituto Oceanografico Universidad de Sao Paulo Sao Paulo
Chile	R/V Alcazar	20 Jan.-17 Feb. 1985	Bransfield Strait	Distribution and behavior of krill; ecology of zooplankton communities; micronutrients; fishes and krill predators; bird studies.	Instituto Antartico Chileno Santiago
F.R.G.	Polarstern	14 Nov.-29 Dec. 1984	S. Drake Passage, Off Elephant Is., E. Bransfield Strait	Physical,chemical oceanography; phytoplankton, zooplankton and ichthyoplankton; bacterial studies; benthos investigations.	Institut fur Seefischerei Hamburg
F.R.G.	Polarstern	3 Jan. - 5 Mar. 1985	E. Bransfield Strait, Off Elephant Is., Weddell Sea	Physical, chemical oceanography; phytoplankton, zooplankton, krill, ichthyoplankton; sea ices biota, benthos, fish, birds and marine mammals.	Alfred Wegener Institute fur Polarforschung Bremerhaven
F.R.G.	Walther Herwig	24 Jan.-4 Mar. 1985	Scotia Sea	Fish studies; krill biological distribution; quantitative studies of benthos.	Institut fur Seefischerei Hamburg
F.R.G.	Walther Herwig	7 Mar.-16 Apr. 1985	Off Elephant Is., Bransfield Strait	Phytoplankton, hydroacoustic studies; benthos studies; krill distribution and abundance.	Institut fur Seefischerei Hamburg

SIBEX PHASE 2 (continued)

Country	Ship	Dates	Area Investigated	Research Activities	Supporting Institute or Organization
Atlantic Ocean Sector					
U.K.	John Biscoe	30 Dec. 1984-29 Mar. 1985	Bransfield Strait; Southern Drake Passage	Physical oceanography; phytoplankton, zooplankton, krill, ichthyoplankton studies; Bird/Krill (predator/prey) studies; Krill swarm studies; Net avoidance investigation	British Antarctic Survey Cambridge
Indian Ocean Sector					
Australia	Nella Dan	Dec. 1984-Feb. 1985	S.W. Indian sector, Prydz Bay	Physical, chemical oceanography; phytoplankton; krill biology & behavior; hydroacoustics; seabird & mammal observations.	Dept. of Science & Technology Antarctic Division Kingston
France	Marion Dufresne	3 Jan.-15 Feb. 1985	S.W. Indian sector, Prydz Bay	Physical, chemical oceanography; phytoplankton; zooplankton; krill biology and physiology; hydroacoustics; seabirds and mammals observations; fish larvae collections; pelagic fishes; bottom-trawlings (mainly for fish)	Terres Australes et Antarcticues Francaises Station Zoologique Villefranche-sur-mer; Museum national d'Historie naturelle
Japan	Kaiyo Maru	23 Nov. 1984-4 Feb. 1985		Physical, chemical oceanography; phytoplankton, krill krill biology and hydroacoustic studies.	Far Seas Fisheries Research Laboratory Tokyo
S. Africa	Africana II	20 Feb.-23 Mar. 1985	S.W. Indian sector	Physical, chemical oceanography; phytoplankton, hydroacoustic and krill biology studies.	Sea Fisheries Research Institute Cape Town
Pacific Ocean Sector					
China	Xing Yang Hong No. 10	INFORMATION NOT AVAILABLE YET			Second Institute of Oceanography, Han Zhao

APPENDIX 2. Meetings and Workshops held since the 1984 Report to SCOR

Meeting	Place	Date	Report Reference
Post-FIBEX Acoustic Workshop	Frankfurt, FRG	3-14 Sept. 1984	BRS No. 40
Meeting of the BIOMASS Working Party on Bird Ecology	Marburg, FRG	20-11 Sept. 1984	BRS No. 41
Meeting of the BIOMASS Working Party on Fish Ecology	Dammarie-les-Lys, France	25-29 Aug. 1984	BRS No. 42
Meeting of the BIOMASS Executive	Bremerhaven, FRG	2-3 Oct. 1984	BRS No. 39
Post-FIBEX Seabird Data Workshop	Cape Town, South Africa	10-18 April 1985	(report in progress)
Meeting of SCOR Working Group 54	Dammarie-les-Lys, France	26-28 June 1985	(report in progress)

ANNEX IV

WORKING GROUP 76

ECOLOGY OF THE DEEP SEA FLOOR

Seven members of the WG met at Wohldorf (Hamburg) on 22 and 23 June, 1985 prior to the Deep Sea Biology Symposium held in Hamburg from 23-29 June. Members of the group spoke to various participants at the symposium and held two further short meetings during the week. From mid-day on 22 June the group was joined by the SCOR Executive Committee Reporter Dr. J.-O. Stromberg.

Preliminary discussions

Some correspondence between members of the WG, concerned principally with the wording and interpretation of the terms of reference had taken place prior to the meeting. Although this correspondence had left some problems unresolved, and although the WG felt that some aspects of the terms were still unclear (particularly para 3), such semantic discussions did not seem to be worthwhile at this time. Instead, the following preliminary general statements were agreed by the group.

There is a need for an independent organization such as SCOR to address the problems of the potential impact of human activities on the deep sea environment since there are already considerable pressures to take decisions on such activities on the basis of available data, even where these are inadequate, and to underestimate the importance of unanswered questions.

Deep sea benthic biologists as a group are less cohesive than those scientists concerned with most other aspects of oceanic species since they use a variety of techniques and equipment producing results which are difficult to compare. Although WG 76 is not considered to be a suitable forum for determining the details of the necessary standardization, it could perhaps identify those areas where such standardization is most urgently required.

The group decided to postpone any consideration of the third term of reference and to concentrate initially on terms 1 and 2. These would be treated together by attempting to identify those areas of deep sea biology which are insufficiently well-known to assess the probable impact of human activities of any type on deep sea ecosystems.

As a start, the basic problem of quantifying the BIOMASS of deep sea organisms was considered under the widely accepted size divisions of microbiota, nanmbiota, macrofauna and megafauna. In the event, it proved impossible to discuss biomass measurements without at least some reference to rates.

MICROBIOTA - generally considered to consist of those organisms less than about 2 µm long and largely made up of bacteria.

In the absence of a microbiologist member, the group felt itself to be seriously unqualified to discuss this subject in any detail. Nevertheless, we believe that no reliable technique is available with which to assess the biomass of deep sea bacteria. Although such techniques are urgently required, we felt that such biomass measurements alone are of particularly limited value in this size category and that techniques for the determination of microbial productivity, with or without the measurement of biomass, must be developed. (Subsequent discussions with microbiologists at the

Symposium, particularly Art Yayanos and Jody Deming, confirmed that this conclusion is substantially correct although great advances have recently been made on culturing and categorizing barophilic bacteria).

NANOBIOTA - organisms from 2 to about 40 μm in length and in the deep sea consisting largely of protistan groups such as the ciliates and suctorians.

The group again felt the lack of specialist knowledge. Nevertheless, we are confident that very little information is available on the biomass of deep sea nanobiota and that nothing is known about their productivity rates; such information may prove to be crucial in understanding the flow of energy through deep sea communities.

MEIOFAUNA & MACROFAUNA - these two categories together cover the size range from the upper limit of the nanobiota to the indeterminate limit of the megafauna (see below).

Although the meiofauna and macrofauna are the best known size groups of the benthic fauna, there are no universally agreed size fractionating criteria and different authors use various limits between 250 and 500 μm (or even 1000 μm) to separate the two categories. Consequently, the available data on numerical abundance and biomass are difficult to compare. Agreement on at least some standard sieve sizes, and possibly floatation techniques to be used by all workers is urgently required.

While considerable information on rate processes, including growth, reproduction, respiration and productivity is available for shallow water localities, virtually nothing is known for the deep sea other than measurements of community metabolism.

Although these size categories seem to be sampled adequately by the available grabs, the fear was expressed that even the best samplers may still be underestimating the abundance of meiofauna and small macrofauna due to loss of the most superficial layers of the sediment due to the bow-wave effect.

MEGAFAUNA - there is no agreed universal definition of the megafauna and almost every study of this size category deals with a unique suite of organisms.

Since the megafauna includes not only an enormous range of size but also infaunal (within the sediment), epifaunal and benthopelagic forms no single technique can be expected to sample the whole of the megafauna adequately.

In particular, the deep-living infauna is not collected at all at present. Quite new techniques would have to be deployed to sample this faunal component before its importance can be even roughly assessed. However, the group felt that the results to be obtained would probably not repay the effort involved and that this should not be considered to have a high priority.

In summary, while the group felt that there are a number of serious gaps in our ability to sample the benthic and near benthic megafauna adequately, the necessary technological basis is already available and could be developed relatively easily given adequate funding. This is not so true for the micro- and nanobiota.

BENTHOPELAGIC FAUNA - Although the group restricted its attention largely to the benthic communities we recognised the need for detailed qualitative and quantitative studies of the pelagic fauna in the lower part of the water column and particularly within a few metres of the sea-floor. As for the benthic megafauna, the basic technology for the relatively conventional approach using nets and traps is already available, but the benthopelagic community should also be amenable to study using

acoustic techniques currently being developed.

Having thus spent a large proportion of the available time in discussing the problems of obtaining quantitative data on the abundance of the benthic and near benthic organisms, it was clearly impractical to go through the same procedure for the other more complicated parameters needed to characterize deep sea populations, including the following:

Extent and rate of periodic and aperiodic movements/migrations.
Trophic relationships including rates of ingestion, assimilation, respiration and excretion.
Reproduction, including age at maturity, fecundity, larval/juvenile dispersion and mortality.
Population structure, including recruitment and mortality.

Instead, the group therefore discussed a number of more general problems and came to the following major conclusions.

Biologists alone will never be able to assess the probable impact of human activities on deep sea ecosystems. Accordingly, multidisciplinary studies involving chemists, geologists and physicists, as well as biologists, are urgently required.

The amount of information required to assess, from first principles, the impact of any particular human activity is probably not achievable in the time available before such impacts are likely to take place. Instead, the group felt that the only practical approach is to study actual impact events in the field. Ideally, these should involve impacts designed and controlled by scientists themselves. Such experiments would certainly present technical difficulties and would be expensive, but an assessment of the feasibility of this type of study is currently being conducted in the U.S. In the meantime, the group felt that scientists should take advantage of any pilot studies carried out by industrial organizations.

Such industrial studies are either (a) technical assessments in which specific equipment or techniques are tested but no attempt is made to simulate all aspects of a commercial operation, and (b) true pilot studies in which all aspects of a commercial operation are assessed; in the case of manganese nodule mining, for instance, such a study should involve an operation of at least 10% of a full scale commercial undertaking.

In assessing the probable impact of a commercial operation the type (a) are clearly less valuable than type (b), but both types should nevertheless be monitored.

Previous attempts to monitor such tests, and particularly the U.S. experience in monitoring a type (a) test of manganese nodule mining, emphasize the importance of scientific involvement at a very early stage.

During the Hamburg meeting the group learned that a joint French/German pilot manganese nodule mining operation is planned for 1987. This test will, apparently, use a 12m suction head, but it is not clear whether it would be a type (a) or type (b) operation. We assume that the test will be carried out in the Clipperton Fracture Zone, a region which has already been the subject of an extensive report to the U.S. National Academy of Sciences with recommendations on the designation of stable reference areas specifically intended to "preserve representative deep sea biota and to provide areas against which the extent of mining's impact on biological organism can be determined".

In view of the importance which the group attaches to monitoring the impacts of such tests, we feel that the early involvement of the scientific community in planning

the projected test is of the highest priority, despite the short lead time.

For the future, the group recommends that a period of at least three years would be necessary to plan an adequate monitoring programme to accompany commercial tests and that such planning should be through an international organization since the costs involved are likely to be very high.

The group made no plans for future meetings, but expects that its future activities will be dictated to some extent by the outcome of the pilot operation mentioned above.

ANNEX V

REPORT OF THE

SCOR/IOC COMMITTEE ON CLIMATIC CHANGES AND THE OCEAN

Introduction

The WCRP has become operational in several respects and, therefore, CCCO's activities have been focused on organizing operational programme elements and the involvement of governments and intergovernmental agencies. Both the Intergovernmental Oceanographic Commission (IOC) and the World Meteorological Organization (WMO) are addressing WCRP implementation. The IOC convened the first session of its Programme Group on Ocean Processes and Climate in March 1985 immediately preceding the 13th session of the IOC Assembly. Both of the meetings reviewed operational projects, on sea level and subsurface heat storage observations for example, and administrative matters associated with the WCRP. The WMO is taking a slightly different approach and will convene a WCRP Planning Meeting early in 1986 at which the first WCRP Implementation Plan will be presented to Government. CCCO is cooperating in the preparation of this plan.

This report provides the present status of several of the oceanographic activities of the WCRP being organized or proposed by CCCO in cooperation with the WMO/ICSU Joint Scientific Committee (JSC) for the WCRP and other IOC and SCOR bodies. For information on the overall objectives and strategy of the WCRP and other oceanographic activities one may refer to SCOR Proceedings, Vol 20, Annex X, of the Scientific Plan for the WCRP, WCP Series No. 2, 1984.

Study of the Tropical Oceans and Global Atmosphere (TOGA)

TOGA's experimental design is based on the concept that air-sea interactions in the tropics can significantly affect climatic events on regional to planetary scales. As such, the design of the programme has been divided into three major components:

"Ten-year measurements" will be conducted which consist of monitoring atmospheric, interface, and oceanic variables;

"Surveillance of the tropical ocean and global atmosphere in real-time in order to enhance the awareness of impending events, e.g., Los Ninos and monsoons;

"Modelling Studies" of the coupled ocean-atmosphere system and model sensitivity studies.

These three components are described in detail in the Plan for the TOGA Scientific Programme which was completed in April 1985 by the CCCO/JSC TOGA Scientific Steering Group (available in publication form July/August 1985). The TOGA "Ten year measurement" component began in January 1985. That implies that comprehensive data comprising observations of SST, sea level, subsurface thermal structrure, ocean circulation, surface fluxes, surface and upper level winds, and others, and products derived from these data sets, will be available in good time for use by the research community and to those conducting the "surveillence" of ocean and atmosphere for anomalous events. A major activity of TOGA, therefore, has been to organize the collection, processing and dissemination of data obtained from *in situ* and remote sensors. A network of international data centres has been proposed and negotiations are underway with

laboratories, data centres and governments to establish these centres, hopefully in 1985. Agreements to operate centres have been reached thus far with India (Radiosondes) and the U.S.A. (Global SST). The details of the functions of all centres, including their interaction with the WDC System, are contained in the TOGA Implementation Plan now in preparation at the International TOGA Project Office which opened for business in November 1984 in Boulder, Colorado, U.S.A. The office, which receives scientific direction from the TOGA SSG, and supports the Office of the Director of the WCRP and CCCO Secretariat, has been staffed by U.S.A., Indian, Canadian and French experts. Its Director is Dr. R. Fleming, U.S.A. Detailed planning and coordination of the expanded data systems required for TOGA are being carried out in cooperation with WMO and IOC, primarily through the WWW and IGOSS programmes.

The ultimate goal of the TOGA modelling effort is to develop coupled ocean-atmosphere models which are capable of successful long-range and seasonal forecasting. Progress in modelling will depend upon several important factors. One of the most essential elements in achieving this progress is the availability of a highly quality-controlled data set. The observing systems and their implementation are, to a large degree, driven by modelling requirements. Research into the various aspects of modelling is performed by individuals and/or groups coordinated by the SSG. The CCCO Modelling Panel and the JSC Working Group on Numerical Experimentation have collaborated in a study of the sensitivity of atmospheric models to SST and the organization of a conference on Coupled Models (Mat 1984). Twelve Major Meteorological Centres are involved in the Sensitivity Study. A workshop on Inverse Modelling and data assimilation was held in April 1985 and another Workshop on Coupled Models is planned for late 1986.

World Ocean Circulation Experiment

The strategy for WOCE will be described in the WOCE Scientific Plan being prepared for initial review in 1985 and dissemination in 1986. The details of the research programme will continue to evolve in consultation with the members of the international community of oceanographers. The goals of WOCE are: to develop models for predicting climate change and to collect the data necessary to test them; and to determine the representativeness of the specific WOCE data sets for the long-term behaviour of the ocean, and to find methods for determining long-term changes in the ocean.

In order to develop a practical experimental design for WOCE, three Core Projects have been identified that will require special attention because of the need to overcome logistical difficulties, to obtain special resources and to coordinate the activities of many groups. Although there is some overlap between the Core Projects, each demands a rather different aproach to experimental design. The WOCE SSG has now embarked on detailed study of each of the projects, which are:

1) The Global Perspective:
The aim of testing global circulation models will not be achieved unless the WOCE data set is truly global in extent. Satellites provide the systematic global coverage, for the first time. In-situ measurements will be designed to fill gaps in the existing coverage and to increase the sampling density in areas of special importance for the understanding of the global circulation. Tests will include comparison of scalar distributions including chemical tracers, and the distribution of eddy kinetic energy, depth of winter convection, seasonal and interannual variability of the general circulation, etc.

2) Inter-ocean Fluxes:
The global balances of heat and water depend on large-scale fluxes within and between the oceans. Special attention will be paid in this Core Project to the linkage between the Pacific, Atlantic and Indian Oceans effected by the Antarctic circumpolar

current.

3) Gyre Dynamics:

The third Core Project is concerned with testing and understanding of the dynamical balance of the ocean within a basin. The gyre dynamics project will be concerned with measuring all the contributions to the dynamics of the cyclonic and anticyclonic gyres in the North Atlantic Ocean and the associated intense currents. The aim will be to test current ideas concerning the effects of transient eddies, diabatic processes in and below the seasonal boundary layer, exchange with peripheral basins, etc., and to test their representation in computer models of large scale circulation.

The resources required for WOCE are of two categories: those that already exist in oceanographic institutes which can, in principle, be obtained through the normal funding mechanisms available to principal investigators; and resources that are not now available and which cannot be obtained by the normal mechanism. Resources of the second category will be included as specific highlighted items in the WCRP Implementation Plan. They include satellites, a dedicated research ship (RV WOCE), floats and drifters, expandable instruments (XBT's, XCTD's), Voluntary Ship meteorology and current profilers, data management, a sea level network, and vastly improved computers for modelling.

The WOCE International Planning Office was established at the U.K. Institute of Oceanographic Sciences (IOS), Wormley, late in 1984. The Office Director is Dr. G. Needler, Canada, with the remainder of the staff presently provided by IOS. The basic responsibility of the office is to support the scientific planning of WOCE as it develops within the SSG.

The WOCE timetable calls for an intensive observation period starting with the launch of the new generation of ocean-observing satellites (TOPEX-POSEIDON, ERS-1, NROSS) in about 1990, and continuing for 5 years. In situ measurements that have to be made while the satellites are operating will be concentrated into that intensive observation period. Other oceanographic measurements less directly related to the satellites may start earlier than 1990 and extend over a longer period, up to ten years if logistically necessary. The analysis of WOCE data is expected to continue for five years after the intensive observing period, taking ten years in all (nominally 1990-1999).

CCCO Activities Begun in 1985

1) Flux of CO_2 between the Global Ocean and Global Atmosphere

An important aspect of Stream 3 of the WCRP is the question of the rate of uptake of CO_2 by the ocean and the evolution of this rate as oceanic chemistry changes because of increased dissolved inorganic carbon (DIC) and as oceanic physics changes because of increased green house effect and changes in atmospheric circulation. To attack the problem in the ocean requires inputs from physicists, chemists and biologists. As planning for TOGA and for WOCE proceeds, it is evident that the non-physical aspects of this problem will not be adequately dealt with by the respective Steering Groups. It was concluded that it is necessary to appraise the state of the science to determine whether it is yet feasible to mount a comprehensive global study of CO_2 uptake in the ocean. CCCO therefore established a CO_2 Advisory Panel led by Professor Revelle to specify quantitatively what global budgets and regional fluxes related to the carbon cycle would be useful for the WCRP and to identify measurement techniques needed to achieve that goal including (i) carbon in the ocean, (ii) sediment flux, (iii) satellite ocean colour and (iv) in situ biological measurements. The Panel will specify a modelling programme needed to interpret and integrate these measurements, outline a measurement strategy and compare that strategy with the TOGA and WOCE plans.

2) Palaeoclimatology

One way to better understand the dynamics of the Earth's climate is to obtain high resolution climatic records of the last climatic cycle (the period which elapsed since the last time when the climate was very similar to the present one, about 120,000 years ago). Recent studies of this time period show the climatic changes may occur much more rapidly than believed previously. Since the interglacial period in which we are living today is in its terminal stage, the understanding of the mechanism of these rapid climatic changes becomes of utmost interest. Ice core data indicate that major variations in the CO_2 content of the atmosphere accompanied the climatic variations of the last ice age. The CO_2 changes in the atmosphere indicated in ice cores are such as to amplify the climate change indicated in the geologic record. Since CCCO is concerned with the possible effects of anthropogenic CO_2 on the Earth's future climate, and the role of the ocean, it has reconstituted the Palaeoclimatology Panel under the leadership of Dr. J. Duplessy with the charge to focus on promoting research on that part of the geologic record which may lead to an understanding of the ocean's role in the global carbon cycle and its variability.

ANNEX VI

REPORT ON LAW OF THE SEA

At the 25th Executive Committee Meeting of SCOR, in 1983, it was recommended that SCOR undertake an assessment of the impact of the U.N. Convention on the Law of the Sea on the conduct of oceanographic research in areas which now fall under the jurisdiction of coastal states. This proposal was circulated to SCOR Committees with a request for advice on how SCOR might best carry out such an assignment. A few Committees had responded by the time of the 27th Executive Committee Meeting; their comments are summarized below.

AUSTRALIA: Experience is limited but there are already indications of the influence of political considerations These could jeopardize, for example, physical oceanography in support of WCRP. Some convention articles (e.g., 246, 249) are subject to differing interpretations that may create difficulties as will increased planning and logistic complicaations. IOC and its regional bodies may facilitate access negotiations. The experience of international projects such as TOGA will be relevant in assessing the impact of UNCLOS.

JAPAN: An extensive statement on "Smoother promotion of marine scientific research in waters under national jurisdiction" was submitted and is reprinted here as Appendix A.

POLAND: Adherence to provisions of the Convention on marine scientific research is urged, and the proposed SCOR activity is supported: "either SCOR or IOC could undertake a study of the practice of coastal states with respect to marine research based on collection and analysis of national legal acts of coastal states, comparison of the results of analyses, and submission of the results of investigations to national SCOR committees and other interested international organizations. The data collected could serve as the basis for discussion of measures to be undertaken by the international community of scientists in order to facilitate marine research".

UNITED KINGDOM: A SCOR impact assessment is discouraged because the convention is not yet in force; a SCOR study "would be likely to cause resentment and result in restrictions which might not otherwise arise"; if such a cataloque of information were required, it would more appropriately be undertaken by an intergovernmental body.

SOUTH AFRICA: Comments of individual respondents were summarized. SCOR should reach consensus on the interpretation of relevant articles and national contacts should be identified to facilitate the granting of consent. Some respondents felt the proposed assessment was premature.

SOVIET UNION: While the proposed assessment could be approved, it should be delayed for a year or two while national policies and legislation are developed. IOC should be encouraged to continue with WMO to elaborate the legal status of ODAS and to develop a truly international status for scientific research vessels in order to simplify procedures for foreign port calls.

UNITED STATES: While the proposed assessment would be useful, the difficulty of obtaining good data must be recognized. In making the analysis, precise definitions of "denials" and "delays" are needed. SCOR should note the forthcoming IOC meeting on "Creating favourable conditions to marine scientific research and international cooperation in spaces under national jurisdiction".

ANNEX VI - APPENDIX A

SMOOTHER PROMOTION OF MARINE SCIENTIFIC RESEARCH IN WATERS UNDER NATIONAL JURISDICTION

In recent years, the jurisdiction of coastal waters has been greatly extended beyond hitherto normal limits, resulting in stronger regulation of marine scientific research. Many nations have either extended the limits of their territorial waters or established exclusive economic zones (EEZ) or fishery zones, and as a result various kinds of difficulties have emerged in the conduct of marine scientific research, partly due to the differences among the standpoints of the nations concerned. Consequently, the availability of scientific information on such areas has sharply decreased.

The Convention on the Law of the Sea adopted in April, 1982 by the Third Conference on the Law of the Sea provides that maritime nations have the right to regulate and authorize marine scientific research in their exclusive economic zones extending to 200 nautical miles from their coastlines and beyond this distance with respect to continental shelves, and that not only the conduct of marine scientific research but also publication of results, if circumstances might require, has to be consented to by the maritime nation.

Since the ocean is impartible and research of it can become effective only with the mutual cooperation of the nations concerned, it is strongly desirable in order to promote the study of marine sciences to ensure scientific research as free as possible throughout the oceans. Needless to say, the marine sciences, like other scientific disciplines, serve peaceful ends, and are for the benefit of all mankind. Thus, with the reality of the extension of national jurisdiction over oceans, we urge the need to make efforts to advance marine sciences, while avoidiing objections as much as possible.

Based on the above, effective measures must be taken:

As few regulations as possible should be imposed on the conduct of foreign and international scientific research under the national jurisdiction of maritime nations and publication of results.

The establishment of smooth and efficient procedures to obtain the consent of maritime nations for marine scientific research is especially important.

In addition, it is hoped that international agreement to the effect that scientific research is carried out with the least possible objections will be achieved.

Recently, not a few nations have extended their jurisdiction over coastal waters and now the regulation of marine scientific research covers most of the globe. There are three modes of implementing national jurisdiction; namely, over territorial waters, exclusive economic zones and fishery zones. In territorial waters, maritime nations have the "exclusive right" to regulate, authorize and conduct marine scientific research which can be carried out only with the "express consent" of the maritime nation. In exclusive economic zones, maritime nations have the "right" to regulate and authorize scientific research, which is conducted with their implicit consent. Although maritime nations give their consent to research projects by other nations in "normal circumstances", they may, however, at their discretion, withhold such consent. Maritime nations have the right to require the suspension or cessation of any research activities in progress on their own judgement. In fishery zones, the conduct of scientific research concerning fisheries requires the consent of the maritime nation

concerned.

Since modes of jurisdiction differ from nation to nation, various difficult issues have emerged in the conduct of marine scientific research. For example, if one nation holds a position on a fishery zone and another on an economic zone, an agreement between them on marine scientific research would be difficult to achieve. Under such conditions, one party will not enter into negotiations with the other for obtaining its consent in conducting scientific research in the waters under its jurisdiction, and consequently even the execution of research based on an international project undertaken by scientists of both nations will become a contentious issue.

Under the circumstances, nations are becoming increasingly reluctant to perform scientific research in internationally awkward areas, resulting in a steep decrease in the availability of scientific information.

On April 30, 1982, the Third Conference of the Law of the Sea of the United Nations managed to adopt the Convention of the Law of the Sea in the tenth year after its initial talking, Japan casting a vote for it. However, as this Convention has to be signed and ratified by nations, it may be many years until it takes effect, and we can expect a long time to elapse before an international marine agreement (including scientific research) is established. Although we can make no guesses about what the future holds, we cannot help but think that the regulation of marine scientific research is tending to become more difficult.

It comes to mind that with the reality of the extension of national jurisdiction, marine scientific research should be promoted.

Though there is much yet to do, positive attitudes and efforts of nations are especially desirable since the focal issues are international in their very nature. We hope that nations will keep in touch with each other, in order to take the necessary measures to smoothly carry out scientific research in waters under national jurisdiction. Above all, procedures to obtain consent of maritime nations would be of the greatest import. We expect nations to make the efforts to elaborate the conditions wherein marine scientific research based on mutual cooperation might be thoroughly promoted, by establishing procedures as smoothly and efficiently as possible.

ANNEX VII

IAMAP AND IAPSO CONTRIBUTIONS TO THE PROGRAMME OF THE IUGG GENERAL ASSEMBLY, VANCOUVER, AUGUST 9 - 22, 1987.

The programme will include twenty IUGG symposia. Of these the following involve IAMAP and/or IAPSO cosponsorship:

No. 1 Quo vadimus - Where are we going? IAPSO.

No. 2 Instability Within the Earth and Core Dynamics. IAPSO.

No. 3 Impact of Global Positioning System on Geophysics. IAMAP, IAPSO.

No. 4 Variations in Earth Rotation. IAMAP, IAPSO.

No. 8 Hydrological Regimes and their Subsurface Thermal Effects. IAMAP, IAPSO.

No. 10 Comparative Planetology. IAMAP.

No. 11 Differences between the Arctic and the Antarctic Atmosphere. IAMAP.

No. 14 Dynamics and Monitoring of Pollution. IAMAP, IAPSO.

No. 15 Contribution of Geophysical Sciences to Climate Change Studies. IAMAP, IAPSO.

No. 16 Marginal Ice Zone Processes. IAMAP, IAPSO.

No. 17 Low Latitude Ocean-Atmosphere Interaction. IAMAP, IAPSO.

No. 18 Long-term Variations in Ocean Climate. IAMAP, IAPSO.

IAMAP has planned the following association symposia:

1 Surface Energy Fluxes, Models and Observations

2 Aerosols and Climate

3 Middle Atmosphere Science

4 Mid-Latitude Cyclones

5 Mesoscale Analysis and Forecasting, Incorporating Nowcasting

6 Role of Convention in Mesoscale Development

7 Prediction of Transitions in the Climate System on Interannual Time Scales

8 Dynamics of Flow Over Topography

9 Microwave Remote Sensing

10 Scientific Status Report on Weather Modification

11 Tropospheric Chemistry and Acid Rain

12 High Latitude Tropospheric and Boundary Layer Processes

IAPSO has planned the following symposia:

1 Satellite Oceanography and the Role of Satellite Observations in Large Scale Oceanographic Programmes

2 Large Scale Oceanographic Studies

(a) Pacific Ocean
(b) Atlantic Ocean
(c) High Latitude Oceans
(d) Global Ocean Circulations

3 Intermediate and Small Scale Processes and Structures in the Ocean

4 Marginal Seas and Straits

(a) Physical Aspects
(b) Chemical Aspects

5 Optical Variability and its Relationship to Biology, Physics and Dynamics of the Upper Ocean

6 Ocean Data-Assimilation and Prediction

7 Coastal, Nearshore and Shelf Oceanography

8 Physical Oceanography Based on Acoustics

9 Recent Studies in Marine Chemistry

(a) The Role of Bacteria in Redox Processes in the Marine Environment
(b) Significance and Interpretation of Trace Element Distribution in the Oceans
(c) Importance of Hydrothermal Processes of the Geochemical Mass Balance

10 Physical, Chemical and Geophysical Oceanography

ANNEX VIII

REPORT OF THE SCIENTIFIC COMMITTEE ON PROBLEMS OF THE ENVIRONMENT

General Meetings

During the period covered, the SCOPE Executive Committee held its XVIIth meeting in Paris in October 1984. A main item in its agenda was the preparation of the VIth SCOPE General Assembly to be held in Washington D.C., U.S.A., on September 9-13, 1985. Another important point of discussion was the participation of SCOPE to the envisaged ICSU programme on Global Change (see below).

Scientific Activities

Biogeochemical Cycles

The fourth international workshop on "Transport of Carbon and Minerals in Major World Rivers" was held in Tianjin, China, in May 1985. It was followed by a one day session on problems of global habitability, which was attended by many scientists from various scientific institutions of China. Besides this main "Transport in Rivers" project which terminates in 1985, the SCOPE/UNEP Carbon Unit in Hamburg has initiated a three years study on the flux of carbon and detritus from land to sea in the area of the German Bight and the southern part of the North Sea. It has organized two international workshops on Marine Biogeochemistry (Goa, India - Octrober 1984) and on Black Shales (Hamburg, F.R.G. - June 1985). Preparations are underway for a proposed five years study (1986 - 1990) on "Global Carbon and Nutrient Cycling in Lakes and Estuaries".

As a SCOPE contribution to the joint WMO/ICSU/UNEP programme for the assessment of CO_2 impact on the environment and human activities, the International Meteorological Institute in Stockholm organized jointly with WMO, in May 1984, an expert meeting on the reliability of crop-climate models for assessing the impacts of climatic change and variability. A comparison of several crop simulation models, using standard climate scenarios, has been undertaken as a pilot study to test procedures for expanded, longer-term crop/climate model evaluation activities. Other expert meetings were organized by the IMI to examine the consequences of a climate change for boreal forests and to review the problem of the rate of released CO_2 as a function of future energy developments. A series of monographs as well as the final SCOPE report on the global CO_2 problem is presently being finalized.

The activities of the SCOPE/UNEP Sulphur Unit in Pushchino, USSR, and the operation of its liaison and documentation center for all aspects of the biogeochemical sulphur cycle have been continued. An international workshop on "the Evolution of the Global Sulphur Cycle" was held in Tallin, USSR, in July-August 1984 and concentrated mainly on a) the evolution of the sulphur cycle in geological times; b) the preindustrial sulphur cycle and the changes due to anthropogenic influence in recent times; and c) the interaction of sulphur, nitrogen, carbon and oxygen cycles in sulphur dominated ecosystems. Preparations have been undertaken for a proposed new study (19086 - 1988) on the natural and anthropogenic sulphur cycle in the hydrosphere.

The first Metals Cycling workshop, held in Toronto, Canada, in September 1984, focussed on the cycling of arsenic, cadmium, lead and mercury. The relative anthropogenic sources were considered and quantified when possible; major knowledge gaps, especially at the regional level, were identified and discussed.

The first phase of the Acidification in Tropical Countries study has been initiated in 1985. A series of case studies at the national level are being developed, using standard guidelines provided by the Scientific Advisory Committee responsible for the study.

The series of regional studies on Nitrogen Cycling, undertaken by SCOPE since 1977, has been completed with an international workshop held in Aarhus, Denmark, in June 1985, which focussed on Nitrogen Cycling in Coastal and Marine Environments.

Ecotoxicology

The first phase of the study on Ecotoxicology and Climate has been implemented in 1984-85. The aim of the study is to develop ecotoxicological principles that will be applicable to non temperate regions in order to assess the fate of environmental chemicals and their effects in such areas. The study concentrates on data available from the tropical, arid, sub-polar and high mountain regions. An international workshop will be held in July 1985.

The 4th SGOMSEC workshop was held in Ottawa in August 1984. It concentrated on the positive value of short term toxicity tests for no genotoxic effects. Preparations are underway for SGOMSEC 5 which will be held in Mexico City, Mexico, in August 1985, and will focus on methodologies for the assessment of exposure to chemicals of human and non human biota - including measurements of levels near the exposed organism, modelling and the actual assessment in biological material.

Land Transformation

Preparatory studies have been undertaken by expert groups to consider the feasibility of two proposed studies on a) Urbanization and Land Transformation and b) Changes in Savannas.

Ecology of Biological Invasions

Within the framework of the international project outline, various national projects have developed independently with the purpose to assemble data bases, identify problems and specialists, and synthesize knowledge. National symposia and meetings have taken place in 1984-1985 in Australia, South Africa, United Kingdom and USA.

In addition, five international working groups have been established to address specific problem areas and have begun in 1985 to work on a) Invasions into nature reserves, b) Modelling the invasion processes, c) Invasions into Mediterranean ecosystems, d) Invasions into tropical ecosystems and e) Temporal perspective on invasions in continental Europe.

Global Change

SCOPE has joined efforts with INTECOL, the International Association for Ecology, to contribute to the feasibility studies undertaken within ICSU for a possible long term interdisciplinary programme on Global Change. Preparations are underway for an ICSU/SCOPE/INTECOL international workshop to be held in October 1985 at the invitation of the US National Academy of Sciences. The workshop will consider temporal and spatial scales in biogeochemical cycling and identify the research needed to determine interactions with global environmental change.

Environmental Consequences of Nuclear War

The ENUWAR project undertaken in 1983 is now under completion. Its aims and mandate were to assess global climatic and biological effects of several scenarios of nuclear exchange - as distinct from the well known immediate consequences - restricting this examination to scientific issues and eschewing policy questions or matters of advocacy.

The project developed a series of international workshops, each concentrating on a specific aspect but building also on the discussions and conclusions of the previous ones. In addition to the six earlier workshops held, the following meetings have taken place since June 1984: a) Cloud-physics and scavenging mechanisms for particulates - Tallin, August 1984; b) Groundwater contamination from fallout - Delft, October 1984; c) Radiation effects on human and non-human biota - Paris, October 1984; d) Ethics and morality - Bellagio, November 1984; e) Agriculture response to nuclear war - Colchester, January 1985; f) Human impacts - Hiroshima, February 1985; g) Atmospheric uncertainties relating to nuclear winter predictions - London, February 1985; h) Ecological effects - Toronto, March 1985; i) Effects in the southern hemisphere, Melbourne, March 1985; and j) Effects on tropical ecosystems and agriculture, Aracas, April 1985.

A synthesis and editing workshop was held in Colchester, United Kingdom, in June 1985. Two synthesis scientific volumes are being prepared to deal respectively with a) the atmospheric and climate consequences of nuclear war, and b) the biological consequences and the ecosystem response. A summary popular version is also in preparation.

Publications

Two reports have been published in the SCOPE series during the period considered.

SCOPE 25 - Appraisal of Tests to Predict the Environmental Behaviour of Chemicals - March 1985.

SCOPE 26 - Methods for Estimating Risk of Chemical Injury: Human and Non-human Biota and Ecosystems.

In addition, several national or regional contributions have been published directly at the initiative of the National Committees for SCOPE.

The SCOPE Newsletter published three times a year is distributed free of charge through the Paris Secretariat and the National Committees. In addition, an ENUWAR Newsletter has been regularly published by the project on Environmental Consequences of Nuclear War.

ANNEX IX

LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Antarctic Circumpolar Current
AGU	American Geophysical Union
AOSB	Arctic Ocean Sciences Board
ASLO	American Society for Limnology and Oceanography
BIOMASS	Biological Investigations of Marine Antarctic Systems and Stocks
CCAMLR	Commission for the Conservation of Antarctic Living Marine Resources
CCCO	Joint SCOR/IOC Committee on Climatic Changes and the Ocean
CHEMRAWN	Chemical Research Applied to World Needs
CMG	Commission for Marine Geology
CONACyT	Consejo Nacional de Ciencia y Tecnologia (Mexico)
COSPAR	Committee on Space Research
CTD	Conductivity/Temperature/Depth
DIC	Dissolved Inorganic Carbon
ECOR	Engineering Committee on Oceanic Resources
EEZ	Exclusive Economic Zone
EOS-80	International Equation of State of Seawater 1980
ERS-1	Earth Remote Sensing Satellite (of ESA)
ENUWAR	Environmental Consequences of Nuclear War
ESA	European Space Agency
FAO	Food and Agricultural Organization
FGGE	First GARP Global Experiment
FIBEX	First International BIOMASS Experiment
GARP	Global Atmospheric Research Project
GEMSI	Group of Experts on Methods, Standards and Intercalibration
GESAMP	Group of Experts of the Scientific Aspects of Marine Pollution
GIPME	Global Investigation of Pollution in the Marine Environments
GTS	Global Telecommunications System
IABO	International Association for Biological Oceanography
IAMAP	International Association for Meteorology and Atmospheric Physics
IAPO	International Association for Physical Oceanography
IAPSO	International Association for the Physical Sciences of the Ocean
ICCGRS	Inter-Commission Coordinating Group for Remote Sensing
ICES	International Council for the Exploration of the Sea
ICSPRO	Inter-Secretariat Committee on Scientific Programmes Relating to Oceanography
ICSU	International Council of Scientific Unions
IGBP	International Geosphere-Biosphere Project
IGOSS	Integrated Global Ocean Services System
INQUA	International Union for Quaternary Research
INTECOL	International Association for Ecology
IOC	Intergovernmental Oceanographic Commission
IOS	Institute of Oceanographic Sciences (UK or Canada)
IREP	International Recruitment Programme
ITPO	International TOGA Project Office
IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
IUPAC	International Union of Pure and Applied Chemistry
JOA	Joint Oceanographic Assembly
JPOTS	Joint Panel on Oceanographic Tables and Standards
JSC	Joint Scientific Committee for the WCRP (of ICSU and WMO)
LEPOR	Long-term and Expanded Programme of Oceanic Exploration and Research

NBO	National Bureau of Oceanography (of China)
NOAA	National Oceanographic and Atmospheric Administration (of USA)
NROSS	Navy Remote Ocean Sensing System (of US Navy)
NSF	National Science Foundation (of USA)
ODP	Ocean Drilling Programme
ONR	Office of Naval Research (of USA)
OOSDP	Ocean Observing System Development Plan
OSLR	Ocean Science in Relation to Living Resources
OSNLR	Ocean Science in Relation to Non-Living Resources
PEX	Patchiness Experiment
PG/SOC	Programme Group for the Southern Ocean (of IOC)
RIOS	River Inputs to Ocean Systems
SARP	Sardine-Anchovy Recruitment Project
SCAR	Scientific Committee on Antarctic Research
SCOPE	Scientific Committee on Problems of the Environment
SCOR	Scientific Committee on Oceanic Research
SEASAT	NOAA Ocean Satellite
SGOMSEC	Scientific Group on Methodologies for the Safety Evaluation of Chemicals
SIBEX	Second International BIOMASS Experiment
SSG	Scientific Steering Group
SST	Sea Surface Temperature
SUN	Symbols, Units and Nomenclature
TOGA	Interannual Variability of the Tropical Oceans and Global Atmospehere
TOPEX	Ocean Surface Topography Experiment
TRODERP	Tropical Demersal Recruitment Project
UN	United Nations
UNCLOS	UN Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
URSI	Union Radio Scientifique Internationale
WCP	World Climate Programme
WCRP	World Climate Research Programme
WDC	World Data Centre
WMO	World Meteorological Organization
WOCE	World Ocean Ciculation Experiment
WOCE-NEG	WOCE Numerical Experimentation Group
WPO	WOCE Planning Office
WWW	World Weather Watch
XBT	Expendable Bathythermograph
XCTD	Expendable CTD