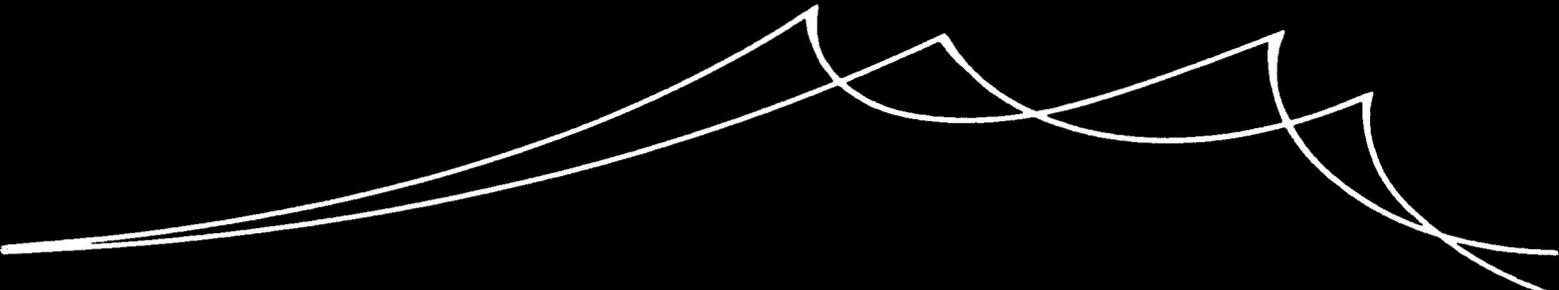


**SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH**



*SCOR  
Proceedings  
Vol. 9*

**INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS**

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

THE EXECUTIVE COMMITTEE

- President: Professor Dr H. Postma  
Netherlands Institute for Sea Research  
Postbus 59, Texel, THE NETHERLANDS
- Past President: Professor Warren S. Wooster  
Rosenstiel School of Marine Atmospheric  
Science  
University of Miami  
10 Rickenbacker Causeway  
Miami, Florida, 33149, U. S. A.
- Vice-Presidents: Professor A. S. Monin  
Institute of Oceanology  
USSR Academy of Sciences  
1 Letnyaya, Ljublino  
Moscow, J-387, USSR
- Dr Klaus Voigt, Director  
Institut für Meereskunde  
Seestrasse 15  
253 Warnemunde, GERMANY, DDR
- Secretary: Mr R. I. Currie  
Dunstaffnage Marine Research Laboratory  
P. O. Box 3  
Oban, Argyll, SCOTLAND
- Ex Officio: Dr T. F. Gaskell  
British Petroleum Co. Ltd  
Britannic House, Moor Lane  
London, E.C.2., ENGLAND
- Professor Dr G. Hempel  
Institut für Meereskunde  
Universität Kiel  
Dusternbrooker Weg 20  
23 Kiel, GERMANY, FRANCE
- Professor H. Lacombe  
Laboratoire d'Océanographie Physique  
Museum d'Histoire Naturelle  
43/45 rue Cuvier  
Paris Ve, Fr

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

**PROCEEDINGS  
OF THE  
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH**

Volume 9

1 September 1973  
London, England

## CONTENTS

### SCOR Proceedings Vol. 9

Contents	Page
Members of the SCOR Executive Committee .....	Inside Front Cover
SCOR Executive Committee Seventeenth meeting - report	
Annex I	Participants ..... 22
Annex II	Statement of SCOR Income and Expenditure 1972..... 23
Annex III	Estimate of finances..... 24 1 January through 30 April 1973
Annex IV	Report of first meeting of Working Group 36..... 25 "Coastal Upwelling Processes" Corvallis, 26 to 29 March 1973
Annex V	Report from chairman of Working Group 38 ..... 33 "Special studies in circumpolar waters south of 40°S"
Annex VI	Report of meeting of Working Group 41 ..... 35 "Morphological Mapping of the Ocean Floor" Wormley, 2 and 3 April 1973
Annex VII	Report from chairman of Working Group 42 ..... 44 "Study of the Pollution of the Baltic"
Annex VIII	Introduction and recommendations from the..... 46 report of the first meeting of Working Group 43 "Oceanography Related to GATE" Miami, 5 to 10 February 1973
Annex IX	Report of second meeting of Working Group 43..... 48 "Oceanography related to GATE", London, 4 to 8 June 1973
Annex X	Notes by Director of GARP Joint Planning Staff..... 51 on discussions on oceanographic programmes related to GARP which took place at the time of the meeting of JOC in London, March 1973
Annex XI	Report of meeting of Joint Oceanographic ..... 54 Assembly Steering Committee, 15 May 1973

Annex XII	Announcements of Symposia: ..... 55 Polar Oceans Conference, May 1974 Marine plankton and sediments, September 1974
Annex XIII	Procedures for Working Groups..... 57
Annex XIV	ICSU Statement to U. N. Sea Bed Committee..... 58
Annex XV	Report by SCOR observer on the Seventh Session..... 60 of IOC WG on International Oceanographic Data Exchange, New York, 9 to 13 July 1973
Annex XVI	Future meetings of SCOR and Associated..... 62 Organizations
List of abbreviations used.....	66

Report on the seventeenth meeting of  
The SCOR Executive Committee,  
Texel, Netherlands, 14 to 16 May 1973

The Seventeenth meeting of the SCOR Executive Committee was held at the Netherlands Institute for Sea Research at t'Horntje, Texel, Netherlands, from 14 to 16 May 1973, with the President, Professor H. Postma in the chair. Professor Postma, as Director of the Institute at Texel, greeted the participants. The programme included an evening reception by the Director and staff of the Institute and visits to the scientific laboratories and the new aquarium.

A list of those attending the meeting is given in Annex I.

## 1.0 ORGANIZATION AND FINANCE

### 1.1 MEMBERSHIP

(i) Professor Pierre Tardent had accepted an invitation to participate in the work of SCOR as an invited member but at the same time forwarded a formal application from the Swiss Academy of Natural Sciences for full membership of SCOR, the SCOR Executive, consulted by correspondence, agreed to accept Switzerland as a member in category III.

The Swiss Committee adhering to SCOR is:  
Swiss Commission for Oceanography and Limnogeology  
Swiss Academy of Natural Sciences  
Attn. Professor P. Tardent, President  
Zool. Institut der Universität, Zurich,  
Kunstlergrasse 16  
8006 Zurich, SWITZERLAND.

Nominations of national members of SCOR are awaited. Professor Tardent ceases to be an Invited Member.

(ii) Following correspondence with the Director of the Oceanographic Institute in São Paulo, an invitation to affiliate with SCOR was sent to the National Research Council of Brazil, and will be considered at the next meeting of the Board of Counsellors.

(iii) It was agreed to renew enquiries with Professor A. A. Al-Kholy with regard to the possibility of the reconstituted Egyptian National Committee for Oceanography wishing to affiliate with SCOR.

(iv) Dr Marko Branica, Centre for Marine Research "Ruder Boskovic" Institute Zagreb Yugoslavia had accepted an invitation to serve on SCOR as an "Invited Member".

(v) Efforts should be made to identify "Invited Members" from other countries with a substantial oceanographic activity but which are not members of SCOR.

(vi) An invitation had been issued to IAMAP to become an affiliated organization but no response had yet been received.

## 1.2 BUDGET AND FINANCE

The statement of SCOR Income and Expenditure for the year 1972 (Annex II) and the estimate for the period January through April 1973 (Annex III) were received.

Canada has elected to increase her annual contribution to \$1500 and so adheres to SCOR in category II from 1973.

When reports on activities under the 1972 contracts were submitted to UNESCO a request was made for similar contracts for 1973 but these contracts and final payments under the 1972 contracts were still awaited. (These final payments were made in May 1973).

The President reported that in February he had been informed that a meeting of the UN Environment Programme Governing Council would be receiving submissions for financial support and he had entered an application for \$18 000 in 1973 and \$18 000 in 1974 to support relevant SCOR working groups [viz 34, 44, 45 and 46] and that, subsequently, this request had also been entered as part of an IOC submission which covered also the nominees on these groups of the other advisory bodies.

It was understood that these, and other, submissions would be used by the UNEP governing council in constructing its general programme at its meeting in June 1973 after which specific requests for financial support for activities contributing to that programme could be considered. It was appreciated that SCOR would have to await the outcome of the June meeting of the Governing Council before it would be possible to determine the best mechanism for seeking financial support from the UN Environment Fund and to learn the degree to which the UN Environment Secretariat would need to be involved in the planning of activities to be supported by the fund.

## 1.3 PUBLICATIONS

IIOE Atlas - Phytoplankton Production and Related Factors. Professor Krey is now confident that material for the atlas will be completed by the end of 1974. The project is to be financed from the FRG contribution to the IOC Trust Fund and a contract was expected to be signed shortly. It would be useful for the ad hoc group appointed by SCOR, Professor Postma and Mr Jitts, to review progress early in 1974 and it was suggested that provision for such a review might be written into the contract.

The proceedings of the Symposium on Biology of the Indian Ocean, Kiel, March/April 1971 had now been published. The delay had been due largely to the printer going out of business. The FRG, Unesco, IOC and SCOR are purchasing copies for distribution to developing countries involved with the subject. It was understood that Unesco would contribute at least \$1500 and SCOR confirmed its agreement to contribute \$500 for such distribution in accordance with a list to be prepared by Dr G. F. Humphrey and Dr B. Zeitzchel. IOC would provide copies for the 43 IOC Depository libraries and it was expected that FAO would look into the possibility of providing copies for the fisheries laboratories of the area.

Unesco was asked to include this publication in its coupon scheme.

## 2.0 WORKING GROUPS

### 2.1 WGs GENERAL

Procedures for the establishment of new working groups were approved. Annex XIII supplements the instructions for working groups which appeared in SCOR Proceedings Vol. I, No 1. These new procedures provide for the appointment of a member of the SCOR Executive as Reporter to the Executive for each group. The President and Secretary would not normally be appointed as Reporters.

Reporters were appointed for groups as follows:

Professor Monin	WGs 28 38 44
Dr Voigt	WGs 21 34 42 43
Professor Lacombe	WGs 10 27 36
Professor Hempel	WGs 35 45
Dr Gaskell	WGs 37 40 41 46
Professor Wooster	WG (15) 47
Mr Currie	WGs(23) 32 (33)

(Groups shown in brackets have been disbanded but some work remains to be done on reports)

Notes for Chairmen of Working Groups and Notes on Travel were also approved.

### 2.2 FORMER GROUPS

WG 15 Photosynthetic Radiant Energy (with IAPSO and Unesco): Mr J. E. Tyler, who was chairman of WG 15 and was now serving as editor of the reports has almost completed the compilation of a data report of almost 1000 pages, to which 15 authors had contributed, and had secured financial support to permit 200 copies to be printed. Copies will be sent to supporting organizations, working group members and participants in the Discoverer [1970] expedition and to the US-NODC.

SCOR was of the opinion that 200 copies of this report would be sufficient and suggested that distribution should include WDC-A and WDC-B, but in view of the highly specialized nature of the report it was not considered necessary to send copies to SCOR National Committees nor the IOC Depository Libraries automatically. These organizations could request a copy if they were interested. (Requests should be addressed to the Office of Technical Publications, Scripps Institution of Oceanography quoting SIO Reference Report Series No. 73-16).

Mr Tyler was again trying to obtain agreement among the members of the group on the wording of the recommendation to meet the terms of reference of the group. The SCOR Executive hoped that agreement would be reached within the next few months and asked Professor Wooster to act as Reporter (see above) in connexion with this group.

WG 23 Zooplankton Laboratory Methods (with Unesco): The Chief Editor, Dr H. F. Steedman, and his co-editors, Drs Hansen and Beers were progressing

satisfactorily with the compilation of the manual of Laboratory Methods in the Study of Marine Zooplankton. Unesco has provision in its 1974 budget for publishing the manual in its series "monographs of oceanographic methodology" and Dr Steedman is in direct negotiation with Unesco on editorial detail.

As requested by the SCOR General Meeting, Dr Steedman had prepared a summary of the major findings for rapid publication which he had submitted to Nature. The Executive Committee was of the opinion that this paper might require further editing to reduce it to about 3000 words and Mr Currie agreed to assist with this task. If Nature considered the paper unsuitable for their journal, Mr Currie would seek to arrange publication in some other appropriate journal.

It was agreed that for the time being no further action should be taken to establish new groups, as had been recommended by WG 23, but the suggestions should be kept under review. It was further agreed that now that the Unesco panel for International Marine Biological Centres had accepted the responsibility for overseeing the completion of the long term experiments initiated by WG 23, it was more appropriate for the chairman of the Panel, rather than SCOR, to communicate with the seven laboratories about continuation of the work and submission of periodic reports.

WG 24 Estimation of Primary Production under Special Conditions (with IBP/PM): The monograph on the Estimation of Primary Production under Special Conditions has now been published by Unesco at a price of \$3. It was felt that it would be advantageous to place announcements of this publication in journals such as Deep Sea Research.

WG 25 Nutrient Intercalibration Experiment (with ICES): The final report of the SCOR/ICES Nutrient Intercalibration Experiment was nearing completion, although data from one participating country were still not submitted; ICES will publish this report in its Cooperative Research Report series. Mr Tambs-Lyche, General Secretary of ICES, invited suggestions for institutions, other than ICES members and the participating laboratories, which should receive copies. Suggestions should be sent directly to ICES.

WG 29 Monitoring in Biological Oceanography (with ACMRR, UNESCO and IBP/PM): Preprints of the final report entitled Monitoring Life in the Ocean are now available in limited quantities. There had been discussion with Dr Longhurst, chairman of WG 29 and editor of the report, regarding the most suitable means of publication. The SCOR Executive was of the opinion that it was important to publish this report as quickly as possible and that the delays inherent in the Unesco monograph series should be avoided. It was agreed that publication in the Unesco technical series would be acceptable provided the masters were retyped to incorporate editorial revisions and that the cover presentation and binding were improved.

SCOR welcomed a proposal by FAO to produce Spanish and French translations of this report and suggested that FAO should discuss publication with Unesco.

### 2.3 EXISTING GROUPS

WG 10 Oceanographic Tables and Standards (with ICES, IAPSO and UNESCO): The group met in Kiel from 24 to 26 January 1973.

Oxygen saturation tables have now been delivered to Unesco for inclusion in the second volume of Unesco Oceanographic Tables and conversion tables for salinity to chlorosity were being printed. Refractive index tables, as a supplement to volume one, had been compiled. The Panel had proposed that the Presidents of SCOR and IAPSO with the Chairman of the Panel issue a statement in the main oceanographic journals, and elsewhere, recommending that the official tables, when published, be used exclusively for calculation of oxygen saturation in sea water.

A second printing of the first volume of tables is now available from Unesco. This contains the official tables for converting relative conductivity to salinity. As many manufacturers of salinometers were providing, with their instruments, tables which did not always accord with the internationally used Unesco conversion tables, the organizations sponsoring the Panel were urged to publicise the necessity of using the official tables.

Also, with the increasing number of manufacturers of salinometers, most of which were based on conductivity measurements, there was evidence that in some instances the accuracies quoted were not correct. It had been recommended that an international intercalibration exercise be carried out on sea water samples of known salinity in the range 38.4‰ to 8‰. The Executive Committee urged as many institutions as possible to notify their interest in participating to Mr Hermann, Standard Sea Water Service, Charlottenlund who would distribute the samples with details of the proposed experiment.

The Panel expressed its concern about the lack of officially adopted formula for converting "in situ" conductivity measurements into salinity and density. There is an urgent need to ensure comparability of figures derived from different "in situ" measurements with those of salinities determined by other methods.

The Executive Committee warmly supported the proposals that precise measurements of conductivity ratios be carried out in the temperature range  $-2^{\circ}\text{C}$  to  $15^{\circ}\text{C}$ , to extend the range of present tables to lower temperatures, and at elevated pressures, to extend the salinity range of the Bradshaw and Schleicher formula, and urged the group to encourage such measurements. It was also noted that after suitable evaluation of those measurements the panel would propose conversion procedures for calculating salinity from "in situ" measurements of conductivity, temperature and pressure. It was decided, however, to defer consideration of the proposal for a new working group to initiate and carry out intercalibration procedures for "in situ" measurements until the next meeting of the Executive Committee by which time more details should be available about new CTD instruments; the chairman of WG 10 should be asked for further advice at that time.

The report of the meeting also contains reports of progress with various other activities including the comparison of real and calculated densities and entropy of sea water and a statement that no additional tables will be proposed for inclusion in the Unesco Oceanographic Tables within two years; it was expected that various new tables might be compiled within four years.

A next meeting of WG 10 at the time of the 1975 IUGG General Assembly was approved.

Two of the ICES nominees on the joint panel, Professor Saalen and Mr Hermann, had resigned because the future tasks for the group were not in their direct field of

interest. Dr Steyaert confirmed that Unesco would continue to pay for ICES nominees to participate in the activities of the group and ICES was invited to nominate two replacement members.

The Executive Committee proposed that the report of the January meeting of WG 10 be published in the Unesco Technical Series, for which it was understood Unesco had already made provision. Professor Lacombe, as Reporter for this group, was invited to undertake the editing of the report for publication and it was suggested that he and Unesco might not consider it necessary to publish the annexes.

WG 21 Continuous Current Velocity Measurements (with IAPSO and UNESCO): The report of the second intercomparison experiment (Akademik Kurchatov, March 1970) is now with Unesco for publication in the Unesco Technical Series. Work has been proceeding on the data from the third experiment (RV Atlantis II, August/September 1972) and when the report becomes available that too should be published in the Unesco Technical Series.

The group is, at present, working on methods for data interpretation and there is a possibility of a further intercomparison experiment being arranged during GATE.

WG 27 Tides of the Open Sea (with IAPSO and UNESCO): The response to invitations to participate in an intercalibration of pelagic tidal pressure sensors from RRS Discovery in late 1973 had been excellent and arrangements for the experiment were proceeding. A report should be available during 1974.

WG 28 Air-Sea Interaction (with IAMAP and IAPSO): The group is planning to meet in Melbourne in January 1974 in association with the IAMAP/IAPSO joint assembly. The Chairman, Professor Charnock, announced his intention to resign at that meeting.

WG 32 Biological Data Inventories (with ACMRR): Dr E. F. Akyuz has been invited to serve as ex officio member for FAO. It was agreed that Dr J.M. Colebrook be invited to represent SCOR at the next meeting of IODE, New York, 9 to 13 July 1973 and that Dr J. Ore Stromberg be added to the membership of the Group.

WG 33 Phytoplankton methods (with IBP/PM): A report on the activities of the working group had been received from the chairman, Professor Banse. The working group had been unable to fulfil all the terms of reference, but they had conducted a full review of current methodology and made an assessment of the need for a manual.

This is clearly a difficult area in marine science, where individual workers tend to develop methods specially for particular problems. Each may have its merits for the task in hand. The best way to give guidance to people just entering the field would seem to be to describe the different approaches, giving a clear statement of the circumstances in which they are relevant, their limitations in one way or another so that the 'novice' will have sufficient information to assess for himself the approach he should adopt.

It was evident from the review of techniques that in many areas further research work is badly needed. There is, for instance, the problem of finding a suitable preservative for the naked flagellates and in the recommendations of the report, proposals are made for further activities in this direction. While the Executive Committee were appreciative of these needs, it was also recognized that problems of this nature had

taxed the scientific community for some time and no very obvious solutions were in sight. A good deal could depend on finding the right enthusiast with the necessary skills and facilities to pursue the problem.

The Committee agreed to accept the report and expressed its thanks to the chairman and members. It also recommended that the report should be published in the UNESCO Technical Series, subject to some editing. In particular it was felt that the appendix should either be expanded to discuss the experiment more fully, or deleted altogether.

In relation to the recommendations it was felt that no immediate action should be taken, but that the Secretary and Professor Hempel should correspond with the Chairman to find out if some specific courses of action could be decided upon. A possible solution might be to organize a series of workshops of relevant experts to tackle the various problems posed.

On the question of the 'Manual', it was noted that the Chairman had already approached Dr Sournia who had agreed to act as editor. This was welcomed and in further negotiations it was felt that the objectives and format of the manual needed careful consideration. In particular the audience at which it was aimed should be clearly defined and this might influence the choice of approach - whether to reproduce existing methodological descriptions, whether or not there was a need to enlarge in detail on some of these or whether a completely new description was preferable. It was recognized that the contents of the manual could, in fact, be closely tied up with future practical activities and a decision would have to be reached on how far it was desirable to delay publication of the manual to await further experimentation.

The Working Group was disbanded in the recognition of the need for more specialized 'follow up' activities.

WG 34 Oceanographic Basis of Ocean Monitoring and Prediction Systems:  
Mr R. R. Dickson (UK) has been appointed Chairman of the Climate Panel. The Executive Committee approved a proposal by Professor Stommel, Chairman of the Working Group, that the Climate Panel meet in October 1973 at the time of a U. S. workshop on the phenomenology of sea-surface temperature anomalies and that the theoretical panel meet at the time of the IAMAP/IAPSO Assembly in Melbourne in January 1974.

It was assumed that discussion of future "MODE" activities would take place at the January meetings in Australia which would be after a series of three related workshop meetings being planned in the U. S. A. for late 1973 on the general theme of the role of the ocean in prediction of climate.

WG 35 Methods in Quantitative Ecology of Coral Reefs: Recent activities of the group have been devoted entirely to preparations for the meeting of the group, and to intercomparison of methods. The meeting will be held on Heron Island, Australia from 2 to 10 July 1973 immediately following the Second International Symposium on Coral Reefs. This preparation has included the compilation of information on methods currently in use.

The Chairman of the group (Dr Stoddart) had sought the opinion of the Executive Committee on the most appropriate method for publishing the handbook on methods which the group expected to produce and reported that, in response to preliminary enquiries,

Springer-Verlag Limited (FRG) had shown considerable interest in the project. The Executive Committee considered that the proposed handbook on methods would be most appropriate for publication in the Unesco "monographs of oceanographic methodology" series which had already included handbooks of methods produced by other SCOR Working Groups. The Executive Committee also considered that, if a detailed report of the intercomparison of methods were to be produced, it would be appropriate for this to be published in the Unesco Technical Series.

WG 36 Coastal Upwelling Processes (with ACMRR and ACOMR): Both the physical and biological panels had met at Corvallis, U. S. A., from 26 to 29 March 1973. The report and the recommendations of the Group (Annex IV) were approved. This included approval for the next meeting of the Group to be held in Kiel, FRG. However, the Executive Committee felt that such a meeting should consider particularly the requirements of CINECA and should, preferably, be held before the CINECA meeting which would probably be held earlier than June 1974.

It was noted that the Group hoped to participate in the organization of symposia at the IUGG General Assembly in 1975 and at the Joint Oceanographic Assembly in 1976.

The Executive Committee noted that Dr Dugdale was proposing to convene an informal group on 31 May and 1 June 1973, immediately following the Second Conference on the Analysis of Upwelling Ecosystems in Marseilles, with the object of preparing recommendations for CINECA for the prosecution of an experiment-oriented programme in the North-West African upwelling region.

Working Group 36 was invited to consider carefully the report which would result from this meeting and to offer its comments and advice to the International Coordinator for CINECA with whom the Chairman of the Group should establish liaison.

WG 37 Marine Plankton and Sediments: The Executive Committee approved the proposal of the Group to convene a symposium on marine plankton and sediments in Kiel from 9 to 13 September 1974. The Chairman of WG 37, Professor Seibold, had indicated that substantial financial support might be required to meet the fares and subsistence of invited participants and members of SCOR WG 37 and to meet some of the administrative costs associated with the symposium. Towards these expenses it seemed possible that Unesco might contribute between \$3000 and \$5000 and CMG hoped to obtain some financial support from IUGS. The SCOR Executive Committee agreed that SCOR should be prepared to contribute towards the cost of the Symposium, but that it was more appropriate for the majority of participants to be supported from national funds. It was agreed, therefore, that the President of SCOR should invite appropriate national committees to support invited participants from their countries and to this end Professor Seibold should be asked to prepare the necessary letters specifying any particular contribution he expected from each invited participant. An announcement regarding the symposium is given in Annex XII.

WG 38 Special Studies on Circumpolar Waters South of 40°S (with SCAR): A progress report (Annex V) was received from the Chairman of the Group, Sir George Deacon. The proposal for the establishment of the membership of the Group was approved and it was agreed that it would be appropriate for the Group to meet in conjunction with the next meeting of WG 34, subject to the approval of SCAR. However, it was pointed out that only the Climate Panel of WG 34 would be meeting at the Workshop in late 1973 and that it would

be more useful for WG 38 to meet with the Theoretical Panel of WG 34 in Australia in January 1974.

Professor van Mieghem suggested that Professor Landsberg, President of the new WMO Commission for special applications of meteorology and climatology might be the most appropriate person to advise on how existing marine meteorological observations made by supply ships might be archived and extracted, but that a more specific statement of the requirement was necessary. It was agreed to invite the Chairman of WG 38 to communicate directly with WMO. It was also suggested that the IGOSS data collection mechanism may assist in making these marine meteorological observations all regularly available.

The Secretary of IOC reported that IOC Assembly in November 1973 would be considering the timing for the next meeting of the IOC International Coordination Group for the Southern Ocean and it seemed likely that such a meeting would be convened during 1974 or 1975. It was agreed that the Report of SCOR/SCAR WG 38 should be conveyed to the Secretary of IOC for consideration by the IOC Assembly.

WG 40 Paleo-oceanography: The membership of the group has been established and the first meeting of the group was to be held in conjunction with a CLIMAP meeting being held in Norwich, U. K. between 17 and 23 May 1973. The Executive Committee noted that this group, which would be studying vertical succession of marine sediments in different parts of the world, was of a truly interdisciplinary character and would be working towards the organization of a symposium on the subject at the Joint Oceanographic Assembly. The membership of the group is Tj. H. van Andel (USA)(Chairman), J. Imbrie (USA), H. H. Lamb (UK), A. P. Lisitzin (USSR), E. Seibold (FRG), N. J. Shackleton (UK), Y. Takayanagi (Japan).

WG 41 Morphological Mapping of the Ocean Floor (with IHB): The report and recommendations of the second meeting of the group, which had been held in Wormley U. K. on 2 and 3 April 1973, (Annex VI) were approved and it was agreed that the report be transmitted, with the endorsement of SCOR, to the Secretary of the GEBSCO Committee, IOC and IHO. The group had proposed major revisions to the style of presentation of a 1:10M bathymetric chart series and the establishment of a geoscience unit to prepare the final compilation of bathymetry for subsequent cartographic drawing, printing and distribution. The Executive Committee considered that, if the proposals of WG 41 could be put into effect, the resulting GEBSCO series would be of much greater value to marine scientists and result in closer collaboration between hydrographers and marine geologists. It was suggested that Dr Laughton might attempt to produce examples of the kind of chart that approximated to the ideal specifications for a new world bathymetric chart series, prepared by WG 41, for presentation at the meeting of the GEBSCO Committee which would be held on 5 and 6 June 1973. (The recommendations were subsequently endorsed by the GEBSCO Committee).

It was agreed that the appreciation of SCOR be expressed to Dr Ulrich for his work as Chairman of WG 41 and to accept his resignation and recommendation that he be replaced as Chairman by Dr A. S. Laughton.

WG 42 Pollution of the Baltic (with ICES): The group held its first meeting in Lund 3 to 5 May 1972 and an informal meeting in Copenhagen 30 September 1972. The next meeting will be held in Kiel 28 to 29 June 1973. A report from the chairman [Annex 0] was accepted. WG 42 had formed four ad hoc groups to examine various aspects

of the problems.

Professor Hela said that the work of the group had become more important regionally than originally had been expected, particularly in view of the plans for an intergovernmental conference which probably would result in a convention for the protection of the Baltic Sea. He was particularly appreciative of the value of SCOR involvement which brought expertise from outside the area and stimulated scientific study. The SCOR Executive assured Professor Hela of its continuing support. The group could undertake the study of many basic problems that can readily be examined in the Baltic and the baseline knowledge so acquired applied elsewhere. SCOR hoped that in due course the group might prepare experiments in which it could involve scientists from other regions. The group should also bear in mind the possible contribution ECOR could make to its work.

The terms of reference for the group were not changed although it was appreciated that at a later stage they may have to be broadened considerably.

Dr Sahrhage undertook to forward to the chairman copies of a recent GFCM (FAO) review of pollution in the Mediterranean and Mr Scott agreed to provide copies of relevant CICAR information.

WG 43 Oceanography related to GATE: Membership had been established since the SCOR General Meeting. The Group held its first meeting in Miami from 5 to 10 February 1973 and had produced a report which contained a plan for a GATE oceanographic programme. This now required some revision, but provided a basis for further planning.

The report had been presented to JOC and to TEB and had met with general approval. On behalf of SCOR, the President expressed great appreciation to the Chairman and members of the Group for the speed with which they had produced an excellent first plan.

In view of the shortage of time before the GATE, the Executive Committee had agreed to a second meeting of the Group in June 1973 to consider questions of data management and implementation of the programme. It had been realised that these questions were, perhaps, more properly the functions of other groups, but WG 43 was the most suitably qualified existing group, could work in collaboration with ISMG and IODE, and there was an urgent need to maintain the impetus.

SCOR agreed that the terms of reference be amended to read:

"To develop plans for an oceanographic programme to be associated with the GARP Atlantic Tropical Experiment and to facilitate its implementation and coordination in cooperation with ISMG and IODE".

It was felt, however, that SCOR might seek financial support for these future logistic planning activities from GARP and from the IOC Fund in Trust. The Group was asked, at its June meeting to estimate its future needs for funds for meetings and for other travel.

The report and recommendations were approved, including the addition of Mr F. Ostapoff to the membership of the group. It was agreed to publish the introduction and recommendations in SCOR Proceedings with the list of members (Annex VIII). The President was authorized to transmit the revised version of the programme for GATE oceanography, which would be produced at the June meeting, to IOC, JOC and TEB and to suggest its

publication in the GARP or GATE series.

WG 44 Tropospheric Transport of Pollutants (with ACOMR and IAMAP): The President reported that he had corresponded with the other sponsoring organizations regarding the establishment of this group but, whilst a number of names had been suggested, no firm action had yet been taken. The Executive Committee agreed that, now that the first meeting of the IOC ICG for GIPME had been held, it was desirable to initiate the work of WG 44 without delay.

It was agreed that the President should invite Dr B. Bolin to accept the Chairmanship of this group and to discuss with him and with Professor Monin, as Executive Committee reporter for this group, the names that had already been suggested with a view to establishing the membership at an early date. It was noted that CNRS would be promoting a symposium on an allied topic, Chemistry of Sea-Air Particulate Exchange Processes, in Nice, from 4 to 10 October 1973.

WG 45 Marine Pollution Research (with ACMRR, ACOMR, ECOR and ICES): The Chairman, Dr G. F. Humphrey, reported on the first meeting of the group which had been held in London on 30 March 1973. It was noted that ACOMR had not yet nominated a member for the group and, until such time as they did, papers should be sent to Professor van Mieghem as Chairman of ACOMR with copies to the Secretary General of WMO. The first meeting of the group had discussed its functions and terms of reference and particularly how best it could serve as a link between the relevant working groups of its various sponsors and the IOC ICG for GIPME. It was emphasized that Working Group 45 had been formed to bring together the activities in this field of the advisory bodies to IOC, and of ICES, but not of the U. N. agencies.

The Executive Committee agreed, that, except on matters of policy, it would be appropriate for WG 45 to act as the link between the sponsoring organizations and the ICG for GIPME and, with this in view, it was agreed to add to the second term of reference for Working Group 45:

"To assist in the identification of the research needs of GIPME".

Communication with IOC should continue to be through the Executive Committee.

The Chairman expected that the group would continue its work by correspondence over the next 12 months and could not foresee a need for a meeting in that time. However, he had noted that the ICG for GIPME had asked WG 45 to consider how to encourage research on processes of microbiological degradation and synthesis of pollutants and he would initiate correspondence among the members of his group on these topics.

WG 46 River Inputs to Ocean Systems (with ECOR, IASH, ACMRR and UNESCO): Establishment of this group had been deferred pending the analysis by a consultant appointed by IOC, Dr D. Eisma, of the replies that had been received to an IOC questionnaire on ongoing programmes of river studies. The preliminary analysis had now been completed and it was considered appropriate to initiate the new SCOR WG 46. It was agreed that Dr Eisma should be a member and it was noted that Unesco had already nominated Dr J. da Costa as its representative.

Again a number of names had been proposed for membership and the Executive Committee agreed that Professor D. Lal be invited to serve as Chairman of the Group and to discuss with the President and Dr T. F. Gaskell, the composition of the Group. However, as Professor W. S. Wooster was in direct communication with Professor Lal, it was agreed that it would be appropriate for him to convey the invitation to Professor Lal and to discuss with him matters concerning the initial membership of the Group on behalf of the President.

### 3.0 RELATION WITH INTERGOVERNMENTAL ORGANIZATIONS

#### 3.1 ADVISORY MATTERS CONCERNING UNESCO AND IOC

At the invitation of the President, Dr M. Steyaert, acting chief of the Unesco Division of Oceanography, presented a paper in which he drew to the attention of SCOR the history of cooperation between SCOR and Unesco but pointing out that, since the administrative separation of IOC from the Office of Oceanography, the Unesco Division had determined four main categories for its future activities. Support for joint working groups, the development of methods and techniques, and exchange of information will continue but Unesco was now anxious to seek advice and cooperation from SCOR in strengthening regional, and inter-regional cooperation in marine science. He was anxious, therefore, that SCOR give early consideration to ways in which it could advise on and, perhaps participate in the development of a network of regional collaborative research programmes, each of which would possibly be a limited topic of relevance to the region; perhaps regional research centres should also be considered.

The continuation of assistance to member states in improving their scientific research capability provides some basis on which to design future regional studies but it would seem advisable to concentrate assistance in fields of study which would subsequently be of interest to other countries in the area.

UNESCO had been working towards this end since 1971 and was concentrating its attention on Asia, South East Asia and Latin America where it was felt that regional programmes could be developed in the foreseeable future. In particular three projects had been identified as an initial phase which could lead to more comprehensive programmes in Asia and South East Asia and preparations for putting these into effect were well advanced. The three projects were -

1. The establishment of a Research Centre on Tropical Marine Planktology within the Indian Ocean Biological Centre at Cochin, India.
2. The establishment of a Research Centre on Mangrove Ecology and Productivity at the Phuket Marine Biological Centre in Thailand.
3. The establishment of an international centre ("The Rumphius Laboratory") within the Indonesian Marine Research Institute at Ambon Island.

SCOR welcomed the UNESCO request for advice, assistance and participation in regional programmes but it was difficult at this stage to see exactly how this might be effected, particularly since SCOR did not feel that, as an international organization, it should become involved in advising on individual laboratory programmes that were not clearly identified as the foundation of a regional collaborative investigation.

There were suggestions that SCOR might form a special advisory group or might select reporters to visit the various centres and maintain continuing contact with them.

The more immediate task for SCOR was to offer comments on the three particular projects now being developed by UNESCO and R. I. Currie, G. Hempel, G. F. Humphrey and W. S. Wooster were invited to consider these proposals carefully and send their comments directly to the Director of the Unesco Division of Oceanography.

The broader issues of ways in which SCOR could help with the UNESCO programme, and the related interests of the IOC WG on Training Education and Mutual Assistance, required careful preparation and further consideration and it was felt that the next SCOR Executive Meeting should be extended to allow a full day for discussion.

Dr O. Tandberg (Sweden) accepted an invitation to serve as convener in collaboration with the President and Secretary, and to prepare and organize such a session which should be designed to identify the role of SCOR in relation to Unesco and IOC programmes of promotion of marine science in developing countries. Dr Tandberg was asked to seek the collaboration of other appropriate ICSU organizations and of FAO/A CMRR.

Suggestions on how such a meeting might be organized, in order to produce detailed recommendations for consideration by the SCOR Executive, should be sent to Dr Tandberg.

Professor J. E. G. Raymont had represented SCOR at a meeting of the IOC WG on Training Education and Mutual Assistance [TEMA] and had suggested that SCOR might help by (1) identifying marine scientists who would give lecture courses, (2) finding shipboard facilities for training personnel, (3) involving more scientists from developing countries in Working Groups.

Professor Hempel who had been chairman of the IOC WG TEMA, felt that one important requirement was for a good Directory of Marine Institutions and Directory of Training Courses and another was to provide high level training in the region.

Other suggestions included the holding of SCOR WG meetings in developing countries and encouraging National Academies and/or IOC and UNESCO to provide funds to extend WG participants' visits so that they might give a series of lectures before returning home.

Dr Steyaert reported that UNESCO had agreed to assist financially with the mounting of a Marine Science Symposium in Hong Kong in November 1973, being organized under the auspices of the Pacific Science Association, and that the organizers had issued a second circular announcing the symposium but were still anxious to obtain advice on the programme. SCOR Executive indicated its willingness to suggest appropriate experts to advise the organizers, if so requested and if given details of the regional problems it was hoped to discuss.

Mr Scott reported that IOC had been following up some of the recommendations of the 1971 Geoscience Workshop in Honolulu (see SCOR Proceedings, Vol. 8, No. 1 Annex XIV) and in particular had been discussing relationships with the ECAFE Committees for Coordination of Joint Prospecting for Mineral Resources in Offshore Areas (CCOP) in East Asia (EA) and in the South Pacific (SOPAC).

A project being planned by member countries of the CCOP/EA to investigate Metallogenesis and the Tectonic Pattern of East and Southeast Asia, has been proposed as an IDOE project. An IDOE workshop, sponsored by CCOP/EA and IOC, for about 40 specialists, is to be held in Bangkok in September 1973 with Dr J. A. Katili as Project Coordinator and Dr C. Y. Li (Secretary, CCOP/EA) as local organizer. SCOR and CMG were willing to offer advice on the scientific programme and would be pleased to review the report of the meeting. [The Chairman of CMG subsequently suggested that Dr F. Gray, a member of the organizing committee, might represent SCOR's interests and bring to the notice of SCOR areas in which SCOR assistance would be appreciated. This recommendation was accepted by the President.]

Plans for considering future activity in the Southwest Pacific, possibly in conjunction with CCOP/SOPAC were not so far advanced although representatives of IOC and SCOR had discussed with Mr J. Brodie a suggestion that activity might be promoted under IDOE. CCOP/SOPAC had so far held only one meeting but it was apparent that possibilities existed for collaboration in marine geoscience investigations in the area.

SCOR had been represented at the second meeting of the IOC Executive Council [IOC - EC II] Paris 7 to 12 May 1973 by Professor Postma (part time only), Professor Wooster and Dr Voigt.

Much of the meeting had been devoted to discussions on the rationalization and restructuring of IOC. On the question of relationships with the advisory bodies there had been some criticism of the fact that many of the scientific problems identified by IOC had resulted in action by SCOR, and other advisory bodies, which had not always entirely provided solutions required by IOC. In many cases this was because IOC requests were not identified in sufficiently precise terms. One suggestion at IOC - EC II was that in future all scientific problems should be apportioned to subsidiary bodies of IOC who could then seek specific scientific advice from the advisory bodies if required.

The SCOR Executive Committee considered various mechanisms for ensuring adequate guidance from IOC and UNESCO on the specific topics they wished to be considered by SCOR and it was concluded that such liaison should continue to be through the SCOR Executive. When IOC or UNESCO identified a scientific problem it was the responsibility of SCOR, and other advisory bodies, to formulate effective and feasible terms of reference for their Working Groups. In cases where it was felt that insufficient attention was being given to a specific aspect of the problem, the eight monthly meetings of the SCOR Executive provided ample opportunity for IOC or UNESCO to register their concern.

The Secretary of IOC drew SCOR's attention to the proposal to form a new IOC Working Committee on Ocean Scientific Policy (which might be renamed Working Committee on Ocean Science), the terms of reference for which would be considered at the IOC Assembly in November. He believed the scientific advisory bodies should be closely involved in the group charged with drawing up general policy for this Working Committee. IOC - EC II had encouraged SCOR to continue its efforts to plan and implement a programme of oceanography related to GATE [see item 2 WG 43] and to develop an oceanographic contribution to FGGE [see item 3.2].

IOC - EC II had agreed to convene an 'ad hoc' group, to meet from 9 to 13 July 1973 just before the ICG for CICAR in Cartagena, Colombia to consider the achievements of CICAR and the value of the programme to the countries involved with a view to using the

findings as the basis for planning future collaborative exercises (however, it had been felt that in future these should be more problem-orientated than regional multi-discipline activities) and also to provide a basis for future collaboration in the Caribbean after the end of CICAR. It was proposed that the group be formed of representatives of four of the countries involved in CICAR and three advisory bodies.

SCOR did not feel able to formulate an opinion on the value of CICAR in the time available but did feel that it might be useful for the group to be assured of the presence of at least one person who had been active in the programme but who had expressed constructive criticism of it. It was suggested that SCOR might nominate Professor H. J. MacGillavry, although it should be understood that no official SCOR viewpoint would be expressed. It was understood that FAO was already considering the need for a Regional Fisheries body and it was suggested that this might form the basis for an expanded body to cover all disciplines.

ACMRR was asked to report to the ad hoc group on proposals for future activity in fisheries and also the broad aspects of marine biology and ACOMR on meteorology and physical oceanography.

In considering the report of the International Co-ordination Group for Global Investigation of Pollution in the Marine Environment [ICG for GIPME] 2 to 6 April 1973, at which SCOR had been represented by Dr G. F. Humphrey, Chairman of WG 45, no reference was made by IOC - EC II to SCOR or the other advisory bodies.

IOC - EC II had taken note that the ICG/GIPME was making slow progress towards the development of a sound scientific strategy and a comprehensive plan for the implementation of GIPME and had requested the Secretary of IOC, with the assistance of ICSPRO agencies to collect background information and to present suggestions related to a strategy and plan for consideration by the next meeting of ICG/GIPME, probably early in 1974. The Secretary of IOC said that he would value advice and assistance from SCOR which the Executive Committee readily agreed to provide, when requested.

IOC had decided that at its Assembly in November 1973 there should be at least one full day of presentations on scientific topics, in addition to the Anton Brunn lectures. Mr Scott reported on the suggestions so far offered and invited ideas from SCOR.

There was general agreement that the Anton Brunn lectures might appropriately concentrate on the Tropical Atlantic, emphasising the developments since ICITA. Possible contributors were K. Voigt and K. Fedorov, other suggestions, particularly of young scientists who could present material interesting to the government representatives at IOC, should be forwarded to Mr Scott.

For the presentations, it was agreed that various aspects of GARP and FGGE particularly the second GARP objective and the development of buoy systems, would be most opportune and a popular review of Mediterranean geology and CIM achievements would be interesting. It was hoped that a substantial proportion of time would be allowed for discussion. The Chairman and Vice Chairman of JOC for GARP and the International Coordinator for CIM would be the most appropriate people to suggest speakers but other suggestions would be welcomed.

### 3.2 FAO

#### International Directory of Marine Scientists

Dr Sahrhage presented examples of a form which FAO invited scientists to complete as the basis for the FAO Register of Experts in Aquatic Science and Fisheries and another, more recent, supplementary form for a Register of Pollution Experts. The FAO expert register used a variety of sources for information which included the scientific literature for the names of authors of published papers. The register was felt to be fully detailed so far as fisheries biology was concerned but nevertheless a high proportion of the 12 000 or so entries were chemists, physicists and geologists and FAO would appreciate assistance from SCOR in designing forms for scientists in these subjects. FAO felt that given this additional detail their integrated computer based information system on aquatic science could be used as the basis for a variety of requirements that had been identified, i. e.

1. Their own requirement for registers of experts in specific disciplines.
2. The International Directory of Marine Scientists.
3. Register of Research Institutions )
4. Register of training activities ) TEMA requirements

After discussion, the Executive Committee recognized these various needs but felt that such a comprehensive system would be difficult to achieve within a reasonable time and there was an urgent need for a new directory listing only names of scientists, their laboratories and descriptors with a name and subject index. Entries should conform to criteria such as those proposed by SCOR for the 1968 Directory; this implied some filter such as National Committees and/or IOC adhering committees. It was agreed that it should be possible to devise a simple form for the requirements of the Directory, which should include a subject classification, or list of possible descriptors, which could conveniently be based on a list produced by the United Kingdom for their own national directory.

There is a need for a Directory to be produced cheaply and at regular intervals. It was not considered wise at this stage to try to combine all the requirements into one comprehensive system. It was agreed that the Secretary of SCOR should convene an 'ad hoc' group during 1973 to prepare proposals for compiling information for a new Directory bearing in mind the three basic requirements stated above and to prepare a subject classification, preferably a shortened form of the UK list. Such a group should include in addition to the Secretary of SCOR, other invited specialists and representatives of IOC UNESCO FAO and ICES and Secretaries of those National Committees which had experience of the problems of producing directories (viz. USA and UK).

It was felt that the IOC-TEMA group had not identified sufficiently clearly its requirements for Registers of Research Institutions and Training courses and it might be suggested that it do so at a future meeting but Professor Hempel and Dr Humphrey were asked to consider this matter and to propose a list of possible questions which might be addressed to institutions so the 'ad hoc' Directory Group and FAO could bear these requirements in mind in their deliberations.

### 3.3 WMO/ICSU GLOBAL ATMOSPHERIC RESEARCH PROGRAMME (GARP)

An informal meeting of a small group of oceanographers (T. Barnett, H. Charnock, A. Gill, K. Hasselmann, C. Mann, H. Stommel) was held on 13 March 1973 just prior to the meeting of JOC to discuss means of activating an oceanographic programme related to the goals of GARP, particularly with respect to FGGE. The group had made a number of recommendations which, subsequently, had been adopted by JOC (See Annex X). These recommendations proposed that the development of an international oceanographic GARP programme should be the responsibility of a SCOR Working Group established specifically for the purpose but that, apart perhaps from the Chairman, nomination of members to this SCOR Working Group could await the IAPSO/IAMAP Assembly in Melbourne in January 1974, during which Assembly provision should be made for a discussion of an oceanographic programme within the global experiment. It was also recommended that an oceanographer should be invited as consultant to the JPS and that a review article of the potentialities of the Global Experiment, and GARP generally, for oceanographic studies should be prepared for publication in a widely read journal. Professors Stommel and Charnock agreed to undertake this task.

The SCOR Executive Committee was in full agreement with the recommendations and, noting also that the IOC Executive Council had requested the scientific advisory bodies, including SCOR, to take under consideration and propose an oceanographic programme for FGGE, decided to establish a working group as requested: WG 47, Oceanographic Programmes during FGGE. It was agreed that it would be desirable for a Chairman to be appointed soon so that he could acquaint himself with the various related meetings during 1973, but that the establishment of the remainder of the membership could be deferred until the Melbourne meetings in January 1974. The Executive Committee, noting that the JOC request to SCOR for assistance was particularly related to the second GARP objective for longer term forecasts which required an improved understanding of processes affecting sea surface conditions and the identification of ocean areas for intensive study during FGGE, decided to invite WG 34 to consider the requirements and to prepare recommendations for the new SCOR Working Group (WG 47).

Professor W. S. Wooster agreed to serve as Executive Committee reporter for the new group and to propose, for appointment by the President, a Chairman for the Group.

Professor van Mieghem undertook to explore with WMO the possibilities for ACOMR collaboration in the new group.

It was noted that, at its meeting in Melbourne in January 1974, immediately before the IAMAP/IAPSO Assemblies, JOC intended to reserve one day for joint discussions with oceanographers.

#### Buoys

WMO/IOC/SCOR and SCAR had agreed to convene a small informal planning meeting to be held in Paris from 12 to 16 June 1973 on 'buoy systems for use during FGGE'. This small meeting was expected to identify the various problems concerned with planning programmes for the utilization of inexpensive expendable drifting buoys and to prepare for a larger ad hoc working group that was to be convened in accordance with a request from the first FGGE planning conference.

## 4.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

### 4.1 ICSU

Following a suggestion at the General Meeting (see SCOR Proceedings Vol. 8, No. 2, p. 66) ICSU transmitted its resolution concerning freedom for scientific research at sea (Annex XIV) to the Ocean Economics and Technology Branch of the United Nations and it had since been distributed as a document of Subcommittee III (Pollution and Scientific Research) of the UN Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the limits of National Jurisdiction.

It was agreed that the President and/or one or both of the Vice Presidents should represent SCOR at the meeting of the ICSU General Committee in Leningrad 20/21 September 1973.

Noting that Dr K. Voigt wished to resign as SCOR representative on the ICSU Panel on WDC's it was agreed to invite Dr J. Crease (UK) to accept this responsibility. As this was a joint SCOR/IAPSO appointment. Professor Lacombe President of IAPSO agreed on behalf of his Association.

### 4.2 IAPSO

Professor Lacombe, President of IAPSO, reported on the future plans of IAPSO. He expected that a final programme for the IAPSO joint scientific assembly with IAMAP in Melbourne from 14 to 25 January would be available shortly. This programme would be concerned mainly with joint symposia with IAMAP on air-sea interaction topics and some special IAPSO sessions on waves.

IAPSO had already determined a number of topics that would provide joint symposia with other Associations of IUGG to be held as part of the IUGG General Assembly in Grenoble August/September 1975 and IAPSO would be participating in the Joint Oceanographic Assembly in 1976.

In response to a request from IAPSO for a contribution of \$2000 from SCOR to aid participation in the Melbourne meeting, it was agreed that this request be considered further by the President when details of the requirements for support became available but the President should at the same time bear in mind other support from SCOR funds that would be required for meetings in Australia at that time.

### 4.3 IABO

IABO has recently formed two new working groups with ACMRR

1. on ecological indices for measuring the state of living resources as effected by environmental stresses. The chairman of this group is Dr H. Regier (Canada) and if funds can be found it is hoped that the membership will be completed and the first meeting held early in 1974.
2. on biological effects of pollutants. chairman Dr J. B. Sprague (Canada).

The SCOR Executive Committee advised that terms of reference for these two groups should be drawn up with great care to ensure that their functions are separately

identified and hoped that a more specific title for the first would be found. The two groups should also take account of other related activities,

- e. g. The Oslo Commission WG on Toxicity  
The WHO programme on sub lethal effects of pollutants on marine animals  
Ideas being developed by ACMRR for a seminar on bioassay and toxicity testing  
and for a seminar on bioaccumulators.

Professor Hempel, President of IABO, reported the growing need for accurate abundance estimate of micronekton (krill etc) and the need for fast development of catching methods. He expected that by the next SCOR Executive Committee meeting IABO will have developed proposals for a number of new working groups some of which might appropriately be formed under SCOR auspices. Dr Sahrhage expressed the interest of ACMRR in the micronekton problem and its wish to be associated with such a Working Group if established.

In a report on preparations for the International Symposium on Coral Reefs to be held aboard MV Marco Polo along the Great Barrier Reef from 22 June to 2 July 1973. Dr Stoddart had again raised the question of the future position within IABO of the present continuing Committee for Coral Reef Symposia which, at its meeting in 1971 IABO had agreed to accept within its framework. Professor Hempel explained that IABO had not yet resolved how best to provide a permanent structure for this and other topics (viz. mangroves, soft bottom benthos) which required continuing international action for which joint working groups with SCOR or ACMRR were not appropriate. He suggested that Dr Stoddart be invited to report to the Continuing Committee at the 1973 Symposium that, appreciating the need for future coral reef symposia to be organized within the ICSU marine science framework, and preferably within IABO, IABO was considering the most appropriate structure for a permanent committee and would be glad if the Continuing Committee would remain in being until the form for its incorporation into IABO had been determined.

#### 4.4 CMG

The Chairman of CMG, Dr T. F. Gaskell reported on the progress with planning of a number of symposia as listed in the report on CMG activities in SCOR Proceedings, Vol. 8 No. 2; many of these were proposed at the 1971 Geoscience Workshop.

He reported also on collaboration with other international organizations. IAPSO had agreed that CMG was the appropriate body to sponsor discussions on deep sea drilling and, with ICG, discussions on plate tectonics. CMG will collaborate with CCOP, ECOR and SCAR in organizing the symposia at the Geological Congress 1975 which relate to the interests of these organizations.

The next meeting of CMG will be held at the time of 'Interocean 73' in Dusseldorf in November 1973

#### 4.5 COSPAR

SCOR had arranged the following contributions to the COSPAR Symposium on 'The Use of Remote Sensing Techniques for Earth Survey Problems', Konstanz, 23 May to 5 June 1973,

Dr D. E. Cartwright, Prospects for Physical Oceanography from Space

Dr J. Joseph and Dr M. R. Stevenson, Possible Uses of Remote Sensing Techniques in Fishery Research and Commercial Fisheries

Another paper of interest to oceanographers was

Dr G. A. Maul, Applications of ERTS Data to Oceanography and the Marine Environment

#### 4.6 INTER-UNION COMMISSION ON GEODYNAMICS

SCOR has notified the Inter-Union Commission on Geodynamics that it looks on CMG as its point of contact with the Commission and does not believe there is any necessity for SCOR to nominate a separate representative.

#### 4.7 SCOPE

Dr G. F. Humphrey agreed to serve as SCOR representative on SCOPE, replacing Professor W. S. Wooster who had expressed the wish to resign.

### 5.0 FUTURE MEETINGS

#### 5.1 JOINT OCEANOGRAPHIC ASSEMBLY

A meeting of the steering committee was held with the chairman, Professor W. S. Wooster, presiding. The report of the meeting is given in Annex XI

It was agreed to accept the United Kingdom proposal that the Assembly be held in Edinburgh from 13 to 24 September 1976.

Mr D. P. D. Scott was invited to serve as chairman of the Logistics Committee and to convene a meeting prior to the IOC Assembly in November 1973.

#### 5.2 SCOR/SCAR POLAR OCEANS CONFERENCE

The Conference will be held in Montreal from 6 to 11 May 1974. A first announcement was issued by the Convener of the Steering Committee, Professor M. J. Dunbar, in January 1973 and a second circular and call for papers were about to be issued (Annex XII).

It was reported that there was a likelihood that the newly formed SCAR Subcommittee on Antarctic Marine Biological Resources would meet at the time of the Conference.

Further consideration was given to the desirability of convening, at the time of the conference, a joint meeting of representatives of SCOR, SCAR, IOC, WMO, FAO, ICES and other international organizations that had interests in promoting the study of different aspects of the polar oceans in order to attempt to coordinate plans and future activities. It was agreed, however, that it might be preferable to defer such consultation until such

time as the need for a meeting had been more clearly defined and specific problems raised. Such a requirement might become apparent at the SCOR/SCAR conference or at the next meeting of the IOC ICG for the Southern Oceans. Meanwhile the different international organizations should continue to collaborate with each other and to this end Professor Dunbar should be asked to ensure that the interested intergovernmental organizations received invitations to participate in the Montreal conference.

### 5.3 18th MEETING OF EXECUTIVE COMMITTEE

After consideration of various possible locations for the Eighteenth meeting, due to be held in January 1974, the Executive Committee decided to accept an invitation from the Australian Academy of Science to meet in Canberra after the IAMAP/IAPSO joint assembly in Melbourne. Australia was preferred because of the importance at that time of reaching decisions about oceanographic programmes related to FGGE, future MODE experiments etc and the fact that many appropriate scientists would, in any case, be in Australia.

It was realised that four SCOR Working Groups were scheduled to meet at that time and in order that there should be no conflict with the IAMAP/IAPSO sessions it was felt that it would be convenient for WGs 34, 38 and 47 to hold their meetings after the Assembly and these might be held in Canberra from 28 January 1974 and be followed by the Executive Committee meeting at which an extra day was to be allowed to discuss possible SCOR contributions to the IOC and Unesco programmes of training and education in developing countries.

National Committees were reminded that they are welcome to send representatives to Executive Committee meetings and the hope was expressed that many would do so in January 1974.

### 5.4 ELEVENTH GENERAL MEETING

The Eleventh General Meeting is due to be held in September 1974. It was agreed that as the Tenth meeting had been, and the Twelfth (1976) meeting would be, held in Europe the 1974 meeting should be elsewhere.

Suggestions for possible locations and scientific topics should be sent to the Secretary. The Executive Committee should decide on the scientific topic by correspondence before the end of 1973.

### 5.5 FUTURE MEETINGS

Professor Simpson mentioned that South Africa would like to act as host to a SCOR Executive meeting at some appropriate and convenient time in the future. Sweden and GDR also offered facilities for future meetings. A list of some future meetings of SCOR and associated organizations is given in Annex XVI.

## 17TH SCOR EXECUTIVE MEETING

Texel, Holland  
14 to 17 May 1973

## List of Participants

## MEMBERS OF THE EXECUTIVE COMMITTEE

Professor Dr H. Postma	(Netherlands)	President
Professor Warren S. Wooster	(USA)	Past President
Dr Klaus Voigt	(GDR)	Vice President
Mr R. I. Currie	(UK)	Secretary
Dr T. F. Gaskell	(IUGS/CMG)	Ex Officio
Professor Dr G. Hempel	(IUBS/IABO)	Ex Officio
Professor H. Lacombe	(IUGG/IAPSO)	Ex Officio

## OTHER PARTICIPANTS

Dr Luis Capurro (Argentine - IOC)  
 Professor H. Charnock (UK)  
 \* Professor Dr I. Hela (Finland)  
 Mr G. E. Hemmen (UK - SCAR)  
 Ir G. A. Heyning (ECOR)  
 \* Dr G. F. Humphrey (Australia)  
 Dr G. Kostjanov (WMO)  
 Professor J. M. van Mieghem (WMO)  
 Dr E. Miles (USA)  
 Dr D. Sahrhage (FAO)  
 Mr D. P. D. Scott (IOC)  
 \* Professor Dr G. Siedler (WG 43)  
 \* Professor E. S. W. Simpson (South Africa)  
 Dr M. Steyaert (UNESCO)  
 \* Dr Olof Tandberg (Sweden)  
 Dr H. Tambs-Lyche (ICES)  
 Mr P. J. van der Westhuizen (South Africa)

\* SCOR Members

STATEMENT OF SCOR FINANCES  
(1 January through 31 December 1972)

<u>BALANCE AS OF 1 JANUARY 1972</u>	<u>\$</u>
In Rome	2 819.23
In La Jolla	<u>26 963.34</u>
\$219.23 in Indian Rupees	29 782.57

INCOME

National Contributions	31 858.29	
UNESCO Contracts	10 000.00	
Savings Account, Interest	<u>1 228.05</u>	
		<u>43 086.34</u>
		72 868.91

EXPENSES

Office		5 487.40
Publication		668.99
Working Groups		
10	1 086.00	
15	5 029.12	
21	3 342.44	
23	8 823.65	
29	4 635.79	
33	26.80	
37	3 360.45	
40	406.00	
41	581.21	
42	<u>997.45</u>	
		28 288.91
Executive Expenses		1 616.49
Representatives, Other Meetings		4 164.96
Support, ICES Symposium		500.00
Support, IAPSO Symposium		1 000.00
Support, N. Z. Data Conference		<u>500.00</u>
Total Expenses		42 226.75

BALANCE AS OF 31 DECEMBER 1972

In Paris	1 219.23 *
In La Jolla	<u>29 422.93</u>
	<u>\$30 642.16</u>

\*\$219.23 in Indian Rupees

ESTIMATE OF SCOR FINANCES  
1 January - 30 April 1973

<u>INCOME</u>	\$
Balance 1/1/73	30 642
National contributions	14 800
Interest on Savings Account	244
FAO Contract re. WG 36	1 200
UNESCO 3rd Contract 1972 final	2 000
UNESCO 3rd Contract 1973 first	4 000
	<u>\$ 52 886</u>
<u>EXPENDITURE</u>	\$
Working Groups	
WG 10	2 367
WG 15	4
WG 21	948
WG 23	341
WG 35	774
WG 36	7 200
WG 40	2 879
WG 41	2 664
WG 43	4 383
WG 45	1 876
	<u>23 428</u>
<u>REPRESENTATION</u>	
SCOPE and IOC-WG	271
TEB	286
IOC-EC II	197
	<u>754</u>
Polar Oceans Conference - advance	1 000
Executive Committee meeting	653
Office	379
Publication	774
	<u>26 988</u>
Losses on exchange - net	109
Balance in hand 30/4/73	25 789
	<u>\$ 52 886</u>
<u>BALANCE AS OF 30 April 1973</u>	
La Jolla	16 140
Paris	8 345 *
London	1 304
	<u>\$ 25 789</u>

\*\$219.23 in Indian Rupees

**REPORT OF THE FIRST MEETING OF SCOR WORKING GROUP 36  
ON COASTAL UPWELLING PROCESSES**

SCOR WG 36 met at the School of Oceanography, Oregon State University, Corvallis, 26 - 29 March 1973. The following members of WG 36 attended the meeting:

Dr K. N. Fedorov (USSR), Chairman  
 Dr R. C. Dugdale (USA), Chairman of the Biological Panel  
 Dr K. Yoshida (Japan), Chairman of the Physical Panel  
 Dr G. Hempel (FRG)  
 Dr H. Minas (France)  
 Dr E. Mittelstaedt (FRG)  
 Dr B. Saint-Guilly (France)  
 Dr R. L. Smith (USA)  
 (Dr D. H. Cushing [UK], Dr R. Margalef [Spain], Dr D. Nehring [GDR],  
 and Dr Y. I. Sorokin [USSR] were unable to attend.)

Observers participating in the discussions of the Working Group were:  
 Dr R. T. Barber (Duke University), Dr D. Halpern (NOAA), Dr C. N. K. Mooers  
 (University of Miami), Dr J. J. O'Brien (Florida State University) and Dr L. F. Small  
 (Oregon State University).

Professor H. Charnock (UK) was invited to attend as a representative for ACOMR, but was unable to do so.

The tentative agenda circulated prior to the meeting provided the necessary guidelines for the discussions. The Working Group met partly in plenary session and partly in two panels. The discussions centered around the following major items:

#### General meeting

- (i) Exchange of general information on observational and theoretical studies on coastal upwelling.
- (ii) Implications of Coastal Upwelling Experiment (CUE) and other observational results for further upwelling studies.
- (iii) Implications of existing theoretical models for the planning and methodology of upwelling studies.
- (iv) Physical\* information required for biological and fisheries investigations, particularly of a prognostic value.
- (v) Optimum ways of combining physical, chemical, and biological studies.

#### Physical panel

- (i) Review of past activities of the panel and the preparation of bibliography of recent work in the physical oceanography of coastal upwelling.

- (ii) Discussion of the field observational work and instrumentation.
  - a. the measurement in the near surface (Ekman) layer made in CUE-1.
  - b. direct measurements of vertical velocity made in "Auftrieb 1972" and in CUE-1.
  - c. the measurements made with profiling current meters.
- (iii) Review of theoretical modeling
  - a. success of two-dimensional two-layer models with simple topography in predicting the time scales for the onset of upwelling and the spatial scales for width of upwelling.
  - b. the necessity for developing 3-dimensional, time dependent models with realistic topographies.

\* Term "physical" includes "meteorological".

#### Biological panel

- (i) Biological categories of upwelling systems.
- (ii) Intensity of primary production and herbivore feeding in relation to environmental factors and community structure.
- (iii) Horizontal processes in relation to upwelling intensity, tongues, patches and fronts.
- (iv) Vertical processes related to nutrient supply, phytoplankton re-seeding and zooplankton migrations.
- (v) Biological coupling between shelf cells and off-shore cells (at the continental slope).
- (vi) Coordination with physical oceanography; international coordination.

The following report was prepared by the Working Group.

#### 1. Introduction

Following the extensive exchange of information on the most recent results of coastal upwelling studies (CINECA, CUE-1, Peru upwelling) and on the outcome of recent theoretical analyses, the Group summarized the present understanding of coastal upwelling as follows:

##### A) Physical Aspects:

There are well known areas in the ocean where climatological coastal upwelling is occurring on a quasi-permanent basis. Superimposed upon it there are intermittent intensive upwelling events which attract more and more attention from physical oceanographers, marine chemists and biologists.

The dynamics of a quasi-steady state upwelling in a geometrically and topographically simple coastal region under stationary wind conditions is now relatively well understood.

It is much less clear what effects on upwelling (e. g. , patchiness) are to be expected from irregularities of the bottom topography and of the coastline in conjunction with variable wind conditions.

The scale of upwelling in a stratified ocean being essentially determined by the baroclinic Rossby radius of deformation, there should be, and there apparently are, important physical differences between some features of coastal upwellings in the areas of different latitudes, different bottom topography and different stratification.

It now seems to be realized that the offshore width of intensive upwelling zones seldom exceeds 10 - 30 km and the associated Ekman layer is of the order of 10 - 20 m in contrast with the common textbook opinion of 100 km and 100 m scales, respectively.

The longshore jet-like current in the direction of the upwelling producing wind seems to be an inherent feature of the upwelling phenomenon. This view is supported by both theory and observations.

The subsurface countercurrent observed in the upwelling zones is a very important factor both in the dynamics of upwelling and in the associated ecosystem. Physical explanation of this countercurrent may require taking into account longshore variations of wind and pressure (sea level), necessitating three-dimensional theoretical models.

The upwelling phenomenon, being essentially three-dimensional and time-dependent, requires a three-dimensional and time-dependent pattern of observation.

#### B) Biological Aspects:

Amongst marine ecosystems those of the upwelling areas stand out for their high productivity and comparatively simple food web structure. Certain parts of upwelling areas have a primary productivity which exceeds neighboring areas by a factor of 10 or more. Fishing yields per hectare in upwelling areas and their immediate vicinity are at least thousand-fold higher than in oceanic areas. Upwelling ecosystems consist of rather few species and trophic levels, primary producers and herbivores being of

relatively large size. Those ecosystems are liable to produce high fishing yields but they are regarded as less stable compared to other systems. The factors controlling primary and secondary production in upwelling ecosystems are not well known.

The biological effects of upwelling reach far beyond the upwelling proper and influence the productivity of rather wide ocean areas, particularly at higher trophic levels.

Between major upwelling areas, considerable differences exist in primary production but even more in secondary production, ecosystem structure and in fishery resources. The continuity, intensity and geographical extent of upwelling govern these biological differences.

The conventional view of upwelling as bands of nutrient and phytoplankton rich water parallel to the coast has been modified by recent observations, experimentation and the development of computer simulation models. In this new concept, still hypothetical in some respects, production is considered to occur most strongly in discrete relatively stable tongues, communicating through subsurface counter currents. The

tongues provide the sites for transfer with high efficiency of organic matter to higher trophic levels.

Upwelling can be considered as occurring at a series of scales, from the local divergence produced by longshore currents passing capes and submarine canyons, to stronger upwelling producing well-defined tongues, and finally to the strongest upwelling in which broad bands of upwelling are found, with much lower productivity. In the latter case nutrient rich water is not conditioned for phytoplankton growth and moves rapidly toward the shelf break and sinks carrying unused nutrients out of the photic zone. In this sense the coastal upwelling ecosystem now appears as more closed than was previously thought. The intermediate upwelling intensity results in the most intense rates of primary production. Intermittency of upwelling is thought to result in the formation of unattached patches. Under these conditions the transfer sites may be extended further offshore and be more diffuse.

## 2. Concepts of future investigations

### Section A. Physical Oceanography

#### Winds

From theoretical considerations the primary driving mechanism of coastal upwelling is the wind stress at the sea surface. Further ocean-atmosphere boundary studies are recommended to determine the relationship between wind speed and wind stress under variable atmospheric and surface conditions, especially at high wind speeds. The temporal and spatial variations of the wind stress near a coastline are poorly known, and their effects on the coastal upwelling circulation need to be better understood. Wind measurements from ships are clearly not sufficient and should be supplemented by meteorological buoys and coastal anemometers. The predictive quality of any theoretical model will depend critically upon the accuracy and resolution of our wind measurements.

#### Horizontal field of motion

Upwelling is such a complex phenomenon that it requires many different approaches and measurement techniques for monitoring the same processes. Therefore, both Eulerian and Lagrangian measurements are necessary. Any planning of current measurements should be made with due regard to bottom topography of the shelf and slope in the area of investigations. It is suspected that underwater canyons and banks have particularly strong influence on the upwelling patterns. During the active upwelling phase, particular attention should be paid to finding and mapping (also contouring in vertical plane) the currents near the surface, such as the offshore flow and the longshore jet-like surface current on the seaward side of the principal upwelling front, and the subsurface countercurrent. Measurements should also be arranged to record the onshore flow and, in particular, to verify the existence of the bottom Ekman layer and to establish its offshore and vertical extent. The remarkably pronounced current structure connected with high vertical shears in coastal upwelling areas requires high resolution profiling current meters equipped with temperature and conductivity sensors. These will be useful in determining the dynamic stability in terms of the Richardson number and elucidating the flow in the thin intermediate intrusive layers observed off Oregon and NW Africa. The results of systematic current monitoring from moored stations may be presented on x-t and z-t planes to make time variations and oscillatory components of horizontal motion better visualized and understood by biological oceanographers.

There can be various patterns of moored arrays of current meters depending upon more specific considerations and also upon the instrumentation available, but there seems to be an explicit need to design these patterns in such a way as to attempt to establish the likely coupling between the local upwelling circulation and the general circulation in the area.

Further studies of the response of the field of motion to changes in wind condition are recommended. Eddy-like phenomena in the horizontal field of motion should be a subject of specific attention.

### Vertical Motion

Estimation of the vertical advective flux of nutrient rich water is clearly of primary importance. The use of free drifting devices capable of sensing the vertical component of water motion have been used off NW Africa and Oregon in 1972. These measurements showed that the vertical velocity is highly variable and occasionally one to two orders of magnitude greater than earlier estimates. Because of the observed spatial and temporal variations in upwelling, interpretation of these (quasi-lagrangian in the horizontal, quasi-eulerian in the vertical) is difficult. It is recommended that direct vertical velocity measurements be made in conjunction with attempts to calculate the divergence from the horizontal velocity field measured from moored arrays of current meters. Measurements by the biological and chemical oceanographers can be helpful in locating areas of intense upwelling. We encourage development of vertical current sensors capable of making time series measurements of vertical velocity at fixed locations.

### Temperature and Salinity Fields

Keeping track of the evolution of three-dimensional temperature and salinity fields in an upwelling area is essential in a number of ways:-

- (i) This evolution is indicative of the upwelling intensity and can provide an independent estimate of vertical velocities.
- (ii) Salinity stratification and its different character in different upwelling areas may have marked qualitative effect on local horizontal and vertical circulation.
- (iii) Temperature and salinity fields and their evolution close to upwelling fronts and shallow coastal areas likely to display some small scale non-steady, intrusive or non-geostrophic manifestations indicative of mixing processes. Frequent occurrence of temperature inversions is one of such manifestations.

There should be several scales of spatial and temporal resolution in temperature and salinity fields monitoring, the use of STD systems being essential for smaller scales together with simultaneous or synchronous current velocity profiling with the same resolution. The precision infra-red measurements from a satellite or an aircraft or even from the bow of a ship are particularly suitable for mapping sea surface temperature. Continuous salinity recording from moored buoys is one of the extremely desirable developments for the future.

### Fronts

Fronts, which in an upwelling area manifest themselves especially in the tempe-

perature fields, are essential features of upwelling dynamics. They tend to be zones of high horizontal and vertical shear and sharp changes of color, and the boundaries of various biological phenomena. Mapping fronts on the sea surface, determining their vertical extent and slope as well as horizontal T, S and density gradients across the fronts should be an essential part of upwelling studies. It is of interest to find out to what extent the different frontal systems observed in the upwelling areas are in fact density discontinuities. The observed cases of apparent stability of these fronts, their temporal evolution and the processes through which they disintegrate are not yet well understood. Therefore both theoretical and observational studies of frontal dynamics must be encouraged. Biological, optical and chemical observations such as: surface color, slicks with concentrations of various organisms, discontinuities of optical characteristics as well as of oxygen and nutrients may help physical oceanographers to detect and to monitor positions of front.

### Theoretical Modelling

Two-dimensional time-dependant numerical modeling of coastal upwelling has advanced to the point where the development of coastal upwelling over regions of simple geometry under steady wind conditions is well understood. These models predict the narrowness of the upwelling band, the time scales for the onset of upwelling and the existence of a longshore jet. Less well understood are the effect of continuous stratification, the development of the undercurrent, and the long time-scale where diffusive effects must be important. Work is needed on the theoretical treatment of frontal zones which are observed to play an important role in physical and biological processes in coastal upwelling. Variations of wind conditions, breaking of internal waves, irregularities of coastal geometry and of bottom topography may be the cause of the patchiness of coastal upwelling. These factors along with a more realistic stratification must be included if the theoretical models are to be predictive.

### Section B. Biological and Chemical Oceanography

The following comments refer to the need of better understanding the determining factors related to different trophic levels. The methodological aspects of those studies have only been briefly discussed by the biological panel and need further consideration by the Working Group by correspondence and at the Second Meeting of the Working Group.

The panel emphasized the particular need for studying the following biological factors determining:-

- a. Primary production: seeding, species composition, conditioning versus inhibition, grazing.
- b. Secondary production: abundance, regeneration rate and size composition of phytoplankton and their variation. Composition and population dynamics of herbivores, their vertical and horizontal distribution relationship to phytoplankton.
- c. Harvestable production: abundance and distribution of herbivores exploitable by fisheries, efficiency of transfer into other exploitable resources and their migrations and shoaling.

In discussing the physical background of biological studies of upwelling ecosystems the panel identified the following requirements of biologists for physical oceanographic research:

Since the pelagic components of the ecosystem are embedded in a fluid medium, biologists must obtain from the physical oceanographers a description of the time dependent velocity field in three dimensions.

For those investigations directed towards the ecosystems of upwelling tongues, the urgent requirement is for a detailed understanding of the velocity fields existing in tongues. The mixing processes at the boundaries or fronts of the tongue are clearly important in the re-seeding and concentration of organisms. Understanding the role of the undercurrent in longshore transport of substances and organisms between upwelling tongues or centers requires a quantitative knowledge of circulation and mixing.

Knowledge of the position and nature of fronts will be necessary to understand the role of these features in bringing about aggregations of organisms and in providing clues to food availability to herbivores and to organisms at higher trophic levels.

The effects of internal waves in the distribution and activities of pelagic organisms currently is receiving attention from biologists. It can be anticipated that these effects are likely to be important in upwelling areas and information about them will be required.

### Ecosystem Modeling

The techniques of systems modeling should be further applied to the study of upwelling ecosystems, to provide focus in the planning stage and to allow the testing of alternative hypotheses when working models have been established. Process models describing the transfers taking place within a parcel of water are necessary to provide the equations for spatial system simulation models.

### Description of the communities

There is a great need for more data on phytoplankton biomass in terms of number of organisms at different size groups and taxa including flagellates. These data should be related to chlorophyll concentrations and to the ratio of live and dead particles at various light levels.

Key species of phytoplankton and herbivores in each area should be identified and cultivated in flow cultures, for measurements of their physiological potentials and requirements.

Dominant species of zooplankton and nekton should be studied for their growth, reproduction and particularly feeding and migratory habits, both diurnal and seasonal.

The vertical distribution of phytoplankton, key herbivores and predators should be studied in order to describe co-occurrences of primary producers, grazers and predators at various depths of photic zone and surface mixed layer.

### Continuous culture

The theories of continuous culture processes should be applied to the study of upwelling tongues. For example, these tongues can be divided into zones, analagous to the tandem chemostats used to produce penicillin and other compounds. The population is produced in the first reactor, some additional uptake of nutrients occurs in the second, and product formation occurs in the last. By this analogy the seaward end of a tongue may be the site of excretion of a number of organic compounds including vitamins and water-conditioning substances. The role of these culture systems, operating at high

growth and loss rates, in the evolution of phytoplankton species could be investigated based upon previous continuous culture results on mutation rates and population processes in bacteria, and using the knowledge of cellular processes developed for laboratory organisms.

#### Primary production at low light intensities

In areas with high nutrient supply but high light extinction primary production at intensities below the conventional 1% light level may be important to sustain dense populations of phytoplankton concentrations at the lower part of the photic zone and even below. Further knowledge of primary production at low light levels is required.

#### Regeneration of nutrients

Special attention to regeneration processes under the photic zone seems necessary in upwelling areas. Sampling along sections normal to the coast covering especially the depth affected by upwelling transport should indicate the regions of enrichment by regeneration of sinking organic material. By this means it should be possible to assess the amount of supplementary regeneration - under the photic zone and the fraction of this in the upwelled water.

#### Dissolved organic matter and trace substances

High concentrations of organisms and high rates of metabolism cause the production of large amounts of a great variety of dissolved organic matter. The importance of these substances for conditioning the water for growth of phytoplankton and for attracting or repelling zooplankton and fishes is little known.

The role of dissolved and particulate organic matter as food of microorganisms requires further study. Particular emphasis should also be given to the occurrence and accumulation of trace metals and man-made trace organics and their influence on phytoplankton growth.

#### Section C. General

Multi-disciplinary character of the research requirements specified above calls for tightly coordinated multi-ship operations with the possibility of aid from satellites and airborne oceanography. New types of modern instrumentation and new methodology require new design of these operations, taking into account specific ship requirements of different research groups. This can best be done through international cooperation. CINECA program may be the first international framework for applying the new concepts.

#### Further Activities of the Group

- (i) The group decided to continue its work through correspondence by
  - (a) reviewing and completing the bibliographies on physical and biological aspects of coastal upwelling.
  - (b) exchanging relevant reprints.
  - (c) clarifying terminology used in upwelling studies.
- (ii) The group decided to have its 2nd General Meeting during the first half of June

1974, prior to the CINECA planning meeting, preferably in Kiel in the Institut für Meereskunde. An invitation to do so has been extended by Dr G. Hempel.

- (iii) The group felt that not less than 5 days is necessary for a productive meeting which would comprise separate panel discussions as well as general sessions.
- (iv) The group considers it desirable to hold a workshop on physics of coastal upwellings during the IUGG General Assembly in Grenoble in 1975 and a Symposium on Coastal Upwellings during the Joint Oceanographic Assembly in Edinburgh in 1976.

## ANNEX V

### SCOR WG 38 (WITH SCAR) SPECIAL STUDIES IN CIRCUMPOLAR WATERS SOUTH OF 40°S Report from Chairman - G. E. R. Deacon

Since the formation of the group the Chairman has corresponded with interested scientists of a number of countries and various ad hoc discussions have been held. However, the full membership of the group has not been established and no formal meetings have been held. This is partly because it has not been possible to identify scientists ready to work on new data and reluctance to organize Antarctic supply vessels into undertaking new programmes of measurements without a clear objective in view and immediate prospects of producing results that would demonstrate the value of the work.

This present report was prepared at a small meeting at the National Institute of Oceanography in the United Kingdom on 19 April 1973.

The views expressed and the ad hoc discussions support the earlier emphasis on the need for information on meridional and zonal transport at all depths. SCAR has gathered information on the capabilities of all supply vessels operating regularly in the Antarctic. The possibilities for utilising some of these ships in programmes to monitor currents and sea surface conditions are now developing in conjunction with the GARP need for increased coverage of meteorological data from the southern oceans, and particularly by plans for using satellites to monitor movements of inexpensive drifting buoys.

The promise of an extensive buoy programme during the First GARP Global Experiment [1977] has been increased and made more immediate by the results of the first successful EOLE satellite monitoring of the drift of a large Antarctic iceberg in 1971/72 by expectations of valuable information from a number of the thirteen EOLE transponders placed on icebergs by ships of seven nations in the 1972/73 austral summer and by the plans for a pilot programme in 1974 for monitoring Antarctic oceanographic buoys by the NIMBUS F satellite.

WG 38 will need to examine the proposals for an extensive buoy programme during FGGE to secure the interest and help of appropriate supply ships in setting out the buoys, to formulate proposals for measurements which supply ships can make in direct support of such programmes and recommend how these measurements should be made and utilised. It seems probable that the recommendations for supply ship programmes related to GARP needs should be limited to measurements of sea surface temperatures and possibly bathythermograph observations, although emphasis must also

be placed on the need for supply ships to ensure they take and transmit full meteorological observations.

Supply ships could be used to deploy many of the buoys, and possibly to make supporting observations, but it will be necessary to maintain the interest of their officers and crews by prompt publication of positive results from their activities.

The Working Group feels that something should be done to make full use of existing marine meteorological observations made by supply ships before asking these ships to expand their activity. Recent atlases and other publications have not incorporated the wealth of marine meteorological data collecting during, and since, the IGY and WG 38 urges SCOR to invite WMO to advise how these data can be archived and extracted. Such analysis must add considerably to understanding of the influence of the Antarctic oceanic regions on world climate and will possibly reveal specific requirements for additional observations which supply vessels might provide.

The Working Group believes that research ships should mainly be left to plan their work in the light of their own special abilities and programmes, but the Group would like to see emphasis on studies of water transport and recommends multi-ship operations in active regions on a scale approaching those of the MEDOC and MODE experiments. It would specially recommend a multiple ship study on and near a convenient part of the Antarctic continental slope, and another in the boundary region between the Weddell Sea and Scotia Sea Currents in  $60^{\circ}$  -  $61^{\circ}$ S,  $47^{\circ}$  -  $52^{\circ}$ W. Both studies would give useful information about final stages of mixing between the surface, deep and bottom layers. They should be made as soon as possible after the winter cooling, and last long enough to study the effects of the passage of two or three major atmospheric depressions. The terminal area in  $55^{\circ}$  -  $60^{\circ}$ S,  $20^{\circ}$  -  $30^{\circ}$ E, influenced by the flow of water across the Atlantic Ocean from the Weddell Sea is another significant region.

The Working Group has noted the recommendation of IGOSS for the collection of additional bathythermograph data in the Southern Hemisphere, and particularly the Pacific sector of the Southern Ocean during FGGE. While supporting this the WG hopes that those vessels equipped for deep ocean studies will give some priority to deeper observations likely to throw more light on transfers between the surface, deep and bottom layers, and on the problems of meridional and zonal transport, with as many observations as possible near the continental slope. Meanwhile, to meet the requirements of FGGE, it will be necessary to establish studies of existing Antarctic bathythermograph data comparable in scope with the existing effective studies of the Northern Hemisphere BT data.

WG 38 will discuss the capabilities of the supply ships for contributing to BT and XBT programmes.

The possibilities of successful study of the Antarctic water circulation are developing rather rapidly and WG 38 needs the advice and assistance of WG 34. I propose that WG 34 be asked to invite a small group of Antarctic enthusiasts to make a concise presentation of their ideas at its meeting and workshop in late 1973. If this proposal is acceptable to SCOR, the expertise of WG 34 will be available to WG 38 in its discussions and the formal membership of WG 38 can be kept small. It is proposed that, for the time being, the membership be:

Sir George Deacon  
Dr A. L. Gordon  
Professor V. Kort

Professor P. Tchernia  
Chairman of WG 34

The group has recently become aware of proposals being developed in the United States of America for an International Southern Ocean Dynamics Experiment. Whilst the details of such a proposal are not yet available, it is apparent that such a project would provide a much needed stimulus for furthering the understanding of circum-Antarctic oceanic processes and will deserve the fullest possible international support and collaboration.

If these proposals become available before the proposed meeting of WG 38 in late 1973, the group will examine them carefully, together with the earlier USSR collaborative proposal, to see what useful contribution the supply ships could make to achieve the stated goals.

ANNEX VI

### REPORT OF SCOR WG 41

#### Morphological Mapping of the Ocean Floor

The second meeting of SCOR WG 41 was held at the National Institute of Oceanography, UK on 2 and 3 April 1973.

The following members of SCOR WG 41 were present: J. Ulrich (Chairman, FRG), A. S. Laughton (Acting Chairman, UK), R. L. Fisher (USA), J. W. Brodie (NZ), Commodore D. C. Kapoor (IHO), D. Newson (UK) and T. Sato (Japan). Apologies for absence were received from E. Uchupi (USA), A. V. Ilyin (USSR) and V. Kanaev (USSR).

The following observers were present: Lt Cdr D. P. D. Scott (IOC), F. W. G. Baker (GEBCO and ICSU), A. J. Kerr (ICA Working Group on Oceanic Cartography), A. Ferrero (IHO), D. P. Bickmore (Experimental Cartography Unit, UK), D. G. Roberts (Acting Secretary, NIO), Mrs G. Kredel (IFM, FRG).

The Chairman, Dr Ulrich, after a few introductory remarks, requested that Dr Laughton take the chair for this meeting.

1. The minutes of the first meeting of WG 41 in Montreal in August 1972 were accepted, and subsequent activity in the field was reported by the Acting Chairman.

Written and verbal reports on the ICA Symposium on Marine Cartography held in Ottawa in August 1972 were given by Mr Newson and Dr Fisher who attended on behalf of SCOR WG 41, and by Mr Kerr, the newly appointed Chairman of the ICA WG on Oceanic Cartography (formerly Marine Cartography). The status and activities of the ICA WG are reported later, but at Ottawa close links were established between SCOR and ICA WGs with some dual membership. The ICA WG meeting was planned to take place in London on 5 and 6 April so that observers could attend both meetings.

The Acting Chairman reported on the activities of SCOR WG 41 at the 11th

General Meeting of SCOR in Oban in September 1972, when the revised terms of reference were accepted and when WG 41 were asked to give particular attention to the value of continuing the GEBCO 1:10 million series.

## 2. Critical review of existing bathymetric charts of the oceans

At the WG meeting a selection of bathymetric charts were displayed, parts of which had been copied and circulated in advance to members together with a list of chart details. The charts were divided into three groups by scale:-

- (a) 1:12 to 1:6 million
- (b) 1:5 to 1:2 million
- (c) 1:1 million to 400 thousand.

A series of questions about these charts were circulated to members and written analyses were received from Dr Kanaev (USSR), Dr Ilyin (USSR), Mr Sato (Japan) and Mr Newson (UK). Copies of these replies were tabled at the meeting. Additional charts were also received and displayed, from Mr Sato (Japan) and Dr Fisher (USA). Details of the Japanese charts were also tabled.

These chart groups were reviewed in order of increasing scale.

### (a) Scales from 1:12 to 6 million

There was general agreement that there was a need for a world bathymetric chart at the scale of about 1:10 million, but that none of the charts displayed fulfilled this need. Users can be divided into (a) scientists who need a world chart to look for global patterns, comparisons between oceans, a basis for distribution of other parameters and as a stimulus to thinking about global problems, (b) librarians and users of libraries covering a wide range of interests, (c) teachers and students, (d) compilers of smaller scale charts and Atlases.

Existing charts show great variations in the concepts of contouring, in visual treatment, in resolution and generally lack a good reliability index. The WG did not address the list of questions to all the charts in turn, but all the points raised were discussed, and particularly with regard to the GEBCO 10 million chart series which is the only internationally produced world series. The following deficiencies of the GEBCO chart were noted, some of which also applied to other world or ocean wide series:-

- (i) the series hardly constitutes a current world series since the publication dates of sheets range from 1923-1970 and only 8 out of 24 were published after 1960,
- (ii) the contouring of sounding data has not been done with due regard to the existing state of knowledge of sea floor morphology or of the geological and geophysical processes active on the sea floor. Because of this, erroneous data has not been identified and rejected. (N. B. contouring by geoscientists of the same data is in no way a generalization. Where contours cross sounding lines they must be consistent with the data. The difference between the geoscientists' approach and the cartographers' is in how to interpolate between sounding lines),
- (iii) no use has been made of the large variety of special surveys contoured at larger scales or of previous work of geoscientists in contouring the collected

- sounding sheets (the WG regretted the decision of the GEBCO Committee to reject, during the preparation of the 4th edition, the contoured Indian Ocean charts prepared at 1:2 million for the IIOE Atlas),
- (iv) there is no indication of the reliability of the contours or of the data on which they are based,
  - (v) the scattered sounding values do not add to the usefulness of the chart unless they represent isolated high or low points,
  - (vi) the contour interval is too wide and the contours too generalized,
  - (vii) the charts do not indicate whether soundings are in corrected or uncorrected metres.

The WG recognized that the quality of a 1:10 million world bathymetric chart depends on the quality of the contoured charts drawn at larger scales and on the quality of the data input. Following a long discussion the ideal specifications for a new World Bathymetric Chart Series were prepared, based on the best points of existing charts and on the needs of oceanographers:-

- (1) the scale should be about 1:10 million,
- (2) the projection should be Mercator except for the polar regions and high latitudes (Mr Sato would prefer a modified polyconic or equal area projection),
- (3) the depths should be in corrected metres,
- (4) the contour interval should be 500 m although occasionally additional intermediate contours could be used in flat areas provided the line weight did not confuse the visual impressions of relief,
- (5) the land should also be contoured in 500 m intervals in order to make direct comparisons of relief,
- (6) the sounding control should be shown as dots where there are random tracks and by labelled boxes where detailed surveys have been used. Carefully selected spot depths of important high and low features should be shown. It is recognized that the very large number of dots in a world series (possibly 10 million) may pose problems,
- (7) the contours must be derived from the best available larger scale charts prepared or approved by marine scientists employing current geological and geophysical knowledge, or from saturation surveys where there is no room for interpretation. Where such charts do not exist, the contouring of soundings at the 1:1 million scale must be done by experienced geoscientists. The resultant patchiness of the final chart will reflect the quality of the input data and indicate the need for more surveys. No attempt should be made to generalize down to the lowest quality data,
- (8) the charts should be relatively up to date, being revised, perhaps, on a rolling 5 year basis as new data becomes available,
- (9) the topography represented in the charts must be easily visualized, requiring the use of multicoloured layer tints or some equivalent cartographic technique. A two-colour or monochrome chart would not be suitable even though it might be cheaper,
- (10) modern cartographic techniques, such as variable line weight to indicate reliability, automatic hill shading, data-banking of contours and updating, need consideration.

(b) Scales from 1:5 to 2 million

It was noted that examples of these mostly comprised the fair copies of charts prepared at 1:1 million and reduced in scale for convenience of the scientific study of relatively large areas of an ocean. They are used extensively for cruise planning and for studying features such as part of a mid-ocean ridge, fracture zones, abyssal plains etc. The existing charts reflect areas of especial scientific interest and do not form part of a designed world series, although a scale of 1:2 million was used for the compilation input for the IIOE Atlas of Geology and Geophysics of the Indian Ocean. The WG noted the desirability of a world coverage at 1:2 million but recognized that this was unlikely to be achieved in the near future, and that charts of this scale should be considered, in international terms, as an intermediate step in the preparation of a 1:10 million chart series. However, it hopes that all such charts will be in corrected metres and will contain contours at 500 m intervals whatever smaller intervals they might have.

There was no support for the suggestion proposed by Pascoe (IHR, January 1972) for a world BM series based on the 1:3.5 million International Series of Navigational Charts, which has different objectives, does not cover many parts of the oceans, and for which the contour preparation so far done, has not been done in accordance with the principles outlined above.

(c) Scales from 1:1 million to 400 thousand

On account of the limited accuracy of navigation in the open ocean, most oceanic data outside the limits of anchored buoys and near shore navigation systems, are collected on scales between 1:1 and  $\frac{1}{4}$  million. The collected sounding sheets for GEBCO are prepared at 1:1 million and the initial contouring of oceanic data is therefore also concurrently done at this scale. The charts examined comprised both compilation charts (and cheap expendable copies of working sheets) where constant updating is possible, and fair drawn charts of regions adjacent to some continental margins. In some cases, the GEBCO collected sounding sheets had been contoured by the Hydrographic Office responsible with widely varying success. For the purposes of compiling the 1:10 million world chart, such contours must be examined and approved by experienced marine geoscientists before inclusion. In themselves, contoured 1:1 million charts are extremely useful for detailed studies of the ocean bed, provided the exact data control is shown. The WG recommended wider publicity and distribution of these charts, which are often only found in oceanographic institutions or similar organizations.

3. Organization of bathymetric data exchange and compilation

The present valuable role of the IHO as the specialised world data centre for soundings was noted and the large contribution made through the volunteering hydrographic offices was welcomed by SCOR WG 41. The system provides the foundation for many scientific studies of the ocean floor as well as the starting point for a world bathymetric chart. The WG considered ways in which the collection and exchange of data could be improved.

- (1) The value in showing data sources as overlays was noted and the SCOR WG 41 recommended that both these and the 1:1 million plotting sheets should also show sources and precise limits of high quality bathymetric surveys made at larger scales. It was noted that such references would permit access to the original sounding data for contouring purposes. It was recognized that in certain cases

only a selected set of soundings might be available or perhaps only contours. In such cases, the selected soundings or reduced contours should be shown on the collection sheets.

- (2) It was noted that many scientists have made use of additional sounding data not put into the GEBCO system. It was regretted that many sources do not routinely transmit soundings to the IHO and the offer of the IOC to find ways and means of including such soundings was welcomed by SCOR WG 41. The WG would particularly welcome the contribution of Russian soundings to the world data centre.
- (3) The increasing number of vessels and institutions processing and storing bathymetric data in digital formats was noted and it was recognized that a study of future methods of automatic data storage, retrieval and transmittal based on standard data formats would be desirable for an extension of the 1 in 1 million sounding collection system. Initially the hand copy exchange system should be maintained using machine plotted output from these sources, but ultimately a mixed system could be used and the IHO should be equipped to read cards or tapes.
- (4) The use of uncorrected and corrected soundings was reviewed by SCOR WG 41. Although uncorrected soundings allow direct comparison with the echo-sounder, there are now different standard speeds of echo-sounder (800, 820 fms/sec, 1500 m/sec), so it was agreed to continue with corrected soundings. The present system of correction is based on Matthew's tables (1939). It was noted there are two disadvantages in the present system:-
  - (a) Changes in correction factor from one area to the next produces a step in the soundings. However these steps are small and relatively rare.
  - (b) Matthew's tables are seriously wrong in areas such as the Kuroshio and Gulf Stream. It was noted Japan has produced a new set of tables for the Kuroshio but still uses the Matthew's (1939) tables to correct the 1:1 million collector sheets that it provides for GEBCO. A revised version of Matthew's tables is being prepared by Canada, UK and IHO, and this will create a problem by mixing soundings corrected by old and new versions. It was suggested that a new series of collected sounding sheets be initiated containing only soundings taken by precision echo-sounding corrected by the new Matthew's tables and whose positions are controlled by a precise navigation system. A new series would ensure that the newer soundings are not lost because of inadequate space to compile them on the existing collected sounding sheets. It is necessary to establish whether the new corrections differ from the old by more than the time fluctuations in apparent depth due to meandering ocean currents.
- (5) The desirability of precisely defining agreed limits to Matthew's areas on a 1:1 million scale was noted and the difficulty of producing 600 plotting sheets containing this data alone was recognized by SCOR WG 41. The possibility of producing all Matthew's area boundaries within a single latitude band on one plotting sheet was noted as a method of minimizing the number of sheets.
- (6) The desirability of continuing the use of Mercator projection for the 1 in 1 million sounding collection series was noted. Arguments in favour of a single longitude scale or of a conformal conic projection were noted but it was felt to be impractical to change the present system.
- (7) It was suggested that ships' names on the border against a line of soundings would be a desirable addition to the chart, that would aid the scientist responsible for contouring the data. Further, it was recommended that the information supplied by oceanographic vessels relating to positional reliability, type of echo-sounder

etc. should be included on the source of overlay. The desirability of including as many soundings as possible on the sheets was expressed and it was suggested all soundings should be written perpendicular or oblique to the ship's track using a dot or the centre of the sounding to indicate position.

The representative of the IHO explained that modifications to the method of preparation of the 1:1 M plotting sheets require the approval of the volunteering Hydrographic Offices participating in the GEBCO programme. Accordingly, the IHO will take steps to inform the concerned Hydrographic Offices of the views expressed by the Working Group.

#### 4. Future of GEBCO

The SCOR WG 41 welcomed the paper "Future of GEBCO" reporting discussions of the future of GEBCO between Rear-Admiral Ritchie (IHO), F.W.G. Baker (ICSU and GEBCO) and D.P.D. Scott (IOC) held at UNESCO on 12 March 1973. It was noted that a priority of LEPOR, approved by the IOC Assembly, is morphological charting of the sea floor.

The IHO representative reported their awareness of the inadequacies of the GEBCO project and that they have been examining methods of evolving a programme with stronger scientific participation. The following points arose from the discussion of "Future of GEBCO".

- (1) IGN have reported low sales of the GEBCO sheets and have stated that they will not be able to continue to bear the present losses incurred through the production of this series. Their proposal for a cheaper production using 2 colours only was felt to be unlikely to meet the needs of the scientific community.
- (2) The low sales are considered to be due to the failure of the sheets to meet the needs of the scientific community and to a lack of publicity.
- (3) The offer of IOC to extend publicity through the International Marine Science Newsletter and through UNESCO publications was welcomed. Although this was unlikely to effect any real improvement in GEBCO sales, it was welcomed as a means of publicizing a future world bathymetric chart series.
- (4) The failure of the GEBCO sheets is discussed above in para. 2(a) and the reasons agreed. However, it was noted that oceanographic institutes will continue to produce their own charts of limited areas and that advantage should be taken of this trend as an input for a future world bathymetric series.
- (5) The obsolescence of much of the GEBCO series reflects partly the lack of effort and funds, but more frequent revision would not overcome the basic objection of the scientific community to the GEBCO 1 in 10 million series as scientific base charts.
- (6) The following proposals were put forward in the paper by Ritchie, Baker and Scott for consideration by SCOR WG 41:-

6.1 'The IHO should continue in its role as the Specialized World Data Centre for bathymetry and as part of this role it should continue to sponsor and generally co-ordinate the existing collection of sounding data on the 1 in 1 million series oceanic plotting sheets'.

SCOR WG 41 accepted this proposal (see Summary of Recommendations 1 and 2) but with the improvements suggested in para. 3.

- 6.2 'The IHO (in conjunction with IOC and SCOR) should investigate methods of automatic data archiving and retrieval as it applies to sounding data'.

It was noted that many oceanographic institutes now acquire bathymetric data in computer compatible form. The present system involves submission of soundings through national hydrographic offices to the regional collecting hydrographic office and thence to the IHO. It was noted that not all hydrographic offices have appropriate data processing facilities and the present system is not set up to handle digital bathymetric data. It was agreed that a study by the IHO (in conjunction with IOC, CMG and SCOR) of data processing methods would be desirable as a future extension of the 1 in 1 million sounding collection system (see recommendation 4).

- 6.3 'The IOC should investigate ways and means of ensuring that all high quality bathymetric data, in particular those from oceanographic research ships, is made available to the IHO for incorporation in the 1 in 1 million sheets'.

It was noted that an improvement in the situation can be effected by IOC, but the most significant improvement will be made if potential contributors can see that a worthwhile final bathymetric chart results. It was noted that individual hydrographic offices could be more effective in compiling data.

- 6.4 'The 1 in 10 million GEBCO sheets be abandoned as a scientific global base chart of the oceans'.

This subject was extensively discussed earlier in the meeting and the proposal is accepted in the form of recommendation 6.

- 6.5 'The list of bathymetric charts prepared by Laughton et al should be studied and a selection made of those which best meet the needs of the oceanographic community in different ocean areas as regards quality, projection and scale. The authors of these sheets should then be approached and asked whether they (or their institutes) would be prepared to continue publication of these specialized bathymetric sheets of the ocean areas already covered and (most important) whether they would be prepared to keep these sheets updated at relatively frequent intervals'.

Much of this proposal was considered in the earlier discussion when it was recognized that a new world bathymetric chart was needed and that the existing intermediate scale charts should not be considered as a suitable substitute. It was felt that a small unit of full time geoscientists associated with an active oceanographic laboratory, but paid for by international funds, could search out suitable charts for the compilation of a new world bathymetric chart at 1:10 million, and prepare the contours from 1:1 million collected sounding sheets in areas where good charts do not exist. The unit should be under the guidance of an advisory group set up by IOC/SCOR/CMG/IHO and should be able to call together ad hoc regional groups of involved regional specialists when necessary, to prepare charts in particular areas (e. g. as took place for the Indian Ocean bathymetry for the IIOE Atlas).

- 6.6 'The IHO to provide the responsible authors (institutes) referred to in 6.5 above with copies of the 1 in 1 million sheets as and when required'.

This is no longer applicable in view of the comments in 6.5.

6.7 'The IOC to publicize the above adopted bathymetric sheets and to negotiate sales arrangements with the authors' institutes'.

It was noted that periodical publication of lists of bathymetric charts and their sources by IOC would be welcome (recommendation 15).

The WG envisaged that the international scheme for the reduction and presentation of sounding data should therefore have three parts:-

- (a) The collection, exchange and compilation of soundings at the 1:1 million scale should continue as presently organized under the control of IHO,
- (b) The preparation of contours, the search for and compilation of contributing contour charts and special surveys, and the preparation of draft compilations of the world bathymetric chart for cartographic drawing etc. should be organized jointly by IOC/SCOR/CMG/IHO as proposed in para. 6.5,
- (c) The final cartography, printing, distribution and sales should continue to be associated with IHO.

A meeting of the GEBCO Committee will take place on 5-6 June 1973 and will be attended by Dr Ulrich (SCOR), Dr Laughton (CMG & GEBCO), Commodore Kapoor (IHO) of SCOR WG 41.

(7) Relationship with the ICA Working Group on Oceanic Cartography

The following members of SCOR WG 41 are also members of the ICA WG on Oceanic Cartography:- Mr D.W. Newson, Mr T. Sato, Commodore D.C. Kapoor. The WG met on 5 and 6 April in London and in addition to the above members, Dr Ulrich, Dr Laughton and Mr Brodie attended the meeting. A close collaboration was thereby established.

The terms of reference of the ICA WG were agreed as follows:-

- "(1) To advance the study of cartographic problems of oceanography,  
(2) To facilitate communication with oceanographers, in order to explore methods of cartographic representation of oceanographic data,  
(3) To maintain a close liaison with the Scientific Committee on Oceanic Research and the International Hydrographic Organization with the object of promoting co-operation and avoiding duplication,  
(4) To confine its attention to Thematic Oceanic Cartography excluding navigational charts".

It was decided that during the 7th ICA Conference in Madrid (28 April - 4 May, 1974) a short symposium should include papers by the editors of the IIOE Atlases on the cartographic and representational problems involved. It was also suggested that a symposium on problems of oceanic cartography might be held at the Joint Oceanographic Assembly in Edinburgh in 1976.

- (8) Dr Ulrich tendered his resignation as Chairman and suggested that he should be replaced by the Acting Chairman, Dr Laughton. This met with the Committee's approval subject to approval from the SCOR Executive.
- (9) Summary of recommendations of SCOR WG 41

Following a thorough review of existing bathymetric charts of the oceans, at scales between 1:12 million and 1:400 thousand, by members of the WG in their own countries, by correspondence and by examination and discussion during the present meeting, the WG has recognized the need for a new world bathymetric chart series based on a world wide compilation of soundings. The WG has noted the excellence of the original concept of the General Bathymetric Chart of the Oceans, inspired and generously supported by successive Princes of Monaco, but has concluded that, in order to meet the full scientific objectives defined by Prince Albert I, the present system for the production of the international bathymetric chart of the oceans requires certain modifications, which will be described.

SCOR WG 41:-

- (1) advises that the IHO continue its role as the specialised world data centre for oceanic soundings, recommends the continuing collection of soundings on a 1 in 1 million scale and welcomes the large contribution made through the volunteering hydrographic offices,
- (2) recommends the 1 in 1 million plotting sheets should show sources and precise limits of available high quality bathymetric surveys made at larger scales,
- (3) recommends IOC should attempt to locate data sources not at present routinely transmitting soundings to the IHO and to find ways and means of including such soundings in the world 1 in 1 million collector series,
- (4) recommends that the IHO (in conjunction with IOC, CMG and SCOR) should implement a study of future methods of automatic data storage, retrieval and transmittal based on standard data formats in parallel with and as a future extension of the 1 in 1 million sounding collection system,
- (5) recognizes the need in the scientific community for a Mercator world bathymetric chart in colour on an approximate scale of 1 in 10 million. Such a chart must be derived from larger scale charts prepared or approved by marine scientists employing current geological and geophysical knowledge,
- (6) notes that wide discussions with colleagues have shown that the 1 in 10 million GEBCO series of bathymetric charts as prepared under the present system does not fulfil the needs of marine scientists because the contouring of the collected soundings has not responded to advances in earth science. Therefore the chart does not portray the closest approximation to the true shape of the sea floor that might be obtained from bathymetric data so interpreted. Additionally, the present series has deficiencies in presentation and is mostly out of date,
- (7) recommends that it be recognized that the world bathymetric chart must be compiled from the best available bathymetric charts, published or unpublished, supplemented by contoured soundings collected on a 1 in 1 million scale,
- (8) believes that a new system of production is imperative and recommends that a guiding committee for the preparation of the world chart be set up with nominations from IOC/SCOR/CMG/IHO. This advisory group should be

composed of active marine scientists and hydrographers and its activities would replace those of the present GEBCO committee,

- (9) recommends a small, full-time geoscience unit consisting of two experienced marine geologists or geophysicists with a draughtsman and secretarial support be set up to handle the task of preparing an acceptable final compilation of bathymetry for subsequent cartographic drawing, printing and distribution,
- (10) recommends this core unit should be internationally funded and based at a centrally located oceanographic institution with an active group in oceanic geology where good map collections and library facilities would also be available,
- (11) recommends that where appropriate, ad hoc consultant groups of marine scientists knowledgeable in particular areas, should be set up to assist the core unit and guiding committee,
- (12) recognizes that the task of draughting for reproduction and printing will need to be considered as a separate stage in the publication of the world chart. We appreciate that funds have been previously made available by the Monegasque government at the comparable stage of the GEBCO 1 in 10 million series but understand that considerable additional funding will be required to implement this new project,
- (13) notes the long association of the world bathymetric chart with the IHO and wishes to continue the association of the final product with the IHO,
- (14) recommends that rapid publication is essential and that revision should be undertaken at frequent intervals on a continuing basis; intervals of revision of any particular chart would be determined by the acquisition or generation of significant quantities of new soundings,
- (15) recommend that wide publicity be given to the new charts produced under the proposed system.

## ANNEX VII

### SCOR WORKING GROUP 42 (WITH ICES) ON THE STUDY OF THE POLLUTION OF THE BALTIC Report from the Chairman - I. Hela

The Working Group has continued its work in the frame of the following meetings and other undertakings:-

- (1) The Working Group had its first meeting in Lund 3-5 May 1972, an ad hoc meeting in Copenhagen 30 September 1972 and will have its second actual meeting in Kiel 28-29 June 1973.

(2) An effort has been made to secure as close connections as possible with the concerned bodies:-

- ICES with its Committees and Working Groups
- International Hydrological Decade
- Conference of Baltic Oceanographers
- Baltic Marine Biologists.

(3) An ad hoc Working Group, with Professor K. Grasshoff, FRG, as convener, was created on the sampling and analytical capacities of the laboratories of the region.

Several non-commercial laboratories have submitted their replies to the prepared questionnaire on their sampling and analytical capacities and have thus showed their goodwill to participate and even to expand their capacities provided funds were available. The greatest problem for many of these laboratories was the lack of appropriate research vessels of their own.

In this approach the following guidelines will be followed:-

- A detailed account of preferred analytical procedures.
- Exchange of analytical expertise.
- Workshops for the working analysts.

In this work close collaboration with the ICES Working Group on Study of Pollution of the North Sea has been advanced through participation of Baltic laboratories in an intercalibration exercise in the second half of 1973.

(4) Another ad hoc Working Group, with Professor H. J. Brosin, GDR, as convener, was created on the sources of waste input to the Baltic Sea. The Questionnaire prepared by that ad hoc Working Group was submitted through the members of the Working Group to all the States of the region. The replies received so far do not cover all the States, however, the outstanding replies are expected to arrive in the near future. A detailed inventory on the waste inputs will then be prepared.

In this work guidelines have been followed which are analogous, whenever feasible, to those applied in the North Sea region.

(5) According to its terms of reference, paragraph (a), one of the tasks of the Working Group is "to identify from the point of pollution the need for further basic hydrographical, biological, biochemical and biogeochemical studies". To this end the Working Group created an ad hoc Report Drafting Group, with Professor B. Bolin, Sweden, as rapporteur, to prepare a long-term programme: "The International Pollution Baltic Year 1975; Protection and Use of the Baltic Sea: a Model for the Future". The Draft Report to cover this programme was prepared in a preliminary manner by the ad hoc Group in Askö, 3-5 January 1973 and finalized thereafter for presentation to the Working Group meeting in Kiel in June 1973 for further debate.

(6) During this development it has become obvious that a special effort is needed in order to organize the immediate input and baseline studies in an effective manner, on the one hand, and to find out how it will be most convenient during the years to come to introduce to the studies of the Baltic Sea and its pollution the most advanced scientific approaches, on the other.

The ad hoc Action Plan Group, with Professor K. Grasshoff as convener, has been created to prepare for the Working Group the first plan how this goal eventually can be achieved. Also it is expected that the Baltic Marine Biologists will pay particular attention to the immediate needs of the baseline studies, as requested by the Working Group.

- (7) The urgency of the input and baseline studies has become most obvious through the new needs of scientific-technical advice on the different aspects of marine pollution at the intergovernmental level.

The needed scientific-technological advice has to cover (1) technological problems, such as the continuous inventory of waste input, and the introduction of new solutions to the waste treatment problems, (2) "Limnological-hydrological" studies for understanding of the inland and immediate coastal problems, and (3) problems of the actual marine pollution. To this last end advice will be available for instance as follows:

- (1) The ICES through its Advisory Committee on Marine Pollution is the inter-governmental advisory body on the problems of the actual marine pollution in the region.
  - (2) The ICES/SCOR Working Group on the study of the Pollution of the Baltic, re-organized and with revised terms of reference, could be the scientific machinery to collect scientific data and results in its field of competence for the ICES Advisory Committee.
- (8) The members of the joint ICES/SCOR Working Group unanimously hope that the role of SCOR be maintained also in the future since this gives access to a greatly expanded source of scientific expertise.

## ANNEX VIII

### AN INTERNATIONAL OCEANOGRAPHIC PROGRAMME FOR GATE

Introduction and recommendations from the report of the first meeting  
of SCOR WG 43, Miami, 5 - 10 February 1973

#### 1. Introduction

The primary objective of GATE, an improved understanding of tropical convection in cloud clusters and its interaction with the large scale circulation, is strongly dependent on accurate determination of the heat, moisture, and momentum fluxes across the air-sea interface on the B-scale (GARP Special Report No. 6 - GATE). An oceanographic program in GATE would be highly desirable for the independent - and in many cases more accurate - determination of these fluxes from appropriate budget measurements in the mixed layer. At the same time GATE will provide a unique opportunity for investigating the response of the oceans to atmospheric forcing on various scales. Although less directly related to the main atmospheric program, it should be recognized that oceanic response studies are central to the GARP objective of developing coupled ocean-atmosphere models for extended forecasting and investigations of climate. It is, of course, also the primary motivation for the oceanographic involvement in GATE.

The concentration of mid-ocean platforms achieved during GATE will not likely be available again for many years, and it is therefore strongly recommended that the opportunity that GATE offers for studying the response of the ocean to the atmosphere be recognized and fully exploited in the planning of GATE.

Salinity and heat budget measurements are planned on the B-scale and within one of the B-scale grid triangles, which will be instrumented with a smaller network of oceanic instruments (C-scale). Oceanic response studies will include phenomena on the C-scale (interface, mixed layer and thermocline response, section 3), the B-scale (baroclinic adjustment, section 4) and A-scale (equatorial current system).

## 2. General Recommendations

The SCOR Working Group 43 recommends that:

- 2.1 This international oceanographic programme be incorporated in GATE.
- 2.2 The coordination of the meteorological and oceanographic programmes be the responsibility of the ISMG; detailed logistic and scientific planning of the oceanographic programme should continue to be carried out by SCOR WG 43 in close cooperation with the ISMG.
- 2.3 The enclosed map of optimum ship positions and survey tracks for the oceanographic programmes during phases I, II, and III be considered as a basis for ship deployment compatible with the meteorological experiment.
- 2.4 Aircraft measurements required for the oceanographic programme be incorporated in the GATE aircraft programme.
- 2.5 The scientific programme of every ship in the B-scale and equatorial A-scale be directed on board by a qualified scientist with sea-going experience.
- 2.6 Provision be made for the assignment of scientific and technical personnel to ships of other nations as required by the oceanographic programme.
- 2.7 Oceanographic intercomparison be incorporated in the GATE programme for intercalibration tests.
- 2.8 IGOSS increase the density of observations in the GATE area during 1974 as specified in this document.
- 2.9 A strong surface radiation programme be established in support of the mixed-layer programme.

---

### Membership of SCOR WG 43

G. Siedler (Chairman)(FRG), V. A. Burkov (USSR), W. Düing (USA),  
I. Galindo (Mexico), J. A. Gonella (France), C. R. Mann (IOC), G. T. Needler (Canada),  
F. Ostapoff (USA), M. Sturm (DDR), J. D. Woods (UK).

REPORT OF SECOND MEETING OF SCOR WORKING GROUP 43  
OCEANOGRAPHY RELATED TO GATE  
LONDON, 4 TO 8 JUNE 1973

1. List of participants

Working Group Members: G. Siedler (FRG)(Chairman), I. Galindo (Mexico) J. A. Gonella (France), C. R. Mann (IOC), G. T. Needler (Canada), F. Ostapoff (USA), M. Sturm (DDR), J. D. Woods (UK).

Other participants: C. J. M. Aanensen (ISMG\*), K. F. Bowden (UK), R. A. Clarke (Canada), J. A. Ewing (UK), A. E. Gill (UK), K. Hasselmann (FRG), H. C. Hoerber (ISMG), D. D. Houghton (ISMG), R. F. Long (ISMG), T. McAndrew (UK), M. Miyake (ISMG), S. R. Petersen (ISMG), G. Peluchon (France), S. G. Philander (ISMG), R. T. Pollard (UK), W. Sell (FRG), J. H. Simpson (UK), R. I. Tait (UK), Y. Tarbeev (ISMG), S. A. Thorpe (UK), B. J. Thompson (IOC), R. Williams (USA).

---

\* ISMG = International Scientific and Management Group for GATE

2. Results of the discussions

- 2.1 The group was informed that the report including the recommendations prepared at the Miami meeting of SCOR WG43 in February 1973 had been approved by the SCOR Executive Committee. It had also been accepted as a basis for further planning by the TEB, and it was endorsed by JOC and IOC.
- 2.2 The group was informed by members of the ISMG about the present status of GATE planning and coordination, particular attention being paid to the central programme, data management and intercomparison experiments.
- 2.3 After an extensive discussion about the character of the GATE central programme, SCOR WG43 produced a statement about the relation between the central programme and the oceanographic programme (see paragraph 3).
- 2.4 Outlines of the data management and analysis systems used for JASIN and JONSWAP were given by R. Pollard and W. Sell as a basis for the discussion of similar tasks for GATE Oceanography.
- 2.5 The data expert from France, G. Peluchon, described the computer facilities at BNDO, CNEOX-COB, Brest, France. This institution was suggested as a possible GATE Oceanographic Subprogramme Data Centre by the French delegates at TEB-IV.

- 2.6 The group discussed in detail data management and analysis for the GATE oceanographic programme, the aircraft programme and routine and inter-comparison measurements. The results of these discussions are presented in a revised version of the report prepared at Miami in February 1973.
- 2.7 The group agreed that the revised report including the additional chapters dealing with the data management and analysis, the aircraft programme and the intercomparison experiments, the routine measurements and the exchange of scientists should be distributed to GATE investigators and to the ISMG as soon as possible. This may be done by using mimeographed copies. It seems desirable, however, to have the report printed within a few months for further distribution. Following the recommendation of the SCOR Executive Committee, a publication in the GATE series was suggested.
- 2.8 It was agreed that the ISMG in cooperation with J. Woods and the chairman of SCOR WG43 will prepare a GATE Oceanographic Subprogramme document which will have a similar basic structure as other subprogramme documents. This document will be based on the SCOR WG43 report.
- 2.9 SCOR WG43 noted with great appreciation that the ISMG will have from now on a stronger oceanographic capability. Much of the operational and logistic planning for the oceanographic subprogramme can now be done by ISMG members. It was, however, considered essential for the success of the oceanographic experiments that ISMG and SCOR WG43 stay in close contact with each other in order to work jointly in the planning. To facilitate communication, the SCOR WG43 nominated three members to be responsible for certain components of the oceanographic programme:

J. Woods	C-scale experiment
F. Ostapoff	B-area experiment
W. Düing	Equatorial experiment

These members are available to be contacted by the ISMG to solve problems concerning the specific experiments. For questions concerning the experiment as a whole, the chairman of SCOR WG43 should be contacted.

- 2.10 After a discussion about intercomparisons of moored current meters, it was agreed that the results of earlier intercomparison experiments by SCOR WG21 should be made available to the members of SCOR WG43 and of the ISMG. It does not seem feasible to carry out such intercomparisons during GATE.
- 2.11 The group agreed that a preliminary list of principal investigators should be compiled. The members of SCOR WG43 from different countries were asked to send relevant information to the chairman by 20 June 1973.
- 2.12 It was the feeling of the group that another meeting of the whole SCOR WG43 would not be necessary before the GATE experiment. There is, however, a need for the participation of individual members of SCOR WG43 (or their representatives) in special meetings. Some of these meetings will have to be called at relatively short notice.

The results of the discussion are summarized in part 4.

2. 13 SCOR WG43 agreed that the SCOR Executive Committee be asked to add Dr R. R. Belević as a second member from the USSR to SCOR WG43, as proposed by the Hydro-meteorological Service of the USSR. This seems desirable in view of the major involvement of the USSR in GATE.
  
3. SCOR WG43 statement on the relation between the GATE central programme and the oceanographic programme
  3. 1 SCOR WG43 welcomes the scheme now proposed by the ISMG which includes the oceanographic programme as an integral part of GATE.
  
  3. 2 The oceanographic programme represents an integrated set of experiments to study the response of the ocean to the atmosphere on a variety of scales. Although an "oceanographic" programme, it falls entirely within the objectives of GARP in being concerned only with atmospheric forcing.
  
  3. 3 SCOR WG43 emphasises the point of view expressed by SCOR WG43 in Miami, February 1973 and by JOC VIII in London, March 1973: "... that the opportunity that GATE offers for studying the response of the ocean to the atmosphere be recognised and fully exploited in the planning of GATE". Thus the GATE oceanographic programme should be regarded as an integral subprogramme of GATE with priority equal to that of the other subprogrammes.
  
  3. 4 The oceanographic programme represents a mutually supporting set of experiments in which it would not be meaningful to set priorities.
  
  3. 5 Certain measurements of the oceanographic programme are essential not only for the coupled ocean - atmosphere problem, but also for purely meteorological questions. These apply to measurements of the sea - surface temperatures and surface waves at the interface itself. It is recommended that the dual significance of these measurements for both the meteorological and oceanographic programme be recognised in setting logistic and operational priorities.

4. Future meetings

Informal planning meeting on GATE Aircraft Programme, July 1973,  
Oberpfaffenhofen/F. D. R.  
SCOR WG43 representative: J. D. Woods

Informal planning meeting on GATE Ship Programme, October 1973,  
Geneva/Switzerland  
SCOR WG43 representative: W. Düng, G. Needler

Informal planning meeting on GATE Data Management, 3-7 September 1973,  
Moscow/USSR.

SCOR WG43 representative: F. Ostapoff

Informal planning meeting on GATE Oceanography Data Management, possibly August 1973, France.

SCOR WG 43 representatives: R. Pollard (for J.D. Woods), W. Sell (for G. Siedler) scientist to be nominated (for W. Düing)

Meeting on GATE equatorial oceanographic experiment

Convener: G. Philander (ISMG)

Possibly September 1973, Europe

SCOR WG43 representatives: V. Burkov, W. Düing, I. Galindo, Hisard (for J. Gonella), M. Sturm, J. Meincke (for G. Siedler), S. Thorpe (for J.D. Woods).

Meeting on GATE C-scale oceanographic experiment

Convener: J.D. Woods (SCOR WG43)

Possibly October 1973, Canada

SCOR WG43 representatives: R. Belević, J. Gonella, G. Needler, F. Ostapoff G. Siedler, J.D. Woods

3 ad hoc meetings on planning of GATE oceanographic programme

Place not yet known, 1974

Approximately 4 members of SCOR WG43 to participate in each meeting

Third meeting of SCOR WG43

Place: At location of GATE Oceanographic Data Centre or of selected analysis institution

Time: April 1975

All Members of SCOR WG43

3 ad hoc meetings on evaluation of GATE oceanographic programme

Place not yet known, 1975

Approximately 4 members of SCOR WG43 to participate in each meeting.

## ANNEX X

### DISCUSSIONS ON OCEANOGRAPHIC PROGRAMMES RELATED TO GARP WHICH TOOK PLACE IN CONNEXION WITH JOC-VIII,

London, March 1973

B. J. Doos, Director J. P. S.

#### A. Ad-hoc Committee on an Oceanographic Programme in GARP

Prior to the JOC meeting (13 March) a small group of oceanographers (T. Barnett, H. Charnock, A. Gill, K. Hasselmann, C. Mann, H. Stommel) held an informal meeting to discuss means of activating an oceanographic programme related to the goals of GARP, in particular with respect to the Global Experiment and the second GARP objective. The committee made the following recommendations, which were adopted by JOC:

1. Development of an international oceanographic GARP programme should be the

responsibility of a SCOR working group established specifically for this purpose. The committee welcomes the initiatives already taken in this regard by IOC and supports the proposed presentations and discussions on the Global Experiment to be held during the IOC Assembly session in November 1973.

2. With the possible exception of a chairman, nomination of members to the working group should be postponed until individual nations have developed concepts for a feasible oceanographic GARP programme. It is recommended that GARP national committees arrange regional meetings of oceanographers this year to consider
  - (a) possible oceanographic programmes utilizing the observational system of the Global Experiment for studies of ocean-atmosphere interactions, and
  - (b) means of furthering oceanographic programmes in general which are relevant to the objectives of GARP (e. g. studies of long-term, large-scale, ocean-atmosphere interactions).
3. Provision should be made for a discussion of an oceanographic programme within the Global Experiment during the IAPSO/IAMAP meeting in Melbourne, January 1974. This would also be a suitable occasion for the nomination of members to the SCOR working group.
4. To assist in the development of an oceanographic programme, an oceanographer should be invited as consultant to the JPS.
5. To generate a wider awareness among oceanographers of the potentialities of the Global Experiment and GARP generally for their studies, a review article on the subject, published in a widely read journal, would be very helpful. Professors Stommel and Charnock have agreed to undertake this task.

Beside the above recommendations on planning, JOC concurred with the ad hoc committee that intensified work is needed in a number of areas in order to develop a successful oceanographic GARP programme:

1. Dynamical models of the response of the ocean to the atmosphere should be extended to include not only the motions but also the heat and salinity distribution, in particular in the upper layers of the ocean.
2. Observational systems for monitoring the ocean need further development to achieve the level of reliability required for studies of the long-term, large-scale interactions relevant to extended range weather prediction or studies of climate.
3. The scales of variability of the ocean need to be determined more precisely in order to resolve aliasing questions arising in the deployment of such observational systems.
4. A series of interaction experiments, such as currently planned in GATE, AMTEX, JASIN, MODE, CUE, ACE, JONSWAP and other projects, will continue to be needed in limited regions of the ocean in order to arrive at suitable parameterizations of the many multi-scale processes governing the coupling at the air-sea interface and within the ocean.

5. Data banks for collecting world-wide oceanographic data, both historical and current, are essential for systematic long-term, large-scale ocean interaction studies. The efforts in this direction by the IOC Working Group on International Oceanographic Data Exchange are very valuable and deserve all support.

#### B. Cooperation between GARP and Oceanographic Programme

In addition to the recommendations of the ad hoc committee, JOC feels that a stronger communication should be established between GARP and existing oceanographic programmes immediately related to the objectives of GARP (such as NORPAX). JOC would be glad to receive planning reports of such projects in order to be able to suggest means for a closer interaction. This is particularly relevant to oceanographic experiments already being considered which could be conducted during the Global Experiment.

In view of the highly appreciated initiative on the part of oceanographers in developing an oceanographic programme in coordination with GARP, JOC intends to reserve one day of its coming IXth session in Melbourne, January 1974, for a joint discussion with the SCOR working group to be formed at that time in Melbourne.

#### C. Oceanographic Programme for GATE

JOC welcomes the oceanographic experiment proposed for GATE by SCOR Working Group 43 (Report February 1973) as a multi-scale ocean-atmosphere interaction experiment central to the goals of GARP, both with respect to the immediate GATE objective of improving the parameterization of tropical processes and with regard to the general problem of parameterizing ocean-atmosphere interactions for extended range forecasting and a better understanding of climate. JOC therefore endorses the statement in the SCOR WG 43 report that "The concentration of mid-ocean platforms achieved during GATE will not likely to be available again for many years, and it is therefore strongly recommended that the opportunity that GATE offers for studying the response of the ocean to the atmosphere be recognized and fully exploited in the planning of GATE".

The proposed oceanographic programme appears compatible with the meteorological programme except in aircraft deployment; the flight patterns required for the oceanographic C-scale work during phase III differ to some extent from the envisaged meteorological flight tracks and make it difficult to utilize the better instrumented meteorological research aircraft effectively within the oceanographic programme. To alleviate this situation, JOC recommends that the French DC7 be equipped with a laser altimeter for surface wave measurements and an infrared sea-surface temperature sensor.

#### D. Oceanographic Programmes and Climate Modelling

JOC requests the assistance of SCOR in determining the steps necessary for encouraging those programmes required to make climatic modelling. JOC expects that both theoretical and observational programmes will be needed. A particular need is for greatly improved understanding of those time-dependent oceanic processes which determine variations in sea surface temperature. Not only vertical processes, which redistribute heat in the upper layer, but horizontal advection and diffusion processes must be dealt with if the problem of climatic variation is to be successfully tackled. The objective would be to bring understanding to a level so that these processes may be parameterized in a coupled atmosphere-ocean model suitable for the study of climate and of fluctuations in climate.

## ANNEX XI

### JOINT OCEANOGRAPHIC ASSEMBLY REPORT OF MEETING OF STEERING COMMITTEE 15 May 1973

The Joint Oceanographic Assembly is scheduled for 13-24 September 1976 in Edinburgh. The Steering Committee for the Assembly met in Texel on 15 May under the chairmanship of Professor Wooster (SCOR); other participants were Professors Lacombe (IAPSO), Hempel (IABO), Simpson (CMG) and van Meighem (ACOMR), together with Ing. Heyning (ECOR), Mr Hemmen and Mr Currie (Royal Society), Professor Postma (SCOR), Mr Scott (IOC), Dr Capurro (UNESCO), Mr Tambs-Lyche (ICES) and Dr Sahrhage (FAO/ACMRR).

General plans for the Assembly had been determined at the last meeting of the Steering Committee, in June 1972 (see Proceedings, Vol. 8, no. 2, pp. 67-68). Within this context, the following additional matters were agreed:

**Programme:** Since both the General and Special Symposia should be of broad interest and interdisciplinary character, they should be organized collectively, with SCOR taking the initial responsibility. Proposals for suitable topics, with brief supporting statements, would be invited from participating organizations, so that a tentative programme could be established before the end of 1973. The sessions of contributed papers would be organized separately by the organizations concerned.

**Financing:** Local expenses would be met by the National Organizing Committee with the help of an appropriate registration fee. Arrangements for bringing scientists from developing countries would be made by the sponsoring agencies of the United Nations system. National committees would be urged to seek adequate funds to bring their scientists, including conveners and invited speakers, to the Assembly. It was estimated that an additional \$60,000 would be required to bring conveners and invited speakers who could not obtain national funding; the sponsoring agencies, such as UNESCO, FAO, WMO and UNEP, would be asked to foresee such an amount in their 1976 budgets. To examine such matters, the Logistics Committee should be established and should meet in November at the time of the 8th Assembly of the Intergovernmental Oceanographic Commission.

**Publications:** FAO should be requested to assume responsibility for compilation and publication of preprints of abstracts for both invited and contributed papers. It was considered desirable later to publish at least the invited papers from the General Symposia and possibly those of the Special Symposia. A selection might also be made of contributed papers for publication in a separate volume. No decision was reached on a possible publisher for such volumes.

**Publicity:** A brief early notice of the Assembly should be prepared for distribution to selected journals before the end of 1973. Members of the Steering Committee will assist in placing this notice in publications of their organizations, and the assistance of national committees will be requested for distribution of the notice in national media.

The next meeting of the Steering Committee will take place in January 1974 at the time of the 18th SCOR Executive Meeting.

## ANNOUNCEMENTS OF SYMPOSIA

SCOR/ SCAR Polar Oceans Conference  
May 1974

The Scientific Committee on Oceanic Research and the Scientific Committee on Antarctic Research are sponsoring a Polar Oceans Conference to be held at McGill University, Montreal, from 6 to 11 May 1974. Canada is the host country, through the agency of the Canadian Committee on Oceanography. A Programme Committee has been formed, and local arrangements are in the hands of the Arctic Institute of North America, Montreal.

The theme of the Conference, in broad terms, is the relation between special physical conditions both past and present in the polar oceans and their consequences for life in the sea; it will include a comparison between the two polar marine regions, between polar and tropical conditions and productivity, and the influence of climatic change. It was originally planned to offer invited papers only, but it became clear that this would not best serve the purpose of the Conference. On Monday to Thursday, the early part of each day will be taken up with the presentation of invited papers defining the concerns of that day's proceedings. These will be followed by contributed papers on related topics. The last two days (Friday and Saturday) will be available as required, for papers, or for group discussions and business.

Papers should fit appropriately within the following general framework:

- (1) Polar water masses: formation and distribution; bottom water; ocean fronts; convective processes.
- (2) Ice: biota; hydrodynamic and biological effects.
- (3) Productivity, poles and tropics: water column stability; production cycles; ecosystem diversity; seasonality; fisheries.
- (4) Climatic change: Cenozoic history; events in the past 200 years; relation between the two polar regions; past changes in productivity.

The Conference registration fee is \$25.00 for the entire 6 to 11 May programme. Accommodation in University residences will be available.

Some prospective participants have sent notice of their attendance. All who propose to attend are urged to notify, as soon as possible, the Chairman of the Programme Committee:

Professor M. J. Dunbar,  
Marine Sciences Directorate,  
Atlantic Oceanographic Laboratory,  
Bedford Institute of Oceanography,  
Dartmouth, Nova Scotia, Canada.

"Marine Plankton and Sediments"  
and 3rd Planktonic Conference

SCOR has asked Working Group 37 to organize a symposium entitled "Marine Plankton Plankton and Sediments" in 1974. The Working Group consists of E. Seibold (FRG) (Chairman) and A. Be (USA), H.M. Bolli (Switzerland), B.M. Funnell (UK), W. Riedel (USA), Y. Takayanagi (Japan), A. Jouse (USSR). Furthermore the 2nd Planktonic Conference, Rome, has asked E. Seibold to organize the 3rd Conference in Kiel.

(1) The Symposium, therefore, is planned together with the 3rd Planktonic Conference to be held in

Kiel, FRG: 9 to 13 September 1974

Accommodation normally will be offered by local hotels. Detailed information will be included in the 2nd Circular. The official language will be English. Discussion remarks will be translated into English by colleagues.

(2) The Programme will be divided between (a) 20 invited papers (b) shorter contributions and (c) demonstrations.

(a) Invited papers will be presented during the morning sessions:

Biogeography (2 lectures), Microfossils in deep sea sediments (4), Biogeography and evolution of plankton in cenozoic and mesozoic deep sea sediments (7), New results from plankton groups (3) and General methods (4). It is planned to publish them in a special volume.

(b) The afternoons are open for shorter contributions (15 min. including discussion time). It will certainly be necessary to organize parallel sessions with special topics. Nevertheless the papers should be of general interest, and not of local value. There are no plans to publish them in "Conference Proceedings".

(c) Near the lecture halls maps and other materials can be displayed. In university laboratories (with microscopes) exchange, examination and discussion of material will be possible.

(3) The registration fee will be US\$20. This will cover all organizational expenses and will entitle each participant to receive a copy of abstracts at the beginning of the Symposium/Conference.

Notification of wish to participate and requests for further information should be addressed to:

Professor Dr E. Seibold  
Geologisches Institut der Universität,  
Olshausenstr. 40/60,  
23 Kiel, FRG.

Tel: 0431/593 2851

SCOR WORKING GROUPS

Procedures

1. General or Executive meetings can decide to form or disband a Working Group (see also Annex IV, SCOR Proc., Vol. 1, No. 1, reprinted below).
2. For each group formed, the SCOR Executive shall nominate one of its members to be reporter for advising the Executive on the Group's activities. A member of the Executive who is a member of a group in his own right would not normally be appointed reporter for that group.
3. A Chairman for each Working Group shall be appointed by the President of SCOR after consultation with the member nominated under (2), other members of the Executive and other organizations' nominating members.
4. SCOR nominees shall be selected by the President in consultation with the Chairman and Executive Committee. All members shall be appointed by the President.
5. When a group is discharged the President shall address letters of thanks for services to all members.

Responsibilities of the Executive Member nominated as reporter for a Working Group are:

- A. To assist the President, as may be required, in selecting the Chairman, SCOR nominees and in corresponding with other nominating bodies.
- B. To assist the Chairman as desired in planning the activities of the Group and preparing estimates of expenses for submission to SCOR Secretariat.
- C. To advise the SCOR Executive on the activities of the Group and to represent the interests of the Group at SCOR Executive meetings.
- D. To obtain reports as appropriate and summarize salient points for SCOR; to evaluate recommendations and suggest what action on them might be taken by SCOR.
- E. To recommend what material should be published in SCOR Proceedings or elsewhere.
- F. To inform the Chairman of the Group and, where appropriate, other nominating bodies, of relevant decisions of SCOR meetings.
- G. When a group is disbanded to assist the President as required in the preparation of letters of gratitude.

General Instructions to SCOR Working Groups  
(Reprinted from SCOR Proceedings, Vol. 1, No. 1)

1. The creation of Working Groups is usually determined at General Meetings; in some cases, where the necessity for establishing a group is clear, action can be taken at Executive Meetings. Sometimes membership is decided at these meetings; sometimes National Committees are consulted first. In all cases, National Committees and relevant international and inter-governmental bodies are asked to nominate observers to participate freely in correspondence and meetings, and to receive documents. The observers are financed by their nominating bodies; SCOR pays fares, per diem and administrative expenses of their nominees.
2. Some Working Groups are in cooperation with bodies such as UNESCO, FAO, IAPO, ICES, etc. In such cases SCOR nominates some of the WG members and finances only them. Decisions on membership are made in close consultation with all the nominating bodies.
3. All Working Groups have terms of reference decided by SCOR (alone or in consultation with other nominating bodies). The Chairman of a Working Group may suggest to SCOR additional terms of reference but may not change those already given.
4. The tenure of Working Groups automatically expires at each SCOR General Meeting. Usually the Chairman of each Working Group is asked to present a written report and to help SCOR decide whether the Working Group should be reformed with or without changes in membership and terms of reference. Working Groups reports may be published by SCOR, UNESCO or other sponsoring bodies, as appropriate. Such publication does not imply SCOR approval or that SCOR agrees to act on any recommendations. SCOR may summarize or adapt the WG report for its own purposes. With joint Working Groups, disbanding, reforming and reporting will be made in consultation with the other nominating bodies.
5. SCOR action after receiving a Working Group report includes...
  - 5.1 Making recommendations to relevant bodies.
  - 5.2 Forming further Working Groups.
  - 5.3 Requesting or arranging (but not financing) laboratory and field studies.

ANNEX XIV

STATEMENT OF THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS  
REGARDING CONDITIONS FOR THE EFFECTIVE CONDUCT  
OF OCEANIC RESEARCH

(Submitted through the Ocean Economics and Technology Branch of the UN as a document for the 38th Meeting of Subcommittee III of the UN Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the limits of National Jurisdiction.)

Natural phenomena seldom correspond in location with national boundaries and their understanding often requires them to be studied wherever they extend or move. This is particularly true in the oceans where ease of access and flexibility of movement are essential for the effective conduct of ocean research. Yet, because of the distribution of resources and of man's activities and their effects on the environment, much of this research must take place in the waters and on the sea-bed within a few hundred kilometers of the coast.

It is for this reason that in 1954 the Bureau of the International Council of Scientific Unions (ICSU) asked UNESCO to convey to the United Nations Organization its belief that fundamental marine research carried out with the intent of open publication is in the interest of the whole of mankind. In 1958, following the Convention on the Continental Shelf, the General Assembly of ICSU requested its National Members to assist in ensuring that permission to conduct investigations of the bottom and the subsoil of the continental shelf be granted to any bona fide scientific research vessel.

Scientific research leads to improved understanding of oceanic features, processes and populations and is, therefore, important for all mankind as a basis for the rational use of the oceans, their resources and for protection of the marine environment. Any regulations or restrictions, on the conduct of open research in the areas beyond the limits of territorial waters, would inhibit the advancement of scientific understanding and would be detrimental to the future welfare of people of all countries.

ICSU, believing that it is in the common interest of all nations to participate and cooperate in ocean research, and to facilitate it to the fullest extent possible, adopted at its 14th General Assembly in Helsinki the following resolution:

"Recalling the position on fundamental research taken by the ICSU Bureau in 1954, and the resolution by the 8th General Assembly in 1958, on research on the continental shelf,

"Noting that the scientists of all countries should be able to conduct open research in the ocean, on the understanding that in so doing they accept an obligation to the adjacent coastal States to ensure that these States shall be able to participate in the research and share fully in its benefits.

"Recognizing that for many countries this will require that greater attention be paid and necessary assistance be provided to strengthen their capability to participate in the research and to utilize the results,

"Recognizing further that there must be an improvement in the exchange and dissemination of scientific information and in the other means whereby scientific results are made available,

"Recommends that in all cases, oceanic research should be conducted so as not to harm the environment or to interfere unjustifiably with other marine activities,

"Urges that every Nation concerned with developing the law of the sea give special consideration to the need for facilitating the conduct of open research

in the ocean - research which is intended for everyone's benefit and is characterized by full and timely availability of research plans and results, and

"Requests its National Members to bring this important matter to the attention of their governments."

## ANNEX XV

### REPORT ON THE SEVENTH SESSION OF THE IOC WORKING GROUP ON INTERNATIONAL OCEANOGRAPHIC DATA EXCHANGE

New York, 9 to 13 July 1973

by J. M. Colebrook - SCOR Observer

#### 1. Data exchange and data referral formats

Considerable progress was made at the meeting with respect to the establishment of agreed formats, even though, most of them are of a provisional or experimental nature.

(a) A revised version of the interdisciplinary inventory report from ROSCOP was accepted and recommended for use for a period of at least 3 years as from 1 January 1974.

(b) A general framework relating to data structure within which specific data exchange formats could be developed was accepted.

(c) A general data format capable of dealing with a wide variety of data types was accepted for experimental use.

(d) It was recognised that large banks of historical physical data already exist (e.g. ICES physical data) and that the formats of such data sets should be recognized for years to come as acceptable for international exchange.

(e) Geological data: the group agreed that the already accepted second level inventory system for geological data IG/GCI should be publicized and member countries urged to adopt this system. It was further agreed that a proposed format for the exchange of geological data be modified to conform with the accepted data structure framework (1b above) and be used on an experimental basis for the next two or three years.

(f) Biological data: the group agreed that member countries should be urged to adopt the second-level inventory scheme for biological data (ROMBI) as proposed by SCOR/ACMRR WG32. Mechanisms for the exchange of biological data have reached the stage of identifying those types of data amenable to exchange. The task of developing suitable formats for exchange was remitted to an ad hoc group on format standardization.

(g) IGOSS data archiving and exchange: the group reviewed the third draft edition of the Manual on IGOSS data archiving and exchange and agreed to some modifications on the recommendation of WMO. Following suitable amendment the manual will be submitted to IPLAN.

## 2. Manual on International Oceanographic Data Exchange

The third edition (revised) of the manual was published as IOC technical series No. 9 early this year. The group asked the secretariat to ensure that any necessary amendments (e. g. the revised ROSCOP form) should be published.

## 3. Data Management problems

(a) Satellite and airborne sensed data: the group agreed that no attempts should be made at this time to develop specific proposals for the exchange of these data. The secretariat were asked to compile and distribute to member nations lists of sources of satellite and remote-sensed oceanographic data.

(b) Instrumental wave data: in response to a report from SCOR an ad hoc group was established to consider the problems and requirements for data management in this field.

(c) GARP Atlantic Tropical Experiment (GATE): largely in response to the report from SCOR WG 43 an ad hoc group was established to study the problems of data management for GATE specifically in relation to secondary users. M. Peluchon is a member of this group and he will also be attending the September meeting of ISMG.

(d) Marine pollution data: the group agreed that its ad hoc group on marine pollution should coordinate closely with the ICG for GIPME, and the group was informed of the activities of the IOC in planning marine pollution monitoring programmes under the framework of IGOSS. It was agreed that the ad hoc group would benefit from the participation of an observer from SCOR WG45. Due to problems in relation to the lack of internationally accepted standards and techniques it was recognised that data referral systems based on agreed formats must play a large part, for the time being, in the international exchange of information on marine pollution data and the ad hoc group was directed to review and evaluate existing systems (e. g. ROSCOP, ROMBI, EDBD) and report to the next session of IODE.

## 4. Training and Education

The group established a task team to prepare a guide to the establishment and operations of national oceanographic data centres. The group was informed about training courses in data management at the USA NODC in cooperation with IOC and noted the offer of the USSR to make available similar facilities in 1974 or 1975. The group recommended IOC to take appropriate steps to provide any necessary assistance to developing countries in the establishment and/or development of national oceanographic data centres.

## 5. Arrangements for international oceanographic data exchange

The group received and approved, following some amendments, a report of a task team outlining proposals for strengthening the arrangements for international oceanographic data exchange based on the concept of a data exchange network composed of existing Declared National Agencies, National Oceanographic Data Centres, Regional centres and World Data Centres, together with a new element, the Responsible National Oceanographic Data Centre envisaged as being complementary to the WDCs and accepting responsibility for a defined area. The task team was given a job of further defining the

role of the RNODC and of preparing proposals for the implementation of the RNODC system for the next session of IODE.

6. Next meeting of IODE

Provisional arrangements were made for the eight session of IODE to be held at FAO, Rome early in 1975.

ANNEX XVI

FUTURE MEETINGS OF SCOR AND ASSOCIATED INTERNATIONAL ORGANIZATIONS

1973

23 May - 7 June	Konstanz, FRG	COSPAR XVI Meeting Symp: Approaches to Earth Survey Problems through the Use of Space Techniques
4 - 8 June	London	SCOR WG43: GATE Oceanography
5 - 6 June	Monaco	GEBCO Committee
12 - 15 June	Paris	Informal planning mtg FGGE buoy systems
19 - 22 June	Bergen	ICES/FAO ICNAF Acoustic instruments in fisheries research
18 - 23 June	Vienna	GESAMP Meeting
22 June - 2 July	<u>Marco Polo</u> on Great Barrier Reef	Symp: Corals and Coral Reefs (IABO Associated)
28 - 29 June	Kiel	ICES/SCOR WG42: Baltic Pollution
2 - 10 July	Heron Island, Australia	SCOR WG35: Methods in Quanti- tative Ecology of Coral Reefs
9 - 13 July	Cartegena	<u>Ad hoc</u> Group assessment CICAR
16 - 19 July	Oberpfaffenhofen	GATE Aircraft Programme
16 - 21 July	Cartegena	IOC-ICG CIQAR
9 - 13 July	New York	IOC-WG-IODE
30 July - 4 August	Helsinki	WMO/WHO Tech. Conf. on obs. of atmos. polln

13 - 17 August	Geneva	IOC/WMO Jt Planning Group IGOSS (IPLAN)
3 - 7 September	Moscow	GATE Data Management
11 - 15 September	Malta	SCIBP/UNESCO Symp. on Eastern Mediterranean
17 - 21 September	London	SCOPE WG Env. Assessment and Monitoring
20 - 21 September	Leningrad	ICSU General Committee
18 - 20 September	Columbus, Ohio	IAG/IAPSO Symp. Marine Geodesy
24 - 28 September	Bangkok	CCOP/EA and IOC: IDOE Workshop, metallogenesis and tectonics E. and S. E. Asia
September	Paris	Editor. Bd. IIOE Geol. /Geoph. Atlas
September	Brest	GATE Oceanography Data Management
1 - 5 October	Halifax	GATE C-Scale oceanographic experiment
1 - 10 October	Lisbon	ICES 61st Statutory Meeting
4 - 10 October	Kiel	SCOPE 2nd General Assembly
8 - 12 October	Paris	GATE Equatorial oceanographic experiment
October	Geneva	GATE Ship programme
8 October - 2 November	London	IMCO Conf. Mar. Polln
17 - 20 October	Victoria, B. C.	SCOR WG34: Climate Panel
30 October - 15 December	At sea (U. K.)	SCOR/UNESCO WG27: Tides of the open sea, intercal.
November/December	New York	UN Law of the Sea Conference - opening
?	?	<u>Ad hoc</u> Directory Group
Early November	Paris	JOA Logistics Group
2 - 3 November	Paris	IOC-EC 3rd Session

5 - 17 November	Paris	IOC - Assembly, 8th Session
13 - 18 November	Dusseldorf	Interocean 73 CMG Meeting

Other possible meetings 1973

SCOR/ACOMR/IAMAP WG44:  
Tropospheric Transport of  
Pollutants

SCOR/ECOR/IASH/ACMRR/  
UNESCO WG46: River inputs  
to oceans

1974

January	Melbourne	JOC for GARP
14 - 25 January	Melbourne	IAMAP/IAPSO Jt Assembly SCOR/IAMAP WG28: Air-Sea Interaction
28 January	Canberra	IAPSO Executive
28 - 30 January	Canberra	SCOR WG34 - Theoretical panel SCOR/SCAR WG38: Special Studies on Circumpolar Waters South of 40°S SCOR WG47: FGGE Oceanography
29 January - 2 February	Canberra	SCOR Executive, 18th Meeting
?	?	SCOR/ACMRR/ACOMR WG36: Coastal Upwelling Processes, Phys. & Biol. Panels
11 - 15 February	Paris	ICES/FAO/IOC Joint Coordi- nating Group, CINECA
5 - 8 March	Geneva	WMO/IOC/SCOR/SCAR <u>ad hoc</u> meeting expendable buoy programmes
April/May	Santiago	UN Law of the Sea Conference - 2nd Session
1 - 6 April	Paris	IOC Gp Exp. Ocean Res. IGOSS (IRES)

6 - 11 May	Montreal	SCOR/SCAR Polar Oceans Conference
6 - 11 May (During)	Montreal	SCAR Subcommittee, Antarctic Marine Biological Resources
May	Vina del Mar	IOC-EC 4th Session
June	Buenos Aires	IOC-ICG Southern Oceans 2nd Session
July	New York	IOC-ICG-GIPME 2nd Session
25 - 31 August	Washington	SCAR/IUBS Antarctic Biology Symposium
9 - 13 September	Kiel	SCOR WG37: Marine Plankton and Sediments Symposium
12 - 22 September	Istanbul	ICSU-GA
30 September - 9 October	Copenhagen	ICES 62nd Statutory meeting
September	?	SCOR XII General Meeting
September	Palma (Spain)	ICG/CMG Mediterranean Marine Geological Conference
1 - 6 October	Bordeaux	OCEANOEXPO Exploitation of the Oceans

1975

April	?	WG43 GATE Oceanography
May	?	SCOR Executive Committee
25 August to 5 September	Grenoble, France	IUGG General Assembly IAPSO General Assembly SCOR/ICES/UNESCO WG10: Oceanographic Tables and Standards
29 September - 8 October	Montreal	ICES 63rd Statutory Meeting

1976

January	?	SCOR Executive Committee
---------	---	--------------------------

16 - 25 August	Sydney	Int. Geological Congress CMG Meeting
13 - 24 September	Edinburgh	SCOR/IAPSO/IABO/CMG Joint Oceanographic Assembly - "Ocean World II" SCOR General Meeting

#### ABBREVIATIONS

ACMRR	Advisory Committee on Marine Resources Research (of FAO)
ACOMR	Advisory Committee on Oceanic Meteorological Research (of WMO)
CCOP/EA	Coordination of Joint Prospecting for Mineral Resources in offshore areas/East Asia
CCOP/SOPAC	Coordination of Joint Prospecting for Mineral Resources in offshore areas/South Pacific
CICAR	Cooperative Investigation of the Caribbean and Adjacent Regions
CIM	Cooperative Investigation of the Mediterranean
CINECA	Cooperative Investigation of the Northern Part of the Eastern Central Atlantic
CLIMAP	Climatical Mapping Programme (IDOE)
CMG	Commission on Marine Geology (of IUGS)
CNRS	Centre National de la Recherche Scientifique
COSPAR	Committee on Space Research (of ICSU)
COSTED	Committee on Science and Technology in Developing Countries (of ICSU)
COWAR	Committee on Water Research (of ICSU)
CTD	Conductivity/temperature/depth recorder
CUE	Coastal Upwelling Experiment
ECAFE	Economic Commission for Asia and the Far East (of UN Economic and Social Council)
ECOR	Engineering Committee on Oceanic Resources
FGGE	First GARP Global Experiment
GARP	Global Atmospheric Research Programme (of WMO/ICSU)
GAT/	GATE Atlantic Tropical Experiment
GEBCO	General Bathymetric Chart of the Ocean
GELTSPAP	Group of Experts on Long Term Scientific Policy and Planning
GESAMP	Group of Experts on Scientific Aspects of Marine Pollution
GFCM	General Fisheries Council for the Mediterranean (of FAO)
GIPME	Global Investigation of Pollution in the Marine Environment
IABO	International Association for Biological Oceanography (of IUBS)
IAMAP	International Association of Meteorology and Atmospheric Physics (of IUGG)
IAPSO	International Association for the Physical Sciences of the Ocean (of IUGG)
IASH	International Association of Scientific Hydrology (of IUGG)
IBP/PM	International Biological Programme/Productivity Marine
ICA	International Cartographic Association (of IGU)
ICES	International Council for the Exploration of the Sea

ICG	Inter-Union Commission on Geodynamics (of IUGG/IUGS) and also used with reference to International Coordination Groups of IOC
ICNAF	International Commission for the Northwestern Atlantic Fisheries
ICSU	International Council of Scientific Unions
IDOE	International Decade of Ocean Exploration
IGCP	International Geological Correlation Programme
IGOSS	Integrated Global Ocean Station System (of IOC)
IGU	International Geographical Union (of ICSU)
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Exchange (Working Group of IOC)
ISMG	International and Scientific Management Group for GATE
IUB	International Union of Biochemistry (of ICSU)
IUBS	International Union of Biological Sciences (of ICSU)
IUCN	International Union for the Conservation of Nature and Natural Resources
IUGG	International Union of Geodesy and Geophysics (of ICSU)
IUGS	International Union of Geological Sciences (of ICSU)
IUPAP	International Union of Pure and Applied Physics (of ICSU)
IUPS	International Union of Physiological Sciences (of ICSU)
IUTAM	International Union of Theoretical and Applied Mechanics (of ICSU)
JASIN	Joint Air-Sea Interaction Project
JOC	Joint Organizing Committee for GARP
JPS	Joint Planning Staff for GARP
LEPOR	Long-Term and Expanded Programme of Oceanic Research
MODE	Mid-Ocean Dynamics Experiment
NODC	National Oceanographic Data Centre (USA)
NORPAX	North Pacific Experiment
ROSCOP	Report of Observations or Samples Collected by Oceanographic Programmes
SCAR	Scientific Committee on Antarctic Research (of ICSU)
SCIBP	Special Committee for International Biological Programme (of ICSU)
SCOPE	Scientific Committee on Problems of the Environment (of ICSU)
TEB	GARP Tropical Experiment Board
TEMA	Training, Education and Mutual Assistance (IOC-WG)
WDC	World Data Centre