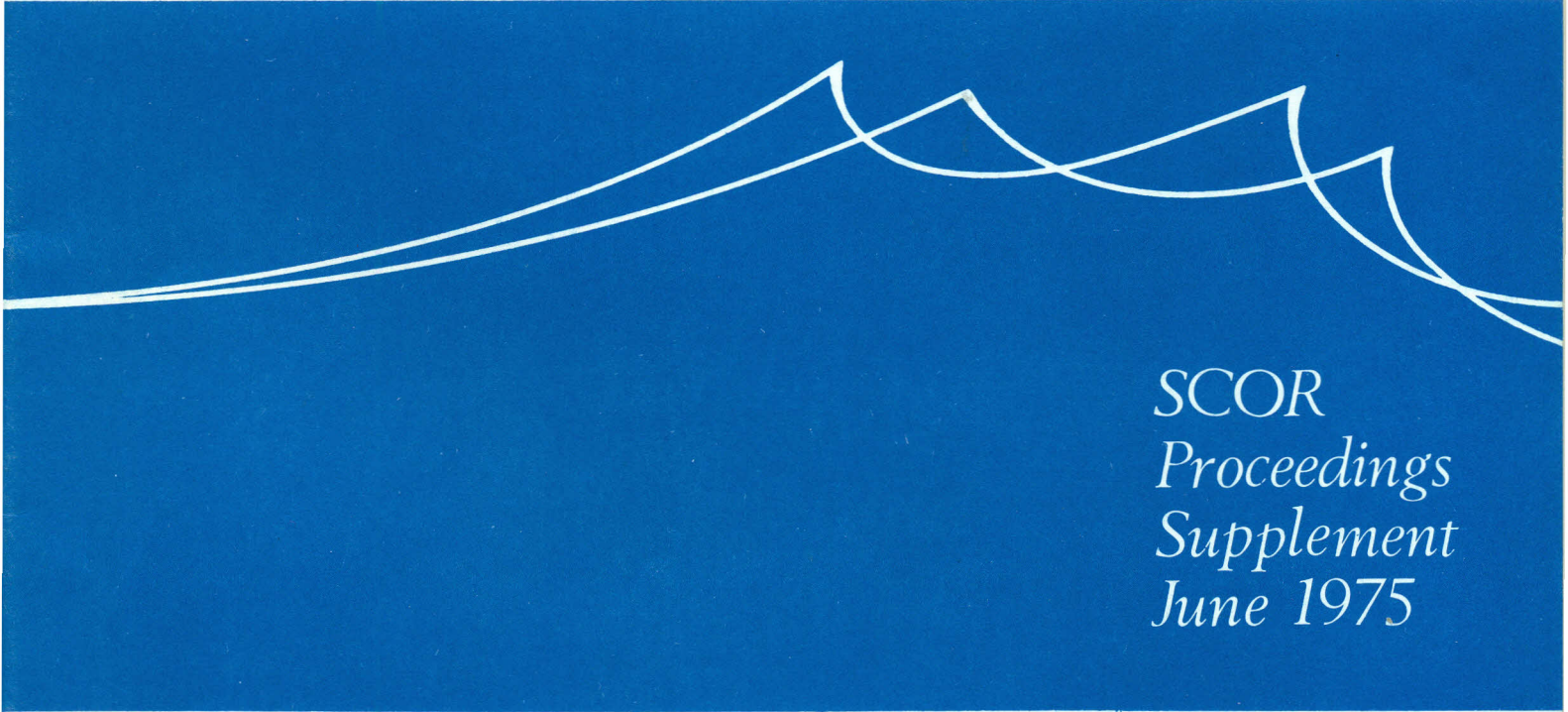


SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

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OF THE  
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH**

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REPORT ON THE TWELFTH GENERAL MEETING  
THE SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

Guayaquil, Ecuador, from 2 to 5 December 1974

The twelfth general meeting of SCOR was held in the Cámara de Comercio, Guayaquil-Ecuador from 2 to 5 December 1974. The scientific component of the meeting was a series of presentations on "El Niño" which had been organized by a steering committee on behalf of the Intergovernmental Oceanographic Commission, the United Nations Educational Scientific and Cultural Organization, the Food and Agriculture Organization and the World Meteorological Organization. The presentations were preparatory to a scientific workshop on 'the Phenomenon known as El Niño' from 9 to 12 December (see Annex III).

Teniente Pedro Cabezas G, Jefe del Departamento de Ciencias del Mar of the Instituto Oceanográfico de la Armada, welcomed the participants on behalf of the Institute and his Director and of Ecuador. During the meeting the participants were entertained at an evening reception by Capitan de Corbeta Raúl Toledo E., the Director of the Instituto Oceanográfico, which was attended by Contralmirante Sergio Vásquez P., Commander in Chief of the Ecuador Navy, and also visited the scientific laboratories of the Instituto Oceanográfico de la Armada. A list of these attending the meeting is given in Annex I.

1.0 ORGANIZATION AND FINANCE

1.1 MEMBERSHIP

National membership

- Brazil: As noted in SCOR Proceedings Vol 10, No. 1, Brazil had accepted the invitation to join SCOR and had elected to adhere in category 4.
- Belgium: The President had invited Belgium to form a national committee and to adhere to SCOR.
- Turkey: The President had addressed an invitation to the Scientific and Technical Research Council to adhere to SCOR.
- Cuba: The President had addressed an invitation to Dr Madruga, Director of the Instituto de Oceanologia in Habana inviting Cuba to adhere to SCOR.

Professor Hempel reported a substantial growth of interest in marine science in the Republic of Ireland where the National Science Council had established a committee on marine science. It was agreed to invite that committee to adhere to SCOR.

Laboratories in Peru, Colombia, Ecuador and Venezuela had been invited to send representatives to the 12th General Meeting of SCOR. For the benefit of representatives of these countries, it was explained that SCOR's role was to encourage collaboration between marine scientists and the practice for countries wishing to join SCOR was first to form a National Committee representing interested institutes in the country and then for that Committee to seek adherence to SCOR and to participate in SCOR meetings.



## 1.2 PUBLICATIONS

The final report of Working Group 33 on Phytoplankton Methods had been published as No. 18 in the series UNESCO Technical Papers in Marine Science under the title of A Review of Methods Used for Quantitative Phytoplankton Studies.

The manuscript of the report of the 1973 Intercalibration of Deep Sea Tidal Meters undertaken by Working Group 27 had been passed to UNESCO for publication in the Technical series in 1975.

The complete manuscript for the handbook on Zooplankton Preservation was passed to UNESCO in September 1974 for publication in the UNESCO series Monographs on Oceanographic Methodology.

Mr Scott reported that the data volume for the IIOE Atlas on Phytoplankton Production and some related factors, compiled by Professor J. Krey and Frau B. Babenerd of the Institut für Meereskunde, Kiel, had been produced and copies were available on request to the IOC Secretariat. The Atlas was nearing completion and IOC will request Professor Postma to visit Kiel to examine the compilation before it is passed for printing in about May 1975. A final meeting of the editorial board for the IIOE Geology/Geophysics atlas had been held in April 1974. This atlas was being compiled in the USSR and it was hoped that the material would be passed for printing about May 1975.

UNESCO had sought advice from SCOR about the desirability of reprinting the first two monographs on Oceanographic Methodology:

1. - On the determination of photosynthetic pigments, and
2. - On zooplankton sampling methods.

Some reluctance in approving such proposals was expressed because of recent progress in methodology but nevertheless there might still be some argument for reprinting in that continued use of methods could provide long time-series data. It was agreed to seek advice and comment from the editors of the two manuals, respectively Dr G. F. Humphrey and Dr D. Tranter.

## 1.3 FINANCE

A Finance Committee consisting of Professor P. Tchernia, Professor J. H. Day and Professor B. Morton, in consultation with the President and Assistant Secretary, examined the statement of income and expenditure to mid-November and estimates of total income and expenditure to the end of December 1974.

The estimates show that it is probable that at 31 December 1974 SCOR will hold adequate working funds (about \$20 000) in addition to a deposit reserve (about \$25 200).

The Committee noted the very large fluctuations from year to year in both income and expenditure, and recommend strongly that the deposited funds, which represent about six months of average expenditure, not be regarded as working funds. Every effort should be made not to draw on this reserve except in the case of urgent need.

According to the recommendations and decisions of the XII General Meeting, the level of proposed activities for 1975 is high but it is expected that national contributions, if maintained at the present level (about \$35 000 a year) together with the regular contracts and the direct sponsorship of specific activities likely to be forthcoming from UNESCO and IOC, should be sufficient for these requirements. A smaller cash balance at the end of 1975 may be expected. The Finance Committee urged National Committees which are



in arrears on subscriptions to pay as soon as possible; the total of the arrears is about \$5 000.

The Finance Committee approved the publication of a statement of income and expenditure for 1974. (Annex II).

#### 1.4 OFFICERS

Professor A. S. Monin had been elected Vice-President in 1968 when the terms of office were three years. In 1970 the SCOR constitution had been changed and Vice-Presidents can now serve two terms of four years. It was agreed to invite Professor Monin to continue in office until 1976.

### 2.0 WORKING GROUPS

#### 2.1 FORMER GROUPS

WG 15 Photosynthetic Radiant Energy (with UNESCO): The recommendations of the Group had been published in SCOR Proceedings Vol 10 No. 1. SCOR hoped that Mr J. E. Tyler would also submit the recommendations for publication in Limnology and Oceanography. Provision for a 'special' symposium on Photosynthetic Radiant Energy is included in the Programme for the 1976 Joint Oceanographic Assembly.

WG 23 Zooplankton Laboratory Methods (with UNESCO): A summary of the results of WG 23 entitled 'Laboratory Methods in the Study of Marine Zooplankton' by H. F. Steedman had been published in Journal du Conseil in June 1974.

After some difficulty with regard to the writing of a section on crustacea, which was eventually prepared by Dr Omori and edited and modified by Dr Fleminger, the complete manuscript for the Manual on Zooplankton Preservation Methods, had been passed to UNESCO in September 1974 by Dr Steedman for publication in the UNESCO series 'Monographs on Oceanographic Methodology'.

#### WG 33 Phytoplankton Methods (with IBP/PM)

- 1) A meeting had been held in Oslo on 21 and 22 November 1974 to discuss the content of a phytoplankton manual, the participants being A. Sournia (chairman), B. Dale, K. R. Gaarder, G. R. Hasle, R. Margalef, I. Nygaard, E. Paasche, K. Tangen, J. Throndsen, E. L. Venrick and B. Zeitzschel. Comments from Professor T. Braarud were also collected. SCOR welcomed the proposals but some concern was expressed that the table of contents might be too ambitious and that certain chapters might go beyond the scope of a manual on methodology of phytoplankton determination. The need for rapid publication, within three years at the latest, was stressed. The secretary will communicate to Dr Sournia these suggestions of SCOR.
- 2) Following consultation with Mrs Hasle, the Secretary had written formally to Professor E. Paasche suggesting that the University of Oslo might arrange a course in phytoplankton sampling for experienced biologists. It was felt that a course for about 8 workers, mainly from developing countries, would be most appropriate. It was hoped that UNESCO, possibly with some financial assistance from Norway, would arrange such a course.



3) Referring to the Report of SCOR WG 33, it was decided to establish an ad-hoc advisory panel with the following terms of reference:

- 1) To define the problems involved in the use of the inverted microscope for counting phytoplankton cells.
- 2) To advise SCOR on possible ways to arrive at quantitative estimates of the bias involved in the different methods of using the inverted microscope in various laboratories with the final aim of standardization and intercalibration and of publication of recommended methods in the future SCOR/ UNESCO manual on phytoplankton methods referred to above.

The report should be ready by 30 April and should be circulated by SCOR to a number of experts for advice prior to the next SCOR Executive Meeting. The publication in a marine science journal of part of the report dealing with item (1) might be envisaged by the authors.

## SCOR/ICES - NUTRIENT INTERCALIBRATION EXPERIMENT

It was reported that Dr Koroleff had indicated that the data had been compiled and were now being subjected to processing. SCOR expressed great concern that the analysis of these data, for which SCOR had made available some financial support, had been so long delayed and emphasized the need for timely publication, to illustrate the large differences obtained by different methods from standard samples.

### 2.2 EXISTING GROUPS

#### WG 10 Oceanographic Tables and Standards (with ICES and UNESCO)

A report of the Executive Committee reporter, H. Lacombe, was received.

The text of a statement by the Presidents of SCOR and IAPSO and the Chairman of WG 10, recommending the use of the standard tables for oxygen saturation, published by UNESCO, had been submitted to a number of journals for publication following consultation with SCOR, ICES and IAPSO Officers.

A report on a salinometer intercalibration experiment outside normal salinity ranges (Baltic low salinity 8‰ and Mediterranean high salinity about 38‰) had been submitted to the ICES Hydrography Committee and is reproduced as Annex IV.

The Standard Sea Water Service had now been transferred from Copenhagen to Wormley, UK, with financial support from IUGG through IAPSO. SCOR expressed sincere appreciation to ICES and particularly to Mr Frede Hermann for the valuable service that had been provided over many years. It was suggested that it might now be appropriate to add low and high range salinity standards and Professor Tchernia offered to provide a 38‰ water for preparation of a high salinity standard.

#### WG 21 Continuous Current Velocity Measurements (with UNESCO)

Dr Steyaert (UNESCO) reported that UNESCO expected to publish the report of the Third Intercomparison (RV Atlantis II - 1972) in the technical series during 1975. UNESCO was asked to ensure that all members of WG 21 received a copy of this publication.

A statement by the chairman, Dr J. C. Swallow, on the present status of the problem on intercomparison of current meters appears as Annex V. SCOR considered that this report and the recommendations might, with benefit, also be published elsewhere and



invited Dr Swallow to consider submitting his statement to one or two appropriate marine science journals.

It was agreed to disband the group, in accordance with the Chairman's recommendation, and the advice of the Executive Committee reporter, K. Voigt. Dr Voigt was invited to keep the field under review and to advise SCOR if and when need arose in the future for further SCOR sponsored intercomparison.

#### WG 27 Tides of the Open Sea (with UNESCO)

The group met in Brest on 16 and 17 September 1974. The report of this meeting appears as Annex VI. A report by the Executive Committee reporter, H. Lacombe, was received.

The report on, and analysis of, the results of the 1973 sea trials of deep sea tidal meters conducted from RRS Discovery were passed to UNESCO in September 1974 for publication in the series UNESCO Technical Papers in Marine Science.

The group's proposal to hold a final session in Grenoble in August/September 1975 was approved after which this group shall be considered to be disbanded. The Group should be encouraged, at this meeting, to produce recommendations on future requirements and/or the need for a new Working Group on specific aspects of the problem. On the recommendation of the Executive Committee reporter for this group it was agreed that the Chairman should visit La Jolla early in 1975 to discuss needs for future activity in this field, to facilitate preparation for the final meeting.

#### WG 28 Air-Sea Interaction

Following the eighteenth meeting of the Executive Committee, IAPSO and IAMAP had been informed that, at the twelfth General Meeting, SCOR would withdraw from this joint working Group. SCOR withdrawal was confirmed; at their meeting in August/September 1975, IAPSO and IAMAP will determine whether or not they wish to continue with this activity.

#### WG 32 Biological Data Inventories (with ACMRR)

The Chairman of the Group, Dr J. Colebrook, had informed the Secretary that he considered the group had completed its task now that the Results of Marine Biological Investigations (ROMBI) form proposed by the group had been adopted for experimental and developmental purposes by the IOC Working Group on International Oceanographic Data Exchange (IODE). However, he had advised that there was one area of biological data handling that required further attention and that was for a feasibility study of a numerical system for biological taxa to facilitate handling of biological data on computers. It was recognized, however, that any such system would have to extend far beyond the marine field and since IUBS has a committee on zoological nomenclature, the IUBS representative agreed that the Union should be invited to consider this need on a wider front.

In accordance with the Chairman's recommendation, WG 32 was disbanded. Dr Colebrook was invited to keep the problem under review and to advise SCOR should a need arise for further SCOR activity in this field. A copy of the ROMBI form is given as Annex XXV.

#### WG 34 Internal Dynamics of the Ocean

A report was received from Professor A. Robinson, Chairman of the Group (Annex VII).

In accordance with the advice of the Executive Committee reporter, K. Voigt,



SCOR approved the holding of an international POLYMODE scientific planning meeting during the first half of 1975 and invited the Chairman to propose who, in addition to the members of WG 34, should be invited to the meeting to ensure that the objectives were achieved. It was expected that in many cases participation in such a meeting would be supported from national sources and the Chairman should advise SCOR of which participants were unable to obtain such support.

It was agreed that identification of the critical problems of internal dynamics of the ocean was not an appropriate topic for the above mentioned meeting and SCOR urged the Chairman to arrange an informal meeting, in August/September 1975, of those members, and others, present in some other capacity at the IUGG General Assembly for this purpose.

#### WG 35 Methods in Quantitative Ecology of Coral Reefs

Having held a successful intercomparison of field methods at Heron Island in 1973, it was felt that the prime task of the Group had been completed and the group was disbanded. The Chairman, Dr D.R. Stoddart, and members of the group should be asked to serve as an editorial group to produce the proposed handbook of coral reef research methods to be published in the UNESCO series Monographs in Oceanographic Methodology.

Dr Steyaert expressed, on behalf of UNESCO, interest in publishing the proposed four language dictionary of reef terminology and SCOR believed that this was an appropriate undertaking for UNESCO, in consultation with IABO, and invited UNESCO and IABO to pursue the matter with Dr Stoddart. This, and other future activities related to coral reefs were considered to be the responsibility of the new IABO standing Committee on Coral Reefs.

#### WG 36 Coastal and Equatorial Upwelling Processes (with ACMRR and ACOMR)

The report of a meeting of the Group, held in Kiel, FRG, from 24 to 28 June appears as Annex VIII. A report from the Executive Committee reporter, H. Lacombe, emphasized that this had been a most successful and informative meeting from which new views on patterns of upwelling were emerging as well as preliminary ideas on the kinds of investigations necessary for studying the processes involved, both physical and biological.

A proposal of the Group that its terms of reference be amended to include equatorial upwelling was approved. The terms of reference now read:

"To review present knowledge of the physical, chemical and biological processes involved in coastal and equatorial upwelling; to evaluate strategies for the investigation of these processes and to recommend appropriate investigations."

Professor S. Zuta (Peru) had accepted an invitation to serve as a member of WG 36.

SCOR approved a proposal of the Group to meet in 1975 and, having been informed by Professor Hempel of the reasons why such a meeting should not be held at the time of the Kiel symposium on upwelling ecosystems in August (see item 5) or the IAPSO symposium on the generation of upwelling and vertical motion in the sea in September, agreed that such a meeting be held after the IUGG General Assembly, as proposed by the Group. It was suggested that USSR might be considered as a possible venue. Details of place and time to be decided by the Group in consultation with the Executive Committee.

#### WG 37 Marine Plankton and Sediments

A report (Annex IX) was received from the Chairman, Professor Dr E. Seibold, on the symposium that had been organized by WG 37 in Kiel, FRG from 9 to 13 September 1974. It was agreed that the group had completed its task and should be disbanded but the



members of the group under Professor Seibold, were asked to serve as an editorial board for the proceedings which would be published by Micropaleontology Press (New York) as a special volume. Publication was expected in late 1975 and would contain the invited lectures and recommendations of the consultant groups.

The recommendations arising from the symposium were contained in the Chairman's report. In particular a proposal was noted that SCOR sponsor a synthesis meeting in about five years time and Professor Seibold was invited to submit a specific proposal to SCOR at an appropriate time.

#### WG 38 Ocean Processes in the Antarctic (with SCAR)

As requested by the 18th Meeting of the SCOR Executive Committee, the Chairman of the original WG 38, Sir George Deacon, had submitted a final report to the meeting of the IOC International Coordination Group for the Southern Oceans (IOC ICG-SOC) in July 1974.

The membership of the new WG 38 had been established as follows: T. Kvinge (Norway) (Chairman), Sir George Deacon (UK), T. Foster (USA), P. Tchernia (France), A. Treshnikov (USSR). The appointment of two further members was expected shortly. (Subsequently Dr A. Killworth (UK) and Dr V. T. Neal (USA) were appointed). It was suggested that the Chairman might consider expanding the group to include a member from Argentina and possibly also one from South Africa.

A proposal by the Chairman that the group should initiate its work by correspondence and arrange a meeting during the second half of 1975, preferably with one or more of SCOR WG's 34, 37 and 38, at the time of some other international meeting was approved. It seemed probable that the IUGG General Assembly in Grenoble would provide an opportunity for such a meeting.

#### WG 40 Paleo-oceanography

A report from the Chairman, Professor Tj. H. van Andel was received (Annex X). It was noticed that a report on the small workshop on mathematical and statistical models in paleo-oceanography, held in Madison, USA, in April 1974 under the Chairmanship of Dr J. Imbrie with financial support from the US National Science Foundation, was being prepared for wide distribution and that a "Special" symposium on paleo-oceanography was included in the programme for the Joint Oceanographic Assembly, 1976.

#### WG 41 Morphological Mapping of the Ocean Floor

A status report from the Chairman (Dr A.S. Laughton) was received (Annex XI). WG 41 had led to the formulation of specifications for a new GEBCO edition and now that IOC and IHO had established a new joint Guiding Committee for GEBCO, which would hold its second meeting in April 1975, it was agreed to accept the Chairman's recommendation that the task of the group had been completed and that it should now be disbanded.

Mr Scott (IOC) reported that the first sheet of the new GEBCO edition had gone to press in Canada. The problem of financing the establishment of a geoscience unit was being investigated.

#### WG 42 Pollution of the Baltic (with ICES)

The Group had met in Copenhagen from 16 to 17 May 1974. A summary report of that meeting together with a summary report of a meeting of analytical experts from Baltic laboratories, which had been held in Copenhagen in February 1974, are given as Annex XII.



In accordance with a request from the eighteenth meeting of the SCOR Executive Committee, the President had discussed with the Chairman of the Group and with the General-Secretary of ICES the possibility of SCOR withdrawing from this Group. Both had urged SCOR to continue to co-sponsor the Group as also had Dr K. Voigt, SCOR Executive Committee reporter for the Group. Professor Hempel explained that even though the countries involved might soon all be members of ICES there was considerable advantage to the Group in being able to effect cooperation with academic institutions through SCOR and he believed that the subject of the group was of sufficient general oceanographic interest to warrant SCOR's continuing involvement.

It was agreed, therefore, to continue to co-sponsor this working group and to approve the proposed meeting in Copenhagen in May 1975.

#### WG 43 Oceanography related to GATE

Reports of meetings in London in February 1974 and in Leningrad in March 1974 together with a progress report by the Chairman, Dr G. Siedler, appear as Annex XIII. A report was received from the Executive Committee reporter for this group, K. Voigt. It was understood that about May 1975 ISMG hopes to produce a report on oceanographic activities during the field phases of GATE and, at the suggestion of the SCOR Executive Committee reporter for this group, SCOR requested that copies be made available to the members of WG 43 and to SCOR National Committees.

Proposals from the Working Group for an extensive programme of meetings and workshops during 1975 and 1976, which it was estimated might cost up to \$30 000 to \$40 000, were considered. The Secretary of IOC, Mr D. P. D. Scott, reported that in response to a request from SCOR, IOC would make available in 1975 the sum of \$8 000 to help to support these meetings and will consider the possibility of further financial assistance in 1976. SCOR was anxious to facilitate the working up and analysis of the GATE oceanographic data and with some support assured from IOC approved the scale of activities proposed. In particular, the Chairman was authorized to proceed with the arrangements for the third full meeting of the group in Southampton, UK in June 1975 at which time the group should discuss procedures for analysis of the data and elaborate proposals for workshops and other meetings that would be necessary.

Mr Scott reported that IOC was producing an advance bathymetric sheet for the GATE area, using all additional information that had become available. This, together with the ICITA Atlases, would be of value to WG 43.

The WMO Executive Committee had authorised JOC to extend to SCOR an invitation to nominate a representative on the JOC advisory panel for GATE, which would supersede ISMG. On the advice of the Chairman of WG 43, the President had sought and obtained from WMO approval for SCOR to nominate two representatives, one for the A/B scale experiment and one for the C scale experiment. Professor G. Siedler and Dr W. Düing had been nominated as the SCOR representatives.

#### WG 44 Tropospheric Transport of Pollutants (with ACOMR)

It had proved impossible to initiate a working group on this subject, and it was agreed to take no further action to activate a working group. However, there was still a need to organize a workshop type meeting to assess ongoing related international activities, the broad scientific problem and aspects of such problems that would benefit from international action of the sort that SCOR could promote effectively. Such a workshop might also suggest terms of reference for any new SCOR group or groups, taking into account the activities within international meteorological organizations and GESAMP.



Dr R. Chesselet (France) had, in September 1974, expressed his interest in the President's invitation to convene such a workshop but since that time the President had been unable to communicate with Dr Chesselet. It was decided that as much of the activities in this field was in the USA, the US National Committee should be invited to consider the possibility of organizing the workshop, preferably by early summer 1975, and use the international funds available through IOC from UNEP for overseas participants. Suggestions regarding topics and names of possible participants were conveyed to the US SCOR member present.

The Secretary of IOC reported that GESAMP had proposed that a small 'ad hoc' group be formed to study the interchange of pollutants between the atmosphere and the ocean and that WMO should take the lead in convening the group. WMO had nominated two members of the 'ad hoc' group and had invited IOC to nominate two members. SCOR offered a number of suggestions for IOC's consideration.

WG 45 Now known as  
Liaison Panel on Marine Research Related to Pollution (with ACMRR, ACOMR, ECOR, ICES and GESAMP)

In June 1974, National Committees had been asked particularly to consider the views expressed by the Executive Committee in SCOR Proceedings Vol 10 No. 1 regarding the role for SCOR in marine research related to pollution and pollution monitoring programmes so that a statement could be formulated at this meeting. Some National Committees had offered comments as had some members of the liaison panel, all of which supported the views of the Executive Committee. In determining its policy on this matter it was necessary for SCOR to take into account the activities of many other international organizations. In doing so SCOR decided that there was no further purpose to be served by the liaison panel (originally WG 45) and agreed to recommend to the other participating organizations that it be disbanded.

SCOR's opinion on its role in marine research related to pollution can be summarized as follows:

The Thirteenth General Meeting of SCOR supported the points of view developed by the Executive Committee at its meeting in January 1974 and recorded in SCOR Proceedings Vol. 10 No. 1.

As a non-governmental organization, SCOR is desirous not to duplicate activities which are more appropriately under consideration by intergovernmental organizations and intends to limit its activities to those fields for which it has unique access to the necessary expertise.

In the field of marine research related to pollution, SCOR should concentrate on furthering basic studies of water movements, geochemistry and marine ecology and advancing understanding of the boundary processes where the ocean interacts with the land, rivers, the atmosphere and the sea floor. These areas of interaction are the principle transport pathways of pollutants to the ocean. Improved knowledge of the basic processes is essential for understanding the transport of any substance, its fate in the sea and impact on resources and human activity.

The IOC International Coordination Group for Global Investigation of Pollution in the Marine Environment (IOC ICG-GIPME) has now produced a proposed outline of a comprehensive plan. This outline suggests that IOC ICG-GIPME be concerned primarily with regional baseline studies, mass balance calculations and periodic assessment of the health of the ocean which will include studying distribution of pollutants and the biological effects.



The IOC ICG-GIPME will collaborate with other organizations, such as ICES, on regional activities.

The IOC ICG-GIPME maintains liaison with the relevant branches of intergovernmental organizations (such as UN, UNESCO, UNEP, FAO, WMO, WHO, IAEA, IMCO, ICES) with responsibilities in relation to monitoring of pollutants in the marine environment and which are the competent organizations to consider the implementation of rational programmes which might be recommended by IOC ICG-GIPME. SCOR is not concerned with plans for routine monitoring and therefore does not need to maintain direct relationship, on pollution matters, with these organizations provided SCOR continues to be represented at meetings of IOC ICG-GIPME.

The GIPME plan will, from time to time, identify basic scientific problems of the kind appropriate for SCOR to consider and these, together with specific research problems believed to be important by SCOR, are the areas in which SCOR should concentrate its efforts.

In adopting the above approach, SCOR will be able to make the contribution for which it is best qualified to the global study of marine pollution and will take its appropriate place within the logical division of activity in the coherent plan envisaged by IOC ICG-GIPME. SCOR remains willing to help, and to respond to requests for advice from other international organizations, whether intergovernmental or non-governmental, wherever it is competent so to do.

#### WG 46 River Inputs to Ocean Systems (with ECOR, IAHS, ACMRR and UNESCO)

The first meeting had been held in Paris from 24-27 June 1974. The report of this meeting appears as Annex XIV.

The General Meeting of SCOR considered that the group had made a good start in identifying its tasks and confirmed the President's action in approving the convening of a second meeting of the group in early 1975. This meeting will discuss the planning of a scientific workshop on River Inputs to Ocean Systems which might be held in late 1975.

It was noted that IOC had covered the expenses of the first meeting of the group from funds available to IOC under a contract with the United Nations Environment Programme and it was expected that the costs of the second meeting would be met from the same source.

It had been proposed that a sediment microbiologist be added to the membership of the group and suggestions were offered for further consideration. It was also suggested that Dr E. Goldberg (USA), as convenor of the new 'ad hoc' advisory panel on biogeochemistry of estuarine sediments, might assist WG 46 in its work.

WG 47 Oceanographic Programme during FGGE: The group has been established with the following membership: Professor H. Stommel (USA) (Chairman), Professor G. Siedler (FRG), Dr P. H. Hisard (France), Dr M. Miyata (Japan), Dr R. Pollard (UK), Dr A. F. Treshnikov (USSR) and Dr T. Kvinge (Norway).

In his report to the General Meeting, the Chairman had noted that a number of large oceanographic programmes were developing for the equatorial region of all three oceans to take place in 1978-79 and take advantage of the atmospheric data coverage of FGGE. The proposals for these programmes, such as the continuation of GATE type studies in the Atlantic, MCNEX, NORPAX, had not been generated by WG 47 and until now JOC had not suggested that oceanographic programmes could contribute to the objectives of FGGE, therefore WG 47 had been concerned more with ocean investigations that could take advantage of FGGE. At the meeting of JOC in November 1974 it had been de-



terminated that ocean reaction to wind was important for the first, as well as the second, GARP objective, particularly in relation to atmospheric prediction models of 2 to 3 weeks or more. For this reason there was need for limited data on the mixed layer to be incorporated into FGGE.

It was decided that it was not essential for WG 47 to take early action to generate further proposals for programmes purely to take advantage of FGGE, but WG 47 should, if possible, attempt to coordinate the work being planned for each individual ocean. There was, however, now an urgent need for WG 47 to consider, by correspondence and possibly by a meeting during 1975, the design of an oceanographic programme that would contribute directly to the objectives of FGGE. The Chairman should be asked to initiate early action on this matter bearing in mind also that JOC has requested its ad hoc working group on Coupled Atmosphere-Ocean Models, in cooperation with WG 47 and other relevant SCOR Working Groups, to prepare a plan for presentation at the next meeting of JOC which would include an oceanographic programme for FGGE and an experimental programme for coupled models.

WG 48 The Influence of the Ocean on Climate: The membership of this group has not yet been established although the Chairman, Professor H. Charnock (UK) was in correspondence with a number of interested scientists. The composition of the Climate Panel of the group, transferred from WG 34, remained unchanged. See Annex XVI for a statement on the current activities and objectives of the panel.

The Chairman was asked to take note of recommendation 5 of the Sixth session of the WMO Commission for Atmospheric Sciences, as endorsed by the WMO Executive Committee at its meeting in June 1974, which emphasizes the need for understanding the response of ocean circulation to changes in atmospheric circulation to facilitate studies of climatic change.

It was reported that in response to a proposal by the Secretary General of ICSU, arrangements were being made for an informal meeting on 22 January 1975 of representatives of ICSU, WMO and UNESCO to discuss various aspects of the integration of climate research. SCOR believed that such a meeting was timely and could produce valuable guidelines for planning future activities aimed at understanding climatic change. It was agreed to suggest to ICSU that the following be invited to the meeting to represent the interests of the ICSU organizations concerned with marine science: Professor A. S. Monin (USSR), Professor H. Charnock (UK), Professor H. Stommel (USA) and Professor H. Lacombe (France).

After the informal meeting in Paris, the Chairman of WG 48 may feel it desirable to reconsider the terms of reference and structure for his Working Group in the light of any revised arrangements that were agreed. If so, he should submit his proposals to the President for consideration by the Executive Committee by correspondence.

Noting the successful WMO-ICSU-UN conference on the physical basis for climate and climate modelling that had been held in Wijk, Sweden from 29 July to 9 August 1974, it was suggested that it would be beneficial if copies of the report of that meeting, when available, were to be made available to members of interested Working Groups of SCOR (e. g. WGs 34, 40, 47, 48 and 49) and the SCOR Executive Committee.

One of the important observational inputs for studies of climatic change were the long-time-series from the North Atlantic Ocean Stations. It was hoped that some of these



stations would be continued but it was understood that the number was likely to be reduced considerably.

#### WG 49 Mathematical Modelling of Oceanic Processes

Dr K. Bryan (USA) had agreed to serve as Chairman of WG 49, and invitations to serve as members had been issued to a number of scientists. Professor Lacombe is Executive Committee reporter for this group.

#### WG 50 Biological Effects of Ocean Variability (with ACMRR)

The membership of this group had been established as follows:

ACMRR nominees: A. Longhurst (UK) (Chairman), D. H. Cushing (UK),  
O. Dragesund (Norway)

SCOR nominees: J. Namias (USA), P. Smith (USA), R. Le Brasseur (Canada)

Professor G. Hempel is SCOR Executive Committee reporter for this group.

Dr Longhurst reported that, as a majority of the members of the group would be present at the workshop following the SCOR meeting, he would convene the first meeting of the group in Guayaquil. The report of that meeting appears as Annex XV.

### 2.3 NEW WORKING GROUPS

No new working groups were established at this meeting but four different ad hoc advisory panels were formed to advise on possible future actions for SCOR. See items 2.1 and 3.2.

The four panels are on:

The inverted microscope method of phytoplankton counting - convenor Mrs G. Hasle.

Mangrove ecology - convenor Professor W. E. Odum.

Lagoons - convenor Dr A. Ayala-Castañares.

Biochemistry of estuarine sediments - convenor Dr E. Goldberg.

## 3.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

### 3.1 INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

As requested by the 18th meeting of the Executive Committee, CMG had provided comments on the preliminary report on Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia, prepared by a joint IOC-CCOP IDOE workshop, in September 1973. These comments had been submitted to IOC on behalf of SCOR.

At the fourth session of the IOC Executive Council (IOC EC-IV) SCOR had been asked for advice on a proposal from CCOP/SOPAC that a study of the utilization of nutrients and thermal energy of deep oceanic waters be included in LEPOR. This question had been referred earlier to the Executive Committee for consideration. After discussion, SCOR concluded that it appeared unlikely that this subject was appropriate for LEPOR but remained unclear exactly what was envisaged. In any case it did not appear to be a strictly oceanographic programme and IOC was advised to refer the matter, with more information, to ECOR and ACMRR.



IOC resolution EC-IV. 10 sought SCOR's advice on a recommendation of the Tropical Experiment Board of GATE that consideration should be given to the publication of an atlas of the oceanographic data collected during GATE. A proposal for such a synoptic atlas prepared by Dr G. Philander of ISMG of GATE had been sent to WG 43 for comment. The Chairman of WG 43, Professor G. Siedler and the SCOR Executive Committee reporter for that group, Dr K. Voigt, had both indicated that such an atlas would be useful, particularly if it could be produced quickly and inexpensively. SCOR supported these views and invited WG 43 to suggest how best the relevant material could be compiled rapidly and published in a simple, inexpensive manner. These suggestions will be submitted to IOC.

Mr Currie reported that he had conveyed to FAO such material for the proposed International Directory of Marine Scientists as he had received from National Committees and he believed that the views SCOR had expressed regarding the content of the directory had been taken into account. He understood that FAO now hoped to produce a first draft in 1975. SCOR expressed regret at the delays in producing the draft and stressed to FAO the need for a new directory and hoped that its production would be pursued with vigour.

SCOR will be represented at the fifth session of the IOC Executive Council from 3 to 8 March 1975 in Venice.

### 3.2 UNESCO

Dr M. Steyaert, UNESCO Division of Marine Sciences presented a number of proposals related to the UNESCO's programme of promotion of networks of regional research programmes in marine science, in which SCOR might assist.

#### Mangrove Ecology and Productivity:

Dr W. E. Odum (USA) had been engaged as a consultant by UNESCO to prepare a review of the scientific problems of these areas. A copy of Dr Odum's report had been transmitted to SCOR. Resulting from a formal request from the Thai authorities for UNESCO to develop a research programme on mangrove ecology and productivity at the Phuket Marine Biological Centre, UNESCO had produced a draft proposal for a preliminary survey of the flora and fauna of the swamps, sediments and detritus accumulation of the mangrove areas of Phuket. A copy of this draft proposal was presented. In his capacity as SCOR member responsible for liaison with UNESCO, Professor J. E. G. Raymont had produced, following consultations with UNESCO, an extensive list of scientific studies required in the mangrove environment but it had not been possible from this to define the priority tasks warranting attention by SCOR.

Professor J. H. Day had represented SCOR at the first international symposium on mangrove biology and management, Hawaii, October 1974. Professor Day's report included an identification of research priorities.

It was agreed to support the UNESCO decision to proceed with the establishment of the proposed research programme at Phuket but to suggest that comparative studies in other regions could be deferred for the time being.

SCOR decided to establish an ad-hoc advisory panel on mangrove problems:

- 1) to assist the UNESCO Division of Marine Sciences in their planning of a regional research programme on mangrove ecology and productivity and to keep SCOR informed.
- 2) to advise SCOR by 30 April 1975 whether there is a special need for a SCOR working



group on oceanographic aspects of the mangrove ecosystem and if so to propose terms of reference.

### Lagoons and Estuaries

Dr Steyaert reported that in pursuance of its desire to develop regional programmes in the coastal zone, UNESCO was considering asking SCOR to establish working groups on the biogeochemistry of estuarine sediments and on lagoons. UNESCO was in the process of engaging consultants to review and summarize the scientific knowledge on these subjects as follows: microbiology and biochemistry of estuarine sediments - Dr T. Fenschel (Denmark); geochemistry of estuarine sediments - Professor R. Woolast (Belgium); Lagoons - not yet determined.

There is an increasing interest in multiple use of lagoons and estuaries including fisheries, aquaculture and swamps and land reclamation. In many cases the engineering and fisheries expansion programmes may conflict and not take into account the possible sensitivity of the ecosystem. The proper knowledge of coastal lagoons and estuaries is not only of a great value to science but also to the economy, particularly in developing countries.

Much work is being carried out in various parts of the world with, in some cases, obvious duplication of efforts, lack of clear objectives and with non-comparable methods. Standardization of concepts and methods for the assessment of the various types of lagoons and estuaries seems needed for timely advice on wise management.

It was decided to establish an ad-hoc advisory panel on biogeochemistry of estuarine sediments to assist UNESCO, and their consultants, in identifying the scientific problems and for determining if there is a need for a special working group of SCOR, bearing in mind the activities and plans of WG 46. Dr E. Goldberg (USA) accepted an invitation to serve as convenor of the panel.

This panel should report to SCOR by 30 April 1975.

It was also decided to establish an ad-hoc advisory panel on lagoons to assist UNESCO, and their consultant, in identifying the scientific problems in this subject and to recommend if there is any useful action SCOR can take, such as the examination of methodological problems and/or promotion of a symposium on the oceanographic aspects of lagoons, taking into account the activities of WG 46 and the panel on biogeochemistry of estuarine sediments. Dr Ayala-Castañares (Mexico) accepted an invitation to serve as convenor of this panel.

This panel should report to SCOR by 30 April 1975.

### Symposium on Tropical Zooplankton

The ninth meeting of the UNESCO Advisory Panel for Marine Biological Centres had expressed a need for a symposium on tropical zooplankton to be held in Goa, India about February or March 1976 at the time of the next meeting of the Advisory Panel and the initiation of a UNESCO supported research programme on tropical zooplankton at the Indian National Institute of Oceanography at Goa. SCOR accepted an invitation from UNESCO to co-sponsor the symposium and recommended that the UNESCO Advisory Panel constitute the organizing committee for the symposium. If the Panel wished to co-opt additional members for this purpose, SCOR would be pleased to offer suggestions.

### UNESCO Advisory Panel for Marine Biological Centres

Dr Steyaert reported that, in accordance with the terms of reference for the Panel, three replacement members would have to be selected at the next meeting, in early 1976



and the advice of SCOR on such replacements would be appreciated. SCOR will suggest names at its next Executive Committee meeting. Dr Steyaert invited SCOR's comments on an idea that the terms of reference of the Advisory Panel might be extended to make the Panel responsible for supervising and/or co-ordinating the various research activities within the expanding UNESCO regional programme. SCOR accepted that the Panel might properly have a coordinating function but suggested that for that purpose membership of the Panel might have to be expanded.

#### Liaison between SCOR and UNESCO

The appointment, at the eighteenth Executive Committee meeting, of Professor Raymont to effect liaison between SCOR and UNESCO had proved most valuable and had been greatly appreciated by both organizations.

It was considered desirable that this kind of semi-formal contact should continue but as the work-load was obviously increasing it was agreed to invite Professor P. Tchernia to assist Professor Raymont in this task. In the geological field, CMG already maintained close contact with UNESCO and problems related to the Earth Sciences could be referred to CMG. There may develop a need to appoint further members to what was becoming a SCOR/UNESCO informal liaison panel.

### 3.3 TRAINING EDUCATION AND MUTUAL ASSISTANCE

Most of the contribution that SCOR can make in this field will be in relation to the relevant activities of IOC and UNESCO.

In plenary and at an informal evening session National Members of Argentina, Australia, Canada, France, Federal Republic of Germany, Japan, Mexico, Netherlands, Peru, South Africa, Sweden, United Kingdom, United States and Venezuela discussed the present and future role of SCOR in strengthening oceanography in developing countries.

Reference was made to the report of the relevant discussions at the 18th SCOR Executive Meeting. Representatives of IOC and UNESCO contributed by describing the efforts of both organizations in the development of regional programmes of training and mutual assistance.

The general position of SCOR regarding the development of marine science can be summarized as follows:

SCOR's primary task is to further international scientific activity in all branches of oceanic research. This is based on the premise that in the long term the advancement of marine knowledge and free availability of the results of marine research must be of benefit to all nations.

It is of general scientific, political and economic interest to develop open marine research on a world wide basis. It is essential that as many countries as possible participate in this development and share its benefits.

As in all branches of science there is an obligation on marine scientists to communicate their results and methods to others and to assist them in their scientific work. Non-governmental scientific organizations have a particular role to play in the transfer of science across borders. The improvement of communication and collaboration between marine scientists of different disciplines and countries is regarded as one of the important tasks of SCOR in the promotion of marine science.

The present state of development of the major disciplines of marine science in the



various parts of the world shows a great diversity which does not fall necessarily in the common categories of developing and developed countries, e.g. laboratories in Latin America have reached very high competence in certain fields of pure and applied marine science; on the other hand, oceanography is neglected in a number of industrialized countries.

The raising of the academic level of marine science institutes is a long term process which requires continued efforts in the development of training programmes at all levels in national or regional academic institutions.

When training abroad is designed to provide a scientist with specialized expertise, which might lead to a higher academic degree, the interests of the home laboratory of the candidate should be taken into account when selecting the topics for specialized study.

Each country will develop its own policy regarding marine science according to the national needs and potentials. National authorities guided by scientists should formulate their interests regarding international cooperation and assistance. SCOR should encourage scientists of all interested countries to identify and communicate their specific problems and needs for further development of marine science.

In accordance with resolution 11 of ICSU 15th General Assembly, October 1974, the highly developed laboratories (and similarly research vessels) should devote effort to the solution of urgent scientific problems of the developing countries. However, the building up of local competence in training and research seems at least equally important and SCOR might play a useful role in advising and assisting UNESCO in its work of planning and implementing regional projects for the development of the marine sciences taking into account the great diversity of needs in the different regions and countries. Regarding further cooperation between SCOR and UNESCO in this respect reference is made to SCOR Proceedings 10 (1), p. 36 para. 6.

Collaborative programmes should be planned jointly by scientists of countries having research interests in the region. SCOR might consider this when commenting on IOC proposals and might assist scientists in developing countries to participate in those discussions from the outset.

In the course of the discussions a number of suggestions were made on how to bring scientists of developing countries into closer contact with the other parts of the scientific world, and how to assist them in their scientific work. The following suggestions were offered for further consideration in the national SCOR committees and in the SCOR Executive.

- a) To create public awareness and by this to help the local scientific community, SCOR should continue, and perhaps expand, its policy of holding general meetings, as well as meetings of its executive committee and scientific workshops in countries where marine research activity was being newly developed.

SCOR working groups should consider meeting in developing countries wherever this was appropriate to their activity.

The contacts between the participants of the various types of SCOR meetings and the local scientific communities might be intensified by the arrangement of seminars and lectures, to create local interest and initiative on topics of particular importance for the region.

Port calls of foreign research vessels at places where marine science activities are going on should if at all possible be of sufficient duration to establish close contacts with local laboratories, particularly if the port was near a developing



regional centre and if a collaborative project in the area was being considered.

- b) Awareness of the actual needs and potentials of research institutes and teaching facilities of developing countries can best be achieved by bringing scientists of advanced laboratories into personal working contact with scientists of developing laboratories. SCOR through its national committees should promote scientific collaboration on the level of institutes and individuals. The concept of sistership between institutes working in different areas but dealing with similar scientific problems carries great prospects, as it is based on mutual scientific interest instead of one-way assistance schemes. It permits steady building up of scientific competence and brings into close contact scientists of different age and levels of training. Important elements of the sistership concept include post-graduate fellowships, exchange of senior and junior scientists for visits and extended periods of collaborative research, participation in expeditions and their analysis up to joint publications of the results, assistance in building up libraries and instrumentation. In most cases preference should be given to large projects instead of a multitude of small and short term assistance enterprises.

When a developing laboratory wants to enter a new field of research, assistance from senior visiting experts may be required. When a University wishes to introduce new disciplines into its curriculum or establish advanced study courses in marine science it will often be necessary to seek the assistance of experienced senior University teaching staff from abroad in the development of suitable courses. As such senior scientists may find it difficult to stay for the extended periods necessary, it might suffice for well qualified junior experts to be appointed to collaborate with local staff for extended periods under the guidance of the senior experts who would make periodic visits.

Students and junior scientists of advanced laboratories show an increasing interest in working in developing countries together with local scientists. The new IOC programme for assistant researchers might facilitate the financing of such schemes.

Senior scientists and university staff should be encouraged to take their sabbatical at institutes of developing countries where counterparts in their own research interests exist.

- c) Whenever appropriate SCOR should include in its working groups one or two scientists from developing countries.

SCOR should keep in mind the particular scientific needs of developing countries with regard to the management of coastal areas and the needs for relatively simple standardized methods and instrumentation for marine research, exploration and environment control.

SCOR may advise UNESCO, FAO and WMO on the holding of advanced training courses in specialized methodology.

- d) The increasing complexity of modern oceanographic equipment makes it particularly important for laboratories in developing countries to receive advice and assistance, upon request through the Members of SCOR, in such matters as the selection of appropriate and less expensive equipment and the calibration and maintenance of instruments.

It is equally important to the promotion of training in science, to promote training in adequate maintenance of the tools of the science.

Mr Scott reported that the next meeting of the IOC Working Committee on Training.



Education and Mutual Assistance was planned to be held in Manila in September 1975. Regional meetings are tentatively scheduled for Mexico City, Casablanca, Saigon and Cairo.

Professor Wooster reported that a workshop on problems of technological transfer had been held recently in the USA and that he would endeavour to obtain copies of the report of that workshop for distribution, through SCOR, to National Committees. The Ocean Policy Committee of the US National Committee was planning a long term study of the problem.

It was reported that IOC had instructed its Secretary to propose to the Governing Council of the new UN University that marine science, its application and role in human affairs, be included in the curriculum for the University and to develop proposals for a course. SCOR strongly supported the proposal and agreed to offer advice and assistance, if requested, in the design of suitable courses at graduate and post-graduate level.

SCOR was informed of plans to hold a college on the physics of the ocean and atmosphere from 9 September to 5 December 1975 at the International Centre for Theoretical Physics at Trieste. The course will be designed mainly to give young graduates in mathematics and physics from developing countries an appreciation of the scientific problems in the ocean and atmosphere. The directors of the course will be Professors Deacon, Fye and Garcia with the collaboration of Professors Finetti, Fonda, Furplan, Marussi, Morelli and Mosetti, of the University of Trieste. An initial bulletin describing the course will be issued shortly and further information is obtainable from the Centre at P.O. Box 586, I-34100, Trieste, Italy. SCOR invited its members to offer comments on the bulletin, when issued, and encouraged national committees to assist participants and invited lecturers.

#### 3.4 FAO/ACMRR

Noted that Dr H. Kasahara was now the Secretary of ACMRR. The next meeting of ACMRR was scheduled from 8 to 12 September 1975 in Lisbon.

#### 3.5 WMO/ACOMR

Mr G. Verploegh reported that the next meeting of ACOMR would be held in Geneva from 10 to 15 March 1975 and that the agenda would include such matters as cooperation with SCOR WG 36, JOA and atmospheric aspects of pollution. SCOR will be invited to send a representative to this meeting.

Professor Charnock enquired whether ACOMR could be asked to report on the present status of the proposed WMO project on historical sea surface temperatures. If this programme was not proceeding, some other organization might consider taking it up.

#### 3.6 ICES

Present SCOR relationship with ICES was concerned mainly with WGs 10 and 42 and with ICES co-sponsorship of JOA Symposium S11 on controlled ecosystem experiments.



## 4.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

### 4.1 AFFILIATED ORGANIZATIONS

#### CMG

A report was presented by Dr T. F. Gaskell and Professor E. S. W. Simpson on CMG activities and a review of the results arising from the International Marine Geoscience Workshop, Honolulu, September 1971. (Annex XIX).

CMG was intending to prepare a proposal for a second marine geoscience workshop to draw up guidelines for future international collaboration. SCOR looked forward to seeing the proposal when it became available.

#### IABO

A report by the Secretary, Dr T. Wolff, was received (Annex XX). Professor Hempel reported that it was expected that the next issue of IABO Proceedings would be published in June 1975, the last having been in June 1973.

#### IAMAP

IAMAP had become an affiliated organization of SCOR and was collaborating in some of the Working Groups of SCOR. SCOR's desire for a closer link with IAMAP was expressed. Professor Charnock drew attention to the IAMAP News Bulletin No. 6, extracts from which appear as Annex XXI.

#### IAPSO

A report was received from the Secretary of IAPSO, Dr E. LaFond, on activities of IAPSO relating to SCOR (Annex XXII).

In response to a request from IAPSO for financial assistance towards the expenses of the many symposia in which IAPSO was involved during the IUGG General Assembly in 1975, SCOR supported in principle offering assistance for invited speakers and for ensuring balanced attendance but in view of the possible high cost of all the SCOR Working Groups that would be meeting at that time, was unable to make a commitment to IAPSO at this stage. IAPSO was invited to indicate to SCOR, names of scientists they hoped SCOR might assist and the amount requested in each case. The Officers of SCOR would decide to what extent these requests could be met when it became known what SCOR funds would be required to meet the expenses of their own working group members unable to obtain support from other sources to attend the Grenoble meetings.

### 4.2 ICSU

A report was received from Professor G. Hempel, SCOR observer at the 15th General Assembly of ICSU, September 1974, and appears as Annex XVII. Attached to this report is ICSU resolution 9 which urges National Members of ICSU to advise their governments of the importance of effective international cooperation in long-term programmes of oceanic research and to encourage the participation of their scientists in the formulation of national policies.

This ICSU resolution also invites SCOR to provide a short statement on the scientific aspects of the possible further development of oceanography under a new ocean regime.

After discussion, SCOR asked Professor Wooster to arrange meetings with a number of participants to determine the form of such a statement which, it was subsequently



agreed, should contain facts describing ocean research. Professor Wooster will draft a statement in accordance with the guidelines agreed, will discuss this with a number of those who were present at this meeting. A revised draft will then be submitted to the SCOR Executive Committee for approval prior to transmission to ICSU and to National Committees.

SCOR expressed appreciation to the Officers of ICSU for their consideration of the interests of marine science and, if required, would help in identifying observers to attend the 1975 Geneva session of the UN Law of the Sea Conference.

As requested by recommendation 1 of the meeting of the ICSU General Committee in September 1973, following consultation with the members of the Executive Committee, the Secretary had submitted to the fifteenth General Assembly of ICSU a statement entitled Cooperation in Marine Research.

ICSU Panel on World Data Centres - As representative of SCOR and IAPSO on the ICSU Panel on World Data Centres, Mr J. Crease (UK) had attended a meeting on the panel in Ankara on 18 September 1974. Mr Crease's report appears as Annex XVIII.

#### 4.3 ICSU UNIONS

##### IUGG

The President of IUGG, Professor H. Charnock, had invited other relevant ICSU organizations, and subsidiary bodies of those organizations, to send representatives to the IUGG General Assembly in Grenoble, France from 25 August to 6 September 1975. It was agreed that the President should nominate an official representative of SCOR. It was noted that at least five Working Groups of SCOR were planning to hold formal or informal meetings during that Assembly. Expenses of representatives of SCOR Working Groups not meeting at Grenoble would not normally be met by SCOR.

#### 4.4 ICSU COMMITTEES

##### COSTED

It was not considered necessary for SCOR to nominate a representative on COSTED, because marine sciences did not constitute a major part of COSTED's concern, but SCOR should inform COSTED of its interests in this field, ask to be kept informed of COSTED activities and inform COSTED of the outcome of the discussions at this meeting on training, education and mutual assistance.

##### SCOPE

Because of SCOR's primary responsibility for promoting fundamental scientific research, because research directly related to marine pollution and monitoring was being dealt with by a variety of other international bodies, and because problems relating to the marine environment constituted only a small part of SCOPE's interests, it was considered unnecessary for SCOR to be formally represented on SCOPE. However, SCOR is ready to respond to specific questions which might be formulated by SCOPE where these are appropriate to SCOR's competence and activities. SCOPE has a representative member on SCOR so continued liaison is assured.

SCOPE had identified seven main projects as the components of its mid-term programme, and had invited other international organizations to nominate correspondents for those projects in which they were interested in collaborating.

One such project was Environmental Monitoring and Assessment (SCOPE Project 6)



but as marine monitoring and assessment was the subject of attention by appropriate inter-governmental agencies, SCOPE should be advised not to duplicate these activities except where it is necessary for them to consider the role of the ocean in particular global cycles. In such cases SCOPE might seek advice from SCOR on the appropriate source for the required information. It was not considered necessary for SCOR to be represented on the SCOPE Monitoring Commission nor to nominate a correspondent for this Project. SCOR did, however, consider that it could offer assistance to SCOPE on two projects - [Project 1: Biochemical Cycles and Project 5: Simulation Modelling] and agreed to invite Dr E. Goldberg (USA) to serve as SCOR correspondent for these two projects.

#### SCAR

At its 13th meeting in September 1974 SCAR took note of a series of meetings during 1974 that had been concerned with the southern oceans and, in particular, the Biology working group of SCAR had invited the collaboration of SCOR and IABO in promoting marine biological investigations in the region. IABO has been invited to nominate members for appropriate subsidiary groups of SCAR viz: SCAR working group on Biology, sub-committee on marine living resources of the southern oceans, study group on biological monitoring and the group of specialists on Ice-Shelf drilling programmes.

It was reported that the US plan to drill through the Ross Ice shelf had been postponed to the 1975/76 season but preparatory geophysical studies of the shelf would continue in 1974/75.

#### SCOR/SCAR Polar Oceans Conference

The resolutions and recommendations of the conference, held in May 1974 appear as Annex XXIII.

The Chairman of the Conference Steering Committee, Professor M. J. Dunbar, was in negotiation with McGill-Queen's University Press regarding publication of the Conference proceedings. The Press would not commit themselves until they had seen the completed edited texts which were expected to be available during the first half of 1975.

#### 4.5 ECOR

Being informed that Dr T. F. Gaskell expected to attend the World Petroleum Conference being held in Tokyo in May 1975, SCOR invited him to represent SCOR at the General Assembly of ECOR which would be held at that time.

A brief history of ECOR, by Ir. G. A. Heyning, is given as Annex XXVI.

### 5.0 FUTURE MEETINGS AND SYMPOSIA

#### 5.1 Symposium on Coastal Upwelling Ecosystems

Professor Hempel announced plans, developed mainly by biologists of SCOR Working Group 36, to hold a symposium on Upwelling Ecosystems in Kiel, FRG from 25 to 28 August 1975. In planning this symposium account had been taken of the IAPSO symposium on Generation of Upwelling and Vertical Motion in the Sea which would be held in Grenoble, France in September 1975. SCOR agreed to Professor Hempel's proposal to



co-sponsor, with the Deutsche Forschungsgemeinschaft, the Kiel symposium and agreed to make available up to \$6 000 and to encourage UNESCO and FAO to provide financial support, primarily for participants from developing countries.

The hope was expressed that in future all requests for co-sponsorship or financial support for symposia would be made known to SCOR Officers and to UNESCO as early as possible and in any case well in advance of SCOR meetings at which such requests might be discussed.

## 5.2 Nineteenth Meeting of the Executive Committee

An invitation from South Africa for SCOR to hold an Executive Committee meeting in that member country was accepted. The meeting will be held in Stellenbosch from Wednesday 12 November to Saturday 15 November 1975 inclusive, and National Committees will be welcome to send representatives.

Only one Executive Committee meeting will be held between the 1974 and 1976 General Meetings but because of the long time between these meetings, special meetings of the SCOR Officers may be arranged as convenient.

## 5.3 Joint Oceanographic Assembly - 1976

The Steering committee for JOA met on 3 December 1974. The agreed outline programme for the Assembly appears as Annex XXIV.

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In closing the meeting the President expressed sincere thanks of SCOR to Capitán Raúl Toledo E. and to the Instituto Oceanográfico de la Armada of Ecuador for the facilities that had been made available for the meeting and for the pleasant social engagements. Particular thanks were expressed to Tte P. Cabezas and his staff who had contributed so much to the success and congenial atmosphere of the meeting.



## List of participants

## MEMBERS OF THE EXECUTIVE COMMITTEE

*Professor H. Postma	Netherlands	President
*Professor W. S. Wooster	USA	Past President
*Mr R. I. Currie	UK	Secretary
*Dr T. F. Gaskell	IUGS/CMG	Ex Officio
*Professor Dr G. Hempel	IUBS/IABO	Ex Officio
<hr/>		
*Mr G. E. Hemmen	UK SCAR	Assistant Secretary

## OTHER PARTICIPANTS

*Dr A. Ayala-Castañares (Mexico)	*Eng. A. Lonardi (Argentina)
Eng. H. Ayón (Ecuador)	*Dr A. R. Longhurst (UK)
Tnte. Fg. P. Cabezas G. (Ecuador)	*Dr Ryuzo Marumo (Japan)
Dr D. H. Cushing (UK)	*Professor B. Morton (Australia)
Dr M. E. Chamorro (Perú)	Dr J. Namias (USA)
*Professor H. Charnock (UK)	Professor G. L. Pickard (Canadá)
Dr B. D'Anglejan (Canadá)	*Professor J. Raymont (UK)
Professor J. H. Day (South Africa)	Dr G. Reyes-Vasquez (Venezuela)
*Dr L. Dickie (Canadá)	Mr D. P. D. Scott (IOC)
*Dr R. Dorrestein (Netherlands)	*Dr E. S. W. Simpson (South Africa)
Dr D. Enfield (Ecuador)	Dr M. Steyaert (UNESCO)
*Dr E. D. Golberg (USA)	Dr J. O. Stromberg (Sweden)
Eng. O. Guillén (Perú)	*Professor P. Tchernia (France)
Dr R. Jimenez (Ecuador)	Mr G. Verploegh (WMO)
*Dr E. C. La Fond (USA)	Mr O. A. Van der Westhuysen (S. Africa)

\* = SCOR Members



## ANNEX II

STATEMENT OF SCOR INCOME AND EXPENDITURE

(1 January - 31 December 1974)

BALANCES 1 JANUARY 1974

New York	15 586.64	\$
London	257.89	
Paris	<u>9 247.45</u>	25 091.98

INCOME

National Contributions		37 900.00
Contracts		
IOC-1973 Regular contract	10 000.00	
UNESCO-1973 Regular contract	10 000.00	
IOC-UNEP support for RIOS	3 260.07	
UNESCO special contract WG 27 (1973)	5 000.00	
UNESCO-1974 Regular contract	<u>8 000.00</u>	36 260.07
Interest on deposit account		1 706.30
Exchange difference		<u>114.18</u>
		<u>101 072.53</u>

EXPENDITURE

Scientific activities		
Working Groups		
23	162.68	
27	4 143.11	
33	2 815.32	
34	225.00	
35	- 113.94	
36	4 897.61	
42	567.23	
43	3 074.52	
46	<u>3 260.05</u>	19 031.58
Symposia		
Polar Oceans Conference	2 013.72	
Marine Plankton and Sediments	<u>5 000.00</u>	7 013.72
Representation at other meetings		5 631.32
Travel expenses - advisory role		
TEMA	1 220.00	
Mangroves	<u>1 003.61</u>	2 223.61
Publications SCOR Proceedings		2 545.32
SCOR Meetings		10 480.32
Administration		5 449.90
		<u>52 375.77</u>
Reserve Fund		25 292.94
Accumulated balance 31 December 1974		<u>23 403.82*</u>
		<u>101 072.53</u>

\* represented by:

Funds held by ICSU	4 026.35
Funds held by SCOR	<u>19 377.47</u>
	<u>23 403.82</u>



'EL NIÑO' WORKSHOP, GUAYAQUIL  
4 to 12 December 1974

A Scientific Workshop on the phenomenon known as 'El Niño' was organized by the Intergovernmental Oceanographic Commission, jointly with UNESCO, FAO and WMO, and was held from 4 to 12 December 1974 in Guayaquil. During the first two days of this workshop, a set of invited review papers was discussed; these scientific discussions also formed part of the SCOR General Meeting. The following papers were presented:

1. Collaboration of ocean and atmosphere in weather and climate. (Jerome Namias).
2. Preliminary discussion of the meteorology of the 1972-73 El Niño. (C. S. Ramage).
3. Physical aspects of the 1972-73 El Niño. (Salvador Zuta, David B. Enfield, Jorge Valdivia, Pablo Lagos and Carlos Blandin).
4. Biological aspects of the 1972-73 El Niño.  
Part 1. Faunal distribution (Aurora Chirinos de Vildoso).  
Part 2. The anchovy population (Julio Valdivia).
5. A review of recent research on the circulation of the equatorial and eastern south Pacific Ocean. (Klaus Wyrtki). also:  
El Niño - The dynamical response of the Pacific Ocean to atmospheric forcing (Klaus Wyrtki).
6. Investigations of coastal upwelling processes (Robert L. Smith).
7. The Chile Current system. Part 1: Water masses and circulation in the southeast Pacific Ocean latitudes 18° - 33°D (Hellmuth A. Sievers and Nelson Silva Sandoval).  
Part 2: Primary production of coastal and oceanic waters off north and central Chile (Boris Ramirez R., Sergio Palma G. and Hector Barrientos C.).  
Part 3: Water masses in the northern region of Chile and their variations in a cold period (1967) and in warm periods (1969, 1971-1973) (Fernando Robles, Elias Alarcon and Alvaro Ulloa).
8. The Peru Current system. Part 1: Physical aspects (Oscar Guillen).  
Part 2: Biological aspects (Haydee Santander).
9. Oceanography of the region north of the equatorial front. Part 1: Physical aspects (David B. Enfield). Part 2: Biological aspects. (Roberto Jimenez Santistevan).
10. Models in marine ecology (David Cushing).
11. Biology of the anchovy, *Engraulis ringens*. Part 1: Summary of present knowledge (Romulo Jordan S.). Part 2: Projected Peruvian research (G. L. Kesteven).
12. Effects of environmental variations on the distribution of marine fauna (Marta Vannucci - presented by R. I. Currie).
13. Estimation of the effects of environmental variations on the eggs and larvae of the northern anchovy (Reuben Lasker and Paul E. Smith).

Subsequently, during the period 9-12 December, participants in the workshop considered a number of key scientific problems and the design of programmes for their investigation. A report on their recommendations should be available during the first quarter of 1975.



## SALINOMETER INTERCALIBRATION EXPERIMENT

by

Klaus Grasshoff, Institut für Meereskunde, Kiel

and

Danmarks Fiskeri-og Havundersøgelser, Charlottenlund

Resulting from a suggestion of SCOR/ICES/UNESCO WG10, in a circular letter of 21 May 1974 the members of the Hydrographical Committee of ICES and a number of other institutions were invited to participate in the salinometer intercalibration experiment.

Five ampoules of Baltic water, five ampoules of Mediterranean water and four ampoules of Standard Sea Water P<sub>64</sub> for each salinometer were distributed free of cost to interested institutions. The Standard Sea Water was used for standardization and check of drift of the salinometer and usually 12 measurements were made on the Baltic or the Mediterranean water.

On 15 September results had been received from 25 sets of measurements on Baltic water and 21 sets of measurements on Mediterranean water.

The reproducibility of the measurements of most of the single instruments seems to be good, at least under the circumstances under which the measurements are carried out. The 12 measurements which usually are made for each calibration are seldom deviating more than 0.003 in salinity from their mean value.

The results from the different instruments are, however, deviating from each other as will appear from the following tables, where the mean value for each instrument is regarded.

The chlorinity of the Baltic and the Mediterranean water were determined by precision titration at Institut für Meereskunde, Kiel.

The chlorinity as well as the salinity  $SC_1$  calculated from chlorinity using the formula in the UNESCO Oceanographical Tables and the salinity  $S_K$  calculated from the old Knudsen relation are found in table 1 together with the mean value of all salinometer measurements and the range of these measurements.

Table 1

	C1 ‰	SC <sub>1</sub> ‰	S <sub>K</sub> ‰	Mean value of all measurements	Range
Baltic W.	4.415	7.976	7.999	8.009	8.082 to 7.984
Medit. W.	21.103	38.124	38.121	38.123	38.140 to 38.102

The highest of the salinometer mean values 8.17‰ for Baltic water has been disregarded in this table and in the calculations of the following tables as the user informed us that the instrument seemed to be defective.



Tables 2 and 3 show the distribution of the measurements. For the Baltic water the distribution is far from normal, a few salinometers give far too high values.

In tables 4 and 5 the measurements are grouped after manufacture. It is doubtful whether the values from one of the manufactures is significantly different from the values of the other manufactures.

In the tables  $\sigma$  means standard deviation round the mean value of the measurements for the manufacture in question,  $\sigma_m$  means the standard deviation of this mean value,  $\triangle$  means the deviation from the mean value of all the results as given in table 1.

Measurements of the conductivity of the Baltic and the Mediterranean water are expected to be made by Dr Alain Poisson, Laboratoire d'Océanographie Physique, Paris, who will use KCC solutions as standards.

We are obliged to our colleagues at Laboratoire d'Océanographie Physique, Paris, who arranged the collection of the Mediterranean water.

Table 2

Distribution of Mean Values of the Measurements for the individual Salinometers

Baltic Salinity range ‰	Sea-water No. of measurements
> 8.09	1 (8.17)
8.086-8.090	
8.081-8.085	1
8.076-8.080	
8.071-8.075	1
8.066-8.070	
8.061-8.065	
8.056-8.060	
8.051-8.055	
8.046-8.050	
8.041-8.045	
8.036-8.040	1
8.031-8.035	
8.026-8.030	
8.021-8.025	2
8.016-8.020	1
8.011-8.015	
8.006-8.010	2
8.001-8.005	5
7.996-8.000	5
7.991-7.995	3
7.986-7.990	1
7.981-7.985	2
	<hr/> 25 <hr/>



Table 3

## Distribution of Mean Values of the Measurements for the individual Salinometers

Mediterranean Seawater Salinity range ‰	Sea-water No. of measurements
38.136-38.140	2
38.131-38.135	4
38.126-38.130	3
38.121-38.125	6
38.116-38.120	2
38.111-38.115	2
38.106-38.110	
38.101-38.105	2
	<u>21</u>

Table 4

## Mean Values of the Measurements from the individual Salinometers

## Baltic Seawater

Beckmann	Indust. Man. Sidney	Autolab	Guildline	Hytech Plessey
8.005 -20	7.986 -15	7.987 -17	7.995	7.995
8.003 -22	7.993 -8	7.984 -20		7.997
8.003 -22	7.985 -16	7.992 -12		
8.005 -20	8.000 -1	(8.17) +)		
8.082 -57	8.020 +19	8.037 +33		
8.071 +46	8.002 +1	8.01 +6		
8.006 -19	8.022 +21	7.007 -7		
		8.021 +17		

+) This value has been disregarded, as the salinometer seemed to be defective

8.025	8.001	8.004	7.988	7.996	Mean Value
0.0354	0.015	0.018			$\sigma$
+0.016	-0.008	-0.005	-0.021	-0.013	$\Delta$
0.0134	0.0057	0.0068			$\sigma_m$
7	7	7	1	2	n



Table 5

Mean Values of the Measurements from the individual SalinometersMediterranean Seawater

Beckmann	Industr. Man. England	Autolab	Guideline	N. I. O.	
38.126 <sup>+9</sup>	38.124 <sup>-6</sup>	38.134 <sup>+11</sup>	38.132	38.124	
38.102 <sup>-15</sup>	38.125 <sup>-5</sup>	38.132 <sup>+9</sup>			
38.121 <sup>+4</sup>	38.123 <sup>-7</sup>	38.118 <sup>-5</sup>			
38.119 <sup>+2</sup>	38.132 <sup>+2</sup>	38.105 <sup>-18</sup>			
38.114 <sup>-3</sup>	38.140 <sup>+10</sup>	38.127 <sup>+4</sup>			
38.113 <sup>-4</sup>	38.137 <sup>+7</sup>	38.124 <sup>+1</sup>			
38.126 <sup>+9</sup>					

38.117	38.130	38.123	38.132	38.124	Mean Value
0.0085	0.0073	0.0107			$\sigma$
-0.006	+0.007	0.000	+0.009	+0.001	$\Delta$
0.0032	0.0030	0.0043			$\sigma_m$
7	6	6	1	1	n



## STATUS OF THE PROBLEM OF INTERCOMPARISON OF CURRENT METERS

by J. C. Swallow, Chairman SCOR WG 21

Only a limited number of intercomparisons of current meters have been made, that we are aware of, in contrast to the amount of use made of current meters in general. The results are diverse and somewhat conflicting, and it seems best simply to make some statements about their performance in certain circumstances and then draw some tentative conclusions.

Different current meters compared in moorings with subsurface buoyancy, deep enough to avoid any appreciable surface wave action, give consistent results within the limits set by calibration accuracy, differences in sampling intervals and averaging methods, and the natural variability of the ocean (e. g. first and third SCOR intercomparisons).

Vector mean currents averaged over a few days, obtained simultaneously from current meters in subsurface moorings and from trajectories of neutrally buoyant floats passing close by, also agree within the same limits (e. g. unpublished results of MODE-I). Direct measurements of the displacement of a subsurface mooring, and the low values of variance observed in bursts of rapid sampling using Geodyne current meters in subsurface moorings, suggest that this type of mooring can provide a quiet situation in which a current meter can be expected to behave as it does when towed in a calibration tank. (Gould, Schmitz and Wunsch, 1974 Deep-Sea Res.)

Current meters in moorings with surface buoyancy are disturbed to a greater or lesser extent by the response of the mooring to surface waves. The effects are serious in some cases, in others they appear to be negligible. They are certainly complicated and poorly understood. That motions induced at the surface can have an effect on deep current meters is shown by the high values of variance observed within bursts of rapid samples from a Geodyne meter, closely correlated with wind speed, whilst the variance indicated by similar instruments in a nearby subsurface mooring was smaller by a factor of 500 and uncorrelated with wind speed (third SCOR intercomparison).

In the current records from Woods Hole mooring Site 'D' those from surface moorings are systematically more energetic than those obtained with similar instruments at the same depths in subsurface moorings. The energy ratio varies with depth, but is typically in the range 2 to 4. (Gould and Sambuco, 1974 Deep-Sea Res., third SCOR intercomparison).

On the other hand, good agreement was observed between AMF vector-averaging current meters (VACM) and Geodyne meters in a surface mooring, and an Aanderaa meter in a nearby subsurface mooring, at about 20 m depth in 100 m of water. (Halpern, Pillsbury and Smith, 1974 Deep-Sea Res.)

In the 1972 JASIN experiment, a VACM and an Aanderaa current meter at 10-12 m depth in a surface mooring agreed well in direction averaged over periods of an hour or



more, but the magnitudes of the current vectors from the Aanderaa meter exceeded those from the VACM by a factor of about 3. The scalar distances recorded by the rotors of the two instruments agreed surprisingly well; the discrepancy in vector amplitudes was due to the smaller variance in directions recorded by the Aanderaa meter. The vector mean currents recorded by the VACM agreed with those from drogues passing close by the mooring (P.M. Saunders, personal communication).

In contrast to that result, Aanderaa and Geodyne meters at 50 m depth under surface moorings in the second SCOR intercomparison, in the Akademik Kurchatov in 1970, gave similar vector mean currents.

From these diverse experiences one may tentatively conclude that the effects of wave-induced mooring motion are most severe at great depths in the presence of weak mean currents (as at Woods Hole Site 'D') and are less serious close to the surface and in stronger mean currents. If there are appreciable wave-induced vertical (longitudinal) oscillations of the mooring relative to the water, they will have a serious effect, since none of the current meters compared are designed to work in the presence of vertical relative motion. The better performance of the near-surface Aanderaa meter in the second SCOR intercomparison may have been due to its being offset on a bracket, instead of being inserted, as usual, directly in the mooring line in JASIN 1972.

#### Recommendations

Wherever possible, existing current meters should be used in subsurface moorings. How deep the float should be will depend on the local situation and the purpose of the observations, but the possible effects of wave-induced motions should be kept in mind.

Further study of the effects of mooring design and instrument mounting on the velocities measured by the current meters should be undertaken by users of these instruments. In particular, the problems inherent in near-surface measurements need attention.

Designers and intending users of new types of current meters (e. g. electromagnetic, acoustic) should evaluate them by intercomparison with other current measuring techniques as a necessary part of the development of the current measuring system.

It does not seem appropriate at present for SCOR to sponsor the activities outlined above. Opportunities for further intercomparisons will occur in the course of experiments already planned (e. g. POLYMODE). With no specific task to undertake, it seems best that Working Group 21 should be disbanded. It does not seem necessary to maintain a group permanently just to watch out for future needs for SCOR-sponsored intercomparisons; that purpose could be met by inviting anyone who wished to propose such activity to make the need known to the Executive Committee Reporter for WG 21, Dr Voigt. A group suitable for the proposed task could then be chosen.



SCOR WORKING GROUP 27 (WITH UNESCO)

TIDES OF THE OPEN SEA

Report on 5th Meeting, Brest, France, 16 to 17 September 1974

Members present: D. E. Cartwright (UK), C. G. Dohler (USA), J. L. Hyacinthe (France), W. H. Munk (USA), R. Radok (Australia), T. Teramoto (Japan), S. S. Voit (USSR) and B. D. Zetler (USA).

Schott sent his apology for his inability to attend. Demerliac and Simon of SHOM, Brest, and Le Provost, Grenoble, attended as observers. Zetler acted as Secretary for the meeting.

Cartwright (Chairman) briefly reviewed the present status of Working Group 27 before initiating the task of editing the prepared material for a report on the intercalibration exercise for bottom pressure sensors conducted off Brest in late 1973. The report on the exercise was completed and was to be transmitted to Unesco for publication directly after the meeting.

The report begins with lists of participants and their affiliations, discussion of the objectives of the Working Group, and an account of the principles and organization of the exercise. Then follow sections on instruments and mooring techniques, calibration techniques, brief narratives of cruises, a discussion on the analysis workshop and related matters, analysis of the records obtained in the exercise, and general conclusions.

Various members then reported on recent work and plans for the future. These are summarized:

Munk:

Discussed baroclinic noise as a limit on the accuracy of cotidal and corange charts; described observations of tidal energy at 3, 4, 5, and 6 cpd in the open sea (MODE area) and suggested that these levels of energy are maintained by a balance of input (energy generated in shallow basins propagating into the deep ocean) and dissipation; and computation of tidal currents from pressure gradients in the MODE area including body forces as well as pressure data, sea floor movement (equilibrium earth tides) but not loading tides, and comparisons with observations (barotropic good, baroclinic poor).

Voit:

Presented the USSR tidal analysis of the test data in Workshop 1 (Wormley, Nov. 1973) as computed using the Darwin method on a Minsk Computer 34.

Radok:

Described his tidal research concerning geophysical processes leading to the formation of a lagoon (The "Coorong") in South Australia at times of extremely high river runoff. Of particular interest was the identification of different water masses using T-S (temperature - salinity) diagrams observed in very shallow water (depth of 1 to 2 feet).



Dohler:

Described a Symposium on open sea tidal measurements, with contributions from participants in the WG 27 intercalibration exercise, and others, in an IEEE meeting in Halifax in August 1974 before a very large and interested audience; summarized Canadian open sea tide programme including 18 submersible tide gauges in the Beaufort Sea for periods of about 6 months at 60 m depth, (due to ice cover, the recovery of these gauges had only just started in September 1974), pressure gauges deployed on sea mounts off Vancouver for 2 months at 60-70 meter depths (2 already retrieved) and future plans for similar array deployments.

Cartwright:

Described an array of bottom tide gauges in the Shetland region; analysis of detailed records to study seiche showed peaks of energy at harmonics of the M<sub>2</sub> tide with a very unusual high peak of energy at the 6th harmonic (12 cpd) at the stations nearest the shelf edge, (possibly trapped waves).

Hyacinthe:

Described installation of bottom tide gauge in Brest Harbour providing real time information on instrument drift for six months; near-future plans include obtaining six months of observations at the intercalibration site, and a comparative test with the IOS deep gauge.

Teramoto:

(later) submitted a written report on measurements of internal tides recorded by current meters and thermistors at two layers at several points in Uchi'ura Bay, inside Suruga Bay. These are being studied in relation to the conversion of energy from barotropic to baroclinic tides caused by topographical features, which is a subject of continuing interest at the Tokyo Ocean Research Institute.

The members then briefly considered efforts in numerical modelling of global tides. These include studies by Pekeris and Accad (including earth tides). Zahel (preparing a 1° model for Prof. W.J. Pierson of City University, New York in the NASA programme using a full equilibrium tide input furnished by Cartwright), Felsenbaum (Moscow) on a 3-dimensional model, and Hendershott using empirical data at boundaries and the effect of crustal yielding. The consensus was that there were signs of a slowing down in global modelling in the past two years.

The members then considered the future role of the Working Group. At the time of its formation, three principal programmes (to encourage development of deep sea tide instrumentation, optimize analysis procedures, and coordinate effort on the global tide problem) had been accepted as the rationale for organizing the Working Group. Inasmuch as the first two objectives had been successfully completed and the existing membership of the Working Group is not ideal for tackling the third objective, it was decided that a report would be presented at the 1975 IUGG meeting in Grenoble recommending that this Working Group be discontinued. The report will include a summary statement on progress during the period of the Working Group; furthermore, consideration will be given to including in the report recommendations on future areas of research (possibly with new working groups) tentatively including: (a) utilization of measurements of sea surface topography from space (contributing to numerical modelling of tides and geodesy, and requiring 'sea truth' observations), (b) baroclinic tides (with applications to tidal currents, variability - in particular tidal cusps - and tidal energy dissipation, and (c) climatic changes (low frequency pressure variations).



With reference to the problem of establishing some form of international data centre for harmonic constants derived from open sea pressure observations, the Working Group was gratified to receive a report by Dohler that the Canadian tidal organization has been designated to act for the International Hydrographic Bureau as a data centre for all tidal harmonic constants, including those derived from open sea measurements.

Schott, unable to attend the meeting, addressed a communication to the Chairman on proposed research in internal waves, in particular on energy transfer and dissipation. In it, he summarizes recent published research and suggests possible future contributions in this field by the Working Group. His communication will be considered in the preparation of the report of the Working Group to be proposed for adoption at the next meeting in Grenoble, particularly with regard to (b) above.



## SCOR WORKING GROUP 34 INTERNAL DYNAMICS OF THE OCEAN

Report from Chairman - A. Robinson

I should like to report to the Chairman and members of the SCOR Executive Committee on WG 34 - Internal Dynamics of the Ocean, (recently renamed) with the expanded terms of reference

- a) "To identify the critical scientific problems of the internal dynamics of the ocean and to suggest the most appropriate ways to study them;"
- b) "to advise on the design of mid ocean dynamics experiments."

### a) Critical Problems of Internal Dynamics

Some clarification of this aspect of the terms of reference may be desirable for the Chairman from the Executive Committee, if the EC wishes immediate initiation of activity here. Otherwise WG 34 stands ready to consult with SCOR and others as necessary, but plans to discuss this aspect in general, no later than at a meeting, which I hope to arrange in Grenoble in late summer at the time of the IAMAP/IAPSO Symposium.

### b) Mid Ocean Dynamics Experiments

The next major field experiment, POLYMODE, which was endorsed by SCOR at the recent Melbourne meeting (Proceeding Vol. 10 p. 11) will take place during 1976-1977. Agreement on overall scientific objectives and on the pooling of resources was reached between US and USSR Scientists meeting in Massachusetts in late August (Report dated 30 August 1974) under the auspices of the US-USSR bilateral agreement on Cooperative Studies of the World Ocean. The main scientific objectives are:

- i) A kinematical and descriptive study of the eddy field including eddy-eddy interactions, on significantly longer time and larger space scales than now available;
- ii) The determination of local dynamical balances in a typical mid-oceanic region;
- iii) The determination of contributions to the eddy transports of momentum, heat, and energy and their meridional distribution, and of the interaction of eddies with the mean circulation;
- iv) The exploration of mechanisms of production, transformation, and dissipation of eddy energy;
- v) The development and testing of numerical models of oceanic mesoscale and of the general ocean circulation including (explicitly and implicitly) the mesoscale eddies for the purposes of forecasting, process investigation, and coupling to atmospheric models.

Planning and Coordination of the fully international POLYMODE Experiment should take place within WG 34. To accomplish this effectively will require some additional membership of WG 34, such additional members to be nominated by participating national POLYMODE organizing groups and endorsed by the SCOR Executive. It may be essential to hold an International POLYMODE scientific planning meeting of WG 34 in the spring or early summer to meet scheduling deadlines.

## SCOR WORKING GROUP 36 (WITH ACMRR &amp; ACOMR)

## COASTAL UPWELLING PROCESSES

Report of 2nd Meeting, Kiel, FRG, 24-28 June 1974

SCOR WG 36 met at the Institut für Meereskunde, University of Kiel; Federal Republic of Germany, 24-28 June 1974. 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 D. H. Cushing (UK)  
 Dr G. Hempel (FRG)  
 Dr R. Margalef (Spain)  
 Dr M. Minas (France)  
 Dr E. Mittelstaedt (FRG)  
 Dr D. Nehring (GDR)  
 Dr B. Saint-Guily (France)  
 Dr R. L. Smith (USA)

Prof. H. Charnock (UK) was invited to attend as a representative for ACOMR/WMO, but was unable to do so.  
 Dr Y. I. Sorokin (USSR) was unable to attend.

Observers participating in the discussions of the working group were:  
 Dr R. T. Barber (USA), Dr R. Boje (FRG), Dr J. J. O'Brien (USA), Dr K. -H. Szekiela (USA), Dr M. Tomczak (FRG).

The tentative agenda circulated prior to the meeting met with general approval and was adopted with the addition of a few relevant items.

Most of the items of the agenda were discussed in plenary sessions. Separate meetings of the two panels were organized to discuss:

Items 3, 5 and 9b (Physical Panel)

Items 3, 4 and 6 (Biological Panel)

# 1. Review of the progress achieved over the past year

There was the general feeling of a considerable progress achieved during the past year in the following fields:

- i. Observational programmes in all the three major areas of coastal upwelling:
  - NW African area (CINECA - France, Ghana, GDR, FRG, Mauretania, Morocco, Poland, Senegal, Spain, UK, USA and USSR participating;
  - Oregon area (CUE-II - USA);
  - Peruvian area (Instituto del Mar del Peru, USSR expedition of R.V. Akademik



Kurchatov).

- ii. Interpretation of CINECA data of 1970-1972
- iii. Theoretical modelling (both analytical and numerical)

The accumulated new knowledge helped considerably to widen the present understanding of coastal upwelling phenomenon so that quite a few important steps forward have been made from the position reflected in the 1973 Report of WG 36. The opportunity to compare the information on different upwellings played a substantial role in this progress.

## 2. Comparison of different upwellings

Scientific results of various expeditions in different upwelling areas conducted during 1972 - 1974 were reviewed. Depending upon specific conditions (wind, coastal configuration, bottom topography) coastal upwelling exhibits great variety of patterns. The occurrences of quasi-two-dimensional upwelling along parts of the NW African coast were referred to as contrasting with the long-shore variability and intermittent character of upwelling near the Oregon coast and quasi-permanent patchiness of upwelling in some areas off Peru and NW Africa.

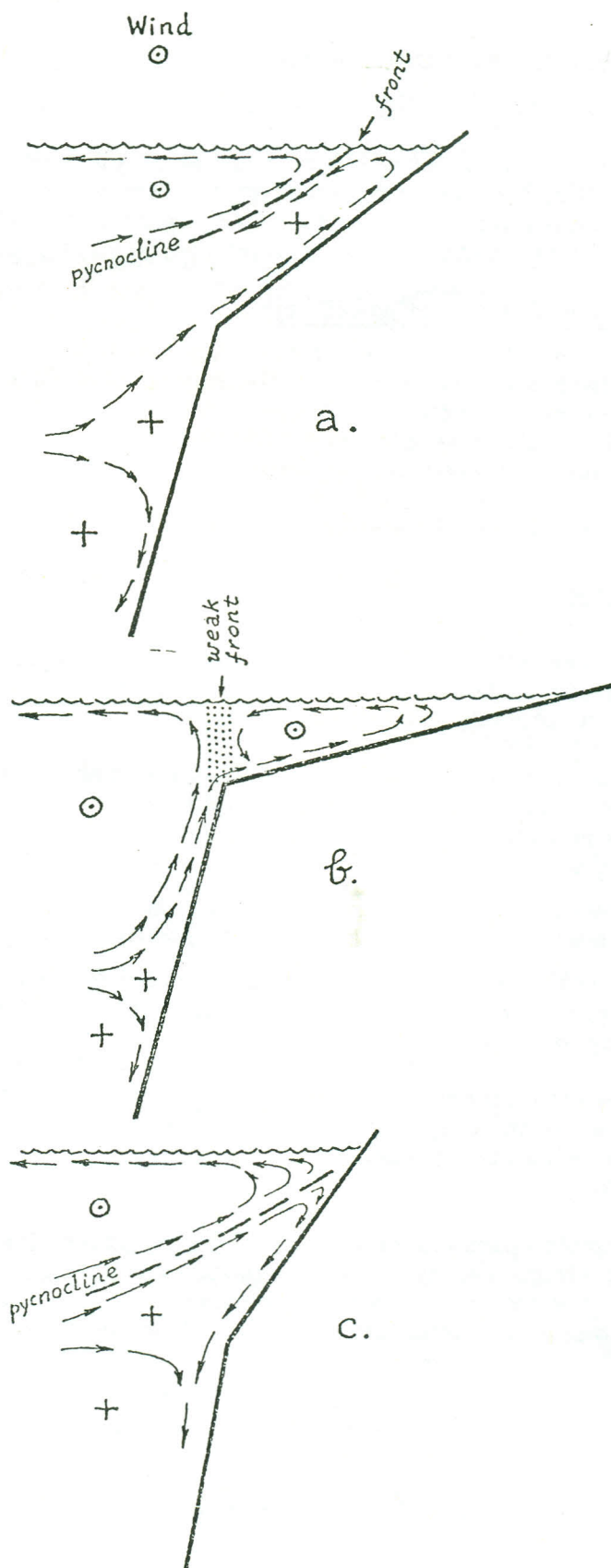
## 3. Visualization of three-dimensional patterns of circulation at different stages of upwelling

It is possible now to suggest several basic patterns of circulation depending upon the width and form of the continental shelf and slope, the intensity and variability of the wind field and the stratification and latitude.

- a) Two cells of upwelling over the shelf with onshore flow and ascending motion from both above and below the pycnocline, but with the flow below the pycnocline being part of a poleward flow. Sinking occurs near the front formed by the pycnocline intersecting the surface.
- b) Upwelling over the slope with a second weak cell of upwelling over a wide and shallow shelf being fed from the slope upwelling.
- c) A single cell of upwelling over the shelf and slope but with sinking associated with deeper on-shore flow. The sinking cell may extend close to the coast depending on local effects.

In all the schemata there exists a deep poleward flow (undercurrent). This undercurrent and the downwelling cell associated with the deeper onshore flow, may be part of the large scale eastern boundary current system and common to all major eastern upwelling areas.

The suggested patterns come as a result of recent observations off Peru, Oregon and Northwest Africa and theoretical models. The patterns may represent stages of development, or states of intensity of the upwelling processes. The following parameters relevant to ecological considerations can be identified for patterns of circulation:





- 1) the depth from which the upwelled water comes
- 2) the characteristic vertical velocity
- 3) the width and position of the upwelling zone
- 4) the ratio of flow normal to and parallel to the coast
- 5) the existence and location of fronts
- 6) the residence time of upwelled water in the euphotic zone.

Although the schemata are two-dimensional in presentation, emphasizing the vertical and onshore-offshore flow, they are part of the three-dimensional circulation. Even for the case of two-dimensional upwelling (by which physical oceanographers mean a mass balance by the onshore-offshore flow alone) the characteristics of the alongshore flow will affect the biological scales. On the other hand, the addition of the third dimension will not necessarily close the circulation within the upwelling region.

We wish to encourage observational and theoretical oceanographers to provide estimates of relevant parameters to these patterns of circulation.

#### 4. Chemical and biological significance of upwelling circulation patterns

An analysis of the expected residence times in the inshore cell of upwelling may be based upon the following velocity estimates provided by the physical panel for average conditions based on measurements off Oregon and in the Cap Blanc area off NW Africa:

	velocity in cm/sec
longshore $v$	10 to 25
upward limb $w_1$	$2 \text{ to } 4 \times 10^{-2}$
downward limb $w_2$	$-1 \text{ to } -2 \times 10^{-2}$
offshore and onshore $u$	4 to 8

The offshore vertical dimension may be taken to be 100 m and the inshore vertical dimension may be set at 50 m. The offshore horizontal dimension,  $x = 20$  km. Using these values, a hypothetical helix could be constructed, giving the following time scales in the various phases:

ascending 1.5 - 3 days, offshore 3 - 6 days, descending 6 - 12 days, shoreward transport 3 - 6 days, total of 13.5 - 27 days. The longshore transport in average conditions would then be roughly 300 km. The mean euphotic zone half-cycle is a useful concept and would be about 10 days in this model. These estimates are, of course, extremely crude and may be regarded as some minimum values of the time scales involved.

The euphotic zone half-cycle appeared to be too short to generate sufficient grazing capacity within its own system unless it circulated more than once. If the material is to be transferred to secondary production, a grazer must be present before the cycle starts.

The euphotic zone half-cycle should be long enough to allow regeneration in faecal pellets, zooplankton liquid excretion and bacterial regeneration. The first two imply grazing. If there is none, phytoplankton and zooplankton are not connected dynamically, and there must be a sedimentation of dead algal cells; there is some evidence of such sedimentation off Cap Blanc.

Off Northwest Africa an inshore and offshore cell sometimes becomes established with a front between the cells; because of the shear there may be transfer across the



front by entrainment and mixing. There may be an association between strong winds and the establishment of two cell circulation pattern. If the lower estimates are taken one can argue that although algae are produced within 7 days, the grazers cannot be generated within such system. If the material can be transferred across the front it is vulnerable to attack by small zooplankton and by euphausiids. The generation time of the small zooplankton may be of the order of two to three weeks whereas that of euphausiids is of many months to two years.

As the trades shift to the north the wind stress weakens and a one cell system may replace that of an inshore and offshore one, then the production over the shelf is advected offshore over the slope. Smaller zooplankton can then be generated within the whole cycle in addition to the euphausiids that are present in any case at the shelfbreak and beyond it. Off NW Africa, the two cell system appears to separate algae and the smaller grazers whereas the one cell system may link them. However, the distinction between the two biological systems may become blurred due to the transient nature of circulation patterns.

The several cell models of coastal upwelling are explicative of many biological phenomena. The two cell system helps to explain segregation of zooplankton: species of small size and with irregular migration in the inshore cell where mixing may be more important than circulation; larger species with more defined or persistent migratory behaviour in the offshore cell. The contact between the inshore and offshore cells provides a mechanism for transfer between the cells. The alongshore undercurrent (counter current) provides a mechanism for the return for migratory animals and for the reseedling of phytoplankton. Decay of the two cell systems into a one cell system, either in time, or in space along a coast, may pass through a stage with a single cell in the surface and, with a horizontal eddy on the edge of the shelf. There is some evidence for the occurrence of such structures and a physical model of this decay or transition would be welcomed by biologists. Biological exploration should provide a sufficiently detailed picture of events (production and transport) on scale commensurate with phenomena affecting, at least, a width twice that of the shelf.

Until now it is not known whether the existence of two cells of upwelling separated by a convergence zone over the shelf break is a very common feature off NW-Africa. The sets of data obtained by the CINECA multiship surveys in February and August 1973 may contain the necessary information on this question. The CINECA Coordinating Group may consider taking early action in the analysis of the data for possible indications of convergences at the shelf break.

Horizontal extension of the system analyzed by biologists as a quasi-closed ecosystem must be a function of the intensity of upwelling. Recognition of this relation may be essential in scaling biological programmes, in order to produce meaningful results. It seems impossible to understand upwelling in a narrow spatial frame, and in this biology and physics pose similar requirements.

#### 5. Effects of coastal configuration and bottom topography on the intensification of coastal upwelling.

Observations carried out in the areas off Oregon, off NW Africa and off Peru gave new evidence that the irregularities of coastal configuration and bottom relief in the long-shore direction influence substantially coastal upwelling patterns. Observations tend to confirm some of the outcomes of the recent theoretical modelling according to which patches of intensive upwelling should be located close to the heads of underwater canyons



and on the equatorward sides of significant capes. Theoretical modelling has still to develop further by taking into account more realistic features of bottom topography, coastal geometry and stratification. In parallel more observations should be made of the three-dimensional motion field in the upwelling areas.

#### 6. Effects of frequency, intensity and duration of upwelling events on the average large-scale productivity in major upwelling areas

Intense upwelling, although transporting very large quantities of primary nutrient into the euphotic zone, may result in reduced rates of primary production through a variety of effects related to a reduced time scale and turbulence. For example, under strong upwelling winds, a two-cell circulation is expected to develop and under these conditions, the time available for phytoplankton to grow and consume all of the primary nutrient may be too short. The problem is compounded by the effect of turbulent mixing in reducing the probability of long periods of exposure to the high light apparently required to "shift-up" the ability of the phytoplankton to take up nutrients and to grow at an enhanced rate. The requirement for strong light and high nutrient concentration for bloom formation can be met at lower rates of upwelling (accompanied by decreased turbulence) or by complete cessation of upwelling. It seems likely that intermittency of upwelling may result in higher rates of productivity. This is an area in which biological modelling based upon physical and meteorological observations made in the major upwelling areas may help attain an understanding of the primary processes resulting in the hierarchy of production and the pattern of ecosystems observed.

#### 7. Field methods of following time-history of upwelled water

Our present understanding of the phenomenon of upwelling is such that it seems hardly possible to select a representative volume of upwelled water and to follow its evolution in time and space from the biological and physical point of view under the real conditions found in coastal upwelling regions.

Instead both physical oceanographers and biological oceanographers are inclined to visualize this evolution in terms of the "residence time" of the upwelled water in the euphotic layer of the upwelling zone. To estimate the residence time, however, it is necessary to understand fully the physics pertaining to the particular upwelling occurrence.

Although the basic concepts of the desirable future investigations are well understood and had already been formulated (cf 1973 Report of the WG 36), there are always some practical constraints both in time and facilities available which require certain priorities to be observed when expeditions are being planned. These priorities are easier to specify for the NW African area, for which the planning of further field studies (for 1975 and 1976) is already in progress.

- #### 7.1 Obtaining three-dimensional information on motion field in the upwelling area
- (Direct current measurements from anchored buoy arrays; current profiling, drogues, etc.). Consideration of the offshore, alongshore and time scales involved may be based on the discussion under items 3 and 4. There is a definite necessity to go to larger longshore scales (100 - 1000 km) of observations in view of the possible role played by continental shelf waves and biological scale associated with the longshore advection. The basic three-dimensionality of the coastal upwelling will be also probably revealed by studies extending over these scales. Estimates of vertical velocity of upwelling may be based upon small-scale buoy arrays



(10-30 km) and use of natural and artificial tracers. There is still need to improve methods of direct measurement of vertical velocity and utilize them more widely. Particular attention should be paid to current measurements in the Ekman layer. Tracing drogues from an aircraft may be one of the desirable methods.

#### 7.2 Biological problems which require special action

Distribution of demersal fish in relation to depth contour under different conditions of upwelling. Special attention should be given to the shelf break and to the deeper parts of the continental slope (>800 m). Echosounder surveys have to be coupled with experimental bottom trawling and with analysis of catches of commercial vessels, taking into account results of earlier surveys, particularly of Poland and GDR. The joint operation of a fishery research vessel together with one or two oceanographic vessels would be most desirable. The fish survey should also be combined with benthos studies and with the examination of the stomach contents of demersal fish.

The trophic position of neuston and macrozooplankton is not yet well known. Studies of the stomach contents of pelagic fish could be most profitably carried out in collaboration with the commercial fisheries and with fisheries surveys. For studies in microneuston and macrozooplankton catches at day and night in hydrographically well defined layers are required. Special attention should be given to euphausiids which are considered to be the major predator of phytoplankton.

The poleward undercurrent as well as the onshore lower, aphotic limb of the upwelling cell(s) should be studied for its contents in phyto- and zooplankton and its microbial activity. For sampling microneuston and macrozooplankton selectivity in those layers, new closing nets might be needed.

- 7.3 Multi-ship approach. Multi-ship approach is fully in line with the interdisciplinary nature of the upwelling studies. Distribution of disciplines and scientific staff between participating ships is naturally a function of compatibility of different shipboard measurements and observational programmes. Biological and physical measurements which require synchronization (e. g. biological and chemical sampling and STD casts) or those which can not be separated in space may be more conveniently carried out from one vessel. However, for the fullest possible realization of physical and biological experiments, separate ships may be assigned to carrying out simultaneously the major elements of the biological and physical programmes.

#### 7.4 Statistical significance and comparability of sampling

Wherever possible sampling techniques in physics, biology and chemistry should be brought in line with each other so that they give fully comparable and statistically significant information.

#### 8. Long-term plans of upwelling research

As discussed under various items of the agenda plans for a future upwelling research should emphasize a coupling of theoretical and observational work and a close link between physical and biological studies.

The WG regards it as natural and desirable that major emphasis is given in



CINECA to the study of upwelling processes rather than to regional surveys. However, the WG recognized the need for surveys particularly in the field of resource assessment and fishery forecasts.

The close similarities in the physical processes in coastal and equatorial upwelling in combination with the striking biological differences call for detailed studies of equatorial upwelling which might also help to understand better some of the phenomena in coastal upwelling ecosystems.

Long term plans along those lines are under consideration in various institutions engaged in upwelling studies. Members of the WG reported briefly on some plans for field work for the years 1975/76. The full success of several of the programmes largely depends on the strengthening of the exchange of personal and equipment between countries. Recent cruises have already greatly benefitted from the input of foreign scientific and technical personal and of scientific equipment. Beyond this exchange it seems necessary to modernize and augment in quantity the equipment (e. g. current meters, closing nets) available for upwelling studies to cope with the increasing demand and expanding the temporal and spatial scales of future studies.

#### 9. CINECA Coordinating Group Meeting

The WG took note of the report of the 3rd meeting of the CINECA Coordinating Group and referred to it at various occasions in the course of its discussions.

After about 5 years of increasing oceanographic research activities in the Canary current system, the area off NW Africa can be considered as one of the better-known areas of the oceans. The picture arising from the investigation seems now to be sufficiently clear and consolidated to build on it programmes of applied research and resources appraisal needed to advise fisheries and other kinds of ocean use. Strengthening of contacts of the scientists participating in CINECA with the interested institutions in the coastal states might help to utilize the scientific results of CINECA. Taking note of SCOR's growing interest in assisting the promotion of marine science in developing countries, the WG feels that careful consideration of the creation and strengthening of efficient oceanographic research units within the coastal states of the CINECA region would be most desirable.

#### 10. Symposia

- (a) IAPSO/IAMAP Symposium on Upwelling Generation, Grenoble, France, 5 September 1975

A symposium entitled "Generation of upwelling and vertical motion in the sea" is planned for 5 September 1975 during the IUGG General Assembly in Grenoble, France.

A member of this Group (R. L. Smith) has been appointed convenor. This Group discussed the symposium and recommended that 12 papers be invited. The convenor asked members to correspond with him offering suggestions as to invitees.

- (b) El Niño Workshop of the IOC, Guayaquil, December 1974

The Group took note of the El Niño workshop scheduled for December 1974 in Ecuador, and that several members of this Group have been invited to attend the workshop. Those members will report on the workshop at the next meeting of this Group, bringing to the Group's attention those scientific issues and problems appropriate for consideration by this Group.



(c) The Third International Symposium on the Analysis of Upwelling Ecosystems.

This will be held in Kiel, Federal Republic of Germany, 24 to 28 August 1975 prior to the IAPSO/IAMAP Symposium. This Symposium is open for contributions in all fields of upwelling research. A report of the Symposium will be provided at the next meeting of this Group.

(d) Joint Oceanographic Assembly, Edinburgh, September 1976

A General Symposium on upwelling and a Special Symposium to include CINECA results are planned for the JOA. For the General Symposium the Group agreed to recommend to SCOR two possible convenors:

Dr David Cushing and Dr Gotthilf Hempel. A paper on the application of upwelling research to the needs of coastal states should be invited. On the other hand, the Group felt that the Special Symposium on scientific results of CINECA during the JOA might be less desirable in view of the proposal of the CINECA Coordinating Group to hold a Symposium on the results of CINECA in the first half of 1977 at a place within the CINECA area.

11. Future activities of the Group

There was a general feeling that in dealing with the phenomenon of coastal upwelling it is difficult to avoid drawing parallels with the phenomenon of equatorial upwelling, both in physical and biological sense. In the Pacific area the close link between the two phenomena can be traced through the El Niño events. Therefore the Group felt that SCOR should consider the necessary adjustment of the Group's terms of reference to cover the equatorial upwelling phenomenon. Another point which SCOR might wish to consider is inviting an oceanographer from the Instituto del Mar del Peru to be a member of the WG 36. This would provide the Group with the first hand information and expert advice on the Peruvian upwelling area and will facilitate to Peruvian scientists the access to scientific information on coastal upwellings.

The Group decided to have its 3rd General Meeting in France from 8 to 12 September 1975 after the IAPSO/IAMAP Symposium on Generation of Upwelling and Vertical Motion in the Sea scheduled to take place in Grenoble on 5 September 1975 in conjunction with the IUGG Assembly. Prof. B. Saint Guily was requested to explore possibilities for holding the Group's meeting in either Banyuls-sur-Mer or Villefranche-sur-Mer, or in UNESCO, Paris.

The Group should continue its work through correspondence in the interval between meetings.



## REPORT OF THE WORKING GROUP 37 SYMPOSIUM

## MARINE PLANKTON AND SEDIMENTS

Kiel, F. R. Germany, 9-13 September 1974 by E. Seibold

The Symposium was held at the Department of Geology and the Auditorium maximum of Kiel University, Kiel. It was preceded by meetings of Consultant Groups with some 100 participants, 5-8 September 1974, on Planktonic Foraminifera (Chairman TAKAYANAGI - Japan, Vice Chairman OLSSON - USA), Pteropods (LALLI - Canada), Radiolarians (PETRUSCHEVSKAYA - USSR, CACHON - France), Diatoms (SCHRADER - F. R. Germany, BURCKLE - USA), Silicoflagellates (LING - USA), Dinoflagellates (TAYLOR - Canada, ROSSIGNOL-STRICK - France), and Coccoliths (PERCH-NIELSEN - Switzerland, NOËL - France). Combined with the Symposium was the Third Planktonic Conference and the Third Symposium on Recent and Fossil Diatoms. During the five morning sessions (8.30-13.00) 20 invited lectures of general significance were presented. Demonstrations, special meetings and informal discussions occupied the middle part of the day. About 130 special lectures were held in four parallel sessions between 15.30 and 19.00.

Approximately 340 scientists (including some Kiel University students) participated. Forty non-attending members were registered to receive the abstract volume and address lists.

It is planned that the invited lectures together with recommendations of the consultant groups will be published as a special volume by the Micropaleontology Press, American Museum of Natural History, New York (Editors W. Riedel and T. Saito).

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An especially appreciated part of the Kiel Symposium was the opportunity provided for contacts between botanists, zoologists and paleontologists working on the same planktonic groups.

Many contributions illustrated the considerable progress in the inter-relation of biostratigraphic successions of various planktonic microfossil groups and the beginning of application of statistical procedures in this field.

There were also many demonstrations of the results obtainable from the application of statistical methods to biogeographical and ecological sets of recent and fossil data.

Results based on investigations of Deep Sea Drilling Project material played an important role in many of the contributions and discussions at this Symposium, demonstrating the dramatic impact of this project on many fields of research covered in the meetings.

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- Therefore:
1. It is recommended that SCOR sponsor a synthesis meeting in approximately five years' time, to consider the advances made during that period in understanding the evolution of the oceanic plankton-benthos-sediment system from the present back through geologic time.
  2. In order to understand the life cycles and mode of life and shell formation in skeleton-bearing plankton, it is recommended that more field experiments and laboratory culturing of these groups be carried out. These objectives might best be furthered by small workshops intended to lead to the establishment of on-going research programmes.



3. Further studies are recommended on the distribution of living representatives of the shelled plankton, and compilation of atlases of distributions for groups where these are not already in progress. Precise delimitations of the taxa involved would be necessary.
4. More attention needs to be given to the physics, chemistry and biology of the deep sea benthic boundary layer, especially in relation to the accumulation and solution of skeletal remains, their burial, and their subsequent diagenesis.
5. Working Group 37 recommends its dissolution after the publication of the symposium volume, anticipated in about one year.

The Working Group gratefully acknowledges the help of the Geological Institute and the University of Kiel, and of the sponsoring organizations: SCOR, UNESCO (Division Marine Sciences), IUGS (Commission for Marine Geology), Deutsche Forschungsgemeinschaft, Kultusministerium Schleswig-Holstein.



## SCOR WORKING GROUP 40

## PALEO-OCEANOGRAPHY

Progress Report by Chairman, Tj. H. van Andel

Since the first meeting of WG 40 in May 1973 developments in paleo-oceanography have been rapid and extensive. Studies in the paleo-oceanography of the late Quaternary have resulted in global data sets for the sea surface temperatures, shoreline positions and ice cover during the height of the last glaciation at 18 000 years BP, which have been used as input in a global dynamic climate numerical model. These studies form part of the internationally based CLIMAP programme which is supported by the International Decade of Ocean Exploration. In pre-Quaternary paleo-oceanography, developments have been equally significant, mainly as a result of the data generated by the Deep Sea Drilling Project. Large papers dealing with the circulation of bottom water in the Pacific during the last 50 million years, with the relation between Cenozoic glaciations on Antarctica and the development of the circum-antarctic circulation, and with the paleo-oceanographic history of the Atlantic can be cited as examples (see Note). These and other publications should appear in print in the next 6-9 months; they will stimulate considerable further activity.

In view of this rapid evolution WG 40 has not pressed the compilation of a report detailing the opportunities in paleo-oceanography as it proposed in its first meeting. A more opportune time for such a report may occur in another year or so, and the item remains on the agenda.

On the other hand, these same developments promise the opportunity for an outstanding and very timely Symposium on Paleo-oceanography at the Joint Oceanographic Assembly in Edinburgh in 1976. Preliminary plans for this symposium were formulated several months ago. At the Kiel meeting of WG 37 a group of members of WG 40 met under chairmanship of Dr E. Seibold to further develop these plans and it is expected that a list of speakers will be complete early in 1975 so that organization of this symposium can begin.

In its previous report, WG 40 made two other recommendations, viz. to organize a small workshop on mathematical and statistical models in paleo-oceanography, and to explore the feasibility of organizing in the USSR a workshop on the paleo-oceanography of the late Quaternary. The technical workshop was held in April 1974 at the University of Wisconsin in Madison under sponsorship of WG 40, chaired by Dr John Imbrie of the group and with financial support of the Advanced Research Project Agency and the International Decade of Ocean Exploration. A report of this very successful workshop is being prepared for wide distribution.

Early in our exploration of the feasibility of the USSR conference the Chairman was informed that under the bilateral US-USSR scientific cooperation programme a Working Group (VIII) had been formed that included amongst its tasks, essentially the objectives WG 40 had in mind. Dr John Imbrie, member of WG 40, was instrumental in organizing the special subgroup devoted to this task and attended the first meeting in the USSR in June 1974. A report on this conference demonstrated that the WG 40 activities as planned were fully included and that it would be wise for WG 40 not to take any independent action for the time being. WG 40 will continue to observe these activities, using Dr Imbrie as a rapporteur and will report from time to time on developments.

At the present time the organization of the Edinburgh Symposium is thus WG 40's principal activity. No meetings are planned in the near future, but the group remains alert to opportunities that might arise late in 1975 or early in 1976.

Note: these publications are:

- Tj. H. van Andel, G. Ross Heath and T. C. Moore, Jr., Cenozoic tectonics, sedimentation and paleo-oceanography of the Central Equatorial Pacific, Special Paper Geol. Soc. Amer. in press.
- J. P. Kennett and R. E. Houtz, eds, Initial Reports of the Deep Sea Drilling Project v. 29, US Government Printing Office, in press.
- W. A. Berggren and C. D. Hollister, Paleogeography, Paleobiology and the history of circulation in the Atlantic Ocean, Special Paper, Soc. Econ. Pal. Miner. in press.



SCOR WORKING GROUP 41  
MORPHOLOGICAL MAPPING OF THE OCEAN FLOOR

Status Report by A. S. Laughton, November 1974

No meetings of WG 41 have been held since January 1974 when the last status report was submitted. However, following the recommendations of WG 41 report of 1973 and the recommendations of the GEBCO Committee meeting of June 1973 (quoted in the Status Report of January 1974, SCOR Proceedings Vol. 10 No. 1), the following events have occurred:

GEBCO

The First Session of the 'Joint IOC/IHO Guiding Committee for the new Bathymetric Chart of the Oceans (GEBCO)' met in Paris in April 1974. It was clear that no money could be found in the 1973-74 IOC biennial budget to fund the geoscience unit as proposed by WG 41 nor were there any acceptable offers of finance from elsewhere. Offers of accommodation and overheads were however made.

Various individuals and organizations had prepared mock-ups of 1:10 million scale charts (or parts of them) in order to study the content and style of representation of the proposed chart series. A revised numbering system was formulated and revised sheet boundaries were prepared to improve the usefulness of individual sheet coverage.

In order to make progress with the new 5th Edition of GEBCO, various individuals undertook to coordinate the compilation and preparation of single sheets.

Cooperative Investigations in the Mediterranean -

The Chairman of SCOR WG 41 was invited to attend a meeting of CIM in April 1974 to discuss charts of the Mediterranean. He was represented at this meeting by Commodore Kapoor of IHB. The outcome of this meeting was the proposal to prepare a new chart of the Mediterranean at a scale of about 1:1 million (in 8 sheets) in two stages:

- '(a) before May 1977, the more reliable soundings will be collected on the British Admiralty 1:250 000 plotting sheets for oceanic soundings, contoured with an overlay showing tracks, and dyeline copies will be made available for distribution:
- (b) in three years time these sheets will be used, supplemented as required by IHB collected soundings, as the basis for a chart on 1:1 000 000 to SCOR WG 41 specification as finalized by the GEBCO Guiding Committee.'

Future of SCOR WG 41

I believe that SCOR WG 41 has now effectively stimulated activity on the Morphological Mapping of the Ocean Floor and that continuity of this activity is ensured by the cooperation of IOC and IHB in the new GEBCO Guiding Committee. In my opinion, WG 41 has now fulfilled its terms of reference and I propose that it now be disbanded.



SCOR WORKING GROUP 42 (WITH ICES)  
STUDY OF POLLUTION OF THE BALTIC  
Report of Meeting, Charlottenlund, 16-17 May 1974

Participants

Dr G. Kullenberg (Denmark) (Chairman)

Mr S. Genders (Denmark)	Dr W. Słaczka (Poland)
Mr O. Vagn Olsen (Denmark)	Dr L. Zmudzinski (Poland)
Mr E. Somer (Denmark)	Prof. B. Bolin (Sweden)
Prof. Dr K. Grasshoff (FRG)	Dr S.H. Fonselius (Sweden)
Prof. Dr G. Hempel* (FRG)	Dr J.-O. Strömberg (Sweden)
Mr A. Haverinen (Finland)	Prof. Dr A. Aitsam (USSR)
Dr A. Voipio (Finland)	Mr H. Tambs-Lyche (Denmark) ICES
Dr H.J. Brosin (DDR)	Mr J. Smed (Denmark) ICES

\* Also Observer for Baltic Marine Biologists

Reports of national activities and plans were presented.

The Group noted that there are a number of bilateral or trilateral agreements between the countries bordering the Baltic, and observed that these had in general led to increased scientific activities and to coordination of national efforts. There had, however, also been instances where lack of sufficient communication had led to regrettable overlap in tasks, and it was felt that the coordinating capability of ICES could play an important role in avoiding this in the future.

Information on the 9th Conference of the Baltic Oceanographers

Mr Smed presented a written report, and supplementary information was given by Professor Grasshoff, who had chaired the Conference.

The Working Group noted with satisfaction that the Conference had supported its work by passing several resolutions directed to the scientific community in the Baltic countries, thereby stimulating actions initiated as parts of the comprehensive study of the pollution of the Baltic.

Reponse of ICES and SCOR to the Report of the Working Group's last Meeting: Information on the Continued Cooperation between ICES and SCOR in the Study of Pollution of the Baltic

The Group noted that its last Report had been accepted by both ICES and SCOR, and that both organizations had agreed that ANNEX 5 to the Report ("Research Programme for Investigation of the Baltic as a Natural Resource in View of Marine Pollution Problems") should be published as a Cooperative Research Report. The General Secretary of ICES



said that this was now under preparation, and that the Report will be published as No. 42 of that series.

Both ICES and SCOR had agreed to sponsor the Special Meeting on Models of Water Circulation in the Baltic (Charlottenlund 26-27 September 1974) and the Chairman informed about the progress in preparation for it.

It was very much regretted that it had been necessary to cancel the International Workshop on Analytical Methods for Potential Pollutants in Sea Water which had been planned for September 1974 in Kiel. The Group recognized that this Workshop would have been of great importance for the effective implementation of its own plans, and hoped therefore that it was a question of postponement rather than cancellation.

The Working Group was informed about a letter dated 5 March from the President of SCOR, and that SCOR considered withdrawing from the Group. SCOR had asked for the Group's views, and it was agreed that the cooperation had been most useful, and probably essential for the results that had so far been achieved. It was the view of the Group that the Baltic was well suited as a pilot area for scientific cooperation on pollution, and that the experiences would be more easily transferred to other areas through SCOR's active participation in the present study. On the other hand, scientific input from areas outside the Baltic and direct access to experience from similar studies elsewhere were of great importance for the Baltic studies, and such input was provided through SCOR's participation. It would be regretted therefore if SCOR withdrew from the Group now, when the further planning and implementation was felt to be at a critical stage. Also, the Group felt that the joint Group is in any case needed until such time as DDR has become a member of ICES.

#### Report on the Input Study

Dr Brosin said that he had received answers to the Questionnaire from all seven countries, but the last answers had been available so late that he had had very short time to draft his report. It should therefore be considered as a preliminary one, and it would be possible, with more time available, to provide a more complete survey of the total input. It would also be possible to supplement the data from the Questionnaires by data in the 1970 report, as well as by other available information. It was noted that while the qualitative information (kinds of pollutants) is reasonably good, the information on quantities is still not satisfactory. In some cases, no other figures are available apart from those reported in 1969/70; in other cases where new figures are reported, the comparison with the earlier ones is difficult and in some cases impossible. There are also important "gaps" in the information, and there are far too few analyses of the content of pollutants or nutrients in domestic sewage and waste water from industry. In some instances the participants believed that better information may be available in national laboratories and institutions, but they have for various reasons not been reported. In some cases this may be because the national investigations have started only recently and may still be in a pilot or exploratory stage.

In other cases, there is a lack of scientific investigations, such as on that amount of pollutants and nutrients discharged to rivers, fjords and estuaries which reach the Baltic area proper. Finally, during recent years one has been aware that air-borne pollutants may be considerably more important than previously assumed, and sufficient information on the input from the air is urgently needed. For all these reasons it is not yet possible to use the acquired knowledge for construction of a budget of the contaminating



substances - or even the nutrients - in the Baltic. The studies of the inputs must therefore be continued. It is premature to start compilation of input data on a regular, for instance, annual, basis but it was expected that the establishment of the Helsinki Commission will make it possible to improve greatly the quality of the data which are at present available.

The Group wishes to draw the attention of the Commission to the importance of this task, and expected that it will use its authority to request the Member Countries to make sufficiently detailed information on the input available according to standardized procedures, in order that the data from all national sources become inter-comparable. The Working Group would be pleased to cooperate with the Commission and make its experience and expertise available to it.

On the other hand, it was stressed that while reasonably complete information on the total input is an absolute necessity, this information alone does not solve any problem. In order to be of value it must be made available for an evaluation of budgets for each substance, and studies of their pathways and effects on the living resources of the Baltic. This is a scientific task, for which full cooperation between scientists from all Baltic countries, and from a series of different disciplines is needed.

Finally, the Group made a brief comparison with the corresponding study of the input to the North Sea, and concluded that with some additional information which is believed to be available, an evaluation of the information which has now been provided in a more quantitative way seemed possible. It was therefore agreed to establish a Sub-Group for this task consisting of:

Dr H. J. Brosin (Convenor)  
Dr A. Voipio  
Mr A. Haverinen  
Dr W. Słaćzka  
Dr G. Weichart

The Sub-Group should report to the next Meeting of the Working Group.

#### Report on Analytical Methods

Reports on the "visiting surveys" and the Meeting of Analysts (Charlottenlund, 26-28 February 1974) were presented by Dr Słaćzka and Professor Grasshoff. The Group complimented Dr Słaćzka and Dr Kremling for their very good work and extensive and useful report, and wished to express its appreciation of the financial support rendered by the Research Council of the Federal Republic of Germany and SCOR for this work.

The Group noted the Report of the Analysts' Meeting, and decided to annex it to its own Report (page 140).

#### Report on Progress of the Base-Line Study

The Coordinator of the Base-Line Study, Professor Grasshoff, reported that it had been necessary to postpone the sampling by one year, but that the time gained had been used effectively for further preparations. He also said that some of the 25 laboratories which had last year indicated a willingness to take part in the study, may in the meantime have withdrawn from it, and that therefore new commitments were needed.



The Group agreed to follow in all essentials the procedure as outlined by the Action Planning Group at the Kiel Meeting.

The Coordinator will make available the necessary instructions by 1 July 1974, and these will then be circulated by the ICES Secretariat to the 25 laboratories, asking for their commitments. It should be made clear that those who take part in the Study must also participate in the joint intercalibration with the North Sea laboratories. Samples for the intercalibration will be distributed by Professor Grasshoff as soon as the laboratories have responded.

It was further agreed that it would be useful to include Kattegat in the Base-Line Study, in order to obtain an effective link with the North Sea Study.

#### The Basic Oceanographic Research Programme

The Chairman reported that the following persons had agreed to act as coordinators for, and head of task teams for, the following tasks:

- Task 2. The Open Sea Experiment: Professor Aitsam
- Task 3. The Baltic Circulation Study: Dr Svansson
- Task 5. The Open Sea, Multidisciplinary, Continuous Stations: Professor Hempel.

It would now be necessary to discuss these three tasks in more detail, and to set up task teams for the detailed planning, and later on, implementation. It would probably be necessary to allow about one year for the 'definition phase', and after that there should be a joint meeting of the teams for scientific discussions. This could take place in conjunction with the next meeting of the Working Group.

It would be necessary at present to look at the other tasks too, and, perhaps designate coordinators for them. During the discussions on this item on its Agenda, the Group benefitted from written comments by Dr Aitsam and Professor Welander on Task 2.

Before the tasks were discussed in detail, the Group considered priorities. It was noted with satisfaction that Task 1 (Exchange of water and matters with the North Sea), which has high priority, is developing satisfactorily in cooperation between some of the countries, and that no action by the Working Group is needed at this stage. Close contacts will, however, be kept with those concerned with it.

It was agreed that Task 2 and Task 5 must precede Task No. 3. It was also noted that Task 4 has to be implemented at national level, and that there is interest in it both in Sweden and Poland.

It therefore appeared reasonable to give priority at this stage to Task No. 2 as far as physical oceanography is concerned, and to Task No. 5 for the biological studies.

Professor Aitsam said that the following persons had been asked to take part in the Task Team for Task 2: Dr Brosin; Dr Magaard (possibly to be replaced by Professor Krauss); Dr Mälkki; Dr Walin; Professor Welander; Dr Kowalik and Dr Kullenberg. The Task Team will, if necessary, supplement itself in order to include all the scientists who are active on the implementation of this task. It was also agreed that the Task Team would meet in Copenhagen on 29 September, immediately after the Special Meeting on Modelling. One would at that time hope to have at least tentative commitments of vessels and equipment, for late 1976 or early 1977, and the further time-scale will then be considered in the light of the outcome from the Meeting on 28 September.



The Group then turned to discussion of Task 5, and Professor Hempel said that he had contacts with the following persons concerning this task:

In the German Democratic Republic: Dr K. Voigt  
In Poland: Dr L. Zmudzinski  
In USSR: Professor Aitsam  
In Finland: Dr A. Voipio  
In Sweden: Professor B. -O. Jansson and Dr S. H. Fonselius  
In Denmark: Dr G. Kullenberg

It is the intention that this circle of correspondents will develop into a Task Team.

It seems possible that an FRG ship will be available for this task in 1977 for working one of the stations three times, and it is hoped that another ship may join. The Convenor of the Task Team will circulate a first draft of a plan for the task shortly, and representatives from the laboratories which are intended to participate should meet early in 1975 for discussion of details. At that time one hopes that commitments will be made of vessels, equipment and experts. It was noted that there is interest in Denmark for participation with optical measurements in this task; and that there are several scientists in Sweden who are interested in participation, although commitment of ship time is not yet possible. On the other hand, there is a possibility that Finland may provide ship time, even if there is a shortage of available experts. The German Democratic Republic intends to participate in either Task 2 or Task 5, and will decide when more detailed plans are available.

It was recognized that the Task Team will have to consider very carefully the original concept of three stations worked three times; if that should not be possible, some reduction must take place, or alternatively, a combination with Task 2 as suggested in last year's report, may be of help. The Working Group discussed criteria for a possible reduction, but agreed to wait for advice by the Task Team. It was also agreed that planning of Tasks 2 and 5 should go on separately in the first instance, and that a possible combination might better be discussed later, when both tasks are defined in more detail.

Finally, it was agreed to use the opportunity provided by the next ICES Meeting to look at the time-table for the planning of this and other tasks during the next year.

The Group thereafter returned to a discussion of Task 4 (The coastal water dynamics experiment), and Professor Hempel reported on discussions he had had with Professor B. -O. Jansson. This task will be undertaken primarily in the nearshore areas, and has therefore to be carried out as a combination of national projects. The Askö Laboratory is interested to make the studies at a rocky shore, but it is not yet clear what resources will be available, or when. It is very important, however, that corresponding studies are made at sandy shores in some other part of the Baltic, preferably in Poland; the two parts of the task must be closely correlated, and there should be an international coordination for the whole task. Professor Jansson would be willing to undertake that task. The Polish participants said that there was interest among Polish scientists for this task, but asked that a formal approach should be made by ICES to the Polish authorities. There is a need for detailed coordinated planning between Swedish and Polish scientists, and they should try to meet during late 1974 or early 1975.

The Working Group recognized the importance of this task, and encouraged further preparations. It asked to be kept informed about their progress so it may help if needed,



and assist in coordinating international participation or in facilitating exchange of scientists and data.

The Group briefly discussed Task 6 (Year-round biological observations) and recalled that the participants from the Lysekil Laboratory had at the Kiel Meeting offered to prepare a list of current national activities. The General Secretary was asked to approach the Lysekil Laboratory (Dr Ackefors) and ask for information. Further joint planning can only be made on the basis of such a compilation.

Concerning Task 7 (Toxic substances through the food chain), it was agreed that one has to wait for the results of the Base-Line Study.

#### Additional Activities

##### a) Continuous collection and updating of information on inputs

The Working Group recognized that this part of its terms of reference had been formulated before the preparations for the Helsinki Commission were started, and that it can only be solved in cooperation with that Commission. The General Secretary of ICES gave some information on the corresponding cooperation between the Council and the Preparatory Committee for the Oslo Commission, and the Group agreed to revert to this item at its next session, or when pertinent information is available.

##### b) Monitoring scheme

The Working Group agreed that a monitoring scheme must be based on a joint base-line study in order to be meaningful, otherwise it will be a waste of money and scientific resources. In due course a joint monitoring scheme will need to be based on national activities, but the Working Group, or ICES, may have an important coordinating function, in cooperation with the Commission.

#### Collaboration with Other Bodies in the Baltic

The Working Group was pleased to note that its membership include persons with contacts with practically all other related activities connected with studies of the Baltic, such as the Conference of Baltic Oceanographers, Baltic Marine Biologists, and the IHD Study of Water Balance of the Baltic. This had been reflected throughout the discussions at the present Meeting, and no specific action is needed at this time.

#### Any Other Business

1. The Group referred to its discussions of the research programme which had resulted in different time-tables for different tasks which had previously been considered part of "The Baltic Pollution Study Year 1975" (later amended to 1976). It was agreed that it was unfortunate, and that it may cause difficulties, for the planning if the year mentioned was misleading. It had now also become clear that one (or even two) years would not be sufficient for the whole programme, and that some tasks would have to wait for the completion of others. It was therefore agreed to amend the designation to read:

#### The International Baltic Pollution Study

2. The Group proposed that it should meet again in about a year's time, when concrete plans for Task 2 and Task 5 are available, and when it can evaluate progress in the Base-Line Study, and also consider a full report on the Input Study.

REPORT OF THE MEETING OF ANALYTICAL EXPERTS  
FROM BALTIC LABORATORIES  
Charlottenlund, 26-28 February 1974

Participants

Mrs I. Beckman	(Sweden)	Miss I. Kraul	(Denmark)
Dr L. Brüggemann	(DDR)	Dr K. Kremling	(FRG)
Mr S. Carlberg	(Sweden)	Mr O. Lindgren	(Sweden)
Mr Lars-Göran Danielsson	(Sweden)	Mrs K. Noren	(Sweden)
Dr M. Ehrhardt	(FRG)	Mr O. Vagn Olsen	(Denmark)
Miss K. Erkomaa	(Finland)	Dr Olafsson	(Sweden)
Dr S.H. Fonselius	(Sweden)	Dr Ch. Osterohrt	(FRG)
Prof. Dr E. Føyn	(Norway)	Mr L. Rudling	(Sweden)
Prof. Dr K. Grasshoff	(FRG)	Dr D. Schmidt	(FRG)
Dr U. Harms	(FRG)	Mrs A. Salo	(Finland)
Miss Anne Helleberg	(Denmark)	Dr W. Słaczka	(Poland)
Dr (Mrs) E. Huschenbeth	(FRG)	Dr P. Solyom	(Sweden)
Dr B. Josefsson	(Sweden)	Dr E. Somer	(Denmark)
Mr O. Karlog	(Denmark)	Dr D. Stadler	(FRG)
Dr F. Koroleff	(Finland)	Mr R. Vaz	(Sweden)

1. As agreed by the ICES/SCOR Working Group at its Meeting in 1973, and confirmed by ICES Resolution 1973/3:2, working analysts from Institutes concerned with studies of the Baltic Pollution were invited to meet at the ICES Headquarters from 26-28 February 1974.
2. Professor K. Grasshoff was elected Chairman of the Meeting and Dr K. Kremling (trace metals) and Dr W. Słaczka (chlorinated and petroleum hydrocarbons) Chairman of the two Sub-Groups.
3. The basis for the discussions was a compilation of methods which at present are applied in Baltic laboratories and which had been prepared by Dr Kremling and Dr Słaczka. As agreed by the ICES/SCOR Working Group on the Study of Pollution of the Baltic these two scientists had visited the Institutes concerned in order to collect relevant information on the methods used in different laboratories. It was the intention to give a true report on the practised methods without any evaluation. The draft Report was distributed to the scientists involved three weeks before the Copenhagen Meeting. The costs for these activities were carried by the German Research Council and by SCOR.
4. The discussions during the three-day Meeting were mainly devoted to sampling and pretreatment of the samples and to some special steps in the analysis. It was also the intention of the Meeting to elaborate some firm guidelines for the planned Workshop on Analytical Methods for the Analysis of Potential Pollutants, Kiel, September 1974. [Subsequently this meeting was cancelled.] The following Recommendations from the Meeting are intended to provide for a more uniform pretreatment of the samples.



5. Sub-Group I: Trace Metals

Trace Metal Analysis for Sea Water

Recommendation: 1) For sea water analysis the samples should not be filtered unless special questions are subject of the investigation and unless the particle load does not exceed 5 mg/l. This figure may be changed, if more information about phytoplankton concentration factors are available.

If filtration must be applied, "Nuclepore" filters with a pore size of 0.4  $\mu\text{m}$  are recommended.

2) Quartz or polythylene bottles should be used for storage of samples. The bottles should be cleaned with pure nitric acid (50%) and then treated with a 1% solution of APDC followed subsequently by a MIBK treatment and finally rinsed with distilled water. Before sampling, the bottles should be carefully rinsed with sample water.

3) The samples should be stored in a deep-frozen condition until analysis. The freezing should be done as rapidly as possible after sampling, preferably with a quick-freezing device.

If the sample is too large to allow deep-freezing within 2 hours after sampling, or if deep-freezing is not possible, acidification with supra pure nitric acid or hydrochloric acid should be done to adjust the pH of the sample to at least 1.5.

In the case of mercury analysis the sample must be acidified with 30 ml concentrated nitric acid per litre sample and stored in carefully prepared glass bottles. Pretreatment should be done by rinsing with concentrated nitric acid, the cleaning with distilled water and finally with the sample water just before sampling. The bottles should be stoppered with glass stoppers. The nitric acid must be checked to be free or very low in mercury.

(Remark: mercury contamination in nitric acid may vary from batch to batch.)

Information:

For pre-concentration steps the co-precipitation method with magnesium hydroxide should be proved as a practicable procedure. For this purpose, supra pure sodium hydroxide is added to the sea water sample until a precipitate occurs. After settling of the precipitate, the supernatant water is decanted or siphoned away. The precipitate is dissolved in acid and quantitatively transferred to smaller bottles for storage or direct analysis.

Analysis of Sediments

Recommendation: 1) It is recommended that a standard procedure for the digestion of sediments should be strictly applied by all labora-



tories carrying out sediment analysis for trace metals. The standard digestion should be made according to the procedure adopted by the Nordforsk (Nordic Research Council)(Dr P. Solyom) expert group on sediment analysis. The method will be circulated after the evaluation of the recent intercalibration exercise, probably in May 1974. (A nitric acid digestion is applied.)

- 2) Because of the strata of different elements in the sediments and the different ways of interaction between water, pore water and sediment it is recommended that sediment sampling devices should allow collection of completely undisturbed cores down to the desired depth. All results should be reported together with the depth and thickness of the analysed layer. Precise description of the sampling and sub-sampling techniques should be presented.

Analysis of Fish (sampling, storage, filleting procedures) will be outlined by Dr P. Solyom and circulated in May/June 1974.

#### 6. Sub-Group II: Chlorinated Hydrocarbons and Petroleum Hydrocarbons

The following compounds should be determined:

- a) Organochlorine pesticides, mainly DDT, DDE, DDD and dieldrine;
- b) Polychlorinated biphenyls (PCB's).

The residues of PVC production were omitted due to lack of experience in their estimation by the visited Institutions.

##### Recommendation: 1) Material for Analysis

- a) Sea water - surface layer (0 - 1m) and deeper layers;
- b) Sediments - surface layer (0 - 1cm);
- c) Biological material - according to the sampling program which will be circulated before July 1974.

##### Recommendation: 2) Sampling

- 2.1 Sea water - by pumping directly from the sea;
  - sampling with stainless steel samplers;
  - sampling with glass bottles.

Caution - In the case of collection of samples from the ship it is necessary to take them from some distance to avoid possible pollution by PCB's from the ship paint.

- 2.2 Sediments - The samples should preferably be collected with the "Kasten" corer to provide undisturbed surface samples.



### 2.3 Biological

Material - The samples should preferably be collected by research vessels. Otherwise material should be obtained from commercial fishing boats.

### 3) Preservation of Samples

Biological material and sediments should be wrapped in aluminium foil and immediately frozen and stored in a deep freezer. The sea water samples should be extracted immediately after sampling to avoid wall effects. As a rule the organic extract should be separated. If this is impossible, the unseparated organic extract (together with the water layer) may be delivered to the laboratories.

### 4) Extraction

4.1 Sea water - liquid-liquid extraction (Josefsson method\*);  
- column extraction (Osterroht method\*);  
- shaking with organic solvent.

4.2 Sediments - extraction in Soxhlet apparatus.

4.3 Biological  
Material - extraction according to the Jensen method;  
- homogenization in normal way;  
- powdering with anhydrous sodium sulphate and sea sand followed by extraction in a small column.

Caution - Fat recoveries during extraction process should be recorded.

### Recommendation: 5) Clean up and Separation

(For all materials under investigation)

Four methods for clean up and separation should be used:

5.1 Method with fuming  $H_2SO_4$  and KOH:

- a) according to the method of Jensen\*;
- b) according to the micromethod of Södergren\*.

5.2 Thin layer chromatography according to the method of Zestöb\*.

\* The names refer to the compilation of methods by Kremling and Słaczka.

- 5.3 Column chromatography according to the method used in Institut für Küsten-und Binnenfischerei in Hamburg (Holden and Moveden method).

Caution - In all cases the extract which contains PCB's and DDE should be oxidized with chromic acid to destroy DDE.

6) The Stationary Phases for Gas Chromatography

Five kinds of stationary phases should be used:

- a) 2.5% QF-1 + 2.5% DC-11 (1:1) on Chromosorb W HP, 100/120 mesh;
- b) 8% QF-1 + 4% SF-96 (67:33) on Chromosorb AW DMCS, 100/120 mesh;
- c) 5% DCFS-1265 + 4% DC-200 on Chromosorb AW DMCS, 100/120 mesh;
- d) 3% OV-1 on Chromosorb AW DMCS, 100/120 mesh;
- e) 10% DC-200 on Chromosorb AW DCMS, 100/120 mesh.

7) Standard Solutions

- a) For organochlorine pesticides in a mixture of DDT, DDE, DDD and dieldrine in n-hexane should be used.
- b) For polychlorinated biphenyls: clophen A-50 in n-hexane should be used.

8) Quantitative Evaluation

Only the peak heights of the estimated compounds should be measured, and then compared with the same peaks of the standard solutions.

DDT - In the case of  $H_2SO_4$  treatment followed by a KOH clean-up process, the difference of the DDE peak height, before and after the treatment with KOH, should be estimated and multiplied by 1.11.

DDT - In the case of thin layer chromatography or column chromatography separations, the height of the DDT peak should be measured directly from the chromatogram.

DDE - In all cases the difference of the DDE peak heights, after the  $H_2SO_4$  treatment and after the oxidation, should be measured.

DDD - In the case of  $H_2SO_4$  treatment followed by a KOH clean-up process, the difference of the peak



heights, before and after treatment with KOH, should be estimated.

- In the case of thin layer chromatography or column chromatography separation, the height of the peak should be measured directly from the chromatogram.

Dieldrine - For its determination only thin layer or column chromatography separation should be used. The height of the peak should be estimated directly from the chromatogram.

PCB's - The total amount of PCB's should be estimated. The total heights of all their peaks, after treatment with KOH, and those related to DDE after oxidation with chromic acid, should be estimated.

Caution - In cases when the individual isomers of PCB's are obtainable, the measurement of each peak height separately should be recommended.

#### 9) Results

The results should be expressed in mg/kg,  $\mu$ g/kg etc. and not in ppm, ppb etc. In the case of biological material the results should be related to lipid weight and to the wet weight, and in the case of sediments to the dry and wet weight.

7. In a joint session of the two Sub-Groups the Recommendations were discussed and also the philosophy of the planned Workshop. The Chairman informed the Meeting about the unexpected small number of preliminary applications to the Workshop, and the reasons for this were discussed.

The Meeting agreed unanimously that the Workshop should be organized if this would be feasible; and in order to make it more easy for persons interested to participate, it was decided to shorten the duration of the Workshop from three to two weeks.

The Meeting was informed that the organizer must have firm applications before 1 April 1974\*.

\* After having received the first applications by 1 April it became obvious that the number of applicants with sufficient expertise in the different fields of the analysis of potential pollutants was not large enough to provide for a sufficient representation of especially the Baltic, and the North Sea laboratories, so that one of the main purposes of the Workshop could not be secured, namely intercalibration of the methods, especially for those samples and substances, where the exchange of samples is impossible for several reasons. In agreement with the organizer and the Steering Committee, the Workshop was therefore cancelled.

The Meeting was also informed about the parallel activities of the Swedish Environmental Protection Board in the frame of the bilateral Swedish-USSR cooperation.

It is intended to issue a revised compilation of the methods from Baltic Laboratories before late summer 1974 and give it a somewhat wider distribution after having received the concession of doing so from all contributing laboratories.



## SCOR WORKING GROUP 43

## OCEANOGRAPHY RELATED TO GATE

Report of Chairman: G. Siedler, 15 November 1974

After the development of the proposals for a GATE Oceanographic Programme in 1973 and the planning of operational details, data management and some aspects of post-GATE activities in late 1973 and early 1974, SCOR WG 43 assisted in conducting the field operations in summer and fall 1974. Dr D. B. Ross kindly served as a SCOR WG 43 representative in Dakar, Senegal during phase III of GATE to help coordinate the oceanographic and the aircraft programme. Several SCOR WG 43 members participated actively in the field operations and the planning sessions in Dakar. It should be noted that the international cooperation during this major experiment was excellent. Although it is too early at this time to judge the results of the field experiment it can be expected that most objectives of the oceanographic field programme were achieved successfully.

According to the earlier suggested plan for post-GATE activities of SCOR WG 43 it is intended to convene the third full meeting of SCOR WG 43 in June 1975 in Southampton, UK to discuss the status of GATE oceanographic experiments and the future role of WG 43 and to suggest procedures for joint scientific analysis of the oceanographic data after the data processing phase, including workshops. The feasibility of these plans will depend critically on the availability of sufficient travel funds.

[Abbreviated reports of two meetings of WG 43 in early 1974 follow. The recommendations of these meetings are not printed because these were all directed to the operational plan for the 1974 field programme.]

Report on the Informal Meeting of the GATE Oceanographic Subprogramme jointly organized by SCOR WG 43 and the ISMG, London, UK, 26 to 28 February 1974.

1. List of participants

C. J. M. Aanensen (ISMG)	J. Merle (France)
J. Alt (France)	L. Miller (USA)
H. J. Brosin (SCOR/DGR)	M. Miyake (ISMG)
K. F. Bowden (UK)	T. de la Moriniere (ISMG)
L. Capurro (IOC)	P. S. Nery (Brazil)
R. A. Clarke (Canada)	F. Ostapoff (SCOR/USA)
J. Crease (UK)	G. Peluchon (France, OSDC)
J. Ewing (UK)	S. R. Petersen (ISMG)
C. A. Franceschini (USA)	S. G. Philander (ISMG)
K. Hasselmann (FRG)	A. Rybnikov (USSR)
H. Hoeber (ISMG)	M. Sturm (SCOR)
D. Kohnke (FRG)	R. I. Tait (UK)
E. B. Kraus (USA)	Y. Tarbeev (ISMG)
R. Kroll (FRG)	S. A. Thorpe (UK)
J. Kuettner (Director ISMG)	R. S. Williams (USA)
T. McAndrew (UK)	J. Woods (SCOR/UK)
J. Meincke (FRG)	

## 2. Purpose of the meeting

The purpose of the meeting was to plan the details of the field phase of the experiment, to discuss post-GATE activities, and to decide upon a course of action to resolve problems that have arisen since the October meeting in Paris.

## 3. GATE operations

Representatives from the following countries presented information on changes in national programmes since the October meeting in Paris: Canada, France, FRG, GDR, UK, USA, USSR. Eight recommendations resulting from the discussions were prepared for consideration in the GATE Operations Plan.

## 4. Post-GATE Activities

It was strongly recommended that the successful cooperation between SCOR WG 43 and the ISMG should continue. The ISMG (Oceanographic group) or its successor will continue as the implementing body within the framework of WMO and the UN; SCOR, a committee of ICSU, will continue to provide scientific advice in cooperation with IOC. Specific items that will require attention include:

1. Data management problems
2. Communication with the other Subprogrammes of GATE
3. Organization of post-GATE workshop meetings
4. Monitoring of the scientific results of GATE and identification of possible gaps in the analysis phase.

It was decided that the composition of the International Data Validation Committee should be as follows:

OSDC and ISMG:	Mr Peluchon (Chairman), M. Merle, Dr Tarbeev, Dr Miyake, Dr Philander (Secretary), Mr de la Moriniere.
USA:	Dr Williams
USSR:	Dr Filipov
SCOR:	Dr Siedler

It is understood that the representatives of the USA, USSR and SCOR may each delegate another specialist to attend specific meetings of the committee.

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Report on the Informal Meeting of the GATE Oceanographic Subprogramme jointly organized by SCOR WG 43 and the ISMG, Leningrad, USSR, 25 to 27 March 1974.

1. List of participants

Dr Arshinov (USSR)	T. de la Moriniere (ISMG)
F. Baumeier (Brazil)	Dr Moroshkin (USSR)
Dr Belyaev (USSR)	Dr Myatch (USSR)
L. Capurro (IOC)	Dr Nogtikov (USSR)
Prof. Davidan (USSR)	F. Ostapoff (SCOR/USA)
W. Düing (SCOR/USA)	G. Peluchon (France, OSDC)
Dr Efimov (USSR)	S. Petersen (ISMG)
Dr Filippov (USSR)	Dr Rybnikov (USSR)
Dr I. Galindo (SCOR/Mexico)	Prof. Samoilenko (USSR)
Dr Gruzinov (USSR)	K. Schnebele (USA)
P. Hisard (France)	Dr Shiryaev (USSR)
Prof. Laghtman (USSR)	M. Sturm (SCOR/GDR)
J. Merle (France)	Dr Tyabin (USSR)
M. Miyake (ISMG)	R. Weisberg (USA)

2. Purpose and results of the meeting

Much of the time of this meeting was devoted to the exchange of information rather than solving specific problems. The previous meeting held in London in February 1974 and its recommendations were the basis of much of this meeting's discussions. The final day was devoted to a discussion and approval of eight further recommendations concerning GATE Operations and Data Management.

## SCOR WORKING GROUP 46 (WITH ECOR/IAHS/ACMRR/UNESCO)

## RIVER INPUTS TO OCEAN SYSTEMS

Report of first meeting, Paris, 24 to 27 June 1974

## Participants:

(i) Members of RIOS working group

- |                    |             |          |          |
|--------------------|-------------|----------|----------|
| 1. D. Lal          | India       | (SCOR)   | Chairman |
| 2. J. S. Alabaster | UK          | (ACMRR)  |          |
| 3. R. Chesselet    | France      | (SCOR)   |          |
| 4. J. A. da Costa  |             | (UNESCO) |          |
| 5. D. Eisma        | Netherlands | (SCOR)   |          |
| 6. F. Fournier     | France      | (IAHS)   |          |
| 7. P. Storrs       | USA         | (ECOR)   |          |
| 8. K. K. Turekian  | USA         | (SCOR)   |          |

(J. S. Burton and E. Eriksson could not attend)

(ii) Co-opted Experts

- |                   |        |
|-------------------|--------|
| Jean-Marie Martin | France |
| A. Walton         | Canada |

(iii) Observers

- F. W. G. Baker, Executive Secretary, ICSU  
 T. F. Gaskell, SCOR executive committee  
 R. C. Griffiths, Assistant Secretary, IOC/UNESCO

The working group unanimously decided that it should concern itself primarily with the basic physical, chemical and biological processes occurring in the river-estuary-ocean systems. Following this discussion the group proceeded to consider its future work and developed a number of objectives for the scientific programme. Thought was also given to the manner by which these objectives could be accomplished.

The terms of reference provided to the group were noted, but the group decided to amplify them so that its scope and aims were spelled out clearly.

On the morning of 25 June the WG met with four UNESCO/IHD Consultants (Messrs Knöpp, Hendricks, Ionescu and Nöthlich) who are charged with drawing up plans for the preparation of a World Registry of Rivers. The WG were informed of their proposed approach and there was a useful interchange of ideas. They agreed to keep the WG informed of their work.



## I. AMPLIFICATION OF TERMS OF REFERENCE OF SCOR WORKING GROUP 46:

The questions with which this group is concerned are:

1. How does river water and its sediment load acquire their chemical qualities in response to climatic, geological and cultural factors?
2. What transformations occur when a river meets the sea?
3. What is the ultimate flux of constituents to the open oceans via river systems?

The working group intends to propose plans of action to enable acquisition of relevant data on a global basis, taking into consideration that useful data are, and will become, available from other international groups interested in the dissemination of natural and man made substances in the hydrosphere. The ultimate goal of this effort would be to develop suitable generalized models capable of describing the physical, chemical and biological processes operative in the river-ocean systems and interfaces, thus advancing our predictive capabilities.

## II. PURPOSES OF SCOR WORKING GROUP 46:

It was generally felt that SCOR Working Group 46, being essentially scientifically oriented, has a significant contribution to make to the advancement of the understanding of the influence of continents on the oceans. This would be fundamental to marine geoscience and to chemical and biological oceanography; moreover, in the long term, it would provide a scientific basis for the design of rational policies for the management of man's activities in the coastal zone, particularly for example with regard to problems of resources, pollution, and coastal engineering.

The main need is for descriptive generalized models of the physical, chemical and biological processes occurring in estuaries and adjacent seaward areas, which could be developed to encompass local situations. This will involve the integration of many scientific disciplines and require studies in representative areas of the globe, for which international cooperation is clearly necessary.

The studies should be designed to obtain field and laboratory data adequate to describe and account for the conditions in estuaries and the neighbouring areas. Such data would include measurements of the quantity and quality of suspended and dissolved substances present in rivers and of their subsequent transport, sedimentation and transformation in nearshore waters.

Studies in different parts of the world would enable comparisons to be made of situations having differing climates, land use and morphology, coastal and near-shore topography, tidal and current regimes, population and degree of river impact. They would enable existing input loads to be estimated and provide the means whereby significant changes could be monitored.

Thus the role of the working group will be to foster scientific research and exchange of information, and to advise international organizations on the fundamental principles of processes at the river-ocean interface, so as to assist in the planning of scientific investigations and monitoring projects.



### III. AN OUTLINE OF IMPORTANT PROCESSES IN RIVER INPUTS TO OCEANS:

The riverine inputs to the ocean system must be viewed as more complex than that derived from the image of a simple channel transport of a fluid to a basin. First, the processes imparting to a stream its chemical properties are diverse and variable, even within a given drainage basin. Second, the encounter between the river with its dissolved and particulate load, with the salty ocean causes radical changes in chemical and physical properties of the components. Thirdly, the particulate load, while on the estuarine floor, for whatever length of time, is subject to the peculiar biological, chemical and physical forces acting there which further modify the composition of water and the suspended matter. The resulting materials are subsequently capable of being transported to the open ocean.

In this section we briefly review the behaviour of particles and dissolved materials on this aqueous journey and the manner in which the composition of marine waters in both the coastal and open ocean may be altered. We further seek to identify the types of studies that will enhance our understanding of the processes involved.

#### A. Streams

The transport of materials by streams to the coastal zone occurs via both dissolved and suspended load. There is an interaction between these two phases that may change the distribution of elements between them as a function of distance downstream, or of seasonal and sporadic events affecting the drainage basin.

The composition of precipitation falling on the drainage basin sets the initial chemical quality of the water, but this is soon altered by interaction with the vegetation, the weathering profile and impervious artificial substances. The changes that occur are:

- (i) The increase of the concentration of dissolved solids by the solution of aerosols collected on the vegetation and impervious substances, and by evaporation;
- (ii) the addition of sulphate from the oxidation of sulphide minerals during weathering and the addition of bicarbonate through the oxidation of organic mineral or passage through limestone or chalk aquifers in both cases cations are also added to maintain charge balance;
- (iii) the mobilization of certain elements from weathering profiles;
- (iv) the addition of humic acids.

The particulate load of a stream is made up of the erosion products of the land and includes both silicate and oxide minerals characteristic of weathering profiles, as well as organic matter, possibly in the form of coatings on these minerals or as separate aggregates.

As the dissolved and particulate load of a stream is carried along, several changes can take place:

- (i) If acid waters are neutralized (say by the dissolution of calcium carbonate or by the alteration of silicate) dissolved iron and manganese will precipitate on the stream bed and on suspended particles. A seasonal increase of stream acidity due, for example, to the oxidation of forest litter, will result in release



of manganese and iron from suspended particles with an increase in the dissolved load. These reactions may influence the distribution of heavy metals between the dissolved and particulate phases.

- (ii) The adsorption of heavy metals, in particular, is effected primarily by the suspended organic particles. A secondary adsorption mechanism involves the clay minerals, but the organic particulate load plays the dominant role. The metal-sequestering capacity of these materials is large; thus there is a tendency to maintain the dissolved heavy metal concentration at low levels even after injection of metal in solution from man-made sources.
- (iii) The relatively "non-reactive" ions, such as sodium, sulphate and chloride will remain as part of the dissolved load.

Thus, by the time stream water encounters the sea, it has already been subject to many processes that may influence its future impact on the ocean system.

#### B. The behaviour of riverine materials in estuaries

Soluble and particulate constituents supplied to the ocean by rivers are subject to new physicochemical, biological, hydrodynamical and sedimentological conditions in estuarine and nearshore areas - this new environment modifies the chemical speciation, the concentration and ultimately the budget of these elements in the ocean. These modifications take place from the beginning of the mixing zone between fresh and seawater to off-shore areas where normal marine salinities are encountered.

For heavy metals, in particular, there is good evidence that the following processes occur in the estuarine system:

- (i) the release of metals from the particulate phase in low-salinity areas possibly through chelation by dissolved organic compounds or some other mechanism peculiar to this interface; and
- (ii) the removal of material from solution by inorganic and organic processes mainly observed in the higher salinity areas of the estuarine system.

Much of our present knowledge of these processes in estuaries comes from studies of systems in industrialized areas, and from laboratory experiments using well defined solid phases.

#### C. Modifications resulting from estuarine sedimentary processes

Once particles have been deposited on the estuarine floor they can remain there for a short period of time before resuspension or they can gradually accumulate over longer periods of time. During their residence on the estuarine floor, chemical changes can take place that will influence the sensible flux of materials to, and ultimately out of, the estuarine system.

Sedimentation, resuspension and erosion depend on the local physical conditions of currents, tides, waves and topography. The mixing of salt and fresh water also results in flocculation and rapid sedimentation of fine materials. Important are the exceptional situations of extremely high river floods, extreme weather conditions (such as hurricanes), high sea levels and tides, all of which in a short period may alter com-



pletely the existing pattern of sedimentation. In some tidal areas most of the suspended matter is trapped in the estuary for a time before it is moved seaward, whereas in protected tidal inlets mud may be effectively retained, resulting in the formation of extensive mud flats and salt marshes.

There may be an exchange of particles between the bottom and the suspension above it; the thickness of this boundary layer being related to such factors as current velocity, particle size and bioturbation.

In the sedimentary column the action of sulphate-reducing bacteria at depth in the anoxic zone can cause the mobilization of iron and manganese. Except where strong organic complexes can solubilize the heavy metals most of them will be retained in the sediment, probably as refractory sulphides. Burrowing organisms act to release elements into the overlying water column. The mobilized manganese and iron, unless transported away from the point of release, will precipitate in oxygenated waters and act to trap heavy metals.

#### D. Supply to the "Open Ocean"

Following the major chemical and physical modifications that occur in the estuarine zone, a variety of physical oceanographic regimes must be considered. At least four such regimes can be recognized, two of which may, in certain circumstances, be considered to represent the "open ocean". These regimes are:

- (i) enclosed sea where a further physical barrier exists in advance of "open ocean" conditions, e. g. Baltic Sea;
- (ii) Semi-enclosed sea such as the Gulf of St Lawrence where there is no sill but where physical and chemical transformation processes may occur prior to the input to the "open ocean";
- (iii) estuarine system entering into a shallow "open ocean" environment such as the North Sea, e. g. Thames Estuary;
- (iv) estuarine system entering immediately into deep ocean, e. g. Congo.

It is recognized that many of the processes taking place in estuaries will continue to occur in the enclosed or semi-enclosed seas of regimes (i) and (ii), e. g., influence of biota and adsorption/dissolution of chemical species via suspended particulate matter and at sediment-water interfaces. Seasonal variations play an important role in these zones, and the influence of atmospheric processes in regimes of substantial size such as the Baltic Sea and the Gulf of St Lawrence, is important.

In the remaining two regimes where the estuarine outputs are in more direct contact with the "open ocean" fewer processes have to be taken into account in assessing the chemical and physical inputs to the "open ocean". Of prime importance is the examination of sediment transport processes within the shallower zones of the type (iii) regime. Similarly in the case of type (iv) attention must be given to sediment transport processes and the possible occurrence of sediment traps in depressions.

#### E. The influence of man

The basic geochemical, biochemical and sedimentological profiles have been



biased in many rivers and estuaries as a result of human activities, and it is important to quantify to what extent this has taken place.

#### IV. RECOMMENDATIONS

##### A. Methodology and Quality of Data

In view of the long and short-term requirements of the RIOS programme proposed here, it is essential that all data acquired have the required precision and accuracy. Methodology will need to be carefully documented, to evaluate the utility of the data.

A system of inter-calibration between laboratories working within the RIOS concept should be established and periodic evaluations of the data will be essential to assure their validity.

Where seasonal and other temporal effects are known or expected to be of significance special attention must be given to the frequency of observations.

##### B. Measurements to be made

In order to obtain a better knowledge of the many problems related to the fate of nutrients, trace metals, organic compounds and organisms in estuaries, it is necessary to measure a number of basic parameters, such as salinity, temperature, pH, oxygen content, flow, river discharge, precipitation, particle load, populations of bacteria, algae and other organisms and biological processes including primary productivity and denitrification.

The study of a number of constituents promises to give a more general insight into estuarine processes. These can be listed as follows, viz: silicon and  $\text{Si}^{32}$ , transitional elements, with special attention to Fe and Mn, toxic metals, with special attention to Hg Pb and Cu (it should be emphasized that this list is not a limiting one in itself).

Also there are a number of determinations that can be made to give a better insight into the various estuarine phenomena viz:  $\text{C}^{12}/\text{C}^{13}$ ,  $\text{S}^{34}/\text{S}^{32}$ ,  $\text{Sr}^{84}/\text{Sr}^{86}$ ,  $\text{U}^{238}/\text{U}^{234}$ ,  $\text{Ra}^{286}/\text{Ra}^{288}$  and  $\text{Pb}^{210}$ .

The different types of measurements that seem useful in the context of RIOS are summarized in Table 1; it may, however, be mentioned that in several cases techniques have already been adequately developed, whereas, in other cases, they have yet to be explored.

##### C. Implementation of the RIOS Programme

The following fundamental questions regarding the transport of material by rivers to the oceans have already been expanded, viz. the source elements, the physico-chemical changes occurring in the near-coastal areas and the final form and quantity of discharge to the oceans. There remains the obvious need for experimental studies on the multitude of river-ocean systems of the world. It is recognized at the outset that the task is of substantial proportions and it is recommended that a number of characteristic systems be examined initially. The choice of these systems should be based on at least the following characteristics:

- (1) climate
- (2) geology
- (3) topography
- (4) estuarine mixing characteristics
- (5) size of river /drainage basin/estuary/sediment load
- (6) impact of man

#### V. FUTURE ACTION PLAN FOR RIOS

The SCOR WG 46 should be represented by at least two members at the International Hydrological Decade Conference to be held in Paris (at Unesco) from 2 to 24 September 1974. These members should report on this Conference to the next session of the WG.

At its second meeting in late 1974 or early 1975, but in any case after the IHD Conference, the SCOR WG 46 should plan a scientific workshop on river inputs and, through SCOR, call for contributions to the workshop from selected scientists actively working on RIOS problems. These scientists would be drawn from a broad spectrum of countries covering major physiographic regions (tundra, temperate and tropical zones) and types of river systems (e. g. with delta or estuary, or without; with high sediment load in relation to total discharge, or not, etc.). The subject matter of the workshop would also cover the main sub-systems such as the river itself, the estuary, and the interface between river and sea in the liquid and solid phases. It is expected that such a workshop will provide the basis for a statement of present knowledge of river inputs to ocean systems. This workshop is expected to form part of a broad ocean programme under which project proposals will be submitted to UNEP by IOC. The workshop would take place towards the end of 1975 and would last from 3 to 5 days.

Meanwhile, the SCOR WG 46, in whole or in part, would expect to meet, at least informally, when the members happened to be attending major international meetings such as that of the IUGG in Grenoble in August-September 1975. Also, if it were thought essential, the WG could arrange for regional scientific meetings of its own.



TABLE 1

LIST OF PROPERTIES TO BE CONSIDERED FOR MEASUREMENT IN VARIOUS PHASES  
WITHIN THE RIOS PROGRAMME

Basic Measurements	Water	Suspended Particles	Sediments	Interstitial Waters	Precipi- tation	Biota
a) <u>Physical</u>						
Flow/discharge	+	+		+	+	
Temperature	+			+	+	
Particulate load	+	+				
b) <u>Chemical</u>						
Salinity	+			+	+	
Major Constituents:						
Na, K, Mg, Ca, $\text{SO}_4$ , ce, $\text{HCO}_3$ $\text{SiO}_2$	+	+	+	+	+	+
Nutrients	+	+	+	+	+	+
Organic Carbon	+	+	+	+	+	+
Dissolved oxygen, hydrogen sulphide	+			+		
Fe, Mn	+	+	+	+	+	+
pH	+			+	+	
B. O. D.	+					
Organic Constituents, e.g. Petroleum, Hydrocarbon, Pesticides	+	+	+	+	+	+
Inorganic: Cd, Hg, Se, etc.	+	+	+	+	+	+
c) <u>Stable and Radioactive Isotope Measurements</u>						
$\text{C}^{12}$ , $\text{C}^{13}$ , $\text{C}^{14}$	+	+	+			+
$\text{S}^{32}$ , $\text{S}^{34}$	+	+	+	+	+	
$\text{Sr}^{86}$ , $\text{Sr}^{87}$	+	+	+			
$\text{Pb}^{210}$ , $\text{Po}^{210}$	+	+	+		+	+
$\text{Ra}^{226}$ , $\text{Ra}^{228}$	+	+	+	+		+
$\text{Th}^{228}$ , $\text{Th}^{232}$ , $\text{Th}^{234}$	+	+	+			+
$\text{U}^{238}$ , $\text{U}^{234}$	+	+	+			+
$\text{Si}^{32}$	+		+			+
$\text{Rn}^{222}$	+			+		
$\text{Pu}^{239}$ , $\text{Cs}^{137}$ , $\text{Fe}^{55}$ (and others)		+	+			

SCOR WORKING GROUP 50  
BIOLOGICAL EFFECTS ON OCEAN VARIABILITY

Report on Meeting, Guayaquil, December 1974,  
by A. R. Longhurst, Chairman

Participants: J. Namias, D.H. Cushing, P. Smith, A. R. Longhurst, G. Hempel (for SCOR) and G. Tomczak (for FAO).

1. Programme for the Seminar S5 of JOA, 1976

We agreed that if this Seminar was to include about 5 - 7 speakers, we should structure it along the following lines: (i) a general conceptual review of the topic (unless such a review should be given in one of the major invited lectures of JOA); (ii) 3 - 4 well-chosen regional review papers on, for instance, the Baltic, Atlantic including North Sea, NE Pacific, Peruvian region (or coastal upwelling regions generally), Japanese region, etc; (iii) review papers on different biological scales of response, covering the range from vertebrates with many year-classes in their populations to invertebrates with several generations within a single year. We also agreed that it was more important to select good speakers with novel things to say than to ensure that all topics were covered.

2. General work plan for the Group

We then discussed our broader objective of generating a multi-author review of biological effects of ocean variability over the scale of more than one year to about 500 years. We agreed that this was a useful exercise despite Dickson and Cushing's forthcoming review of the same topic for Russell's 1975 volume. We felt it was important to attempt global coverage, to discuss processes in all regions, as well as to discuss the mechanisms and principles involved. Dickson and Cushing's review differs in concentrating on the conceptual approach and not attempting a factual global coverage.

We spent some time on the proposal by Saetersdal, supported by Dragesund, that our work should be based on a small number of fisheries case-history studies. We agreed that this might be too restrictive a procedure, if narrowly applied, and preferred to take the line that while fisheries are, indeed, the long-term objective we must consider these within other biotic contexts; we preferred to discuss multi-species fisheries case-histories and agreed the ideal would be fisheries 'ecosystem' case-histories. Cushing pointed out that the 1950 and 1964 heavy year-classes were common to many North Atlantic species and in order to understand such phenomena it would be illogical to restrict ourselves to single species. Moreover, we thought, the biological mechanisms which might be exposed as a result of our work would be common to many species.

The biologists were especially pleased that Jerry Namias had agreed to join the Group, and he agreed to consider the nature of a statement about physical mechanisms which would act as the framework upon which to hang our biological discussions.

We thought it would be possible to hold another session at Aarhus in 1975, at the time of the North Sea symposium, and a full meeting in Britain in September 1976 at the time of JOA.



SCOR WORKING GROUP 48  
OCEAN CLIMATE PANEL

## Current Activities and Objectives by R. R. Dickson

In the past year the Panel has continued to study the oceanographic basis for ocean monitoring and prediction systems for the future and specifically to explore the feasibility of monitoring large-scale, long-period variations in ocean climate. As described in the Panel's first report (January 1974), the Panel has concentrated on the possibility of using certain categories of commercial vessels as 'Phantom Weatherships' in order to provide time-series of essential hydrographic and meteorological parameters from a globally distributed grid of fixed stations.

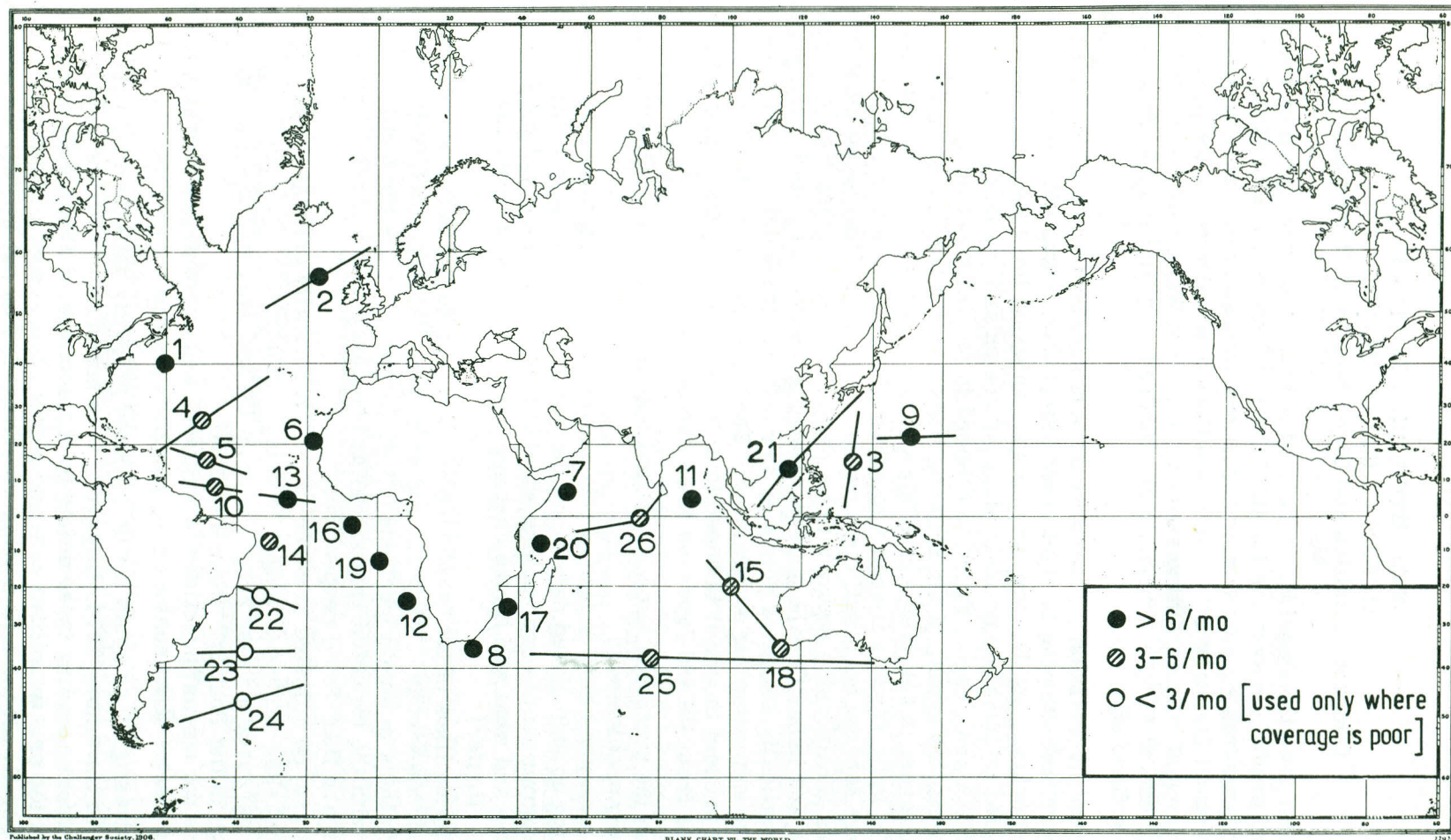
To this end information on commercial bulk carriers was sought from the agencies controlling merchant shipping in eight countries (Japan, USA, UK, Norway, Sweden, Germany, Netherlands and Greece) and 89 such shipping lines were subsequently contacted to obtain detailed information on their shipping routes and traffic frequencies. Two national agencies (USA and Greece) failed to respond to our initial request for information and they will be contacted again; of the shipping lines which were approached, all expressed enthusiastic interest in assisting our study and many gave provisional approval for the participation of their vessels if such a monitoring scheme came into being. Not all proved suitable for our scheme but a sufficient number of suitable lines were identified for a prototype Phantom Weathership network to be drawn up (see attached figure). The coverage in the Atlantic and Indian Oceans appears adequate; so far as possible the stations are located in climatically sensitive points or in positions which correspond to the current WMO merchant ship sampling programme. The coverage in the Pacific sector is almost nonexistent at present though it is hoped that this situation can be improved if a more thorough response from US and Japanese lines can be achieved.

Based on the prototype network, Panel members are currently examining the following ancillary problems:

1. Can an increased distribution of tide gauges on island stations play a useful role in backing up ship-based data along the Phantom Weathership routes? (Tabata)
2. What programme of observations should be required at each of the Phantom Weathership sites and what will be the cost per ship of the instrumentation involved? (Tabata, Hupfer)
3. Can shipping lines of the 'eastern bloc' be added to our network? (Hupfer)
4. From our knowledge of climatic and hydrographic variability, are we putting any of the stations in stupid locations? (i.e. locations where the local variability is out of tune with the expected ship sampling frequency of 3-6 observations per month) (Namias and Iida/Smed respectively)
5. Can the grid be adjusted to cover more 'climatically critical' areas or to continue historical time series no longer in being? (All)
6. Can we persuade a fuller response from US and Japanese lines to extend our coverage in the Pacific? (Namias, Iida)
7. What are the normal practices of weather- and current-routeing adopted by the shipping lines? (Dickson)

These investigations could not be initiated properly until the prototype station grid was drawn up in November 1974. However, it is hoped that it will be possible to issue a preliminary report covering these points by the summer of 1975. This will provide basic information on the practicability, cost and global coverage of a Phantom Weathership operation, hopefully all the information necessary to find out whether such a scheme will generate enough interest to warrant further investigation.







PROTOTYPE PHANTOM WEATHERSHIP NETWORK (naming of shipping lines does not necessarily imply their eventual participation)

<u>Station number</u>	<u>Line</u>	<u>Remarks</u>
1	Torvald Klaveness (1)	Climatically sensitive point (Lamb and Ratcliffe)
2	Torvald Klaveness (2)	
3	Torvald Klaveness (3)	
4	Sir Wm Reardon Smith & Sons Ltd	Island routed
5	Oivind Lorentzen	
6	Fernley and Eger A/S (1)	Cap Blanc upwelling (15 miles offshore)
7	Fernley and Eger A/S (2)	Somali upwelling
8	Exxon (1)	
9	Exxon (2)	
10	Exxon (3)	
11	Exxon (4)	
12	Shell (1)	Conforms to WMO program of merchant ship observations
13	Shell (2)	
14	Shell (3)	Climatically sensitive point at nose of Brazil (Brooks 1926, Lamb 1974); land routed
15	Shell (4)	
16	BP (1)	Conforms to WMO program of merchant ship observations
17	BP (2)	
18	BP (3)	
19	Hilmar Reksten A/S (1)	Conforms to WMO program of merchant ship observations
20	Hilmar Reksten A/S (2)	
21	Terukuni Kaiun Kaisha (1)	
22	Terukuni Kaiun Kaisha (2)	
23	Andrew Weir (1)	
24	Andrew Weir (2)	
25	Cunard (1)	
26	Cunard (2)	Undercurrent station, Maldive routed

15TH GENERAL ASSEMBLY OF ICSU  
ISTANBUL, 23 to 26 September 1974  
Report by SCOR Observer - G. Hempel

This report deals only with items related to marine science or to major political problems.

A report on SCOR's activities in marine resources research ("Report to ICSU 15th General Assembly on Cooperation in Marine Research, August 1974") had been requested by ICSU General Committee in September 1973. The report was tabled at the first day of the General Assembly. Reference to it and additional comments on SCOR's wide field of action was given by Prof. de Jager, who acted as general rapporteur on earth sciences.

On the initiative of Prof. R. Revelle an ad hoc Subcommittee on the Conduct of Marine Research was proposed by Dr Charnock. The Subcommittee consisted of representatives of national delegations of Argentina, Canada, Egypt, India, UK, USA, USSR and myself for SCOR.

Most of the members were non-oceanographers. The Subcommittee met three times. First R. Revelle described the recent developments in the UN Law of the Sea Conference and its consequences for marine research. The draft resolution by W. Wooster was substituted by a much longer version drafted by R. Revelle. His text contained the major elements of regulations for open marine research in the prospective economic zones. Several members felt that a resolution by ICSU should concentrate on the scientists' needs for free development of marine science and on the challenge and obligation of coastal states with regard to ocean research. A new version was drafted by Charnock and Hempel which was adopted by the subcommittee but further shortened by the Resolution Committee and (inadvertently) by the Secretariat.

The General Assembly adopted unanimously the Resolution 9 as given below. The short statement by SCOR as referred to in Resolution 9 is meant for the use of ICSU officers and others participating in the Law of the Sea Conference. It should describe the needs of marine science in general and in developing countries under a new ocean regime. This item together with a general debate on the cooperation with developing countries might be included in the agenda of the forthcoming SCOR General Meeting.

COSTED becomes active in Ghana on a teaching project of environmental science, not including oceanography. A draft resolution by R. Revelle on the assistance of scientists of all countries to solve problems of developing countries was adopted after inclusion of a clause that this might be done by strengthening the research potential of the developing country.

A resolution was adopted almost unanimously regarding the participation of scientific organizations of the People's Republic of China without excluding the scientists of Taiwan. This matter was discussed in much length by the General Committee and by the Assembly. The new president of ICSU is H. Brown, USA; Vice-President F. S. Straub, Hungary; Secretary General Sir J. Kendrew, UK.



15th ICSU General Assembly Resolution No. 9 as adopted 26 September 1974

9. Recalling the resolution adopted in 1972 by its 14th General Assembly in support of open oceanic research, intended for the general benefit of mankind and characterized by full and timely availability of research plans and results, and recognizing the need to increase the capability of many nations if results are to be used to the best advantage, recognizes that the conduct of oceanic research is being affected by new restrictions and issues that have arisen in recent years both as regards the extension of zones under national jurisdiction and the open ocean,

Urges National Members of ICSU :

- i) to advise their governments of the importance of effective international cooperation in long-term programmes of oceanic research, and
- ii) to encourage the participation of their scientists in the formulation of national policies. Such policies would improve cooperation and facilitate:
  - a) the further growth of marine sciences, and
  - b) an increase in the competence in this field in the developing countries interested, and emphasize the need for all countries to assist in these aims, thereby forming a basis for an international agreement at the United Nations Conference on the Law of the Sea,

recommends that the UN and specialized agencies greatly strengthen their assistance to coastal states for the interpretation and application of the results of ocean research and in the training of marine scientists,

requests the Secretary General of ICSU to bring these recommendations to the attention of the organizations concerned of the UN system, and

invites SCOR to provide a short statement on the scientific aspects of the possible further development of oceanography under the new ocean regime.

## ICSU PANEL ON WORLD DATA CENTRES,

Report by SCOR/IAPSO Member J. Crease, Ankara, 18 September 1974

I attended as IAPSO/SCOR member of the panel and as alternate for Dr T. S. Austin, the IOC member. Those present were Professor L. Perek (Chairman), Dr E. R. Dyer (Secretary), Dr P. J. Hart (WDC-A) and Professor W. J. C. Beynon (SCOSTEP).

The panel's duty is to advise ICSU on the management of the WDCs by coordinating member Union interests in geophysical and solar data.

Since its last meeting two years ago the panel had published the third consolidated guide to World Data Centres incorporating guide-lines developed by the specialized sub-centres. There had been a large printing of 8000 copies of which some 5000 had been bought by WDC-A for distribution to its customers. Copies are available from either the WDCs or the ICSU Panel. A supplement will probably be issued in late 1975 including revisions of the meteorology section and amendments the panel has received and approved to the existing guide. The IODE Task Team for the revision of the Guide to Oceanographic Data Exchange may care to note this.

Relations of the Panel with CODATA and FAGS were discussed. Until recently CODATA has been largely concerned with critical constants in physics and chemistry but through a change in the constitution it has broadened its scope to include wider classes of data. It appears however that there is no present intention of CODATA involving itself in the fields covered by the Panel. The Panel is looking at ways of promoting exchanges of views between itself and CODATA.

The most significant debate that commenced, and is likely to continue over succeeding meetings, concerns the relationship between the WDCs and large environmental programmes generating massive quantities of data.

The problem is that even within the ICSU framework some programmes are beginning to generate data equal in volume to the entire present WDC holdings. An example is the GATE programme (jointly between WMO and ICSU) to study the meteorology of the tropical Atlantic. In the event WDCs A & B have accepted responsibility for archival of these data, the arrangements for which are set out in a special supplement to the ICSU Guide to International Data Exchange. However the very success of the WDCs induces other even larger projected programmes to look to the WDCs for archival and retrieval support even in cases where the programmes are not primarily ICSU related.

The danger is that the principles on which the WDCs were founded, and which are set out in the Guide, may be eroded by the advent of these programmes. For example the free availability of data to all bona fide workers often at no cost and never at more than the cost of reproduction has been a great benefit. The WDCs have also traditionally been financially supported by their host countries.

The Panel in its preliminary review felt that the WDC system should respond positively to requests for help from these new programmes but should adhere closely to those traditions on which the system is based. We also considered it vital that the planners of these programmes should make the Panel aware at an early stage of their wish to use the



WDC mechanism so that the appropriateness of the programmes to archival and retrieval within the system be fully discussed.

My view is that within the oceanography discipline we already have a rather successful experience of working within both the ICSU framework and an Intergovernmental one (the Working Committee on IODE of IOC) and should be able to contribute significantly to the debate. For example, there has already been discussion at the IODE meetings of the concept of responsible national centres and perhaps this should be extended to include the idea of national data centres volunteering responsibility for the oceanography content of large programmes. This approach has some analogy with the C centres of the WDC system which have been started by some countries in specialist sub-disciplines of geophysics and solar physics (but not oceanography).

The next meeting of the Panel is tentatively planned to coincide with the IUGG Assembly at Grenoble in August-September 1975.

INTERNATIONAL UNION OF GEOLOGICAL SCIENCES  
COMMISSION FOR MARINE GEOLOGY

Report of Activities for 1974

1. Membership

Current members of the IUGS Commission for Marine Geology are as follows:  
Dr T. F. Gaskell (Chairman) (UK); Dr E. S. W. Simpson (Secretary) (South Africa);  
Professor P. L. Bezrukov (USSR); Dr J. M. Harrison (Associate Member) (France);  
Professor B. C. Heezen (USA); Dr A. S. Laughton (UK); Dr A. E. Maxwell (USA);  
Dr N. Nasu (Japan); Professor E. Seibold (West Germany); Dr G. B. Ushintsev (USSR);  
Dr S. Uyeda (Japan).

2. Meetings

No formal meetings of the Commission were held during 1974. Contact was maintained by correspondence and occasional personal discussions between the Chairman, Secretary and some Commission members.

3. CMG Representation

CMG representatives on cognate bodies are as follows:

SCOR Executive: T. F. Gaskell (Chairman CMG, ex officio)

SCOR: E. S. W. Simpson (Secretary CMG, ex officio)

Joint Oceanographic Assembly Steering Committee: T. F. Gaskell (Chairman CMG, ex officio)

SCOR Working Groups:

37 (Marine Plankton and Sediments)	- E. Seibold, Chairman
40 (Palaeo-Oceanography)	- Tj. H. van Andel, Chairman
41 (Morphological Mapping of the Ocean Floor)	- A. S. Laughton, Chairman
46 (River Inputs to Ocean Systems)	- D. Lal, Chairman

ECOR: T. F. Gaskell

IAPSO Executive: E. S. W. Simpson

IAPSO Commission on Marine Geophysics: G. B. Ushintsev, B. C. Heezen, A. S. Laughton

IOC Indian Ocean Geological/Geophysical Atlas Editorial Board: G. B. Ushintsev,  
A. S. Laughton, E. Seibold, E. S. W. Simpson

CGMW: B. C. Heezen

ICG: S. Uyeda

IHO: T. F. Gaskell, E. S. W. Simpson

GEBCO Guiding Committee (IOC/IHO): E. S. W. Simpson (Chairman), G. B. Ushintsev,  
A. S. Laughton, B. C. Heezen

IGCP: E. Seibold

ICA Working Group on Oceanic Cartography: E. S. W. Simpson.

4. Relationship with other ICSU and Intergovernmental Bodies

(a) SCOR. The Chairman attended the eighteenth SCOR Executive meeting, 29 January to 1 February 1974. Both the Chairman and Secretary of CMG attended the twelfth General Meeting of SCOR, 2 to 7 December 1974. CMG is associated with the following working groups of SCOR:

WG 37: Marine Plankton and Sediments (Chairman, Professor E. Seibold)



WG 40: Palaeo-Oceanography (Chairman, Professor Tj. H. van Andel)  
 WG 41: Morphological Mapping of the Ocean Floor (Chairman, Dr A. S. Laughton)  
 WG 46: River Inputs to River Systems (Chairman, Dr D. Lal).

- (b) Joint Oceanographic Assembly (SCOR/IAPSO/IABO/CMG/ACMRR/ACOMR/ECOR)  
Arrangement for the JOA are in the hands of an international steering committee and a British national organizing committee, and are now well advanced. The assembly will be held in Edinburgh, Scotland, 13 to 24 September 1976, as the fourth of a series of international oceanographic congresses. The programme will consist of general symposia on selected topics of broad interdisciplinary interest, special symposia on selected specialized subjects involving more than one of the marine scientific disciplines, and sessions to be organized by the specialized Associations (IAPSO, IABO and CMG). The Chairman of CMG is a member of both the international and national organizing committees.

(c) IOC

- (i) International Marine Geoscience Workshop (Honolulu, September 1971). The recommendations arising from the Workshop (reported in SCOR Proceedings, Vol. 8, No. 1) have now been fully implemented, as noted in the following documents:

IOC - VIII/6 : Report of the Secretary to the Commission

IOC - VIII/11: Compilation of Component Programmes of the International Decade of Ocean Exploration (IDOE)

IOC - VIII/14 Add. 1: Co-operation with the Economic Commission for Asia and the Far East (ECAFE) - Committees for co-ordination of Joint Prospecting for Mineral Resources in Asian and South-west Pacific Offshore Areas (CCOP/EA and CCOP/SOPAC).

Attached is a review by the Chairman (Dr T. F. Gaskell) of the results of the Honolulu Workshop which suggests that consideration be given to holding a second international marine geoscience workshop to draw up guidelines for continuing international collaborative research.

- (ii) International Indian Ocean Geological/Geophysical Atlas. The final session of the Editorial Board of the IIOE Geological/Geophysical Atlas was held in UNESCO, Paris, 22 to 24 April 1974. The Chief Editor, Dr G. B. Udintsev, reported that the atlas would contain 146 pages with 137 charts, 96 of which he brought to Paris for review. Arrangements were discussed to ensure publication (in Moscow) of the atlas during 1975.

(d) IOC/IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO)

The first meeting of the Guiding Committee was held in Unesco House, 25 to 26 April 1974, with the following membership: E. S. W. Simpson (CMG, Chairman), D. P. D. Scott (IOC, Secretary), W. Bettac (FRG), G. N. Ewing (Canada), B. C. Heezen (USA), W. Langeraar (Neth.), A. S. Laughton (UK), J. H. S. Osborn (Australia), M. Robertou (France), T. Sato (Japan), G. B. Udintsev (USSR), D. C. Kapoor (IHO). Based upon the recommendations of SCOR WG 41 and the previous GEBCO Committee, the Guiding Committee adopted a new set of specifications for the new (Fifth) Edition of GEBCO which would retain the existing scale, projections, basic sheet limits and close association with the IHO and Monegasque Government. The 18 sheets would be produced in three phases of six sheets each: Phase 1 would be undertaken immediately by a number of marine



geologists and geophysicists who expressed personal interest in the areas concerned, and compilation and printing is scheduled for 1974/75. Meanwhile the problems of adequate financing of the project (including salary costs of the marine geoscience unit) would be actively pursued. The following members agreed to serve as a sub-committee on Geographic Names and Nomenclature of Ocean Bottom Features: Ewing, Heezen, Robertou, Scott.

#### 5. CMG Marine Geological/Geophysical Inventories

The Chief, UNESCO Division of Oceanography, has advised that financial stringency has forced the withdrawal of financial support to CMG for continuation of the marine geological/geophysical cruise inventory project for pre-1970 cruises.

It should however be recorded that the formats developed by CMG for the reporting to Data Centres of Marine Geological and Geophysical cruise information after 1970 have been reproduced in Appendix 7 of the IOC Manual on International Oceanographic Data Exchange (3rd Edition), 1973, as sample forms recommended for immediate international inventory services.

### REVIEW OF RESULTS FROM THE INTERNATIONAL MARINE GEOSCIENCE WORKSHOP

Honolulu, 20-24 September 1971 by T. F. Gaskell

The report of this meeting is given in SCOR Proceeding Vol. 8 No. 1. The recommendations of the meeting were accepted by the IOC and as the following notes demonstrate, have been successfully implemented.

#### 1. International Morphologic Mapping of the Ocean Floor

SCOR WG 41 was established, and at the International Hydrographic Bureau Conference in 1972 a resolution was agreed that IHB should co-operate with marine geoscientists on ocean floor mapping. A new GEBCO Committee has been formed with Dr Laughton as SCOR nominee, and Dr Simpson, Secretary of CMG, as CMG representative and also as Chairman of the new IOC/IHO Guiding Committee for GEBCO.

SCOR initiative was instrumental in bringing together together the various interested bodies and in achieving action.

#### 2. Studies of Continental Margins

(a) South-west Pacific area as an example of active margins. With the co-operation of IDOE a successful meeting was held in Bangkok in 1973 (IDOE Workshop on Tectonic Patterns and Metallogenesis in East and South-east Asia). The report of this meeting was commended to IOC by SCOR, and was the subject of a meeting in Korea to organize international action on the Bangkok recommendations. The work of CMG and SCOR ensured that the scientific work was of a fundamental nature as well as looking after practical interests of finding new mineral sources.

(b) South Atlantic continental margins were proposed for study as an example of inactive continental margins. IOC agreed to co-ordinate work in this area. Partly under the aegis of IDOE, multi-national study of the opposing continental margins of



Africa and South America has been actively in progress since 1972, and a symposium organized by the Brazilian Geodynamics Committee is to be held in October 1975.

3. The Mediterranean Sea Floor

The meeting recommended by the Honolulu Workshop has been arranged for September 1975 by the Institut Francais du Petrole and the Spanish Oceanographic Institute with the help of CMG and IAPSO, to be held at the new Spanish oceanographic research Institute at Palma.

4. Studies of Fluvial Supply of Sedimentary Matter to the Sea

SCOR Working Group 46 (River Inputs to ocean systems) held its first meeting under the Chairmanship of Dr Lal in June 1974. The group is holding a meeting early in 1975 to make arrangements for a symposium in 1976 to collect reviews of knowledge of the subject and to underline gaps in present understanding. The group has been welcomed by other bodies, especially those engaged in pollution work, and is, in the tradition of SCOR, concerning itself primarily with the basic physical, chemical and biological processes occurring in the river-estuary-ocean system.

5. Deep Drilling in the Oceans

The recommendations were to find out ways in which other countries might help the US finance the Deep Sea Drilling Project, and to assist in organizing symposia to allow rapid dissemination of the results of the project.

Financial participation has been agreed by some countries and the initial seven year phase of reconnaissance deep sea drilling (DSDP) is to be succeeded in August 1975 by the International Programme of Ocean Drilling (IPOD). Symposia have been arranged at most international conferences to emphasize deep ocean drilling results.

6. Active Ridge Crests and Active Fracture Zone

A major symposium (sponsored by ICG, CMG, IAPSO) is to be held to review the considerable progress made in this field (scheduled for XV IUGG General Assembly, 1976).

7. Paleo-Oceanography

SCOR Working Group 40 was established in 1973 under the Chairmanship of Professor van Andel. The group has been active in preparing a survey of the subject and in meeting at East Anglia, USA and Kiel. WG 40 is preparing for their first big symposium to be held at the Joint Oceanographic Assembly in Edinburgh in 1976.

8. Continuation of Ocean Magnetic Studies

Co-ordinated international effort has proceeded with great vigour.

9. Deep Sea Mineral Resources

The recommended symposium is being arranged as part of the International Geological Congress, to be held in Sydney in 1976. Professor Eugen Seibold of Kiel is convening the symposium with close co-operation from the IAGOD - Commission of Managane.

#### 10. Investigation of Anomalous Oceanic Areas

CMG have joined with IAPSO to organize a symposium at the 1975 Grenoble IUGG Meeting to hear an account of the Mid-Atlantic trench experiments of 1974.

It is suggested by CMG that consideration should be given to holding another Marine Geoscience Workshop, so that it will be possible to plan ahead for another few years of fruitful international co-operation in marine geoscience.

This suggestion might be welcomed by SCOR, IOC, IDOE and others, who might be able to find some country to sponsor another get-together on the lines of the successful Honolulu Meeting.



## THE INTERNATIONAL ASSOCIATION FOR BIOLOGICAL OCEANOGRAPHY

Report of Activities for 1973/74 by T. Wolff, Secretary

## 1. Membership

There have been a few changes in the composition of National Correspondents through whom IABO is working in the various countries. Since Dr M. Ruivo resigned as the Secretary of the Advisory Committee on Marine Resources Research (of FAO), the Chairman of ACMRR, Mr G. S. Saetersdal, has accepted to serve as an ex officio member of the Executive Committee of IABO.

## 2. Meetings

Members of the Executive Committee met during the session of the Intergovernmental Oceanographic Commission in Paris in November 1973 and in Copenhagen in June 1974. The next General Meeting will take place during the Joint Oceanographic Assembly in 1976.

## 3. Proceedings

IABO Proceedings vol. 2 was published in June 1973. The next issue is planned for late summer 1975.

## 4. Working Groups and Committees

4.1 ACMRR/FAO jointly with the Scientific Committee on Oceanic Research (SCOR) and IABO established a working group on Biological Effects on Ocean Variability (WG 50), Chairman: A. R. Longhurst (UK). This working group should review and synthesize data from biological monitoring programmes and from climatological observations from the same region and periods.

4.2 ACMRR/FAO established with IABO a working group on Biological Effects of Pollutants, Chairman: Dr J. B. Sprague. The working group should review the present methods used in bioassay and toxicity tests and should advise on standardized working methods for measuring chronic and sublethal effects on biological processes and activities in the marine environment.

4.3 ACMRR/FAO together with IABO is establishing a working group on Ecological Indices, Chairman: Dr H. Regiev, to measure, survey and to monitor the impact of pollution, nutrient enrichment and other man-made stresses on living aquatic resources.

4.4 UNESCO together with SCOR and IABO is examining the need for a working group on Mangrove Ecology and Productivity. The aims would be to advise UNESCO on practical programmes of research to define key studies necessary to evaluate the use of mangrove swamps for fishery and aquaculture and to examine the effect of reclamation of mangrove swamps on the coastal ecosystems and their interaction with both the marine and terrestrial ecosystems. Professor John H. Day will be acting as SCOR observer at the Honolulu Symposium on the Biology and Management of Mangroves in October.

4.5 SCOR and IABO are considering the best way of promoting further studies on the inverted Microscope Method of Phytoplankton Counting, comprising subsampling from the storage containers, concentration by gravity, and procedures for counting.

4.6 IABO is setting up a Coral Reef Committee which should strengthen communication between scientists engaged in coral reef studies, plan and organize meetings on coral reef research, identify and stimulate further studies of coral reefs, and collaborate with international organizations interested in research and management of coral reefs.

## 5. Symposia

5.1 The Proceedings of the International Symposium on the Early Life History of Fish (Oban, Scotland, May 1973), which was co-sponsored by IABO, are scheduled for publication in August 1974 by Springer Verlag, Heidelberg.

5.2 IABO co-sponsored the International Symposium on the Grey Mullet in Haifa, Israel, in June 1974.

5.3 IABO is actively engaged in the Third International Symposium on Upwelling Ecosystems, Kiel, 25-28 August 1975. The symposium will be interdisciplinary and will aim at the description and comparison of upwelling ecosystems.

5.4 In cooperation with the Royal Society of London and committees on ocean engineering, meteorology and living resources, SCOR is now about to finalize the programme for the next Joint Oceanographic Assembly in Edinburgh, 13-24 September 1976. The Assembly is the fourth of a series of international oceanographic congresses, and the programme will consist of general symposia on selected topics of broad interdisciplinary interest, special symposia on selected specialized subjects involving more than one of the marine scientific disciplines, and sessions of contributed papers, organized by the three associations on physical and biological oceanography and marine geology. Amongst special symposia focusing on biology may be mentioned: regional studies of dynamics and productivity, biological effects of ocean variability, science in relation to fisheries, controlled environment experiments in ecology, and photosynthetic radiant energy.



## SOME ACTIVITIES OF IAMAP

Extracted from IAMAP News Bulletin No. 6 - August 1974

The First Special Assemblies of IAMAP and IAPSO took place in Melbourne, Australia, 14-25 January 1974. The presence of so many atmospheric scientists and oceanographers provided many stimulating opportunities for joint sessions and discussions.

Included in these Sessions was the Presidential address by Dr S. Fritz of IAMAP (Use of satellite observations in meteorology).

One of the major symposia (consisting of 15 half-day sessions) was on the structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations. The Proceedings of this symposium, which received financial assistance from the United States Department of Transportation, have been published by IAMAP.

The Joint Organizing Committee of GARP had met in Canberra the previous week. There was the possibility, therefore, of providing the participants with up-to-date reports on GARP and its subprogrammes.

The CSIRO Division of Atmospheric Physics has received world recognition for its work on boundary-layer meteorology. It was appropriate, therefore, that many scientific sessions were devoted to the problems of the boundary layer, air-sea interactions, and the parameterization of fluxes of water vapour, heat and momentum.

Many scientific sessions were devoted to the problems of the boundary layer, air-sea interactions, and the parameterization of fluxes of water vapour, heat and momentum. Mention should be made of the sessions on polar meteorology (which contained a number of papers on Antarctic problems), on southern-hemisphere meteorology and finally, a session on clouds and radiation.

At the Closing Plenary, IAMAP accepted the invitation from the United States to hold its Second Special Assembly in 1977 in the USA, jointly with IAGA.

The Proceedings of the Melbourne Assembly are being published under the auspices of the IAMAP Secretariat and will be available by the end of 1974.

## IUGG XVI GENERAL ASSEMBLY

Grenoble, France, 25 August - 6 September 1975

Most scientific sessions are expected to be multi-disciplinary, involving more than one Association. Detailed plans for such sessions have been agreed to, so that there is little opportunity to introduce new topics (of interest to IAMAP alone) at this General Assembly.

For each symposium, the 'lead' Association selects the convener, and the other Associations involved name a representative to serve on the programme committee.

IAMAP Commissions and Joint Committees will be expected to meet during the Assembly, and to report back to the plenaries (officers, membership, plans and symposia).

Titles of the symposia for which IAMAP has responsibilities which will be of interest to oceanographers are listed in the IAPSO report (p.175).



## REPORT ON ACTIVITIES OF IAPSO

by E. C. La Fond (Secretary IAPSO)

The main activities of IAPSO were the convening of its FIRST SPECIAL ASSEMBLY held in Melbourne, Australia 14-25 January 1974; co-sponsorship of a symposium on Applications of Marine Geodesy held in Columbus, Ohio 3-5 June 1974; and organization of its General Assembly, scheduled for 25 August - 6 September 1975 in Grenoble, France.

Other activities include transfer of the Directorship of IAPSO Standard Sea-Water Service from Dr Frede Hermann, Charlottenlund Slot, DK-2920 Charlottenlund, Denmark, to Dr Fred Culkin, Institute of Oceanographic Sciences, Brook Road, Wormley, Godalming, Surrey GU8 5UB, England. The tanks, racks, pumps and other gear used in the preparation of standard sea water are now at IOS, and future preparations of sea water standards will be made in England.

In addition to publication of the IAPSO Proces-Verbaux No. 13 covering the First Special Assembly in Melbourne, the Proceedings of the IAPSO sponsored symposium on Optical Aspects of Oceanography held in Copenhagen, Denmark 19-23 June 1972 and edited by N.G. Jerlov and E. Steemann Nielson have been printed in book form by Academic Press; and the Proceedings of the IAPSO sponsored symposium on Physical Oceanography of the Red Sea held in Paris 9-10 October 1972 will appear in the series Comptes-rendus de Colloques published by the French CNEOX (Centre National pour l'Exploitation des Oceans).

## IAPSO FIRST SPECIAL ASSEMBLY

The IAMAP/IAPSO FIRST SPECIAL ASSEMBLIES were held in Melbourne, Australia, 14-25 January 1974. The joint venture by the two Associations was designed to provide an opportunity for discussions on subjects of mutual interest. They shared a common venue, supporting facilities, social programmes, and their separate scientific programmes incorporated four joint sessions.

## Frontier Sessions

An important part of the Assemblies was the three JOINT FRONTIERS SESSIONS, consisting of Presidential Addresses and keynote lectures covering the general topics of the Assemblies and delivered by authoritative scientists in each field. Of special interest to IAPSO were:

(1) Presidential Address by Prof. H. Lacombe on Deep Effects of Energy Transfer Across the Sea Surface: The Formation of Deep Water.

(2) Keynote Addresses by:

Prof. K. Hasselmann on Interaction at the Air-Sea Interface;  
 Prof. B. R. Doos on GARP Sub-programmes;  
 Prof. E. D. Goldberg on Atmospheric Transport of Man-Generated and Other Materials;

Dr R. W. Stewart on GARP Experiments; and

Dr L. M. Fomin on Large Scale Ocean Experiments.



## Scientific Symposia

The scientific programme consisted of independent symposia by each Association and joint symposia devoted to the atmospheric and oceanic boundary layers. For the latter, IAMAP took primary responsibility.

The Joint Symposia and Sessions were entitled:

### AIR SEA INTERACTION -

(1) Measurement and Prediction of Sea Surface Temperature - Convenor: H. Charnock.

(2) Mesoscale Phenomena in the Boundary Layers of the Ocean and the Marine Environment - Convenor: T. H. Ellison.

(3) Air-Sea Interaction in Synoptic and Climatic Development - Convenor: J. Namias.

(4) Meso and Large - Scale Fluxes - Convenor: A. J. Dyer.

GARP - Convenor: R. W. Stewart.

DEEP CONVECTION - Convenor: B. R. Morton.

The IAPSO Symposia, organized by B. R. Morton, and the IAPSO Programme Committee, composed of H. Charnock, C. H. B. Priestly and R. W. Stewart, were as follows:

OCEAN WAVES - Convenor: K. Hasselmann

INTERNAL WAVES - Convenor: P. H. LeBlond

CIRCULATION AND LONG WAVES - Convenor: B. V. Hamon

ESTUARINE DYNAMICS - Convenor: J. B. Hinwood

LARGE OCEAN EXPERIMENTS - Convenor: A. R. Robinson

PHYSICAL OCEANOGRAPHY - Convenor: E. C. LaFond

The impressive success of the Assemblies which attracted 596 participants representing 32 countries, must be credited to the outstanding work of the local Organizing Committee.

A more complete report on the IAPSO First Special Assembly is included in the IAPSO Proces-Verbaux No. 13.

### SYMPOSIUM ON APPLICATIONS OF MARINE GEODESY

IAPSO co-sponsored an international symposium on marine geodesy and its applications, held 3-5 June 1974, at Battelle - Columbus Laboratories, Columbus, Ohio, USA. It was called in response to the growing interest in the challenges and opportunities of marine geodesy in a variety of applications. These include oil and mineral exploration and recovery, boundary determination, pipeline and cable laying, salvage work, and placement of equipment on the ocean floor. Included were discussions of new satellite technology as well as radio techniques for measurements related to oceanography, geodesy, geophysics, and meteorology.

Some 50 technical papers were presented by experts from 14 countries. A total of 191 scientists attended.

The proceedings of the symposium are to be published by the Battelle-Columbus Laboratories.

### IAPSO 16th GENERAL ASSEMBLY

The IAPSO General Assembly will be held concurrently with those of other IUGG Associations in Grenoble, France, from 25 August to 6 September 1975.

#### 1. National Reports

IAPSO has requested National Reports for distribution to participants.

#### 2. Submission of Abstracts

Most papers will be invited, but contributed papers will also be welcome. All scientists who wish to present a paper should send an abstract to reach the appropriate convener no later than 1 March 1975. A copy of the abstract should also be sent to the Association Secretary.

Abstracts (should be no more than 1 page in length and) may be in French or English. (There will not be time to present all the papers submitted). Where practical, the paper should stress interdisciplinary topics. Special abstract forms are available from the French Organizing Committee.

### IAPSO Symposia Scientific Programme

#### IAPSO Sponsored Symposia

- A. Thermodynamics of the Sea and Equation of State
- B. Internal Motion
- C. Influence of Abyssal Circulation on Sedimentary Accumulations in Time and Space
- D. Present State of Plate Tectonics (with CMG, ICG)
- E. Oceanic Microstructure
- F. Radio Oceanography and Remote Sensing of the Ocean
- G. Coastal and Estuarine Regimes
- H. Physical Oceanography

#### Joint Sponsorship - IAPSO Primary Sponsor

- 13. Deep Sea Drilling: The History of the Ocean (with IAVCEI, ICG, and CMG)
- 15. Large Scale Modifications of Fresh Water Systems and Their Effects on the Ocean Environment (with IAHS and IAMAP)
- 20. Marine Pollution (with IAMAP and IAVCEI)
- 26. Physical Chemistry and Inorganic Chemistry of Sea Water (with IAVCEI and IAHS)
- 27. Geochemistry of the Sea (with IAVCEI and IUGG Geochem.)



28. Motion and Structure of Oceans Under a Time-Dependent Atmosphere (with IAMAP). Four parts:

28A MODE and Ocean Experiments

28B Generation of Upwelling and Vertical Motion in the Sea

28C Storm Surges

28D General Circulation of the Oceans

30. Ocean Optics (with IAMAP)

Joint Sponsorship - Other Association Primary Sponsor

9. Analysis, Processing and Interpretation of Geophysical Data (IAGA with all Associations)

12. Submarine Volcanism (IAVCEI with IAPSO)

18. GARP First Objective: Weather Predictability (IAMAP with IAPSO)

19. GARP Second Objective: Climatic Change (IAMAP with IAPSO, IAGA, and IAHS)

21. Atmospheric Pollution (IAMAP with IAPSO and IAGA)

24. Tidal Interactions (IAGA with IAPSO and others)

29. Marine Geodesy (IAG with IAPSO)

## THE SCOR/SCAR POLAR OCEANS CONFERENCE

Montreal, 6 - 11 May 1974

Resolutions

The SCOR/SCAR Polar Oceans Conference made the following resolutions and recommendations addressed to SCOR, SCAR, and IOC.

1. As yet comparatively little research has been carried out on the ice biota in Polar Seas. This biota has been shown to be important in the productivity of these regions. We therefore recommend that comparative studies be carried out on the ecology and physiology of the ice biota in the Arctic and Antarctic.
2. We wish to express our concern at the 'slowing down' of biological oceanographic studies from aboard oceanographic vessels in the Southern Oceans. Since such studies are an important prerequisite for the management of the living marine resources of this region we recommend that efforts should be made to encourage marine ecosystem studies similar to those carried out by the 'Eltanin' in the past few years, and investigations of the stocks of krill, fishes and other organisms of potential economic importance.
3. We draw attention to the importance of taxonomic studies, especially of marine phytoplankton, in the investigation of polar marine ecosystems and recommend that efforts be made to encourage young scientists to train for such research. More employment opportunities should be provided for such taxonomists.
4. We recommend that efforts be made to encourage investigations of the primary and secondary productivity of tropical and subtropical waters so as to enable reliable comparisons to be made of the relative contributions of tropical, subtropical and polar seas to the productivity of the world's oceans.
5. We draw attention to the value of collaborative work between Arctic and Antarctic marine biologists and the importance of workers utilizing the same investigating techniques so as to enable direct comparisons of results to be made. We look forward to a continuation of discussions of the kind initiated at this first Polar Oceans Conference.
6. In view of the increasing tempo of mineral exploration and development in polar seas and the consequent risks of pollution we recommend that encouragement be given to baseline studies of present ecological conditions, especially in Arctic seas, and to investigations of the effects of pollutants, especially of oil, on marine polar organisms.
7. In addition to the national oceanographic programmes that already are in progress or that have been proposed we recommend that encouragement be given to the continuation of the exchange of personnel on research vessels and the exchange of data between countries.



8. We welcome the initiative of WMO in initiating the drifting buoy programme in the Southern Ocean and urge that all countries engaged in research in these regions give their support to this programme.
9. In order to fill an important gap in our knowledge of the oceanography of the Southern Ocean and to assist in the monitoring of climatic and environmental change we recommend that encouragement be given to the making of year-round oceanographic measurements from shore and ice-shelf stations. In particular current and tidal measurements, sea water sampling for salinity, nutrients etc. and observations on iceberg and pack-ice movements could be carried out. We recommend that the IOC International Coordination Group for the Southern Oceans take the initiative in organizing the cooperative collection of such data.
10. In view of our lack of knowledge of winter oceanographic conditions in the pack-ice of Antarctica we recommend that encouragement be given to an international effort to obtain winter oceanographic measurements in the ice-covered ocean surrounding Antarctica perhaps from an ice-breaker drifting with the ice-pack.
11. In view of the comparative lack of data we recommend that more measurements of dissolved and particulate organic matter and of rates of decomposition be carried out in Polar regions.
12. We recommend that every effort be made to maintain existing shore stations in both the Arctic and Antarctic.
13. The conference recommends that the planning activities for future earth-viewing and data relay satellites should consider the importance of data on the polar oceans in the missions. Therefore, the orbit of the satellite should be such that this information can be obtained, and should not be restricted to the lower latitudes.
14. Finally, the Conference recommends that the necessary international efforts be undertaken to prepare new tidal charts for the Polar seas.

JOINT OCEANOGRAPHIC ASSEMBLY

Edinburgh, 13-24 September 1976

Outline Programme

13 September, Monday

- a. m. Registration and SCOR XIII General Meeting
- p. m. SCOR XIII General Meeting

14 September, Tuesday

- a. m. General symposium
  - G1. History of the oceans
- p. m. Special symposia
  - S1. Palaeo-oceanography
  - S2. Geochemistry and ocean mixing

15 September, Wednesday

- a. m. General symposium
  - G2. Ocean circulation and marine life
- p. m. Special symposia
  - S3. Regional studies of dynamics and productivity
  - S4. Depths of the ocean

16 September, Thursday

- a. m. Association sessions
  - C1. IAPSO Continental Shelf Dynamics
  - C2. IABO Microbial processes on the sea floor
  - C3. ECOR CMG Seabed surveys
- p. m. Association sessions
  - C4. IAPSO Characteristics and Generation of the mixed layer and thermocline
  - C5. IABO Contributions in biological oceanography
  - C6. CMG Geochemistry of interstitial water and exchanges across the sediment-water interface

SCOR XIII General Meeting

17 September, Friday

- a. m. General symposium
  - G3. Natural variations in the marine environment
- p. m. Special symposia
  - S5. Biological effects of ocean variability
  - S6. Effect of the ocean on climate and weather



20 September, Monday

- a. m. General symposium
  - G4. Man and the sea
- p. m. Special symposia
  - S7. Oceanography and fisheries
  - S8. Ocean engineering
  - S9. Geoscience, minerals and petroleum

21 September, Tuesday

- a. m. Association sessions
  - C7. IAPSO The Skin of the ocean
  - C8. IABO Dynamics of ecosystems
  - C9. CMG Criteria for correlation of cretaceous and cenozoic marine deposits
- p. m. Business meetings
  - IAPSO
  - IABO

22 September, Wednesday

- a. m. General symposium
  - G5. New approaches in oceanography
- p. m. Special symposia
  - S10. Large scale physical experiments
  - S11. Controlled ecosystem experiments [with ICES]

23 September, Thursday

- a. m. Business meeting
  - CMG
- Association sessions
  - C10. IAPSO Forecasting of ocean currents
  - C11. IABO Contributions in biological oceanography
- Special symposium
  - S12. Radiant energy and life in the sea
- p. m. General symposium
  - G6. Summary lectures

24 September, Friday

- a. m. Business meeting
  - SCOR Executive Committee
- p. m. SCOR Executive Committee

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION  
RESULTS OF MARINE BIOLOGICAL INVESTIGATIONS  
**(ROMBI)**

A reduced version of the ROMBI form is given on the next two pages. Copies of the form and detailed explanations for its use (contained in document IOC/IODE-VIII/INF. 2.) can be obtained from IOC secretariat upon request. At its next meeting the IOC Working Committee for International Oceanographic Data Exchange will be considering the question of having the ROMBI form printed in pads in the same way as the ROSCOP forms are printed.

**UNESCO 1974**



(UNESCO 1974)

SECTION B-PARAMETERS	NO.	QUERY	FORMAT	STUDY DESCRIPTION CODES
<b>BIOLOGY OBSERVATIONS</b>				
B01 PRIMARY PRODUCTION				
B02 PHYTOPLANKTON PIGMENTS				
B03 SESTON				
B04 PARTICULAR ORGANIC CARBON				
B05 PARTICULAR ORGANIC NITROGEN				
B06 DISSOLVED ORGANIC CARBON				
B07 BACTERIA				
B08 OTHER MICROORGANISMS				
B09 NANOPLANKTON				
B10 PHYTOPLANKTON				
B11 ZOOPLANKTON				
B12 NEUSTON				
B13 FISH EGGS AND/OR LARVAE				
B14 MICRONEKTON				
B15 PELAGIC INVERTEBRATES				
B16 DEMERSAL INVERTEBRATES				
B17 PELAGIC FISHES				
B18 DEMERSAL FISHES				
B19 MICROBENTHOS				
B20 MEIOBENTHOS				
B21 MACROBENTHOS				
B22 ATTACHED PLANTS & SEAWEED				
B23 INTERTIDAL ANIMALS				
B24 BIRDS				
B25 MAMMALS & REPTILES				
B26 DEEP SCATTERING LAYER				
B27 ACOUSTIC SURVEY, BIOLOGICAL				
B28 BIOLOGICAL SOUNDS				
B29				
B30				
B31				
<b>POLLUTION OBSERVATIONS</b>				
P01 SUSPENDED SOLIDS				
P02 HEAVY METALS				
P03 PETROLEUM RESIDUES				
P04 CHLORINATED HYDROCARBONS				
P05 OTHER DISSOLVED SUBSTANCES				
P06 THERMAL POLLUTION				
P07 NUTRIENT POLLUTION				
P08 RADIOACTIVITY				
P09 SEWAGE: B. O. D.				
P10 SEWAGE: NITRATE				
P11 SEWAGE: MICROBIOLOGY				
P12 SEWAGE: OTHER				
P13 DISCOLOURED WATER				
P14 BOTTOM DEPOSITS				
P15 CONTAMINANTS IN ORGANISMS				
P16				
P17				
P18				
<b>BIOCHEMISTRY OBSERVATIONS</b>				(Indicate if measurements were taken in water column or organism.)
M01 VITAMINS				
M02 AMINO ACIDS				
M03 ATP, ADP				
M04 DNA, RNA				
M05 FATS & OIL				
M06				
M07				



**SECTION C - FORMAT**

F01 PRINTED RECORD OR TABLE

F02 GRAPHIC DATA PRESENTATION

F03 PUNCHED CARD

F04 PUNCHED PAPER TAPE

F05 DIGITAL MAGNETIC TAPE

F06 ANALOGUE MAGNETIC TAPE

F07 ANALOGUE TRACE

F08 PHOTOGRAPH OR FILM

F09 AUDIO RECORD

F10 OTHER

**SECTION D - SAMPLING**

S01 IS SAMPLING INFORMATION AVAILABLE

YES

NO

S02 SAMPLING GEAR

S03 SAMPLING PROGRAM

S04 METHODS OF ANALYSIS

**SECTION E - DATA STRUCTURE**

(If additional space is needed use blank sheets of paper)

**REMARKS** (If additional space is needed use blank sheets of paper)

Signed \_\_\_\_\_

Date \_\_\_\_\_



A BRIEF HISTORY OF ECOR  
(Engineering Committee on Oceanic Resources)  
by Ir. G. A. Heyning - Treasurer of ECOR

The concept of an international organization of engineers interested in marine affairs originated during studies under the joint auspices of the US National Academy of Sciences and the US National Academy of Engineering which led to the publication of the report An Oceanic Quest in May 1969 dealing with proposals for the International Decade of Ocean Exploration. The relevant NAS and NAE committees noted the lack of an adequate mechanism for providing engineering review and evaluation of international programmes and for involving representatives of industry. Dr Russel S. Keim, secretary of the NAE committee, proposed the establishment of ECOR as a non-governmental international society of professional engineers with interests in marine affairs.

Professor Robert L. Wiegel of the University of California, Berkeley, brought the proposal to the attention of Rear Admiral W. Langeraar, Chairman of IOC (Intergovernmental Oceanographic Commission). During an IOC meeting in Paris in September 1969 a working group reported favourably on the proposal and IOC adopted a resolution encouraging the formation of ECOR. In November 1969 WFEO (World Federation of Engineering Organizations) authorised its Executive Committee to review the possibility of a formal relationship of WFEO and ECOR.

Mainly as a result of the efforts of Dr Keim, in correspondence with various interested national and international engineering bodies, and by convening meetings in Washington, September 1970, and Düsseldorf, November 1970, Statutes of ECOR were agreed. These were ratified by the Founder Members (the national committees of Federal Republic of Germany, France, Japan, Netherlands, Portugal, United Kingdom and USA and the international societies IADC and ISSC) in time for the Founder Council Meeting in Bordeaux, March 1971. At this meeting the Founder Council elected the ECOR Officers, established its By-Laws, arranged for incorporation in the Netherlands and decided to hold the First General Assembly in London, March 1972.

During their meeting in Paris in October 1971, IOC recognized ECOR as an Advisory Body to IOC.

According to the Statutes, ECOR is an international, non-governmental, professional engineering body, whose purpose is to provide an international focus for professional engineering interests in marine affairs, with particular emphasis on:-

- a. Establishing and maintaining international, professional engineering communication in marine affairs.
- b. Providing advice, from an engineering viewpoint, on policy, programme, and organizational matters to international and intergovernmental organizations concerned with marine affairs; or providing such advice directly to individual nations on behalf of these organizations.
- c. Assisting the engineering profession in the development of its capability in the use of the ocean and in the enhancement of the quality of the marine environment, while recognizing that engineering is practiced within legitimate proprietary interests.

In addition, the interests of ECOR include all aspects of engineering practice (such as design, management, operation, planning and research) and all engineering disciplines



(such as biological, chemical, civil, electrical, mechanical, mining, naval architecture and transportation) as they relate to the marine environment.

ECOR now comprises 13 national committees, i.e. of Argentina, Australia, Canada, Fed. Rep. of Germany, France, Japan, Mexico, Netherlands, Norway, Portugal, South Africa, United Kingdom and United States of America, and 6 international associations i.e. FIP, IADC, IAHR, IAWPR, ISSC and WODA.

The Officers of ECOR are:

President:	Prof. Robert L. Wiegel, University of California, Berkeley, USA
Vice President:	Prof. dr. ir. E. W. Bijker, Delft University, Holland
In lieu of Past President:	M. W. Leonard, Council of Engineering Institutions, London, UK
Secretary:	Jack W. Boller, National Academy of Engineering, Washington DC, USA
Treasurer:	Ir. G. A. Heyning jr, Royal Institution of Engineers in the Netherlands
Assistant Secretary:	W. F. Searle jr, Marine Consultant, Alexandria Va, USA
Assistant Treasurer:	Dr J. G. Th. Linssen, Manager IADC, The Hague, Holland

At the First General Assembly of ECOR in London, March 1972, adhering Bodies reported on the selected Main Theme 'Engineering Design to Prevent Abuse of the Ocean'. The combined report was forwarded to IOC and presented to the United Nations Conference on The Human Environment in Stockholm, June 1972.

For the Second General Assembly, to be held in Tokyo, May 1975, 'Engineering Practice for Offshore Structures' has been selected as the Main Theme, subdivided into 4 topics: 'Design of Fixed Steel Structures' - 'Design of Gravity Structures' - 'Installation' and 'Maintenance'. It is hoped to arrive at some ECOR recommendations for offshore structures based on conclusions to be drawn from this Main Theme session. These will be forwarded to IOC and to other interested organizations.

The ECOR working group on 'Surface Waves' produced a report on 'Engineering Requirements for Wave Data', April 1974. Conclusions indicate a vital need for more and standardized data and it is recommended that IOC accept the responsibility for the realization thereof.

Other ECOR working groups are dealing with 'Systems for Monitoring and Management of Data' - 'Mining Exploration and Exploitation' and 'Engineering Aspects of Marine Pollution'.

The US National Committee for ECOR produced a report on 'Outer Continental Shelf Resource Development Safety', January 1973. And a report on 'Civil Manned Undersea Activity', October 1973.

The Japan NC for ECOR produced a 'Status Report of Sea-bed Exploration and Exploitation Technology in Japan'.

The Netherlands NC for ECOR produced a report on 'The Environmental Effect of Dumping Drilling Cuttings in the North Sea and the Wadden Sea', October 1973.

The South African N. C. for ECOR held a three day symposium in Stellenbosch (November, 1972), attended by 120 engineers, on the subject The Ocean's Challenge to South African engineers.



## SOME FUTURE MEETINGS OF SCOR AND ASSOCIATED ORGANIZATIONS

1975

<u>Date</u>	<u>Place</u>	<u>Meeting</u>
3 - 12 February	Paris	IOC Working Committee IGOS and WMO Executive Committee Panel Met. Aspects Ocean Affairs (MAOA)
10 - 12 February	Paris	ICSPRO 11th Session
17 - 22 February	Kingston, Jamaica	IDOE Workshop on Geology and Geophysics of Caribbean
20 - 22 February	London	ICSU-WMO JOC Officers
24 - 28 February	Geneva	WMO Panel Experts on climatic change
3 - 8 March	Venice	IOC EC-V
10 - 15 March	Geneva	ACOMR - 2nd Session
13 - 18 March	Tokyo	IOC CSK-X
17 March - 10 May	Geneva	UN Law of Sea Conference 3rd Session
24 - 26 March	New York	WG 46 River Inputs on Oceans
31 March - 4 April	Palma	CMG/CIM Symp. Geology of W. Med.
April	Caribbean region	IOC CICAR-VII
24 - 30 April	London	IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN GESAMP 7th Session
28 - 30 April	Monaco	IOC/IHO GEBICO-II
May	Geneva	IOC GIPME 3rd Session
12 - 17 May	Rome	IOC IODE 8th Session
18 - 22 May	Tokyo	9 World Petroleum Congress ECOR General Meeting
26 - 30 May	Geneva	WMO EC-27
18 - 19 June	Copenhagen	WG 42 Baltic Pollution
Mid 1975	?	IOC/FAO(GFCM)/ICSEM 2nd Session CIM

Summer	?	POLYMODE meeting WG34 plus national groups
16 - 20 June	Southampton	SCOR/IOC/WMO Informal Workshop GATE 'C' Scale
20 - 21 June	Southampton	WG 43 GATE Oceanography
2 - 7 June	Varna	COSPAR XVIII Plenary Meeting
3 - 10 July	Leningrad	XII International Botanical Congress
9 - 12 July	Aarhus, Denmark	ICES Symp. changes in N. Sea Fish Stock
July, August or September	Geneva	ACOMR 2nd Session
15 - 23 August	Geneva	SCOR/IOC/WMO Informal Workshop GATE Equatorial & 'A' Scale
17 - 23 August	Norwich	WMO/IAMAP Symp. on long term Climatic Fluctuations
18 - 30 August	Vancouver	13 Pacific Science Cong. & Symp. - Aquatic Resources and Management
22 August - 6 September	Grenoble	IUGG/IAMAP/IAPSO General Assembly and related Symposium
25 - 28 August	Kiel	Deutsche Forschungsgemeinschaft/SCOR: Upwelling ecosystems symposium
During 25 August - 6 September	Grenoble	WG 10 Oceanographic Tables and Standards WG 27 Tides of Open Sea WG 34 Internal Dynamics of the Ocean WG 38 Ocean processes in Antarctic WG 43 Oceanography related to GATE
8 - 13 September	France	WG 36 Coastal upwelling processes
September	Manila ?	IOC TEMA-II
8 - 12 September	Lisbon	ACMRR 8th Session
17 - 20 September	Vienna	ICSU Executive Board and General Committee
29 September - 8 October	Montreal	ICES 63rd Statutory meeting
21 - 25 October	Paris	IOC EC-VI
27 October - 8 November	Paris	IOC 9th Assembly



12 - 15 November	Stellenbosch	SCOR Executive Committee
Late 1975		WG 46 (Limited meeting)
Late 1975/Early 1976		WG 46 Symposium on River Inputs
1976		
February	Peru	IOC ITSU-IV
February	Goa or Cochin, India	UNESCO/SCOR Symposium on Tropical Planktonology
15 - 25 August	Sydney	XXV International Geological Congress
10 - 16 September	Washington	ICSU 16th General Assembly
13 - 24 September	Edinburgh	Joint Oceanographic Assembly and XIII General Meeting SCOR

## ABBREVIATIONS

ACMRR	Advisory Committee on Marine Resources Research (of FAO)
ACOMR	Advisory Committee on Oceanic Meteorological Research (of WMO)
AMTEX	Air Mass Transformation Experiment (GARP)
ASFIS	Aquatic Science and Fisheries Information System (FAO/IOC)
CCOP/EA	Committee for Coordination of Joint Prospecting for Mineral Resources in offshore areas /East Asia
CCOP/SOPAC	Committee for Coordination of Joint Prospecting for Mineral Resources in offshore areas /South Pacific
CGMW	Commission for the Geological Map of the World (of IUGG)
CICAR	Cooperative Investigation of the Caribbean and Adjacent Regions
CIESM[ICSEM]	Commission International Exploration Scientifique Mediterranean
CIM	Cooperative Investigation of the Mediterranean
CINECA	Cooperative Investigation of the Northern Part of the Eastern Central Atlantic
CLIMAP	Climatic Mapping Programme (IDOE)
CMG	Commission on Marine Geology (of IUGS)
CODATA	Committee on Data for Science and Technology (of ICSU)
COSTED	Committee on Science and Technology in Developing Countries (of ICSU)
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
FAGS	Federation of Astronomical and Geophysical Services (of ICSU)
FGGE	First GARP Global Experiment
FIP	International Federation for pre-stressed concrete
GARP	Global Atmospheric Research Programme (of WMO/ICSU)
GATE	GARP Atlantic Tropical Experiment
GEBCO	General Bathymetric Chart of the Ocean
GESAMP	Group of Experts on Scientific Aspects of Marine Pollution
GFCM	General Fisheries Council for the Mediterranean
GIPME	Global Investigation of Pollution in the Marine Environment
IABO	International Association for Biological Oceanography (of IUBS)
IADC	International Association of Drilling Contractors
IAEA	International Atomic Energy Agency
IAG	International Association of Geodesy (of IUGG)
IAGA	International Association of Geomagnetism and Aeronomy (of IUGG)
IAGOD	International Association on the Genesis of Ore Deposits (of IUGS)
IAHR	International Association for Hydraulic Research
IAHS	International Association of Hydrological Sciences (of IUGG)
IAMAP	International Association of Meteorology and Atmospheric Physics (of IUGG)
IAPSO	International Association for the Physical Sciences of the Ocean (of IUGG)
IAVCEI	International Association of Volcanology and Chemistry of the Earth's Interior (of IUGG)
IAWPR	International Association on Water Pollution Research
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
ICITA	International Cooperative Investigation of the Tropical Atlantic
ICSPRO	Inter-Secretarial Committee on Scientific Programmes related to Oceanography
ICSU	International Council of Scientific Unions
IDOE	International Decade of Ocean Exploration
IGCP	International Geological Correlation Programme (UNESCO/IUGS)
IGOSS	Integrated Global Ocean Station System (of IOC)
IHB	International Hydrographic Bureau
IHD	International Hydrological Decade
IHO	International Hydrographic Organization
IIOE	International Indian Ocean Expedition
IMCO	Intergovernmental Maritime Consultative Organization
INDEX	Indian Ocean Experiment
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Exchange (Working Group of IOC)
ISMG	International Scientific and Management Group for GATE
ISOS	International Southern Ocean Studies
ISSC	International Ship Structures Congress
ITSU	International Tsunami Warning Service
IUBS	International Union of Biological Sciences (of ICSU)
IUGG	International Union of Geodesy and Geophysics (of ICSU)
IUGS	International Union of Geological Sciences (of ICSU)
JASIN	Joint Air-Sea Interaction Project
JOA	Joint Oceanographic Assembly (1976)
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
MONEX	Monsoon Experiment (subprogramme of GARP)
NASA	National Aeronautics and Space Administration (USA)
NORPAX	North Pacific Experiment
OSDC	Oceanographic Subprogramme Data Centre
POLEX	Polar Experiment (related to GARP)
POOL	Pollution of Oceans Originating on Land
RIOS	River Inputs to Ocean Systems
ROMBI	Results of Marine Biological Investigations (report form)
ROSCOP	Report of Observations or Samples Collected by Oceanographic Programmes
SCAR	Scientific Committee on Antarctic Research (of ICSU)
SCOPE	Scientific Committee on Problems of the Environment (of ICSU)
SCOSTEP	Special Committee on Solar Terrestrial Physics (of ICSU)
SOC	Southern Oceans
TEB	GARP Tropical Experiment Board
TEMA	Training, Education and Mutual Assistance (IOC-WG)
UNEP	UN Environment Programme
WDC	World Data Centre
WODA	World Dredging Association