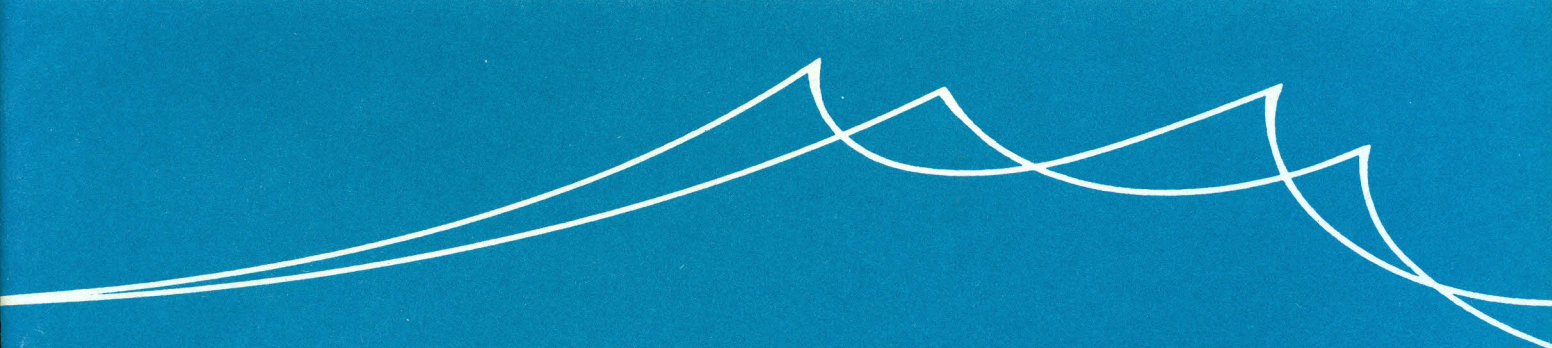


SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



*SCOR
Proceedings
Vol. 14*

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

Scientific Committee on Oceanic Research

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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

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

**April 1978
London, England**

SCOR Proceedings Vol. 14

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**Report of the Twenty-first Meeting of the
SCOR EXECUTIVE COMMITTEE
São Paulo, Brazil – 23 to 26 January 1978**

The Twenty first meeting of SCOR Executive Committee was held in the Instituto Oceanográfico of the University of São Paulo, Brazil, from 23 to 26 January 1978, with the President, Dr K.N. Fedorov, in the chair.

At an opening ceremony, the participants were welcomed by the Vice-Dean of the University, Professor Dr Salim Simão, the Director of the Institute, Professor Dr André Ricciardi Cruz and Professor Afrânio Rubens de Mesquita, representing the Brazilian National Committee, who had made the local arrangements for the meeting. Also present at the ceremony, were Admiral Dr Alberto dos Santos Franco, former Director of the Institute, who had been instrumental in arranging Brazil's membership of SCOR in 1972, and Dr Franco da Fonseca, Chief of the University Cabinet.

At the ceremony an illustrated description of the University activities and buildings was presented.

The President of SCOR expressed on behalf of the Executive Committee, his appreciation to the CNPq (Conselho Nacional de Desenvolvimento Científico e Tecnológico), which sponsors The Brazil National Committee to SCOR, and the University of São Paulo for the invitation to hold the meeting in São Paulo and for the excellent facilities that had been made available.

During the meeting a short seminar was held at which the President and some members of the Executive Committee presented to staff members of the Institute their views on the recent major advances in marine sciences and probable future trends, and members of the Institute staff presented accounts on their current research programmes.

Before commencing the business of the meeting the President invited the participants to stand in silence in memory of the late Professor Wüst.

The Executive Committee devoted considerable attention to three major scientific issues related to items of the agenda. These were the role of the ocean in climatic change and variability, the Carbon Dioxide cycle in the ocean and problems related to the redefinition of salinity.

1.0 Organization and finance

1.1 Membership

National Membership

Argentina – the address of the Argentine national committee should now be shown as:

Comité Argentino de Oceanografía,
Attn: Ing. F. Vila,
Consejo Nacional de Investigaciones Científicas y Técnicas,
Viamonte 1636–38 'A',
Buenos Aires,
Argentina.

Belgium — the address of the Belgium national committee should now be shown as:

Comité national Belge d'Océanologie,
Attn: Mr G. Pichot,
c/o Cité administrative de l'Etat,
Quartier Vésale 2/3,
1010 Bruxelles,
Belgium.

Colombia — the address of the Colombian national committee should now be shown as:

Comisión Colombiana de Oceanografía,
Attn: Señor C.J. Lozano,
Apartado Aéreo 28466,
Bogotá,
Colombia.

Colombia has still not nominated three replacement members of SCOR.

German Democratic Republic — the address of the German national committee should now be shown as:

SCOR Commission of the German Democratic Republic,
Attn: Dr K. Striggow,
Institut für Meereskunde,
253 Rostock-Warnemünde,
G.D.R.

Corresponding organizations

ECOR ECOR has accepted SCOR's invitation for ECOR to become a Corresponding Organisation of SCOR.

The Third annual Assembly of ECOR will be held in Washington D.C., USA, from 3 to 6 May 1978 and will be preceded by a three day workshop on ocean instrumentation. All SCOR National Committees have been sent copies of the announcements of these meetings.

1.2 Publications

a) UNESCO Technical Papers in Marine Science

No publications in this series have appeared since No. 27. The next issue, No. 28, expected in March 1978, will contain the report of the May 1977 meeting of WG 10.

WG 59 has proposed preparing a review of the state of the art in biological oceanographic modelling, with implications for the design of research programmes, for possible publication in the UNESCO Technical Series and the final report of WG 58, expected early in 1979, may also be appropriate for this series.

b) UNESCO Reports in Marine Science

The first two issues in this new series have been published as follows:

No. 1 Marine ecosystem modelling in the Eastern Mediterranean.

No. 2 Marine ecosystem modelling in the Mediterranean.

c) UNESCO Monographs on Oceanographic Methodology

No. 5 – Coral Reef Methods, publication is expected in February 1978.

No. 6 – Phytoplankton Methods, the final text for this manual is about to be sent to reviewers. Because Dr Hasle and Professor Zeitschel are contributors and have already seen most of the text, the Secretary of SCOR suggested to UNESCO that Dr P. Tett be asked to review the material and UNESCO proposes to invite Dr Steedman to comment on the comparison of the preservation methods recommended with those recommended in Monography No. 4 on *Zooplankton Preservation and Fixation*. Publication is expected during 1978.

d) International Directory of Marine Scientists

FAO published the new international directory in December 1977. Copies are being sent to all institutions listed therein.

e) SCOR/SCAR Polar Oceans Conference, May 1974

Published in January 1978 by the Arctic Institute of North America with assistance from the US National Science Foundation, the National Research Council of Canada, SCOR and SCAR.

f) Oceanographic Tables

Following a request from the 13th General Meeting of SCOR, Professor H. Charnock has discussed with UNESCO possible means for achieving more effective distribution of the Tables to oceanographic laboratories and it is now proposed that future tables be published in the UNESCO Technical Papers in Marine Science.

g) BIOMASS

SCOR and SCAR jointly published *BIOMASS Volume I – Research Proposals* in August 1977.

h) Biogeochemistry of estuarine sediments

This report is in the process of final preparation, will be published shortly by UNESCO.

i) JOA 1976

The retyped edited texts of the papers presented at the 'General Symposia' are now with the publishers, Plenum Press Ltd, and will be published under the title *Advances in Oceanography*.

j) ICES Cooperative Research Reports

ICES Cooperative Research Report No. 67, containing the statistical analysis of the results of the 1969/70 nutrient intercalibration experiment, has been sent to national committees.

ICES Cooperative Research Report No. 63, containing a report on replies to a questionnaire to determine sources of input of pollutants to the Baltic Sea and a report on the baseline study of the level of contaminating substances in living resources of the Baltic, has been sent to national committees.

- k) The *IIOE Phytoplankton Production Atlas* prepared by J. Krey and B. Babenerd has now been published by The Institut für Meereskunde of the University of Kiel with support from IOC and the Deutsche Forschungsgemeinschaft. Copies are available from the IOC Secretariat.

l) Plankton Atlas of the south-western Atlantic

A proposal from Dr D. Boltovskoy for the production of a plankton atlas of the south-western Atlantic had been reviewed by IABO and after further discussion between Professor Parsons, Mr Currie and Dr Scintilla A. Prado and other scientists at the São Paulo Instituto Oceanográfico it was agreed that this could be a very useful project and Dr Boltovskoy was given encouragement to seek support for its publication through the FAO and UNESCO regional programmes.

m) Progress in Oceanography

The editors of *Progress in Oceanography* have enquired whether any products from SCOR activities might be appropriate for publication therein. Whilst there was nothing immediately available, the Executive Committee welcomed the suggestion which will be born in mind when reports are produced which warrant a more permanent publication, with a wider distribution than the publication outlets currently available. The review of coastal upwelling was considered to be one possibility.

1.3 Budget and Finance

A provisional statement of SCOR income and expenditure for the year 1977 was presented. The final statement appears as Annex II. The Executive Committee noted that, in 1977, expenditure had, for the first time, exceeded income, partly because of the rising costs of travel and partly because of the increasing requirements for SCOR initiatives. The Executive Committee considered carefully what economies could be made without adversely effecting the flexibility and effectiveness of SCOR but visualised that, even with such economies as were practical, the probability of a continuing increase in the number of important activities would necessitate seeking additional funds. It was hoped that for a number of such activities special contracts might be negotiated with UNESCO and/or IOC but it was suggested that National Committees might consider which of SCOR activities were of the greatest importance and whether any reductions in activities or increases in national contributions were desirable. This question will be discussed further at the next General Meeting.

1.4 SCOR officers

The three Vice—Presidents of SCOR will stand for re-election at the General Meeting in November 1978. The Secretary must retire, having completed the maximum term allowed under the constitution. A new Secretary will have to be elected at the next General Meeting.

2.1 Former Working Groups

WG 36: *Coastal and Equatorial Upwelling Processes* (with IABO, IAPSO and ACMRR):

An editorial board for the volume on physical oceanography of coastal upwelling, consisting of Dr K.N. Fedorov (convenor), Professor B. Saint-Guilly, Dr D. Halpern, Dr E. Mittelstaedt, Dr M. Tomczak, Dr R.L. Smith, had planned to meet in March 1978 but as it was now clear that the draft manuscript would not be completed by then that meeting will be postponed. It was agreed that Dr J.J. O'Brien should be invited to join the membership of the Board and be invited to draft, in collaboration with Professor Saint-Guilly, the chapter on Theoretical aspects.

A meeting will be held of those members of the Board attending the IOC/FAO/ICES Symposium on the Canary Current which will be held in Las Palmas 11 to 14 April 1978.

2.2 Existing Working Groups

WG 10: *Oceanographic Tables and Standards* (with ICES, IAPSO and UNESCO):

Dr O. Mamayev, USSR, has accepted an invitation to become a member of this group.

The report and recommendations of the meeting held in Woods Hole, USA, 23 to 25 May 1977 together with a brief report (Annex III) from the new Chairman of the group, Dr N.P. Fofonoff, USA, were received.

In order to bring to the notice of as many oceanographers as possible the group's recommendation concerning the definition of practical salinity, which was endorsed by the Executive Committee, the group will be asked to prepare an article for publication in *Deep Sea Research*. An *ad hoc* meeting of about six members will be held in Miami shortly to prepare a 'Practical Salinity Scale 1978'.

The SCOR Executive Committee wishes to draw attention of those institutes with appropriate capabilities to the request of WG 10 for accurate measurements to be made of the speed of sound in seawater at elevated pressures and to inform WG 10 of their results.

Following a request from the Twentieth SCOR Executive Committee Meeting, WG 10 had invited Dr J. Gieskes to review the present status of knowledge of carbon dioxide equilibrium in seawater and to prepare a recommendation regarding the possible need for updating the existing tables. Dr Gieskes' recommendations will be considered at the next meeting of WG 10 which will be held in Paris 11 to 13 September 1978.

Members of WG 10 had been asked to canvass further views on the use of SI units, for discussion at its next meeting. Noting that this question would be discussed further, during

the IUGG General Assembly in December 1979, by the IAPSO working group on Symbols, Units and Nomenclature, it was agreed to remind the President of IAPSO that it was important that IUGG take into account the needs of other users of marine data before adopting the use of units or symbols for physical oceanography.

WG 34: *Internal Dynamics of the Ocean* (with IAPSO):

A summary and conclusions (Annex IV) of the SCOR/JOC Study Conference on General Circulation Models of the Ocean and their relation to Climate, Helsinki, May 1977 has been sent to national committees. Full Proceedings of this Conference, some 850 pages in two volumes, will be produced in limited numbers in January 1978 by the GARP Activities Office of WMO, and negotiations are in progress for publication of the full proceedings in scientific literature at a later date.

WG 34 had met at the time of the Helsinki conference.

The SCOR Executive Committee believed that the group had complied with its terms of reference in identifying the problems of internal dynamics of the ocean. In view of the need to analyse the data from POLYMODE (1977 – 1978) before much further progress could be made, it was agreed to ask the chairman if this group might be disbanded at the General Meeting in November.

WG 40: *Paleo-Oceanography* (with CMG):

Although WG 40 had essentially complied with its original terms of reference by organising a symposium during JOA in 1976, the 13th General Meeting had decided to continue the group with revised terms reference and membership. The Chairman, Professor Tj. van Andel, had initiated correspondence with his members but had concluded that the relatively small number of active workers in this field did not believe that a workshop was necessary and consequently he had recommended that the group be disbanded. The Executive Committee, noted that SCOR's function was to identify areas in which SCOR involvement can assist, but in many instances communication between active workers was sufficient to enable major advances to be made without the help of SCOR. It was agreed to recommend that WG 40 be disbanded at the General Meeting in November 1978.

However, the Executive Committee recognised that paleo-oceanography will have an important role in the context of the climatic history of the Earth and it may prove desirable, at a later stage, to form an interdisciplinary group on this subject.

CMG was invited to consider what further action was desirable in relation to the three topics identified in Recommendation 8 of the 1976 Marine Geoscience Workshop and also to advise SCOR whether there was any need for international action relating to pre-Cambrian ocean history.

WG 42: *Pollution of the Baltic* (with ICES, IAPSO and IABO):

A report from the Chairman (Annex V) and a report by Professor Hempel on this group were discussed and accepted. With regard to a specific request from the "Baltic Marine Biologists" for the addition to the Working Group of two or three more marine biologists from the Baltic Area, it was suggested that this request could be better directed to ICES. It was felt that following the recent reorganisation of ICES committees, the opportunity now existed for ICES to facilitate the attendance of additional members even if these

members are not attached to national fishery laboratories. SCOR will, nevertheless, continue to support the activities of this group.

WG 43: *Oceanography related to GATE* (with IAMAP and IAPSO):

A report from the Chairman was considered. This report was based on a meeting of the GATE Symposium Steering Committee, 11 to 13 January 1978 at which had been discussed both the programme for the GATE Symposium on Oceanography and Surface Layer Meteorology, Kiel FRG 16 to 20 May 1978 and the proposals for a GATE Oceanographic Atlas.

It was noted that 65 contributions had been accepted for oral and poster presentation at the Symposium. It was regretted, however, that despite the major contribution of the USSR to the GATE oceanographic experiment only one contribution had been offered from that country.

The SCOR Executive Committee agreed to invite IOC and WMO to support financially convenors and invited speakers who might require such assistance. SCOR will be prepared to support up to four of the convenors.

Consequent upon the recommendation of Professors Stewart and Wooster, as requested at the Twentieth meeting of the Executive Committee, SCOR support for the Atlas proposal prepared by WG 43 had been conveyed to IOC. The tenth session of the IOC Assembly had endorsed the proposal in general. The GATE Symposium Steering Committee had revised some details of the Atlas proposal, to take into account comments that had been received from IOC and SCOR, and had recommended the appointment of an Atlas Editorial Board consisting of Dr F. Ostapoff (Chairman) and six other full members with five corresponding members. It was agreed that SCOR should comply with a request from IOC to appoint the Editorial Board but support from IOC and WMO should be sought for at least half the expenses of meetings of the Board, the terms of reference of which should be:

1. to plan the structure and content of the GATE Oceanographic Atlas, in consultation with the principal investigators.
2. to advise the editors on the preparation of Atlas material.
3. to review and select the final material for publication.

The revised proposals, prepared at the January 1978 meeting, will be transmitted to IOC with SCOR support.

WG 44: *Ocean Atmosphere Materials Exchanges* (OAMEX) (with IAMAP, IAPSO):

A report from the Chairman (Annex VI) was received. The Executive Committee wished to encourage the activities of this group and approved a meeting later in 1978. It was noted that WG 44 would have an important contribution to make, on exchange processes at the air/sea interface, to the broad problem of carbon dioxide in the ocean (see item 2.4).

In their early correspondence, the group was discussing the need for training courses or 'study institutes' on OAMEX problems. It was agreed to point out to Dr Chesselet that his group should concentrate on process studies, which might necessitate the

organisation of workshops or symposia to review the state of knowledge, but should not become engaged in organising training courses. The group could, of course, make recommendations, through SCOR, to other organisations such as UNESCO, about the need for such courses if it so wished.

WG 46: *River Inputs to Ocean Systems* (with ECOR, IAHS, ACMRR, UNESCO, CMG IAPSO and IABO)

The goals of SCOR Working Group 46, as outlined in SCOR Proceedings Volume 11, have an urgency and priority for execution. They concern the quantitative and qualitative understanding of the interaction of the constituents of river waters and sea waters in the estuarine zone and the processes that give rise to the composition of a given river water.

The strategies to accomplish these goals have been formulated by the Working Group; phase one of this strategy includes only surveys of related research activity and the organisation of a workshop, after which the group may proceed to the planning of required field activities and formulation of recommendations regarding training programmes. Financial support for phase one has been sought from UNEP through IOC but at the present time no decision has been made by UNEP although the application has been pending since 1975.

The urgency remains to improve understanding of the river inputs to ocean systems to provide the information necessary for the proper management of coastal marine resources. Furthermore over the past several years there have been very great advances in accurately analysing trace constituents in natural waters and in sampling them without contamination.

It was agreed to advise WG 46 that if no definite offer of support was received from the current session of UNEP, the group should organise an initial workshop without further delay on a more modest scale than originally desired. (An offer of support from UNEP was received by cable to IOC on 8 February 1978).

WG 47: *Oceanographic Programmes during FGGE* (with IAPSO and IAMAP)

The Executive Committee, consulted by correspondence, had agreed to the appointment of Dr W. Simmons as Secretary of WG 47. Dr Simmons is at the GARP Activities Office in Geneva and he and Mr G. Withee, the IOC staff member responsible for oceanographic programmes during FGGE, are working in close liaison with each other and have agreed a list of coordinated IOC/GAO activities required to support oceanographic aspects of FGGE.

Dr Simmons presented to the Tenth Session of the Assembly of IOC a status report dated October 1977 from the Chairman of WG 47 summarizing the proposed oceanographic programmes prepared by the three panels of WG 47. This report and the plans for oceanographic studies had been commended by a recent meeting of the WMO Executive Committee.

Appreciation was expressed to Brazil for facilitating a recent meeting of the Atlantic panel to discuss cooperative work in the western tropical Atlantic during FGGE.

The representatives of the Chilean National Committee confirmed their intention to participate in FGGE and in the drifting buoy programme and asked to be placed on the mailing list for future WG 47 reports.

It was noted that some members of the Indian Ocean Panel would participate in an INDEX planning meeting in January 1978 and the Atlantic Panel was planning a full meeting at the time of the GATE Symposium in May 1978. It was expected that most of the intended participants in this Atlantic panel meeting would be attending the GATE Symposium under other auspices but some SCOR support would be required.

An invitation was received from IOC for SCOR to participate in the early stages of level IIc FGGE oceanographic data management planning. Considering that effective FGGE data management would be important for future climatic studies, it was agreed that SCOR should assist in any way possible. IOC should be advised to include Professor H. Stommel, Dr J.J. O'Brien, Professor H. Charnock and Dr J. Crease in the list of people to be invited to participate in the first IOC/WMO preliminary planning meeting to be held in Washington D.C. in February 1978. Professor R.W. Stewart and Professor P. Tchernia accepted invitations to review, on behalf of SCOR at the invitation of IOC, the documents that will be produced as a result of that meeting.

WG 48: *The Influence of the Ocean on Climate* (with IAPSO and IAMAP)

A substantial report of the panel on monitoring ocean climate fluctuations (Chairman Dr R. Dickson) is being produced by WMO in limited numbers for distribution to interested scientists concerned with the GARP climate dynamics sub-programme, IGOSS and SCOR. The latter will include the members of the SCOR Executive Committee, WGs 34, 47, 49 and COG. Appreciation was expressed to WMO for their rapid reproduction of this report.

At the General Meeting in November 1978, the Executive Committee will recommend that WG 48 be disbanded — see item 2.3 on COG.

WG 49: *Mathematical Modelling of Oceanic Processes* (with IAPSO)

WG 49 and its panel on equatorial modelling met in Helsinki in May 1977, at the time of the SCOR/JOC Study Conference referred to under WG 34. It was clear that there existed a wide range of problems in mathematical modelling of the tropical oceans but that any advances would now be too late to affect FGGE planning. The results of POLYMODE and FGGE would provide substantial new data but until then it was believed that interaction among modellers was good and therefore the Chairman should be asked whether the present group should be continued after November 1978.

The *Ocean Modelling Newsletter* was considered to be a valuable means of distributing information on current activities and appreciation was expressed to the Editors. The Executive Committee wished to encourage strongly the continuation of the newsletter, whether or not WG 49 was disbanded.

WG 51: *Evaluation of CTD data* (with IAPSO)

The Chairman, Dr J. Crease, expects to arrange a meeting of the group later in 1978, after further work by correspondence. The Executive Committee was anxious to encourage the group to stimulate early action in this field. To this end Professors Stewart and Tchernia agreed to convey to the Chairman their ideas on import subjects for the group's attention and it was suggested that the symposium (WG 43) in May might be asked to identify any problems revealed by the GATE experiment.

All users of CTD probes should be encouraged to notify WG 51 of problems encountered.

WG 52: *Estimation of Micro-Nekton Abundance* (with IABO, ICES, SCAR and ACMRR)

The report on Working Group 52, from the Chairman, Professor Percy was received. (Annex VII). Correspondence with members of the group had been initiated and it was planned that the members and others would prepare reviews of net sampling and acoustical assessment methods for four micro-nekton groups – euphausiids, decapods, squid and fish.

The Executive Committee approved a request by the Chairman for travel funds to enable him to visit members of the group to discuss their review papers.

In view of the considerable importance which the Executive Committee attaches to the work of this group and in particular its relevance to the work of WG 54 on the "Living Resources of the Southern Oceans", it was hoped that the members would participate actively and expedite the work of the group.

WG 53: *Evolution of the South Atlantic* (with CMG)

Professor Simpson reported that he had requested the programme committee for the International Geological Congress, Paris, 7 to 17 July 1980, to allocate two full days for the WG 53 Symposium. When the response to this request was received he would proceed with detailed planning. No meetings of WG 53 are envisaged but some financial assistance may be requested for the participants in the Symposium.

WG 54: *Living Resources of the Southern Oceans* (with SCAR, ACMRR and IABO)

BIOMASS Volume I – Research Proposals was published jointly by SCAR and SCOR in August 1977 and copies have been distributed to National Committees and interested scientists and were presented at meetings of the IOC International Coordination Group for the Southern Oceans in September 1977 and the Tenth Session of the IOC Assembly in October/November 1977.

The BIOMASS proposals had been welcomed at these meetings, relevant recommendations from which were noted.

It is proposed to publish *BIOMASS Volume II, selected background papers from the Woods Hole Conference*, late in 1978.

A meeting of WG 54 is being planned in Kiel, F.R.G. from 31 May to 3 June 1978 at which research priorities will be discussed and mechanisms will be proposed for furthering the scientific and logistic planning of the BIOMASS programme. A number of members of the group expect to attend the SCAR General Meeting earlier in May and informal discussions will be held there.

WG 55: *Prediction of El Nino* (with IAMAP and IAPSO)

Professor D. Stuart, USA, has accepted an invitation to serve as Chairman and has initiated correspondence with his members. A report was received from Dr Stuart in which he proposed a first meeting of the group in conjunction with the IOC/FAO/ICES Symposium on the Canary Current in April 1978 and a possible further meeting later in the year. These proposals were approved.

The Executive Committee confirmed its view that this group should not be concerned with biological aspects, which should be considered separately (see item 3.1 1-10C),

WG 56: *Equatorial Upwelling Processes* (with IAPSO, IAMAP and IABO)

In addition to the Chairman, Dr H. Rotschi, France, four scientists have been invited by the President to serve as members of a physical panel and six as members of a biological panel. A report from the Chairman was received in which he proposed that, as many members of WG 56 would be attending the IOC/FAO/ICES Symposium on the Canary Current in April 1978, it would be convenient to hold the first meeting of WG 56 at that Symposium and the members of the physical panel attending the GATE Symposium (WG 43) in May could meet then. These proposals were approved.

WG 57: *Coastal and Estuarine Regimes* (with IAPSO, UNESCO and ECOR)

A meeting of the Group was held in Hamburg, FRG from 3 to 5 November 1977. A brief report from the Chairman was discussed.

The following proposals from the Group were approved:

- i. That the four members of the sub-working group on modelling be co-opted as full members of the WG and the sub-group be discontinued.
- ii. That an interdisciplinary meeting on coastal and estuarine regimes be organized in 1982, possibly as part of the next JOA.
- iii. That the next meeting of the group be held in Tallinn from 4 to 6 September 1978 immediately after the tenth International Coastal Engineering Conference in Hamburg, which members of the group expect to attend on national funds. A further meeting is planned at the IUGG General Assembly, 2 to 15 December 1979 which members expect to attend.

The SCOR Executive Committee expressed some concern at the wide ranging nature of the subjects the group had discussed, which had included such matters as the feasibility of a data centre and education programmes. Because of the growing importance of the coastal zone and the likelihood of greater concentration on this area by inter-governmental agencies it was inevitable that SCOR would become increasingly involved in studies of coastal processes. The attention of WG 57 will be drawn to the need for them to concentrate on the scientific, process oriented, studies and to the fact that a number of other matters should be referred by them, through SCOR, to UNESCO. The Group was asked to identify what it believed to be the scientific priorities which could be accomplished within a finite time span.

The attention of WG 57 has been drawn to an International Symposium on the coastal Dynamics of Inland Seas, Lakes and Oceans being planned for the Spring of 1979 by the Canada Centre for Inland Waters.

WG 58: *Arctic Ocean Heat Budget* (with IAPSO)

Membership of WG 58 has been established as follows:

Dr A. Foldvik (Chairman) Norway, Dr K. Aagard (USA), Dr P.D. Killworth (UK),
Dr J. Meincke (FRG), Dr E.L. Lewis (Canada), Professor C.A. Paulson (USA),
Dr E.C. Carmack (Canada).

The identification of a Soviet member of this group is still awaited.

WG 58 held its first meeting in Halifax, Nova Scotia, from 17 to 19 October 1977 and a brief report by the Chairman (Annex VIII) was received. The group is now working on the preparation of a full report on the state of knowledge of the Arctic Ocean Heat Budget. This report might be appropriate for publication in the UNESCO Technical Series or in *Progress in Oceanography*.

A further meeting in Bergen in September 1978 was approved at which time the composition and material for the report will be discussed further. The SCOR Executive Committee regretted the absence of active participation by the USSR but agreed that the final draft of the report should be sent to the USSR Academy of Sciences before being published.

WG 59: *Mathematical Models in Biological Oceanography* (with IABO):

The first meeting of WG 59 was held in Wormley, U.K., from 6 to 9 December 1977. A report of that meeting (Annex IX) was considered. It was noted that the intentions of the group included the production of a review of the state of knowledge of biological oceanographic modelling, with implications for the design of research programmes. This review may be suitable for publication in the UNESCO Technical Series. The Executive Committee approved a proposal by WG 59 that its next meeting be held in February or March 1979, to consider drafts of sections of the review.

It was agreed that a physical oceanographer should be invited to the next meeting of the group, the name of Dr J.J. O'Brien was suggested, that Dr G. Radach be invited to represent WG 59 at the next meeting of WG 57 and that Dr F. Wulff be invited to represent WG 59 at a Conference on Ecological Modelling to be held in Denmark in August/September 1978.

WG 60: *Mangrove Ecosystems* (with IABO and UNESCO):

Professor S.C. Snedaker, USA, has accepted an invitation to serve as Chairman of this group, Professor Parsons is Executive Committee reporter. The Chairman's views on an initial membership of the group of about 6 to 7 scientists is awaited. It is expected that the first meeting of the group will be arranged in February 1978 with financial assistance from UNESCO.

WG 61: *Sedimentation Processes at Continental Margins* (with CMG):

Dr I.N. McCave, UK, has accepted an invitation to serve as Chairman of this new Working Group. Professors Postma and Simpson are in correspondence with Dr McCave regarding the initial membership of the Group. Professor Simpson accepted an invitation to serve as Executive Committee reporter for this group and to pursue the establishment of the group.

2.3 Committees

**Committee on Oceanography and GARP (COG)
(and other aspects of climatic change and variability)**

The first meeting of COG had been held in Helsinki on 27 May 1977. The Chairman, Professor H. Charnock submitted a report to the Tenth Session of the Assembly of IOC.

Professor Charnock had suggested that because of the breadth of the problems related to climatic change and variability which included time scales longer than those with which GARP was concerned it might be appropriate for SCOR to consider changing the name of the Committee so that it would not be limited to relationships with GARP. This would be particularly relevant if ICSU were to develop its plans for an ICSU long term study of world climate — recent correspondence with ICSU on this subject is given as Annex X.

The Executive Committee had an extended discussion on all matters related to oceanographic aspects of climate variability and prediction. The Committee felt that oceanographers have a great deal to contribute to the studies of climatic changes at all time scales in explaining their causes, as related to the ocean, and in providing the important part of the basis for their prediction — through paleo-oceanographic research, numerical modelling (hindcasting), studies of CO₂ cycle in the ocean, studies of the large-scale ocean-atmosphere interaction and through identifying and assembling files of climatically important oceanographic data. The Committee was of the opinion that at this stage SCOR should maintain a close liaison with all the international bodies interested in climate studies, including ICSU and IOC for GARP, and provide them with timely advice on the role of oceanography in these studies. The Executive Committee was further convinced that a more vigorous action in this field, preferably on an intergovernmental level, will be required at a later stage, and that IOC should take this into account when it considers the definition of its future role, functions and structure. To ensure the presently required high degree of alertness of SCOR to the needs of climatic research the Executive Committee decided to establish an interdisciplinary Committee on Climatic Changes and the Ocean to replace its present Committee on Oceanography and GARP and SCOR Working Group 48.

In considering the activities of this Committee, the SCOR Executive Committee agreed that the first term of reference should result in a concise report that could be given wide distribution and would serve to put in perspective the role of the ocean and of oceanic research in the eventual understanding and prediction of climate. The Committee should also be charged with preparing an action plan for mobilization of oceanographic effort toward solution of the climate problem.

The terms of reference should make clear the interdisciplinary character of the group. Thus membership should include representation from the fields of physical, chemical, and biological oceanography, and marine geology and geophysics. Expertise is required in the following areas:

Dynamics of the surface layer, and ocean-atmosphere interaction.

Ecology of surface layer biota.

Interactions between the surface and deeper layers.

The historical record (paleo-oceanography).

The following terms of reference were agreed:

SCOR Committee on Climatic changes and the Ocean

- 1) To assess the role of the ocean in climatic change and variability, the effects of such change on the ocean and its biota, and the ways in which oceanic research can contribute to the understanding and prediction of climatic change.

- 2) To identify research problems requiring increased attention.
- 3) To identify impediments (scientific, technological, institutional) to achieving a more effective mobilization of oceanographic effort toward solution of the climate problem.
- 4) To keep under review relevant SCOR activities and to propose ways whereby they can be made more effective.
- 5) To advise SCOR and the organizations with which it interacts on matters pertaining to climatic changes and the ocean.

Professor Wooster undertook to enquire of a number of scientists whose names were proposed whether they would be interested in serving on this Committee and to prepare recommendations regarding membership for further consideration by the SCOR Executive Committee.

2.4 Proposals for new Working Groups

The carbon budget of the ocean

A number of National Committees, who had been consulted by circular on the proposal that SCOR might establish a new working group in the carbon budget of the ocean in support of the SCOPE project on the global cycle of carbon dioxide, had expressed interest and approval.

The advisory committee for the SCOPE Carbon project will be appointed by their Executive in May, 1978 and in their proposed terms of reference, liaison with SCOR, amongst other organisations, is identified as one of their tasks.

Correspondence with the Chairman of WG 44 (OAMEx) had identified the involvement of that group and Dr J. Gieskes had been invited to report to WG 10 on the present state of knowledge on the carbon dioxide equilibrium constants in seawater. Some action by SCOR was thus already in hand but it was considered that a broader interdisciplinary group was needed to tackle the full width of the problem. It was thus agreed to create a new working group with Professor E.D. Goldberg (USA) as Chairman and Executive Committee Reporter which would include chemists, physicists, biologists and geologists, with the following terms of reference:—

WG 62: *Carbon Budget of the Ocean*

To identify the knowledge required:

1. to evaluate the ability of the ocean to act as a reservoir for the excess carbon dioxide in the atmosphere resulting from fossil fuel combustion, deforestation and other changes in the land biosphere. This reservoir may include the organic and inorganic deposits, the particulate and dissolved organic matter, the living organic and the dissolved inorganic carbon.
2. to determine the fluxes of carbon between the atmosphere and the oceanic reservoirs. This will involve the rates of ocean/atmosphere interaction at the sea surface, the rates of the chemical and biological processes, the mixing at different levels in the deep ocean and the dynamics of fixation and solution from the carbonate deposits.

3. The Working Group should utilise the expertise of other working groups of SCOR (such as WG 10, 44 and 46) and is required to provide advice and assistance, as required, to the SCOPE Carbon Cycle Project.

High Energy environments

Professors Postma and Simpson had been asked, in consultation with ECOR, to examine the need for the establishment of a Working Group or Symposium Committee on this topic. The issue had originally been identified by 1976 Marine geoscience workshop, but discussions had now revealed that there was already very active interest in this field and it was being dealt with adequately in the Coastal Engineering Conferences and International Association for Hydraulics Research and ECOR. It was considered, therefore, that the involvement of SCOR would be superfluous and it was decided to take no further action.

2.5 SCOR Scientific Rapporteurs

Scientific Rapporteur on Marine Pollution

Dr Dybern had attended various relevant meetings during 1977 as SCOR observer. A report from him on the second session of the IOC Working Committee for GIPME was received. The Executive Committee concurred with his recommendation that, although GIPME will in due course require scientific support and advice from SCOR and therefore SCOR should continue to observe the developments of GIPME, it was probably unnecessary to send a special observer to the next few meetings which were likely to be largely concerned with coordination and with a careful development of a pilot (an experimental) monitoring programme. Dr Dybern had recommended a re-examination of SCOR's relations with SCOPE. The Executive Committee re-affirmed its view that, with Professor E.D. Goldberg representing SCOR in relation to the SCOPE project on biogeochemical cycling, which included the SCOPE Carbon Cycle project, and Dr Dybern observing developments in SCOPE which might relate to marine pollution, the links with SCOPE in areas of common interest were satisfactory.

The Executive Committee considered that Dr Dybern was fulfilling a most useful role for SCOR in keeping in touch with developments in a number of organisations.

Scientific Rapporteur on Coastal Research

Much of the activities of interest to SCOR were currently being considered by WG 57 but Professor Postma will continue to advise SCOR when developments arise in other bodies on which SCOR advice might be advantageous.

3.0 Relations with Intergovernmental Organizations

3.1 IOC

- a) Resolutions from the IOC Assembly which may have implications for SCOR were noted. Those of particular relevance were:
 - i. X-2 Phenomenon known as El Niño (also discussed under WG 55)

- ii. X-3 Scientific investigations in the north and central western Indian Ocean
- iii. X-5 Oceanographic programmes for FGGE (also discussed under WG 47)
- iv. X-12 Southern Oceans (also discussed under WG 47)
- v. X-16 Compilation of the GATE oceanographic atlas (also discussed under WG 43)
- vi. X-24 Recommendation to the general conference of UNESCO for an amendment to the statutes.

In connexion with X-2, the Chairman of WG 55, Professor D. Stuart, had been invited to serve as SCOR observer at the new IOC/WMO/CCPS Working Group on the Investigation of El Niño which is to consider ocean wide programmes in support of the regional activity, ERFEN.

Following a request from the IOC EC-VIII to look into the possibilities of using biological indicators for predicting 'El Niño', Dr Angeles Alvarino of the Southwest Fisheries Center, La Jolla visited, at the request of SCOR, a number of laboratories in Ecuador, Peru and Colombia to discuss the problem with local scientists. It appears there is insufficient published evidence on biological indicators of El Niño, and Dr Alvarino had indicated that it would be necessary to establish a coordinated programme both to analyse existing plankton collections from the region and to establish a continuing programme of plankton sampling.

In relation to a further request to SCOR contained in the IOC Resolution EC-VIII.6, Professor K. Wyrski and Dr G. Kesteven had been invited to make an appraisal of the existing physical and biological programmes in the region and have indicated the types of projects which they considered need to be mounted. These views will be conveyed to IOC.

- b) The tenth session of the IOC Assembly had decided to continue the Scientific Advisory Board until the eleventh session, without any change in name. The President of SCOR had asked that the following statement be included in the report of the meeting:

'Since it has now been agreed to keep the Scientific Advisory Board of the IOC for another two-year period under the same name and with the same functions, SCOR wishes to go on record with an expression of concern over duplication of efforts between SAB and SCOR, already evident at the second session of SAB in April 1977. SCOR is further concerned with the implication coming from the present name of this IOC subsidiary body, namely that apparently scientific advice provided to IOC by SCOR and other official advisory bodies is considered inadequate.'

- c) As regards the post-IDOE development of LEPOR, the SCOR Executive Committee considered a number of replies from National Committees and took notice of the results of last year's planning exercise in the U.S.A., as summarized in the report "Ocean Research in 1980's" prepared for the US National Academy of Sciences. The Executive Committee was of the unanimous opinion that no attempts should be made to prepare or update the extensive catalogues of all possible scientific projects covering all the fields of oceanography. Rather the selection should be made of high priority scientific problems arising from the most important research currently under progress. In this sense the approach

of the US report "Ocean Research in the 1980's" was welcomed and it was felt that SCOR might provide a useful link between proposals of such nature coming from various National Committees by planning future activities of its Working Groups along the most important directions. The SCOR Executive Committee was also of the opinion that IOC's involvement in the post IDOE development of LEPOR would depend largely on the results of the present reappraisal of the future role and functions of the IOC. Further discussion of this matter will take place at the General Meeting in November 1978.

Professor Wooster undertook to arrange that copies of the final summary report on the examination of these issues in the USA will be sent to SCOR National Committees.

- d) IOC has invited SCOR to consider again action to promote an oceanographic programme in the northern Mediterranean to study the influence on the sea of cyclogenesis caused by mountains, to be related to the GARP sub-programme on air flow over and around mountains. The SCOR Executive Committee reiterated the view expressed in 1975 that although this was an interesting phenomena and worthy of study, it was not appropriate for SCOR attention. It was considered to be essentially a regional problem which should be referred by IOC to interested countries in the region. France had already taken a considerable interest in the proposal. As mathematical modellers might be interested it was agreed to suggest to IOC that Dr J.J. O'Brien, Chairman of WG 49, might be consulted.
- e) Arising from a request from the first session of the IOC Working Committee for GIPME, which had been referred to a number of SCOR WGs, WG 59 had offered its views which are given in Annex XI.
- f) The SCOR Executive Committee, consulted by correspondence, had supported and conveyed to IOC the CMG expression of support for a Soviet proposal to produce geological/geophysical atlases of the Atlantic and Pacific Oceans, provided these were limited to including data from the IDOE period.
- g) It was reported that Dr G. Philander, USA, had enquired about what steps could be taken to expedite production of a bathymetric chart of the GATE area which was not now being supported within the USA. The correspondence was conveyed to Professor Simpson with a request that CMG take any necessary action, possibly by bringing the requirement to the notice of the next meeting of the GEBCO guiding Committee.

3.2 UNESCO Dr K. Voigt, IOC, acted for UNESCO at the meeting

- (a) **Coastal lagoons.** It was announced that there would be a seminar on coastal lagoons to be held at Duke University, USA, in August, 1978 convened by Dr J. Costlow. UNESCO is planning to organise a major symposium on coastal lagoons in 1978/9. 220 replies have been received to the coastal lagoon questionnaire.
- (b) **Mangroves.** UNESCO is preparing a bibliography on mangrove ecology which it is hoped will be published in late 1978. A symposium is being organised in Asia in 1979.
- (c) **Photosynthetic pigments.** No information was available from Dr Jeffrey on progress on this subject.

- (d) **Coral reefs.** The President of IABO had received a request from UNESCO for the assistance of IABO/SCOR in the formulation of an overall research programme on Coral Reefs. It was decided to ask IABO to nominate a suitable consultant to perform this work for UNESCO.
- (e) **CSK Plankton Collections.** Responsibility for the CSK plankton collections presently housed at Singapore, is being taken over by the Japanese Government and Dr Takenouti will remain available to advise on them. The material will be accessible to specialists wishing to pursue studies on the region.

3.3 ACMRR/FAO

It was reported that ACMRR was about to be restructured after which proposals regarding future collaboration with SCOR may be formulated.

3.4 WMO

The only matters concerning WMO interests in marine science were considered under items 2.1 (WGs 34, 47 and 48) and item 2.3 (COG).

3.5 ICES

SCOR had been approached by the President of ICES, Mr B.B. Parrish, with regard to a proposal currently being considered by ICES, for an international expedition in 1981 to further studies of the biology of the European Eel. It was decided that in the first instance it would be desirable to ascertain the views of the community of biological oceanographers on the proposal, before its interdisciplinary aspects were considered, and the matter was therefore referred to IABO. The report of the January 1978 meeting of the ICES pre-planning group is given as Annex XII.

Dr Voigt announced that 105 papers had been offered for the IOC/FAO/ICES CINECA Symposium on the Canary Current but there was a grave shortage of funds to support participation. There was clearly a great deal of interest in the meeting and it promised to be an event of major importance especially to workers on upwelling. The Executive felt that they should urge National Committees to give as much help as they could, in getting support for participants.

4.0 Relations with Non Governmental Organizations

4.1 Affiliated organizations

CMG

Dr Scrutton, Secretary CMG had submitted the annual report of CMG. A summary of the issues relevant to SCOR is given in Annex XIV.

SCOR did not feel able to support financially the symposium on crustal properties at passive margins, Halifax Nova Scotia June 1978 because the processes to be discussed were deeper in the earth's crust than SCOR's normal range of interest.

The proposed symposium on oceanic crust and seawater interaction could not be accommodated separately at the IUGG General Assembly in December 1979 but as IAPSO had agreed the topic was suitable for this meeting it will be included as a subsection of the IAPSO symposium on Ocean Geochemistry.

IABO

A report on the activities of IABO had been received from the President, Professor T.R. Parsons (Annex XV). IABO had been consulted by SCOR on a number of issues which are referred to in the relevant parts of these proceedings.

IAMAP

A report on the activities of IAMAP had been received from the President, Professor C. Junge (Annex XVI). The SCOR Executive Committee was interested to learn of the establishment of an IAMAP commission on climate and hoped that close collaboration would be affected between this commission and SCOR's new committee on climatic change and the ocean.

IAPSO

A brief report on the activities of IAPSO had been received from the Secretary, Dr La Fond (Annex XVII). Dr Stewart, President of IAPSO reported further on the plans for the IUGG General Assembly, Canberra, December 1979.

Professor Woods was making steady progress with the planning of a SCOR/IAPSO Workshop on Oceanic turbulence which would be held in April or May 1979 and this would shortly be publicised by IAPSO.

It was still intended to have the proposed workshop on the fluxes and composition of particulates in the ocean and although it may prove impractical to hold it during the IUGG Assembly it was hoped to arrange it at a convenient venue at about that time.

4.2 ICSU

- i) Reference has already been made to the recommendation from the eighth meeting of the General Committee of ICSU dealing with a long-term study of world climate under COG above and appendix X.
- ii) Another resolution was a proposal that ICSU undertake a survey of the management of radioactive wastes. The Executive concurred with the reply of the President to the Secretary General, ICSU (Appendix XIII).
- iii) Note was taken of the ICSU General Committee Recommendation 13 regarding the principle of Universality.

4.3 ICSU Unions

IUPAC Professor Goldberg reported that he had made good progress with IUPAC in identifying marine scientists who would act as correspondents with the 20 or so appropriate projects of IUPAC, and members of the commissions with whom they would communicate. Both he and the IUPAC Division of Applied Chemistry had

written inviting their participation and an encouraging response had been received. In most cases the names of two marine scientists had been proposed for each project. It was stressed that the role of these individuals would be to correspond, and that SCOR would, in general, be unable to fund their participations in meetings.

4.4 ICSU Committees

COSPAR (and other matters related to satellite oceanography)

- i. A few National Committees had already indicated that they considered the *IOC Manual of Interpretation of Orbital Remote Sensing Satellite Photography and Imagery for Coastal and Off-shore Environmental Features* to be of value and the SCOR Executive Committee wished to remind other National Committees of the usefulness of this publication.
- ii. Four Bruun Memorial Lectures had been presented at the Tenth Session of the Assembly of IOC on the Theme 'Application of Satellite and Remotely Sensed Data to Oceanography' and these will be published in the IOC Technical Series.
- iii. A concise version of a report by Dr J.R. Apel, IOC consultant, on *Past, present and future capabilities of satellites relating to the needs of ocean science* had been produced as document IOC-X/21. The full text of this report will be published in the IOC Technical Series.
- iv. Dr D.E. Cartwright had suggested that, as his interests in remote sensing were limited to one or two aspects it might be preferable for SCOR to invite Dr J. Gower (Canada) to replace him as the SCOR liaison with COSPAR. This was agreed but Dr Cartwright should still be asked to attend on behalf of SCOR the IUCRM colloquium on passive radiometry of the ocean, Victoria B.C., June 1978 and be invited to assist Dr Gower, as appropriate, in bringing to SCORs notice developments in this field.
- v. Attention was drawn to an invitation from NOAA/NESS to organisers of marine research programmes to provide information about cruise plans to assist planning of the schedule of Coastal Zone Colour Scanner (CZCS) aboard *Nimbus G* (Annex XVIII). The SCOR Executive Committee urged interested marine research institutions to comply with this request in order that the maximum value might be derived from this programme of remote sensing of ocean colour and temperature in the coastal zone, data from which will be made available to investigators at reasonable cost on an unrestricted basis.

5.0 Other Meetings

An invitation had been received from the South African Council for Scientific and Industrial Research for SCOR to participate in a international workshop on the Transfer of Pollutants in two southern hemispheric Oceanic systems, to be held at Plettenburg Bay, South Africa, 23 – 25 April, 1979. It was agreed that SCOR should participate in this meeting and Professor Goldberg would represent SCOR.

Fourteenth General Meeting of SCOR

An invitation from the French National Committee and the Centre National pour l'Exploitation des Océans (CNEXO) to hold the fourteenth General Meeting at the Centre Océanologique de Bretagne at Brest was accepted with gratitude. The meeting will take place from 13 to 17/18 November 1978. The main scientific subject of this meeting will be a two day symposium and discussion on oceanic fronts being organised by Dr K.N. Fedorov who had already sent invitations to review lecturers and a number of specialists to participate in the discussion.

In closing the meeting the President expressed thanks to the University of São Paulo, for the facilities that had been made available and for an enjoyable churrascaria, and particular appreciation to Dr A. de Mesquita and Sra Lydia Swann for their hard work both in preparing for and during the meeting.

List of Participants
Twenty-first SCOR Executive Committee Meeting

Members of the Executive Committee

Dr K.N. Fedorov	USSR	President
Professor H. Postma	Netherlands	Past President
Professor E.D. Goldberg	USA	Vice President
Professor P. Tchernia	France	Vice President
Mr R.I. Currie	UK	Secretary
Professor W.S. Wooster	USA	Reporter for Publication
Professor E.S.W. Simpson	IUGS/CMG	Ex Officio
Professor T.R. Parsons	IUBS/IABO	Ex Officio
Professor C. Junge	IUGG/IAMAP	Ex Officio
Dr R.W. Stewart	IUGG/IAPSO	Ex Officio

Mr G.E. Hemmen	UK/SCAR	Assistant Secretary
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Other participants

Dr K. Voigt	UNESCO and IOC
Professor A.R. de Mesquita	Brazil
Cdr G. Valdivia	Chile
Mr R.A. Kelly	Chile

STATEMENT OF SCOR INCOME AND EXPENDITURE

(1 January to 31 December 1977)

Balances 1 January 1977	\$	\$
London	12 284.01	
Paris	<u>8 823.62</u>	
		21 107.63
Reserve Fund		63 226.11
		84 333.74
Income		
National contributions Contracts		37 400.00
IOC Regular Contract 1976 (final)	2 000.00	
UNESCO Regular Contract 1976 (final)	1 000.00	
IOC Regular Contract 1977 (first)	10 000.00	
UNESCO Regular Contract 1977 (first)	9 000.00	
IOC Special Contract GATE Symp.	10 000.00	
UNESCO Special Contract - Mangroves	<u>10 000.00</u>	
		42 000.00
Balance from JOA 1976		1 504.71
Interest		3 421.72
Gain on exchange		48.57
		<u>\$ 168 708.74</u>
Expenditure		
Scientific Activities		
Working Groups		
10	2 791.60	
38	345.47	
42	1 127.43	
43	6 037.77	
46	383.35	
47	18 145.01	
48	320.00	
54	153.63	
55	1 681.84	
57	6 940.32	
58	5 151.81	
59	4 108.71	
34, 49, COG & Climate Conference	13 057.82	
Coral Reef Symposium	2 520.00	
Geoscience Workshop (1976)	<u>5 000.00</u>	
		67 764.76
Representation at other meetings		
SCOPE	813.11	
GEBCO	297.26	
IOC - EC-VIII	1 005.34	
IOC - X	1 710.93	
IOC - GIPME	665.97	
IOC - SAB	208.00	
IOC - SOC	935.50	
WMO - FGGE	<u>825.42</u>	
		6 461.53
Publications		
BIOMASS	72.53	
Proceedings Vol 12	1 456.97	
Proceedings Vol 13	1 984.45	
Phytoplankton manual (prep)	<u>152.50</u>	
		3 666.45
SCOR Meetings		
EX 20		8 617.10
Administration		<u>8 002.41</u>
		94 512.25
BALANCES 31 DECEMBER 1977		
Funds held by ICSU Paris		2 312.16
Funds held by SCOR London		37 441.57
Deposit account		34 442.76
		<u>\$ 168 708.74</u>

SCOR WORKING GROUP 10 (WITH IAPSO, ICES AND UNESCO)

OCEANOGRAPHIC TABLES AND STANDARDS

Report from Chairman

The eight meeting of the Joint Panel of Experts on Oceanographic Tables and Standards was held May 23–25 at the Woods Hole Oceanographic Institution, Woods Hole, Mass. to consider redefinition of salinity and progress toward a new equation of state for seawater. A complete report of the meeting has been submitted by Dr K. Grasshoff to SCOR, ICES, IAPSO and UNESCO.

A recommendation (Recommendation 1 - below) for a practical salinity scale, defining salinity in terms of conductivity using a potassium chloride standard, was drafted. Additional measurements necessary to complete the definition are underway. A subgroup meeting is scheduled for March 1978 in Miami to review the new data and to prepare final recommendations for the next meeting in Paris of the Joint Panel in September 1978. Travel funds for Dr F. Culkin (U.K.) and Dr A. Poisson (France) are requested to attend the March meeting in Miami.

A recommendation (Recommendation 2 - below) for a new equation of state has been drafted by the Joint Panel. Data sets suitable for defining the equation of state were identified. These will be used to develop the final version of the equation. A recent calibration of the deadweight piston gauge at W.H.O.I. yielded corrections to pressure that exceeded error limits and consequently required recalculation of the formulas for both pure and sea water. The additional computation is not expected to affect the schedule for preparation of the equation of state.

The next Joint Panel meeting is scheduled for *September 11–13, 1978* at UNESCO in Paris.

N.P. Fofonoff

WG 10 Recommendation 1/1977

Practical Salinity Scale (1978)

We recommend that:

- (1) Absolute salinity, symbol S_A , be defined as the ratio of mass of dissolved material to the mass of solution. In most cases this quantity cannot be measured directly and a practical salinity, symbol S , shall be defined for reporting oceanographic observations.
- (2) The practical salinity scale be based on a Standard Seawater having a fixed conductivity ratio at 15°C to a potassium chloride solution made by dissolving a known weight of this salt in a given weight of pure water. The Standard Seawater used to determine the above ratio will be obtained from the North Atlantic and have a chlorinity of 19.3740 ‰. This Standard Seawater will establish the 35.0000 ‰ point on the scale. The conductivity ratio (R_{15}) at 15°C of weight diluted or evaporated Standard Seawater to the

35.0000 ‰ standard will be measured. The equation of these weight diluted or evaporated salinities as a function of R_{15} will fix the practical scale.

- (3) For all seawaters other than Standard Seawater the practical salinity will be determined from the equation $S = F(R_{15})$ where

$$R_{15} = \frac{C(0, 15, S)}{C(0, 15, 35)}$$

and $C(0, 15, S)$ is the electrical conductivity of sample sea water at 15°C and atmospheric pressure. Thus all seawaters having the same value of R_{15} will have the same practical salinity.

- (4) Practical salinity be related to absolute salinity by an equation

$$S_A = a + bS$$

where the parameters a and b are dependent on the ionic ratios of the sample. For Standard Seawater $a = 0$, and $b = 1.00488$ approximately; any improvement in these values shall serve to change S_A not S . It is probable that " a " may be put equal to zero for nearly all water masses with negligible error.

- (5) Equations to convert observed values of conductivity ratios at temperature t and atmospheric pressure to practical salinities including the final form of the equation $S = F(R_{15})$ be formulated by March 1978. The equations and recommendations for practical implementation should be based on the observations of Bradshaw, Culkin, Dauphinee, Millero, Poisson, and such other investigators whose cooperation may be requested by the Panel. A meeting of the principals of at least one week, under the chairmanship of Lewis, is deemed necessary and should be funded.
- (6) The effects of pressure on the conductivity ratio should be the subject of a further meeting to take place as soon as possible after completion of new experiments by Bradshaw and Schleicher, hopefully by the end of 1978.
- (7) By June 1978 each batch of Standard Seawater be labelled with its value of R_{15} as well as chlorinity. The relationship

$$S = 1.80655 Cl$$

commonly used previously should no longer have any definitive value. Consequently any changes noted in the constant will not affect either parameter.

- (8) After endorsement of these proposals by the sponsoring organizations (UNESCO, ICES, SCOR, IAPSO) revision of the practical salinity scale should not be entertained except under most extra-ordinary circumstances. The relation $S = F(R_{15})$ will then define practical salinity and not be subject to changes in data fitting procedures or minor changes in the properties of Standard Seawater.

WG 10 Recommendation 2/1977

Equation of State of Seawater

After reviewing the available data sets and empirical formulae fitted to the individual sets, we note that existing formulae do not meet the requirements set by the Panel. Recent measurements by Bradshaw and Schleicher (1976) of thermal expansion and compression of pure and sea water and of sound speed by Chen and Millero (1976b) show that significant improvements can be made to the Chen/Millero formula as discussed at the seventh meeting of the Joint Panel at Grenoble.

We recommend that:

- (1) The data sets consisting of the direct measurements of relative density using a magnetic float densimeter as obtained by Chen and Millero (1976a) and Millero, Gonzalez and Ward (1976), the direct measurements of thermal expansion and compression by Bradshaw and Schleicher (1976), and the sound speed measurements of Chen and Millero (1977) be adopted as the definitive data sets to calculate the coefficients of the equation of state of the general form adopted by Chen and Millero (1976a).
- (2) Other data sets be examined for consistency with the equation of state developed from the four above definitive data sets but not be used in the formulation of the equation.
- (3) The Panel does not endorse further measurements on the equation of state of pure water or seawater. The data sets selected appear to be of adequate precision and accuracy to meet the present and anticipated needs of oceanographers. The Panel recommends that the equation be considered definitive and should not be subject to minor modifications.
- (4) A working party consisting of Bradshaw, Chen, Fofonoff, Millero and Schleicher be formed to develop the equation of state from the selected data sets by March 1978. The working party will meet in Woods Hole or Miami to review the formulation and to draft a comprehensive paper to communicate the equation of state to the oceanographic community.

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JOC/SCOR STUDY CONFERENCE ON GENERAL CIRCULATION MODELS OF THE OCEAN AND THEIR RELATION TO CLIMATE

Helsinki, 23–28 May 1977

Summary and conclusions

The purposes of the JOC/SCOR Joint Study Conference were twofold. First, the meeting was designed to review our understanding of the problems of numerical modelling of the ocean itself. Second, the Conference sought to reach a better understanding of the role of the ocean in numerical models of the climatic system as a whole, comprising the atmosphere, the land surface, the biomass, the cryosphere, as well as the oceans. In this system, the ocean — with its vast capacity and immense areal extent — is the most significant variable component of the atmosphere's boundaries, its impacts being primarily effected through the sea surface temperature. But the processes within the oceans which largely determine the sea surface temperature are themselves influenced by the motions of the atmosphere. Hence, modelling of the behaviour of either medium over long time scales must take into account the behaviour of the other; and the joint review attempted in this conference is therefore an inescapable necessity.

The conference largely achieved its purposes. The major problems which must be unravelled in order to develop realistic ocean models were exposed and our present knowledge of them well summarized. Similarly, a wide variety of efforts to model climate under various assumptions concerning oceanic behaviour were presented and encouraging attempts to model the joint ocean-atmosphere system were outlined.

Perhaps more important than the specific information presented, however, was the opportunity afforded by the conference for oceanic and atmospheric scientists to consider together the problems of their coupled media. Members of both groups emerged from the meeting with a better understanding of and respect for each other's problems.

The best summary of our present knowledge of modelling the oceans and the atmosphere on climatic time scales is contained in the papers themselves, while the intangible joint understanding fostered by the conference largely lies in the minds of the seventy-odd participants. An overview and synthesis of the reviews will be possible only upon careful study of the conference proceedings. Thus, a further distillation of the information already presented at the meeting will not be attempted here but it may be useful to delineate a few major problem areas which clearly emerged from the papers and discussions and to indicate some directions for future research and observations which would bring us closer to an understanding of the ocean's long-term behaviour and its role in climate. A small working group gathered after the close of the conference to attempt this task, and its results are presented below in as compact a form as possible, and organized under the major problem areas as perceived by the group.

Oceanic Heat Transport

In the tropics, the earth receives more heat from the sun than it radiates back to space while, at the poles, the converse is true. Working together, the ocean and the atmosphere jointly transport sufficient energy between these regions to balance their budgets and thus maintain an

equilibrium climate. The sea-surface temperature distribution which is thought to significantly influence climate is in turn influenced by the oceanic circulations producing this transfer.

The best contemporary estimates of the mean oceanic contribution to this heat transport, computed indirectly as residuals from atmospheric and satellite-observed radiative data, are considerably higher than earlier estimates, although there is uncertainty in these newest estimates. Moreover, there are indications of significant oceanic heat transports between the hemispheres, although there is again uncertainty even in the sign of the mean transport. Model experiments suggest that the atmosphere can readily adjust its circulation to accomplish the heat transport required to maintain an equilibrium climate. If we assume that the total heat transport by atmosphere and ocean together remains approximately constant from year to year (although varying with the seasons), then variations in the oceanic component in any particular year may have profound implications for the dynamics of the atmosphere. The long term average oceanic transport may thus essentially control the corresponding atmospheric transport, with important implications for the atmospheric general circulation. Perhaps more significantly, inter-annual variations in oceanic transport (of which there is some evidence) may be reflected in major interannual variations in the large-scale dynamics of the atmosphere.

Present indirect estimates of oceanic transport should be refined, and new computations should be made both for independent periods of regard and, if possible, independent *in situ* data sources. This will require long-term observational efforts in critical regions, e.g. the western boundary currents (see below), but care should be taken that limited observational resources are not diluted in a multiplicity of sub-critical efforts. The possible relationships between variations in oceanic heat transport and climate variations on seasonal and inter-annual time scales should be studied. In particular, the oceanic heat transport in the southern hemisphere and its variations should be studied in relation to variations in southern hemisphere climate.

Oceanic Processes

In order to model the evolution of the ocean on climatic time scales, one must explain the flow of heat within the ocean. How is the structure of the upper layers of the ocean determined? How does the heat absorbed in these layers become redistributed through the depth of the ocean? In these processes, what are the relative roles of mixing along constant-density surfaces and vertical diffusion by small-scale turbulent processes? There are many uncertainties, and these are reflected in the discrepancies in magnitude between the large-scale vertical mixing implied by simple energetic considerations and that which can readily be explained.

A number of constructive steps may be pointed out in this area:

- In connexion with the formation of the *surface boundary layer*, observational/modelling studies are needed to determine where one-dimensional models are adequate and where more complex advective models are essential. In the former case, it appears essential that the effects of small-scale turbulence at the lower boundary of the mixed layer be considered more fully than has been the practice. Observational studies, such as those scheduled to be carried out near OWS-P in the near future, and by the JASIN programme somewhat later, will be of great value in the development of models and parameterizations of the upper layers of the ocean. For the purposes of climatic study, it is vital that the relatively few existing long-term records from ocean stations, e.g. OWS-P be continued.
- The **processes** governing *large-scale vertical mixing* within the ocean interior are not well understood. Simple model calculations based on traditional vertical diffusion concepts

are not in accordance with results from geochemical data. It has been suggested that vertical diffusion can be explained by mixing along weakly inclined isopycnals. Further model studies and data analyses are needed to develop useful parameterizations of these processes.

- *Deep circulation processes* are not well understood. Here there is a most constructive role to be played by simplified analytical models. However, numerical models should also be employed to determine the extent to which they can simulate the thermally driven circulation. For climatic time scales, it is essential that models incorporate in some fashion the theories of deep water formations so as to successfully predict the formation of water masses over long time periods and large spatial scales. The possibilities of indirect energy transfer to the deep circulation through mesoscale eddies raise new and challenging problems for large-scale ocean modelling. Further work should be done to reconcile the circulation inferred from tracers and simulated by models, particularly in high latitudes.

Despite its vastness, many of the ocean's most significant effects occur in relatively small regions, often in thin bands. These smaller-scale high-magnitude processes greatly complicate the observation and modelling of the ocean in comparison with the atmosphere. Some of the most significant examples are cited below:

- Across the *ice margin* separating polar pack ice from open water there is a tremendous contrast in albedo, temperature, roughness, and thermal inertia. Energy fluxes between the surface and the atmosphere differ by as much as two orders of magnitude across this boundary. Hence it appears that relatively small variations in the position of the boundary could produce relatively large variations in energy inputs to the atmosphere. Additionally, there may be immediate practical influences such as, for example, the fisheries. Changes in the position of the ice margin are no doubt related to both atmospheric and oceanic parameters. From the standpoint of climate modelling, one of the most interesting and important factors may be the possible relationship between large-scale oceanic heat transports and the position of the ice margin, a relationship which would permit a potentially important feed-back mechanism. A useful data base for the study of these problems is being accumulated, but there is a need for more work on the dynamics of the ice margin on the macro-scale, on the relationship between the ice-margin and large-scale oceanic circulations, and on the sensitivity of climate to perturbations in the position of the ice margins.
- *Coastal upwelling* similarly produces a thin strip of ocean with marked temperature contrasts and high variability in space and time. Observation and modelling of the dynamics of coastal upwelling have made great progress, and a comprehensive review paper would be highly useful at this stage. It appears that more complete comparisons between model results and observations would shed light on this phenomenon. It is known that coastal upwelling is a major determinant of climate near the coast, and that variations in offshore conditions are reflected in conditions on nearby land. However, the possibilities of regional effects and feedbacks over much larger areas deserve both careful analysis by statistical methods and model experiments.
- Of larger extent are the *boundary currents*, their extensions and their associated recirculation which dominate the large-scale oceanic heat flux discussed above. While the climatic effects of these currents are global in extent, their physical dimensions are relatively small. Hence efforts to monitor the heat transport of the major boundary currents are highly valuable, although care must be taken to attempt to monitor critical indices and to avoid dilution of resources.

- *Equatorial processes* within the ocean pose unique problems. Theory indicates the presence of wave phenomena, but their structure has not yet been completely determined by observation, and their significance for climate is largely unknown. There are however, indications of long-period variations in equatorial flow which merit further investigation. Interactions between the various equatorial modes and mean equatorial currents need to be studied by appropriately designed field experiments and more detailed numerical models. The observational programme will probably require deployment of a substantial number of current meters. The relevance of tropical oceanic phenomena of this type to climate cannot be determined until their interaction with other ocean circulations such as upwelling is understood; this interaction is thus an important area of study. Other tropical oceanic processes are, however, already known to be of major importance to climate. There are indications that the Indian summer monsoon is greatly influenced by precedent oceanic conditions to the south. The detailed wind and oceanographic observations planned in the Indian Ocean during the FGGE will be most helpful in studying and modelling this relationship. Similarly, the El Niño seems to be clearly linked with large-scale equatorial atmospheric and oceanic processes spanning the Pacific. The El Niño investigations planned for the near future should be considered as a pilot study to determine the need for and nature of a possible major field programme on this problem and other aspects of tropical dynamics in the post-FGGE period.
- *Mesoscale eddies* severely complicate the modelling of the ocean. New generations of eddy-resolving models with resolutions high enough to minimize requirements for parameterization and including thermal driving are required, together with new types of sub-grid scale parameterizations covering the parameter ranges representative of the ocean. Parameterizations of eddies derived from such models must account for both their direct effects and their indirect effects in driving the deep circulation through pressure forces. Sensitivity and parameter studies should be further encouraged for the purpose of assessing heat transport characteristics of climate interest. In addition to modelling, observations are needed over many years to collect reliable statistics on eddy characteristics and their implications for eddy transports, particularly for their characteristic time scales.

Atmosphere-Ocean Interactions

Both model experiments and actual observations now unequivocally demonstrate coupling between ocean and atmosphere on climatic time scales. Since these interactions may be the key to achieving some degree of skill in the prediction of climate variations, considerable additional attention needs to be devoted to their study.

- *Empirical studies* of air-sea interactions have now given convincing evidence of back-interactions of the oceans on the atmosphere on a time scale of months. Further careful case studies are required with good statistical controls. These empirical studies should be extended to the equatorial zone, and both regional and possible global linkages should be investigated. The possible linkage may extend far downstream for ocean anomalies in mid-latitudes, and reach into both hemispheres from the equator. Hence a wide variety of possible effects should be investigated. However, the limited data set available demands that plausible physics and guidance from model experiments serve as a guide in the selection of cases for study and in the drawing of inferences from statistical relationships.

- *Oceanic responses* to different types of large-scale atmospheric forcing, both in mid-latitude and tropics, should be studied by a combination of numerical model experiments and the analysis of existing long-term time series. These investigations would help in the design of critical field experiments to test the large-scale response of the ocean to atmospheric forcing in particularly sensitive areas, such as the equatorial current system and the western boundary currents.
- In parallel, *atmospheric responses* to ocean anomalies need special investigation. On the basis of pilot model experiments, it appears that ocean anomalies produce weak atmospheric signals in mid-latitudes, but strong responses in the tropics. These results are of great importance and clearly merit further investigation. In particular, there may be a need for a long-range equatorial Pacific observational programme with a strong modelling component employing a number of modelling approaches. Such a programme would contribute, as noted above, to the study of the El Niño as well as tropical-midlatitude relationships.

Modelling Development and Methodology

Global models attempting to simulate climatic variations over periods approaching a year clearly must include an interactive ocean. But the difference in time and space scales between the atmosphere and ocean suggests that distinct methodologies may be appropriate for each. This disparity also complicates the problems of coupling models of the two media. Some problems of special interest are:

- *Ocean modelling methodology* should be pursued on a broad front. No single problem nor even small groups of problems, can be cited as the principal barriers to progress. The principal processes determining the sea-surface temperature are not yet properly defined, let alone given priority. Hence a broad approach is needed on a variety of modelling and parameterization techniques. For example, both primitive-equation and quasi-geostrophic models of the ocean have their own advantages and areas of application; intercomparisons between them can help to determine their appropriate roles in climate study. Similarly, techniques for model nesting require study. In general, it is increasingly important to verify ocean models on a water mass basis. Progress is being made on the development of models which can indeed simulate formation of water masses. But it must be recognized that the processes which determine sea-surface temperature and indeed, the structure of the entire water column, vary markedly as a function of scale and region.
- *Coupled modelling* presents its own problems because of the disparity in time and space scales noted above. In particular, the mechanics of coupling employed in extended simulations with atmosphere-ocean models require careful design and evaluation. However, the development of a smoothly functioning coupled model will by itself be fruitless unless the physical processes embodied in it are realistically modelled. The present work on coupled general circulation models needs to be extended to simplified models of various types, and should include response and sensitivity studies with these models. The seasonal signal, whose nature will be somewhat better defined by the FGGE, represents a convenient and useful benchmark for calibration of a hierarchy of coupled models.
- *Simplified models* of various types are of great practical importance in climate study. In particular, two-dimensional coarse-resolution time-averaged thermodynamic models show considerable promise. Existing work should be extended to a fuller treatment of

the ocean. Models based on higher order thermodynamic constraints, e.g. entropy concepts, could be of great importance. However, it would seem that the concepts involved should be verified on a number of simple physical systems including, for example, laboratory models, before application to the atmosphere in an uncritical fashion. It should be emphasized that simplified coupled models would be highly useful experimental tools at this state of atmospheric modelling.

- Among the simplified models, those employing *stochastic forcing* merit special attention. Due to the difference in time scales between the media, the atmosphere may be considered as a stochastic driving factor on the ocean. Simplified models should be developed in which the atmosphere is treated statistically, and drive the ocean through its mean state and stochastic variability, but in which the atmosphere's mean state and stochastic characteristics are influenced by feedbacks in which the ocean plays a major role. For example, as suggested by Lorenz, an atmospheric GCM may be employed to generate statistical realizations for use as proxy data to force an explicit ocean model.

In conclusion, the Conference revealed great interest, much activity, and considerable progress in the investigation of the behaviour of the oceans and the atmosphere as elements of the system which determine the climate of our earth. The development of oceanic models suitable for use in comprehensive climate models was shown to be a highly complex problem which cannot be resolved simply by application of computer power. The ocean can interact with the atmosphere on a wide range of space and time scales, and the dynamical structure of these various scales needs to be better understood before realistic coupled ocean-atmosphere models can be constructed. Continued progress will require parallel research on many different questions, but above all a continued interaction between the oceanic and atmospheric research communities at least as intimate as that between the fluids which are the subjects of their study.

SCOR WORKING GROUP 42 (WITH ICES)

BALTIC POLLUTION

Report from Chairman

The main activity of the WG during 1977 has been the final preparation and execution of the Baltic Open Sea Experiment 1977, (BOSEX 1977).

The final programme was drawn up at a workshop in Copenhagen in January 1977 and discussed at the subsequent meeting of the WG (21 January). The report from this meeting was presented at the SCOR XX Executive Meeting.

BOSEX was carried out in the period 5 to 24 September, with 11 ships from all Baltic countries participating. Current meters and other instruments were moored according to plan and all instruments were recovered after the experiment. The full data return has not yet been reported, but where I have information it looks very satisfactory.

Due to very strong winds, peaking at full storm force in the middle of the period, most ships could not work all the time as planned. The larger ships could keep the central station occupied, and from that station we have time series of chemical observations during the whole period except 1 day. The chemical and physical mapping of the BOSEX square also went satisfactorily, although not covering the whole period.

The biological programme suffered most from the bad weather condition. However, fairly extensive micro-biological observations were carried out, as well as primary production measurements, plankton sampling and fishing.

The special physical experiments regarding current structure, mixing and temperature structure with extensive CTD profiling were carried out but not to the extent which had been planned, due to the weather. A limited part of the continuous chemical mapping could also be carried out.

My feeling is that the experiment was very successful. We got some quite interesting records of the influence of very strong winds on the vertical structure of both current and S, T. The development and successive penetration of inertial oscillation could be followed, and probably also both the generation and decay phase of the wind-generated mixing. My feeling is also that the chemists are quite satisfied, but it remains to be seen how much biology was really obtained.

The time schedule for analysis is that data return and preliminary results will be presented at the Baltic Oceanographers meeting in April and the 2nd level inventory should be ready by the ICES meeting in September. There we will further present our results. Probably small *ad hoc* groups will cooperate on interpreting various parts of the data material. I hope that we will not lose the interdisciplinary aspects of it all.

The next WG meeting is scheduled for the end of April 1978 following the Baltic Oceanographers meeting. It is my feeling that the interest in the Baltic scientific community is quite large and that we generally hope this kind of work will continue.

Regarding the membership of the WG, I intend to write to all present members, informally specific problems of interest to the Helsinki Interim-commission. It appears that the work of the WG has generated a certain amount of interest.

Regarding the membership of the WG I intend to write to all present members, informally enquiring into their interest to take an active part in future work. Possibly this may bring about some voluntary exchange so that we can meet the request or suggestion from Baltic Marine Biologists. The problem is that some of the biologists in the WG do not find time to participate as much as one might wish.

It was good to learn that SCOR will continue its involvement in WG 42, and I hope this brief report will not influence you to the opposite.

Gunnar Kullenberg

SCOR WORKING GROUP 44

OCEAN ATMOSPHERE MATERIALS EXCHANGES (OAMEX)

Report from Chairman

After the formal approval on membership given by the last SCOR Executive Committee Meeting, a circular letter (October 29, 1977) was sent by the Chairman to all the Group members. An intense exchange of correspondence between the Chairman and many of the Group members has started and it was felt that many problems could be approached this way before the first OAMEX meeting was held.

The "Summer Seminar route", as suggested in a circular letter, was very well received by several members and also by the Group SCOR Rapporteur: Professor C. Junge. It was felt that every effort should be made in order to adequately combine activities with other groups. This means that a short meeting of the OAMEX WG could take place in Fall 1978, in order to prepare this action among other matters.

Since the involvement of the OMAEX WG in the "CO₂ problem" was not very well delineated in regard to other SCOR WGs already formed or to be formed, this question was raised in a letter from the Chairman to Professor Fedorov. A reply of Professor Fedorov and other reactions (from Mr Currie and Professor Junge) were received and will be discussed among the Group members in a near future.

Along these lines, a "Questionnaire" covering several administrative and scientific matters, and taking into account the exchange of ideas expressed to the Chairman, is being prepared and will be circulated soon among the WG members.

It has been agreed that the volume on the *Tropospheric Transport of Pollutants and other substances to the Ocean* (J. Prospero Ed.) which is going to be issued in the near future by the US/NAS will provide an important "springboard" for initial discussions, inasmuch, as said by one of the Group members, as there is pointed out so much of what we do not know.

From October 3 to October 7, was held the first session of the GESAMP/Working Group in Dubrovnik on Interchange of Pollutants between the Atmosphere and Oceans, under the chairmanship of Dr W. Garrett and sponsored by WMO. The question of coordination of activities of the Group with the SCOR Working Group No. 44 on Ocean-Atmosphere Materials Exchanges (OAMEX) was raised. It was agreed that, due to the fact that Dr Chesselet is a member of this Working Group and Chairman of OAMEX, it will be possible to avoid unnecessary duplication. However, some difficult problems might be usefully discussed by both groups.

R. Chesselet

SCOR WORKING GROUP 52

ESTIMATION OF MICRO-NEKTON ABUNDANCE

Report from Chairman

Correspondence with members of the working group has been initiated in hopes of reaching a consensus on (a) the types of organisms to be included as "micronekton" and (b) the most effective way to achieve our goal of reviewing assessment techniques.

A tentative plan is for WG members and other experts to write reviews of net sampling and acoustical assessment methods for four micronekton groups (euphausiids, shrimps, squids and fishes). These reviews, in addition to other invited papers, could be the basis for a SCOR sponsored symposium and published proceedings on "Assessment of Micro-nekton Abundance".

A meeting of the full WG 52 is not being planned at this time for 1978, and will not be considered until initial planning has been completed by correspondence. However, the chairman requests \$1000 for travel expenses to discuss review papers with individual members, as well as subcommittee members, while he is on the sabbatical in Japan and Norway.

W.G. Pearcy

SCOR WORKING GROUP 58
THE ARCTIC OCEAN HEAT BUDGET

Preliminary Report submitted to 21st Meeting of SCOR Executive Committee

During 17–19 October 1977, SCOR WG 58 met at the Bedford Institute in Nova Scotia. Our terms of reference were

- I) to assess the present state of knowledge of the Arctic Ocean heat budget and the physical processes which control it, and
- II) to recommend a coordinated and international research effort to significantly improve the understanding of the heat budget and the controlling processes, taking into account the plans for the Polar Sub-programme of the Global Atmospheric Research Programme.

We made considerable progress on item I and were able to identify the major components and processes of the Arctic Ocean heat budget, including the important information gaps. We also made a good start on discussions of an appropriate plan of research (item II), at least in outline. The following brief summary is a preliminary report only; a full report is being prepared as the basis for the next meeting.

The group unanimously desires to meet again in September 1978, at the Geophysical Institute in Bergen, to discuss in detail the various research plan components (item II) as well as certain unresolved matters under item I.

1. The Arctic Ocean heat budget relates to a number of general questions of atmospheric and oceanic circulation, to climate and its modification, and to the rapidly increasing human use of the north. While a number of heat budget studies have been done for the Arctic, they tend to be fragmentary and incomplete, nor is there very much information on variability at almost any frequency. The budget studies to date do, however, point toward the more important component processes.

The heat budget can be thought of in terms of the storage of energy within the basin (including internal rearrangement with time), and of changes in the energy storage through exchange with the seas to the south and with the atmosphere. We note that in the physics of the Arctic Ocean, the role of fresh water is extremely important, since it is the salinity stratification which limits convective mixing (and sensible heat exchange with the atmosphere) and permits ice formation. The storage and flux of buoyancy is therefore an integral part of the general heat budget problem, and processes causing vertical exchanges will be of major interest.

2. With respect to energy storage, there is a very great need for synoptic inventory studies of heat and buoyancy on a regional scale, with some emphasis on more localized areas of special importance. Good vertical profiling is essential in these studies. The synoptic oceanographic sections that are so common at lower latitudes are not available over large parts of the Arctic Ocean and constitute a serious lack. The technical and logistical aspects of such synoptic work are well within present capability.

3. Heat exchange with the atmosphere is a strong function of the ice thickness distribution. Two problems appear to be particularly important. One is the parameterization of areally integrated surface heat fluxes as a function of ice thickness. Matters both of physics and of statistics (e.g., over what scales is the ice distribution stationary?) are involved. The second problem relates to the surface exchange through large areas of open water (polynyas). The exchange through relatively small leads has been studied on several occasions, but the physics of exchange processes in large open-water areas appears to be more complex. Such exchange raises both oceanographic and meteorological questions (e.g., the possible penetration of the arctic atmospheric temperature inversion).
4. The most important avenue of advective flux is the passage between Greenland and Spitsbergen. Low-frequency variability is of particular interest. Present work on the transport of sensible heat and salt through the eastern part of this passage needs to be continued and expanded to include the more difficult western portion as budget studies will inevitably require total flux measurements. The export of ice through the western portion is also a first-order term in the heat budget, and it is necessary to undertake an appropriately designed study of this export on rather long time scales (years).
5. Finally, the Greenland–Norwegian Sea is of considerable importance. While it is formally not part of the Arctic Ocean, it connects with the Arctic Ocean and many of the processes that occur there are intimately tied to the Arctic Ocean heat budget. Experiments designed to elucidate the transformation of water masses in the Greenland–Norwegian Sea (e.g., bottom water formation) and their subsequent redistribution, are therefore of major consequence to the present discussion.

A. Foldvik

SCOR WORKING GROUP 59

MATHEMATICAL MODELS IN BIOLOGICAL OCEANOGRAPHY (WITH IABO)

Report of meeting

Wormley, UK

6–9 December 1977

Working Group 59, *Mathematical Models in Biological Oceanography* was set up on the advice of IABO, in 1977, with the following terms of reference:

- To suggest mathematical methods in marine ecology for the design of research programmes in the open sea and the nearshore waters.
- To suggest experiments for the treatment of biological data collections with particular reference to the development of mathematical models.
- The working group should maintain contact with SCOR WG 49 on mathematical modelling of oceanic processes.

The first meeting was held at the Institute of Oceanographic Sciences, Wormley, UK from 6 December to 9 December, 1977.

Present were: K.H. Mann, Canada Chairman; T. Platt, Canada, Vice Chairman; J.M. Colebrook, UK; D. Smith, Australia; M.J. Fasham, UK; R. Ulanowicz, USA; F. Wulff, Sweden, J. Field, S. Africa.

Regrets were received from G. Radach, F.R.G.; M. Vinogradov, U.S.S.R.; V. Menshutkin, U.S.S.R.

J.W. Horwood, UK was invited to be present to contribute expertise in fisheries modelling.

The working group recommends that its first contribution to meeting the terms of reference should be production of a review of the state of the art in biological oceanographic modelling with implications for the design of research programmes. Such a review may well be suitable for publication in the series of UNESCO Technical Papers in Marine Science.

The group discussed the form and content of this review, and the members have agreed to produce drafts of their sections which will be the basis for integration into a coherent document at a future meeting. Attached is a provisional outline of the review, with indications of the possible allocation of responsibility for writing. The suggested date for submitting draft sections to the Chairman is 1 December 1978, and we *recommend* that a second meeting of WG 59 take place in February or March 1979.

The working group noted the item in the terms of reference requiring us to interact with those concerned with mathematical modelling of oceanic processes, and *recommends* that the group be allowed to invite to its next meeting a physical oceanographer with experience of interacting with biologists.

The group discussed a request to advise GIPME on the value of biological modelling in marine pollution studies, (see SCOR Proceedings Vol. 14 Annex XI).

A request for liason with WG 57 was received. We *recommend* that Dr G. Radach of Hamburg attend their next meeting, in Hamburg 28 August to 1 September, 1978.

Proposed UNESCO Technical Paper on "Mathematical Models in Biological Oceanography"

Chapter 1. THE CLASSES OF MODELS IN BIOLOGICAL OCEANOGRAPHY (Mann)

(i) Ecosystem models

- (a) Compartmental flow diagrams.
- (b) General simulation models of fluxes to produce time and/or space series of state variables.
- (c) Holistic approaches to whole ecosystems.

(ii) Process models

- (a) Models of single processes.
- (b) Models with several processes coupled. These grade into ecosystem models.

(iii) Choosing the appropriate model

Comments on defining the problem and choosing the appropriate methods, including models.

Chapter 2. ECOSYSTEM MODELS (Wulff)

(i) Conceptual diagrams

On the need to consider conceptually how the ecosystem appears to be functioning, before embarking on mathematical modelling.

(ii) General simulation models (Wulff/Mann)

The current 'state of the art' usually involves expanding compartmental flow diagrams into mathematical models designed to produce time or space series of state variables. The chapter discusses value and limitations.

(iii) Holistic approaches to ecosystems

- (a) Topology of food webs. (Ulanowicz)
- (b) Size spectral analysis. (Ulanowicz)
- (c) Unstructured food webs. (Fasham)
- (d) Statistical mechanical (e.g. Kerner) (Fasham)
- (e) Irreversible thermodynamics including Odum and Pinkerton (Platt)
- (f) Levins' Theory of the Niche and other system properties. Loop analysis. (Platt)

- (g) Other approaches. (Collaborative)

Chapter 3. PROCESS MODELS

- (i) Models of single processes, all variables observable and capable of experimental manipulations, e.g. Primary production as function of light, zooplankton grazing as function of food, fish stock recruitment. (Field)
- (ii) Models of single processes, all variables observable, but not all capable of experimental manipulation; e.g. models of plankton patchiness, larval fish mortality, seasonal succession in the phyto-plankton etc. (Colebrook)
- (iii) Models with several processes coupled, e.g. multi-species fish management models. (These grade into ecosystem models). (J. Horwood (Lowestoft))

Chapter 4. IMPLICATIONS FOR DESIGN OF RESEARCH PROGRAMMES

- (i) Measurement of size spectra where appropriate. (Ulanowicz)
- (ii) Food web analysis using isotope tracers, dyes or gut analyses; trace element analysis. (Smith)
- (iii) Implications for sampling of knowledge of scales of variability in time or space. To be considered in relation to biomass or growth.
 - (a) General considerations. (Platt)
 - (b) Survey design. (Colebrook)
- (iv) Power spectrum of state variables, as a diagnostic tool (with applications to model validation). (Fasham)
- (v) Instantaneous measurements, in situ, of rate processes in populations (e.g. metabolism). (Smith)
- (vi) Critical physical qualities of interest to biological modellers. (Platt/Fasham/Radach)
- (vii) On interfacing biological and physical models - a case history. (Colebrook)
- (viii) The need for simultaneous time series of adequate duration and resolution of important biotic and abiotic variables, (Colebrook)
- (ix) Indices of response to stress. (Ulanowicz)

Note: Dr Ulanowicz will contact Dr Tibor Polgar, Martin Marietta Laboratories, Baltimore, for the input of a benthic ecologist wherever appropriate, but especially in Chapter 4.

LONG-TERM STUDY OF WORLD CLIMATE

Text of a circular dated 21 September 1977 from the Secretary General of ICSU to all Unions, Committees and Scientific Associates

I should like to draw your attention to Decision 6 of the 8 Meeting of the General Committee concerning a long-term study of World Climate.

I should be grateful if you would let me know if your organization would like to participate in such a study and if so if you would indicate the names of suitable contacts, and provide brief notes concerning activities relating to climatic change and the effects of climate change on humanity.

Decision 6 of the eighth meeting of the General Committee of ICSU, September 1977.

6. The General Committee endorses in principle the proposal for a long-term study of World Climate and recommends that a survey be undertaken by an appropriate ICSU group in the field of competence of ICSU bodies relative to such a study. The General Committee authorizes the Executive Board to explore the modalities of cooperation with WMO and other appropriate international organizations in consultation with appropriate members of the ICSU family and to submit to the General Committee a proposal concerning the ICSU-WMO agreement.

Letter of 14 December 1977 from Secretary, SCOR to Secretary General ICSU

With reference to your circular GC/49/77, SCOR would be most interested in participating in an ICSU Long-Term Study of World Climate and within our organization we can offer names of a number of suitable contacts.

Scientific activities relating to the understanding of climatic change and to the possible interactions between climatic change and man have been described in many publications. It is generally agreed that the ocean is an important component of the atmosphere-ocean-earth-cryosphere system and almost all of SCOR activities are relevant, to a greater or lesser extent, depending on the time scale of the climatic change under consideration.

For example, on the somewhat shorter of the climate time scales relevant activities of SCOR working groups on internal dynamics of the ocean and mathematical modelling are being co-ordinated by a SCOR Committee of Oceanography and GARP (COG) – the second objective of GARP being concerned with climate dynamics. We also have a working group on the prediction of El Niño but this is, of course, concerned with even shorter time scales but some of their findings may be relevant.

On the much longer time scales there have been substantial advances in knowledge in recent years deriving from studies of deep ocean sediment cores and historical sea level change. A particular example of this is the climate mapping project (CLIMAP) of the International Decade of Ocean Exploration.

This work falls under the general heading of paleo-oceanography which, of course, also includes studies of the evolution of ocean basins and the reconstructions of historical circulation patterns. Perhaps to a lesser extent than the examples mentioned, the biologists have an important contribution to make from the point of view of biological indicators of past changes.

SCOR wishes to emphasise to ICSU its view that the climate problem provides ICSU with an opportunity to integrate the work of many of its Committees and Unions to make a valuable contribution to an interesting and important problem. SCOR believes that ICSU should play at least as important a role in this field as the intergovernmental organisations concerned.

SCOR, with its affiliated organisations, CMG, IABO, IAMAP and IAPSO, could identify experts in different aspects of the problem, many of whom could contribute meaningfully to any ICSU study but, in the expectation that initially ICSU will wish to formulate a more detailed proposal for ICSU initiative, SCOR offers two names for your consideration. One is Professor H. Charnock (UK), Chairman of COG; and the other is Professor Tj. Van Andel (USA), Chairman of our Working Group on Paleo-oceanography. We are confident that the broad knowledge and experience of these two will be of direct assistance in the preparatory stages and they would know whom to consult if specialist expertise were required in any field of marine science.

SCOR's Committee on Oceanography and GARP (COG) held its first meeting in May 1977, at the time of the SCOR/JOC Study Conference on General Circulation Models of the Ocean; and their relation to Climate. In late January 1978, the SCOR Executive Committee will consider a request from COG to consider whether its name does not link the Committee too closely to GARP and that it might be preferable to rename it "the SCOR Committee on Climatic Change" to enable it more appropriately to serve as the focus within SCOR for all the various marine science studies that are relevant to the interaction between ocean and climatic variability on all time scales.

I am sending a copy of your Circular, Decision 6 of your General Committee Meeting, and this response, to all SCOR National Committees for information. We could arrange to discuss the matter further at the next meeting of the SCOR Executive Committee, in January 1978, if that seems desirable.

THE USEFULNESS OF MODELLING IN RELATION TO STUDIES OF MARINE POLLUTION

By SCOR WG 59

The working group encourages the application of simple process models to marine pollution problems. Such models have been successfully applied to pollution episodes in the past, they provide a good framework upon which to organize measurement programmes; they are usually tractable mathematically and they are prerequisite to the construction of larger community simulations.

We further encourage the construction and employment of qualitative compartmental flow diagrams. They are a significant help in organizing thinking about biological communities and frequently point out gaps in knowledge about an ecosystem. Even without detailed knowledge of the processes involved along each pathway, they can often foster one's understanding of total system behaviour. In our review article we hope to expand upon this latter point by referring to methods for analyzing compartmental networks in lieu of numerical or analogue simulation.

We would caution investigators not to rely too heavily on the results of whole ecosystem simulation models, until the individual component processes are better understood. There are not many validated models of whole ecosystems available for use. Even those community models purported to be validated under unpolluted conditions are not necessarily valid under polluted conditions.

Finally, we should like to call attention to attempts to develop holistic measures of community behaviour which may provide reliable indices of ecosystem response to pollution stress. Again, we hope to provide more details of this approach in our review document.

ICES INTERNATIONAL EEL EXPEDITION

In response to a resolution adopted at the 1976 Statutory Meeting of the International Council for the Exploration of the Sea, a pre-planning group met at the Danish Institute for Fishery and Marine Research on 24 January 1978 to consider the organisation of an International Eel Expedition. The group consisted of:

F.W. Tesch, Chairman
J. Boëtius
F.R. Harden Jones
J.D. McCleave
A. Christoffersen

Classical work by J. Schmidt in the early 1900's on the life history of European and American eels (*Anguilla anguilla* and *A. rostrata*) produced indirect evidence that the European eel spawns in the Sargasso Sea, and suggested also a spawning area for the American eel to the southwest. Re-examination of Schmidt's eel larvae collections by J. Boëtius have shown Schmidt's conclusions concerning European eels to be broadly correct. No new information of American eels has emerged. The larvae are presumed to drift on major North Atlantic current systems to repopulate European and American fresh waters.

Spawning or maturing eels have not been caught in the Sargasso Sea, or in fact anywhere off the continental shelves of Europe or North America. No eel eggs have been identified from plankton collections in the Sargasso; small larvae have been used to roughly define the spawning area for European eels. Similar collections are not available to allow the same inferences for spawning areas of American eels. Migration routes, spawning conditions, spawning behaviour, and spawning times of adults are unknown. Development, feeding and growth of leptocephali are unknown. Mechanisms for species separation in larval migration are speculative.

To add significantly to our knowledge of the biology of both species of eels, further information is required as to the depth, area, and season of spawning; the growth and distribution of the larvae; and the presence of adult eels of both species in the spawning area. Having regard to the large sea area involved (10–30°N, 50–75°W) and the probable length of the spawning season (January to May, peak period February–March), satisfactory cover could only be provided by several research ships supporting an International Expedition. It is envisaged that the work will include egg, larval, and plankton surveys, mid-water fishing, echo surveys and oceanographic observations.

The major objectives of the expedition include:

- (1) delimiting the spawning areas of the American and European eels;
- (2) determination of the spawning period of the two species;
- (3) determination of patterns of larval drift and species separation in the North Atlantic;
- (4) determination of rates of feeding and growth related to drift in the North Atlantic;
- (5) capture of adult eels in the spawning areas;

(6) determination of movements of migrating eels.

As the large research vessels of many countries are programmed two or three years in advance, it is suggested that the expedition should take place in 1981.

It would be advantageous for a preliminary reconnaissance cruise to take place before the main expedition and it is suggested that the Federal Republic of Germany's research vessel "*Anton Dohrn*" would undertake this in 1979* under the leadership of Dr F.W. Tesch. During this cruise, problems of sampling technique and egg and larval identification will be resolved. Information gained during this cruise would be passed to the participants before the main expedition.

It is proposed that a planning meeting for the 1981 expedition should be held during the Statutory Meeting of ICES in Copenhagen in 1978 (2-7 October).

* This would not exclude other ships from joining the work that year.

RADIOACTIVE WASTE DISPOSAL

Circular dated 21 September 1977 from the Secretary General of ICSU to Unions and Committees

I should like to draw your attention to Decision 11 of the eighth Meeting of the General Committee concerning a proposed study of Radioactive Waste Disposal.

I should be grateful if you would let me know if your organization is interested in participating in this study. If so, it would be appreciated if you would provide me before *1 January 1978* with the names of one or two experts for consideration by the Executive Board when it appoints an *ad hoc* Committee to initiate this survey.

Decision 11 of the ICSU General Committee, September 1977

11. The General Committee supports the proposal that ICSU undertake a survey of the management of radioactive wastes and authorizes the Executive Board to take appropriate action prior to the next meeting of the Committee.

Letter of 4 November 1977 from President, SCOR to Secretary General ICSU

I think it is important that ICSU should recognize that there are many national and international bodies with responsibilities of varying degrees for the management and control of waste disposal, and the monitoring of its effects. It seems hardly desirable for ICSU to become involved in these aspects of the overall subject which is only marginally scientific. I believe it is in the interests of ICSU, however, to consider the scientific aspect of various problems of waste disposal. Whenever environmental questions related to coastal discharges of waste products and to their dumping in the deep sea arise, SCOR's competence is involved.

The monitoring of coastal discharges, although essentially an engineering rather than a scientific activity, has resulted in the generation of significant scientific data. Materials in the discharge can prove to be useful tracers for studying water movements. In turn, the knowledge gained provides guidance for those controlling the discharge, and aids in the appraisal of the impacts to be expected from the discharge.

Uptake of discharged material by marine organisms is extensively studied and the reconcentration factor has received particular attention by marine scientists.

Solutions to problems which could arise from deep ocean dumping are likely to prove much more elusive. Accidental or long-term leakage from supposedly sealed packages is a very real possibility. The processes of dispersion and transport in deep water, biological uptake and interaction with sediments, and physical or biological return to the surface, are at present very poorly understood. Further, the level of research now being conducted on these matters is not such as to produce a rapid increase in understanding.

With respect to the proposed ICSU *ad hoc* Committee, SCOR is prepared to suggest one or two names of experts. However, I should prefer to defer this until the nature of the discussion to be conducted within the Committee is more clearly defined in order to ensure that the most appropriate persons are identified.

CMG REPORT 1977

IOC/IHO Guiding Committee for GEBCO

The fourth meeting was held in UNESCO, Paris, 2–3 May, 1977. Matters discussed included – (a) Publication of the GEBCO glossary of Undersea Feature Terminology, (b) Recommendation of Mauritius Marine Geoscience Workshop concerning standard digitization of bathymetric data for quick dissemination, (c) Report on GEBCO 5th Edition to 11th International Hydrographic Conference, (d) Implications of failure to secure UNDP funding of the International GEBCO Geoscience Unit, and (e) Liaison with the Commission for the Geological Map of the World (CGMW).

The following revised short compilation programme was noted:

- Sheet 5.05 (NW Indian Ocean) – published
- 5.01 (NE Atlantic) – complete, in press
- 5.04 (North Atlantic) – in final stages of compilation
- 5.12 (northern South Atlantic) – compilation complete
- 5.06 (western North Pacific) – expected completion October 1977
- 5.02 (NW Pacific) – expected completion end - 1977
- 5.16 (southern South Atlantic) – expected completion end - 1977
- 5.18 (Southern Ocean) – expected completion March 1978
- 5.03 (NE Pacific) – expected completion mid - 1978
- 5.17 (Arctic) – expected completion end - 1978

Remaining sheets in preparation.

It should be noted that the Canadian Hydrographic Office has committed itself to publication of only the first four in the above list, unless funds are available to adequately support the International GEBCO Geoscience Unit, to be housed in the CHS in Ottawa.

The fifth meeting of the GEBCO committee will be held in Monaco in November, 1978.

ICG

CMG is co-sponsoring with ICG Working Group 8, a symposium on "Crustal Properties Across Passive Continental Margins", Halifax, Nova Scotia, 19–23 June, 1978. This follows from a recommendation of the Mauritius Marine Geoscience Workshop (August, 1976).

CCOP

Dr Edward M. Davin acted as CMG representative at the 13th Session of the Committee for Co-ordination of Joint Prospecting for Minerals in Asian Offshore Areas (CCOP) held in Kuala Lumpur, Malaysia, 22 November – 4 December 1976. He submitted a summary report to CMG. A full report of the session is obtainable from Dr C.Y. Li, CCOP Program Manager, c/o ESCAP, U.N. Building, Bangkok, Thailand. It is hoped that Dr Davin will act as CMG Representative at the CCOP meeting in Manila, 21 September – 4 October, 1977.

Acting on Resolution 76/4 adopted at the plenary assembly of the Commission for the Geological Map of the World held in Sydney, August, 1976, the Secretary-General of CGMW convened a working group to discuss a programme for producing geoscience maps of the sea floor. The group met in Paris on 4 May, 1977 and included the following members of CMG: E.S.W. Simpson, R.A. Scrutton, B.C. Heezen, and A.S. Laughton. It is expected that CMG will continue to act in an advisory capacity throughout the programme of preparation of geological and thematic maps of the sea floor.

Symposia Publication Status

The papers given at a number of symposia organised, sponsored or co-sponsored by CMG in the last few years have been edited for publication in special volumes. The status of these volumes is as follows:

- (a) "Economic Geology of the Sea Floor (excluding fuels)", 25th IGC, convened by E. Seibold to appear in "Contributions to Sedimentology", Stuttgart, 1978.
- (b) "Circum-Antarctic Marine Geology", 25th IGC, convened by D.E. Hayes to appear in "Marine Geology", Vol. 24, No. 5.
- (c) "Synthesis of Deep-Sea Drilling in the Indian Ocean", 25th IGC, convened by C.C. von der Borch and edited by J.R. Heirtzler — no information to hand at time of writing.
- (d) "Structural History of Mediterranean Basins", ICSEM/ICG/CMG symposium, Split, 1976, convened by L. Montadert and edited by J. Biju-Duval and L. Montadert and published in "Editions Technip", Paris, 1977.
- (e) "Active Margins of the Western Pacific", 25th IGC, convened and edited by S. Uyeda to appear in "Tectonophysics", 1978.

THE INTERNATIONAL ASSOCIATION FOR BIOLOGICAL OCEANOGRAPHY (IABO)**Report of Activities, 1977****3rd International Coral Reef Symposium (reported by Professor F.H. Talbot)**

The 3rd International Coral Reef Symposium was held during May 1977 in Miami. The meeting was attended by some 450 scientists and over 200 papers were presented. Topics covered such areas as community structure and dynamics, seasonality, coral reef nutrition, reef growth, reef age, reef plankton, pollution effects and reef management.

Research areas identified as needing special attention in the future were

- (1) A Tropical Plankton Workshop,
- (2) A Handbook on Coral Reef Impact,
- (3) Mapping of World Reefs, and
- (4) Investigation of recent catastrophic destruction of hard coral cover of coral reefs.

It is tentatively planned to hold the next Coral Reef Symposium during 1981 in Israel.

Other Symposia and Working Groups

Correspondence has been exchanged on the possible need for a symposium on Plankton indicators. At present, it appears that such a symposium might be best held as part of some larger oceanographic meeting to be decided in the future. Dr Raymont (U.K.) has initiated correspondence on the need for a panel to discuss the biochemistry of zooplankton. Dr Snedaker (USA) has been appointed chairman of the SCOR/UNESCO Work Group on Mangrove Ecology and this group is expected to meet in the near future.

Communications

The list of IABO correspondents has been increased by the inclusion of Malaysia. A newsletter has been sent to all national correspondents and information on national activities has been requested. Opinions from IABO have been sought on a number of topics which are currently under study. These include the ecological impact of a Sea Level Canal in Central America, an Atlas of the Zooplankton of the Southwestern Atlantic Ocean and possible affiliation with the International Seaweed Association.

INTERNATIONAL ASSOCIATION OF METEOROLOGY AND ATMOSPHERIC PHYSICS

Activities related to SCOR during 1977

A three day Symposium on Air—Sea—Interaction was held at the IAMAP/IAGA Joint Assembly, Seattle, August 22 to September 3. About 45 papers were presented about half of which were devoted to an extensive review of the Air Mass Transformation Experiment (AMTEX), a subprogram of GARP. Some papers were also concerned with results of the USSR National Expedition "Typhoon-75" and planning for the JASIN Expedition.

In the course of other Symposia during the Assembly, problems of gas exchange between ocean and atmosphere were discussed in relation to the global cycle of CO_2 and N_2O .

Plans are now being finalized for Canberra 1979. There will be seven joint symposia on subjects related to the oceans in which IAMAP participates or takes the lead together with IAPSO and other associations.

IAMAP established a new Commission on Climate (Chairman: R. Newell, USA) at the Seattle Assembly to cover the important interdisciplinary field of climate variations and climate dynamics including the role of the oceans.

INTERNATIONAL ASSOCIATION FOR THE PHYSICAL SCIENCES OF THE OCEAN

Report on the Activities, 1977

The seven IUGG Associations met in Durham, England, in August 1977 to make plans for the next IUGG General Assembly, which is scheduled to be held in Canberra, Australia, from 2–15 December 1979. IAPSO's scientific program will consist of the following:

IAPSO Symposia Topics

1. Small Scale Motion and Structures in the Ocean
2. Intermediate Scale Motion and Structures in the Ocean
3. Large Scale Motion and Experiments in the Ocean
4. Acoustic Stratigraphy of the Deep Oceans
5. Shelf Break Circulation and the Exchange Processes
6. Symbols, Units and Nomenclature in Physical Oceanography
7. Radiant Energy in the Sea
8. Marine Pollutant Transfer Processes
9. Remote Sensing of Oceanographic Variables
10. Ocean Geochemistry
 - Fluxes and Chemistry of Particulate Matter in the Ocean
 - Geosecs Results in the Indian Ocean
 - Nature and Origin of Cherts
 - Ocean Crust and Sea Water Interaction
11. Physical, Chemical and Geophysical Oceanography

Inter-Association Symposia Co-Sponsored by IAPSO

1. Geochemical Evolution of the Atmosphere, Oceans and Crust
2. Sea Level, Ice Sheets, and Climatic Change
3. New Techniques in Geophysical Instrumentation
4. Problems of Coastal and Estuarine Zones
5. Origin and Structure of the Southern Ocean
6. Relationship between Variation in the Earth's Rotation and Geophysical Phenomena
7. Evolution of the Upper Mantle
8. Recent Crustal Movement
9. Volcanism and Climate
10. Ocean and Atmospheric Boundary Layers
11. Geodetic Applications to Oceanography
12. Tidal Interaction
13. The margins of the Indian Ocean

Circulars giving more details will be issued early in 1978.

Other IAPSO Meetings

1. IAPSO co-sponsored an IUTAM/IUGG International Symposium on Monsoon Dynamics, held in New Delhi, India 5–9 December 1977. It was attended by approximately 100 Indian scientists and 50 scientists from other countries.
2. IAPSO is co-sponsoring an International Symposium on Interaction of Marine Geodesy and Ocean Dynamics, to be held in Miami, Florida 10–12 October 1978.
3. IAPSO is co-sponsoring a GATE symposium on Oceanography and Surface Layer Meteorology, to be held in Kiel, Germany 16–20 May 1978.
4. IAPSO is sponsoring an Ocean Turbulence Workshop to be held in Kiel, Germany, in the spring of 1979.

Other Activities

1. IAPSO Working Group on Symbols, Units and Nomenclature in Physical Oceanography plans a scientific session for the General Assembly, and will issue a report on its proposals for use of SI units prior to the Assembly.
2. IAPSO Committee on Tides and Mean Sea Level plans scientific sessions for the General Assembly and is preparing a report on useful results derived from pelagic tide records.

Letter from Dr W.A. Hovis
Chairman, Nimbus Experiment Team
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Environmental Satellite Service
Washington, D.C. 20233

22 December 1977

We are endeavoring to alert the oceanographic research community that beginning in about August 1978 ocean color measurements will be made with the Coastal Zone Color Scanner (CZCS), which will be aboard the NASA Nimbus G spacecraft. The CZCS is the first sensor specifically devoted to ocean color measurements. It is a multi-spectral scanner designed to study processes in coastal zones by remote sensing of both color and temperature. The instrument is not intended to operate continuously, but only on command. A brief description of the CZCS is available to acquaint you with the history behind its development and its characteristics.

This letter is an effort to organize the CZCS oceanographic investigations to function in conjunction with those oceanographic investigations scheduled to be performed by institutional scientific researchers in the USA, as well as those of foreign countries. We would like to locate and hear from all researchers who are scheduling oceanographic missions during the second half of 1978 and in 1979.

Interested institutions, or investigators, should provide information to this office concerning: the schedule for their research vessels, including geographic locations; date and time of missions; types of measurements to be taken; and any other pertinent information that may assist in judging the feasibility of CZCS operation over their scheduled vessel research areas.

Data from the CZCS, processed to calibrated radiance or equivalent blackbody temperature, will be available to investigators through the Environmental Data Service of NOAA at a reasonable cost. The data will be available on an unrestricted basis after initial validation is accomplished, but only for limited areas because of spacecraft power limitations. We will make every effort to operate the sensor over areas where oceanographic investigations are underway. but we need your help to identify places and times.

Please let us know if you have knowledge of any other institutions or researchers in the United States, or in foreign countries, who have research vessel programs, and may be interested in the CZCS.

FUTURE MEETINGS OF SCOR

and affiliated organizations

Date	Place	Meeting
1978		
March	Miami	<i>Ad hoc</i> meeting on practical salinity scale (WG 10)
11–14 April	Las Palmas	during IOC/FAO/ICES Symposium on the Canary Current
		WG 55 – Prediction of El Niño
		WG 56 – Equatorial Upwelling Processes
		Editorial Group physical aspects of coastal upwelling
13–14 April	Honolulu	Pacific Panel WG 47 – Oceanographic Programme during FGGE
28–29 April	Warnemünde	WG 42 – Pollution of the Baltic
28 April	London	CMG meeting
16–18 May	Costa Rica	WG 60, Mangrove ecosystems.
16–20 May	Kiel	SCOR/IAPSO/IAMAP/WMO/IOC/DMG/GATE Symposium on Oceanography and Surface Layer Meteorology
” (during)		WG 43 – Oceanography related to GATE (final meeting)
” ”		GATE Atlas Editorial Board
		Physical Panel WG 56 – Equatorial Upwelling Processes
22–24 May	Paris	Atlantic Panel WG 47 – Oceanographic Programmes during FGGE
31 May – 2/3 June	Kiel	WG 54 – Living Resources of the Southern Oceans
19–23 June	Halifax NS	CMG Symposium on Crustal properties across passive margins
3–5 September	Tallin	WG 57 – Coastal and Estuarine Regimes
5–7 September	Bergen	WG 58 – Arctic Ocean Heat Budget
11–13 September	Paris	WG 10 – Oceanographic tables and standards
25–26 September	Copenhagen	WG 51 – Evaluation of CTD Data

13-17/18 November	Brest	Fourteenth SCOR General Meeting with discussion on Oceanic Fronts
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Meetings approved in 1978 – details to be arranged

WG 44 – Ocean Atmosphere Materials Exchanges
WG 55 – Prediction of El Niño
(second meeting in 1978)

Other possible meetings in 1978

WG 61 – Sedimentation Processes at Continental Margin
WG 62 – Carbon Budget of the Ocean
SCOR Committee on Climatic Changes and the Ocean

1979

March		Workshop on River Inputs to Ocean System (WG 46)
March		WG 59 – Mathematical Models in Biological Oceanography
April	Woods Hole	ICES/SCOR Symposium on Early life history of fish
April/May	Kiel	IAPSO/SCOR Workshop on Oceanic Turbulence
May/June		SCOR Executive Committee – 22nd meeting
2-15 December	Canberra	IUGG General Assembly: IAMAP IAPSO meetings and symposia – some with CMG WG 57 – Coastal and Estuarine Regimes
November/ December	Australia?	IAPSO Symposium on Fluxes and Composition of particulates in the Ocean
to be arranged		WG 52 – Estimation of Micro-nekton abundance.

1980

January		SCOR Executive Committee
7-17 July	Paris	International Geological Congress: CMG SCOR/CMG Symposium on evolution of the South Atlantic
September		Fifteenth SCOR General Meeting

ABBREVIATIONS

ACMRR	Advisory Committee on Marine Resources Research (of FAO)
AIDJEX	Arctic Ice Dynamics Joint Experiment
AMTEX	Air Mass Transformation Experiment (GARP)
ASFIS	Aquatic Science and Fisheries Information System (FAO/IOC)
BIOMASS	Biological Investigations of Marine Antarctic Systems and Stocks
CAS	Commission on Atmospheric Sciences (of WMO)
CCPS	Comisión Permanente del Pacifico Sur
CER	Coastal and Estuarine Regimes (WG 57)
CINCWIO	Cooperative Investigation on the North and Central Western Indian Ocean (IOC)
CINECA	Cooperative Investigation of the Northern Part of the Eastern Central Atlantic
CMG	Commission on Marine Geology (of IUGS)
COG	Committee on Oceanography and GARP (of SCOR)
COSPAR	Committee on Space Research (of ICSU)
CSK	Cooperative Study of the Kuroshio (IOC)
CTD	Conductivity Temperature Depth
ECOR	Engineering Committee on Oceanic Resources
ERFEN	Estudio Regional del Fenómena 'El Niño'
FAO	Food and Agriculture Organization of the UN
FGGE	First GARP Global Experiment
FIBEX	First BIOMASS Experiment (WG 54)
GAO	GARP Activities Office (at WMO)
GARP	Global Atmospheric Research Programme (of WMO/ICSU)
GATE	GARP Atlantic Tropical Experiment
GEBCO	General Bathymetric Chart of the Ocean
GIPME	Global Investigation of Pollution in the Marine Environment
IABO	International Association for Biological Oceanography (of IUBS)
IAGA	International Association of Geomagnetism and Aeronomy (of IUGG)
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)
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
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)
IHO	International Hydrographic Organization
IIOE	International Indian Ocean Expedition
IMCO	Intergovernmental Maritime Consultative Organization
INDEX	Indian Ocean Experiment (GARP)
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Exchange (Working Group of IOC)
IPSCAM	International Programme for Study of Climate and Man
ISOS	International Southern Ocean Studies
IUBS	International Union of Biological Sciences (of ICSU)
IUCRM	Inter-Union Commission on Radio Meteorology (ICSU)
IUGG	International Union of Geodesy and Geophysics (of ICSU)
IUGS	International Union of Geological Sciences (of ICSU)

IUPAC	International Union of Pure and Applied Chemistry (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
MIT	Massachusetts Institute of Technology (USA)
MODE	Mid-Ocean Dynamics Experiment
MONEX	Monsoon Experiment (subprogramme of GARP)
NEADS	North East Atlantic Dynamics Studies (subgroup of WG 34)
NESS	National Environmental Satellite Service (USA)
NIRO	Scientific Research Institute for fisheries and oceanography (USSR)
NOAA	National Oceanographic and Atmospheric Administration (USA)
NORPAX	North Pacific Experiment
OAMEX	Ocean-Atmosphere Materials Exchanges (WG 44 of SCOR)
OWS	Ocean Weather Ship
POLEX	Polar Experiment (related to GARP)
RIOS	River Inputs to Ocean Systems
ROMBI	Results of Marine Biological Investigations (report form)
ROSCOP	Report of Observations or Samples Collected by Oceanographic Programmes
SAB	Scientific Advisory Board (of IOC)
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)
SIBEX	Second BIOMASS Experiment (WG 54)
STD	Salinity Temperature Depth recorder
TWOS	Tropical Wind Observing Ships (FGGE)
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VAP	Voluntary Assistance Programme (IOC)
WDC	World Data Centre
WHO	World Health Organization
WHOI	Woods Hole Oceanographic Institution (USA).
WMO	World Meteorological Organization
XBT	Expendable Bathy Thermograph