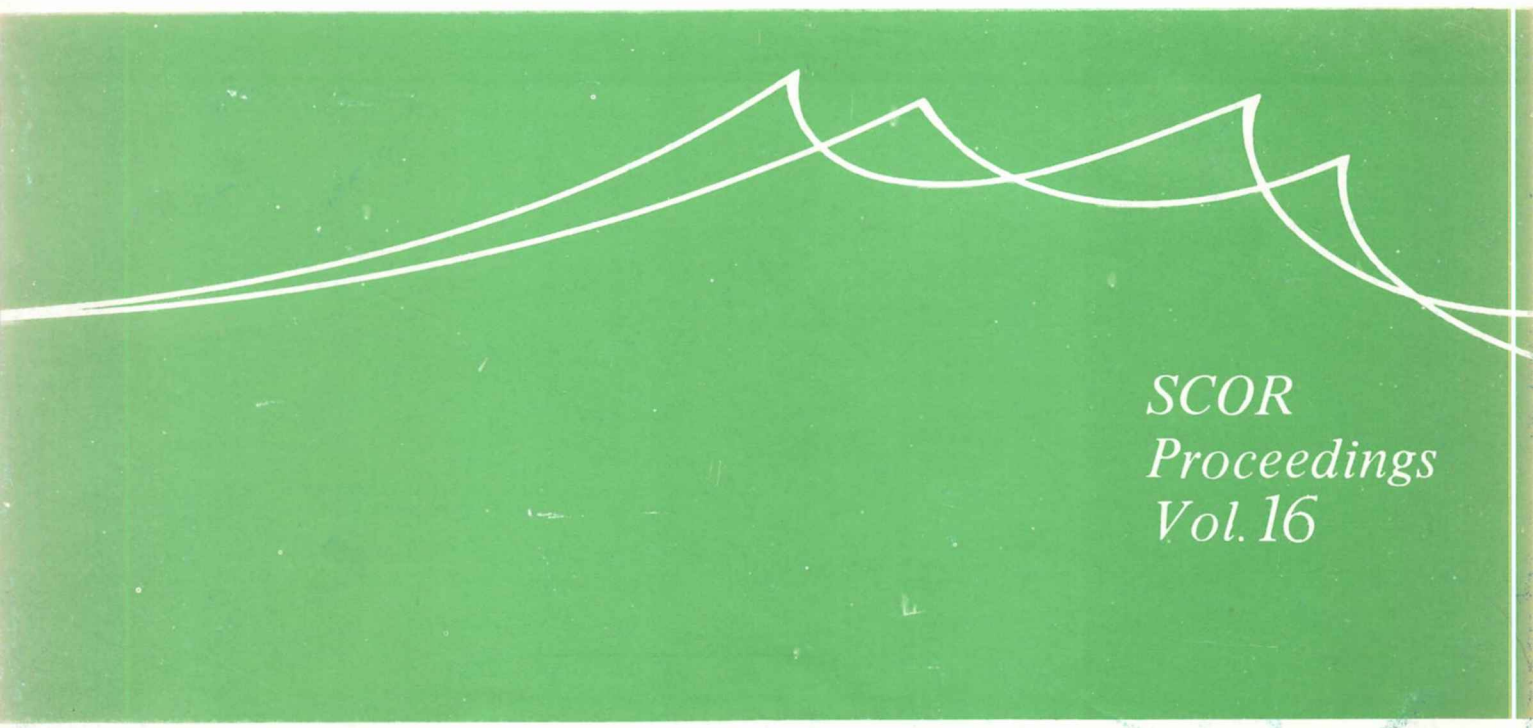
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

Scientific Committee on Oceanic Research

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PROCEEDINGS
OF THE
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

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Contents

Report of the Twenty Second Meeting of the SCOR Executive Committee, Kiel, FRG – 22 to 25 January 1980

The twenty second meeting of the SCOR Executive Committee was held in the Christian-Albrechts University, Kiel, Federal Republic of Germany, from 22 to 25 January 1980, with the President, Dr K.N. Fedorov, in the Chair.

The participants, see Annex I, were welcomed to Kiel by Professor G. Hempel on behalf of the University of Kiel and the Deutsche Forschungsgemeinschaft. The President of SCOR welcomed particularly the representatives of National Committees, the corresponding organisations, IOC, UNESCO and ICES.

On 23 January a symposium was held in the Institute für Meereskunde on future trends in international and interdisciplinary marine science.

1.0 Organisation and finance

1.1 Membership

National Membership

Early in 1979 Turkey accepted the invitation to become a member of SCOR and elected to adhere in Category I. The Turkish nominated members of SCOR are Professor Dr Remzi Geldiay, Professor Dr Hakki Oranc and Professor Dr T. Balkas.

The Netherlands National Committee has nominated a third member of SCOR – Dr J. van der Land.

The Indian National Committee has appointed Dr S.Z. Qasim as a nominated member of SCOR in place of Dr Raghu Prasad.

Affiliated Organisations

Professor D. Lal (India) has become an 'ex officio' member of the SCOR Executive Committee as President of IAPSO, in place of Dr R.W. Stewart.

Dr W.L. Godson (Canada) has become an 'ex officio' member of the SCOR Executive Committee as President of IAMAP, in place of Professor C. Junge.

Represented Organisations

IUTAM has appointed Professor F.N. Frenkiel (USA) as its representative on SCOR.

IUPAC has invited Dr E.I. Hamilton (UK) to effect liaison with SCOR – IUPAC did not consider it necessary to have formal representation on SCOR.

Status of Scientific Rapporteurs

It was agreed to recommend to the General Meeting of SCOR in September 1980 tha SCOR Scientific Rapporteurs be made members of SCOR in Category 2 and that the SCOR Constitution be modified accordingly.

1.2 Publications

Supplement to SCOR Proceedings 1979

A *Supplement to SCOR Proceedings* containing addresses of National Committees and information about membership of SCOR and its working groups, the SCOR Constitution, Procedures for Working Groups and other details as at mid 1979 was issued in October 1979 with amendments notified to that date. A second amendment sheet will be issued with SCOR Proceedings Vol 16 No. 1.

UNESCO Technical Papers

No 30, containing the report of the meeting of WG10 in September 1978, was published in 1979.

No 31, expected to be published in February 1980, will contain the results of a UNESCO initiated world-wide survey of coastal lagoon research.

No 32, expected to be published about May 1980, will contain the report and guidelines from the UNESCO/IABO/Duke University Seminar on Coastal Lagoons, held in September 1978 and reports on present and future coastal lagoon research.

Plans for future issues in this series include:

The report by Drs Jeffrey and Lorenzen on their intercalibration tests of chlorophyll and oceanographic methodology.

Background papers on the studies leading to the proposals for a new practical salinity scale and a new equation of state for seawater.

Proposals by SCOR that the full reports of the 1979 meetings of WG44 and WG62 be printed in this series.

UNESCO Monographs on Oceanographic Methodology

No 6 *Phytoplankton Methods* – published 1979.

No 7 *Mathematical Models in Biological Oceanography.* The manuscript from WG59 is about to be transmitted to UNESCO.

Future Monographs

Mangrove Methods – the first draft was expected during 1980 following the meeting of WG60.

Photosynthetic Pigments in seawater – no information was available on progress with the revision of Monograph No 1.

Estimation of Micro-Nekton Abundance – a manuscript was expected to result from the April 1980 workshop being organised by WG52.

Salinity Methods – it was not expected that work on this monograph would commence until 1981.

A monograph on the identification of cephalopod beaks was expected to result from a proposed workshop on this subject.

IOC Workshop Report Series

No 21 of IOC Workshop Report Series contains the report of the IAPSO/SCOR/IOC Workshop on *Turbulence in the Ocean*, May 1979. IOC was requested to ensure that distribution included all SCOR National Committees.

University of Bergen Report Series

Report No 52 of the Geophysical Institute of the University of Bergen, published in June 1979, contains the report of SCOR WG58. Copies have been distributed to National Committees and to members of the Executive Committee.

JOC Publications

The GARP Activities office of WMO has now published and distributed the report of the November 1978 JOC/SCOR Specialist Meeting on *The Role of the Oceans in the Global Heat Budget*.

The GARP Activities office has published and distributed the final report of SCOR WG43 on *Oceanography Related to GATE*.

Other Publications

Papers from the 1977 *JOC/SCOR Study Conference on General Circulation Models of the Ocean and Their Relation to Climate* were published in *Dynamics of the Atmosphere and Oceans* in May 1979.

Papers from the *GATE Symposium on Oceanography and Surface Layer Meteorology* had been refereed and were being prepared for publication as two special issues of *Deep Sea Research*.

The Editor of *Progress in Oceanography* had indicated to Professor Woods his agreement to publish the papers from the 1978 SCOR *Interdisciplinary Discussion on Oceanic Fronts*, probably as individual papers during 1980 which might later be brought together in one cover. Professor Woods had compiled all the manuscripts and was in the process of finalising his review of physical aspects.

Distribution of Publications and Feedback

In a general discussion on reports of symposia, workshops etc. and recommendations arising therefrom it was agreed that more efforts should be made to obtain comments and reactions from the scientific community. Effective distribution was considered to be most important in this process. Chairmen were encouraged to prepare recommended distribution lists for the full reports and, where appropriate, submit brief reviews of the results of such workshops or symposia for publication in the scientific literature. National Committees should, when they receive such reports, attempt to ensure that they are made available to scientists active in the field. UNESCO published lists of available publications in *International Marine Science Newsletter*, which by inviting requests for copies had proved to be an aid to distribution.

1.3 Budget and Finance

An interim financial statement for 1979 was considered; the final statement for 1979 is given as Annex 2.

At the SCOR General Meeting in 1978 an "austerity budget" of $67500 was prepared which would exhaust the total amount of money for 1979. At the same time, however, recommendations were adopted to increase revenues for that year (SCOR Proc. 15 page 9). One recommendation was a request to double national contributions; the other asked for increased support from ICSU and intergovernmental bodies.

At the Executive Meeting in Kiel the Finance Committee consisting of Professors Postma (Chairman), Hempel and Wooster reported that these requests had had considerable success. National contributions had increased by $24000. The IOC contract was raised by 25%, yielding an extra $3000; the UNESCO contract by 15%, giving an extra $1500. ICSU from its UNESCO subvention had added $12000 and $5000 from its own funds. Including refunds and some payments of arrears of contributions the increases to SCOR income in 1979 had enabled the Executive to agree to support certain activities beyond the austerity budget.

The Finance Committee was appreciative of the positive reaction to SCOR's requests for additional income. At the same time it was disappointed by the fact that some countries showed a considerable arrear in payments notwithstanding repeated reminders.

In agreeing to the increases, some National Committees had pointed out the difficulties they had faced in obtaining the approval of their governing bodies for large increases and had requested that, in future, SCOR consider adjusting the levels of contributions more frequently, to offset the effects of rising prices, regardless of the level of reserve funds held by SCOR. This request was referred to the General Meeting of SCOR. The percentage adjustment of levels of national contributions to ICSU might be taken as a suitable guideline.

For 1980 guaranteed income can be predicted at $103500. An ICSU grant of $12000 is expected, of which $8000 was allocated for CCCO and $4000 for BIOMASS. Including the balance of 1 January about $145500 will be available for 1980. On this basis the finance committee prepared a budget leaving a reserve of about $20–25,000 the end of this year. This budget was adopted.

1.4 Future Structure and Working Procedure for SCOR

1. *The Role of National Committees*

The SCOR Executive Committee again stressed the need for greater input to SCOR affairs from National Committees particularly in identifying subjects warranting international attention by SCOR. SCOR was intended to serve the needs of scientists and it was particularly important for National Committees to bring the existence of SCOR and its potential for helping them to the attention of younger scientists. The next JOA should be used to demonstrate this.

It was agreed that greater use might be made of National Committees in seeking names of possible scientists to serve on working groups although it was pointed

out that National Committees were already entitled to nominate corresponding members to all groups, although few ever did so. Additionally, SCOR might, where desirable, solicit the assistance of National Committees in ensuring that WG members are provided with adequate facilities, especially where experimental work associated with WG activity is needed.

2. *Continuity of the Executive Committee Beyond 1980*

Although all three Vice-Presidents were eligible for re-election for one further term it was suggested that some rotation in September 1980 would be desirable both to bring new blood to the Executive Committee and to stagger replacement of Officers although some continuity other than the past President was desirable.

Taking into account a number of suggestions regarding possible future officers it was agreed to recommend to the General Meeting in September 1980 that Professor H. Postma be appointed Chairman of the Nominations Committee. Meanwhile, all members of the Executive Committee and all National Committees were invited to convey to Professor Postma any suggestions they may care to offer.

3. *SCOR Secretariat*

Following a suggestion at the 1978 General Meeting that in 1980 SCOR should consider its future long-term administrative arrangements, the Canadian National Committee, with the approval of the Canadian National Research Council, had been considering the possibility of Canada offering to provide host facilities for the SCOR Secretariat. The Dalhousie University of Halifax, Nova Scotia had subsequently offered to provide accommodation at no cost to SCOR.

The SCOR Executive accepted with sincere appreciation the provisional offer from the Canadian Committee and undertook to make available up to US $20000 p.a. for salaries, post and telegraph and routine office expenses. The Canadian SCOR Committee agreed to confirm their offer in due course after further discussions with The National Research Council and to suggest the name of a person or persons who might be appointed as Executive Secretary of SCOR. It was agreed that the Executive Committee be consulted about the proposed appointment after which the President should arrange that the Executive Secretary designate attend the General Meeting in September.

2.0 Subsidiary Bodies

2.1 Arising from Former Working Groups

No progress was reported on the preparation of the review of physical aspects of coastal upwelling. A message from the Executive Committee was despatched to Drs J.J. O'Brien and R.L. Smith conveying to them a sense of urgency of the task and asking

them to use the opportunity of the WG56 meeting in Seattle in February 1980 to discuss with the other members of the Editorial Committee present a realistic timetable for the preparation of the review.

2.2 Existing Working Groups

WG10 ***Oceanographic Tables and Standards*** (with ICES, IAPSO and UNESCO)

A meeting of the group was held in September 1978 and an ***ad hoc*** meeting during the IUGG General Assembly in Canberra. A report of the Chairman is shown in Annex III.

The recommendation as to the definition of a practical salinity scale was adopted at the General Assembly of IAPSO and at its last Statutory Meeting ICES had also recommended its acceptance. IAPSO indicated that they would accept the SCOR decision as to the adoption of the new equation of state of seawater at one atmosphere, the definitive equation for which would be forwarded to SCOR in time for consultation before the General Meeting in September 1980.

The SCOR Executive welcomed these developments and, in view of IAPSO Resolution 6 asked its Secretary to consult with the Chairman of WG10 and such others as seemed appropriate as to the optimum way of introducing the new equations to users. The Secretary was asked to discuss his proposals with IAPSO and ICES before September 1980. The new equations are also relevant to the IAPSO Working Group on Symbols Units and Nomenclature as well as to some other SCOR Working Groups.

It was agreed that a further meeting of the present Working Group was desirable; it was expected that the various sponsors of the group would contribute to the costs in the same proportions as for earlier meetings. It was essential that the report and recommendations of the meeting, particularly concerning future functions and membership, be submitted to the General Meeting of SCOR in September 1980.

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

The working group is preparing an authoritative volume on the importance of mesoscale eddies in marine physics, chemistry, biology, geology and geophysics. To help in its preparation Dr W.R. Holland (NCAR) and Dr R.C. Bernstein (SIO) had accepted the President's invitation to join the group. Others have agreed to be co-opted to the working group to deal with particular aspects of the work.

A working meeting on their project was held in Canberra in December 1979 (Annex IV) when progress was reviewed and additional authors suggested. The volume is expected to be published in 1981 as a solid bound volume of a review journal or as a book.

The working group will organize, in conjunction with the final symposium of the US–USSR POLYMODE program, a companion general symposium on eddies in marine science, emphasizing a review of a decade of results for non-specialists, global summaries, implications and applications. It also plans to meet, following the POLYMODE Symposium, to assess progress and recommend directions for further research into eddy dynamics.

WG42 ***Pollution of the Baltic*** (with ICES)

The report of the last meeting of the group in January 1979, has been published by ICES as paper number CM.1979/E:2.

The next meeting will be held in Copenhagen from 20 – 22 February 1980. The main topics to be discussed will be how to process the data from BOSEX (1978) and to consider whether another collaborative experiment will be needed. Mr H. Tambs-Lyche reminded the SCOR Executive Committee that the results of research programmes initiated by WG 42 were of relevance to the control of pollution, under the auspices of the Commission on Protection of the Marine Environment of the Baltic (the Helsinki Commission), which had recognised ICES as one of its scientific advisers. WG 42 also contributed to other groups which were considering ways to monitor trends in pollution and their effects on organisms.

The Chairman of the group should be asked to provide a brief summary of the scientific aspects of the groups' activities for the SCOR General Meeting in September 1980.

WG44 ***Ocean-Atmosphere Materials Exchange*** (with IAMAP, IAPSO)

A summarised report by the Chairman on the meeting of the group in November 1979 (Annex V) was received. It was recommended that the full report and recommendations, when available, be published in the UNESCO series *Technical Papers in Marine Science*.

The proposal of WG44 to organise a workshop on the air/sea interface was approved, but it was urged that an appropriate title be found, 'Air/Sea Interaction' being considered insufficiently specific. The SCOR Executive Committee suggested to WG44 that it might be beneficial to hold the workshop in conjunction with the IAMAP Assembly symposium on the role of the ocean in atmospheric chemistry in Hamburg in 1981 (see item 4.1). In planning such a workshop the interests of IOC, the JSC for the WCRP and ICES should be taken into account. The Chairman was asked to communicate with IAMAP regarding this proposal.

WG46 ***River Inputs to Ocean Systems*** (with ECOR, IAHS, ACMRR, UNESCO, CMG, IAPSO and IABO)

The workshop on *River Inputs to Ocean Systems* was held in Rome in March 1979. Editing of the papers was being undertaken by Dr J.M. Martin and Mr R.C. Griffiths. IOC/UNESCO would arrange for their publication as a single volume. As this publication will carry the name of SCOR, IOC should be requested to submit a copy of the edited text to Professors Postma, Simpson and Goldberg for their approval on behalf of SCOR.

Meetings of WG46 were held at the time of the workshop, the report of which is given in Annex VI.

It was agreed to invite the Chairman to proceed, in correspondence with his members, to develop proposals for monitoring programmes in river mouths and to develop further proposals for future action by the group. In this connection the attention of the Chairman should again be drawn to the recommendations of the 1970 *Marine Geoscience Workshop* which had been a factor in establishing the group and which had

proposed specific process-oriented workshops on subjects such as estuarine mixing and sediment transport. To assist in developing these future plans it was suggested that the Chairman co-opt Dr J.D. Burton as Vice-Chairman.

WG47 ***Oceanographic Programmes During FGGE*** (with IAPSO and IAMAP)

The Indian Ocean Panel of WG47 met at Woods Hole in October 1979 and an account of the work was presented (by Dr Luyten and Dr Fieux) at the General Assembly of IUGG in Canberra, December 1979. A note on the physical oceanographic problems of the Western Indian Ocean was prepared for the IOC.

The Indian Ocean Panel will meet again in Wormley (UK) in June 1980, the Atlantic Ocean Panel in Paris (France) in June 1980, and the Pacific Ocean Panel will meet in La Jolla (USA) in August 1980.

The Chairman should be invited to present to the SCOR General Meeting in September 1980 a brief account of what had been achieved by the oceanographic programmes during FGGE and the Group's proposals for further evaluation of this work.

A final FGGE oceanography workshop is expected to be held in April 1981, in Venice (Italy).

If the results of FGGE were included in the programme for the 1982 JOA, WG47 should be asked to plan that symposium.

WG51 ***Evaluation of CTD Data*** (with IAPSO)

The plans of the group to meet in Rostock (DDR) in Spring 1981 were approved. The SCOR Executive Committee wished to stress the urgency of the tasks entrusted to the group in connection with the necessity to standardize CTD procedures as soon as possible, The SCOR Executive therefore encouraged the Chairman of the Group and its members to collect from national laboratories any available information on technical and methodological problems encountered in CTD operations and data handling.

WG52 ***Estimation of Micro-Nekton Abundance*** (with IABO, ICES, SCAR and ACMRR)

Most of the euphausiids sampled on the SCOR-sponsored cruise of the *Johan Ruud*, 19 – 25 February 1979, in three fjords of northern Norway, have been enumerated and measured by the Institute for Marine Research University of Kiel. The results comparing numbers per m^3 and sizes of euphausiids caught in five different nets (ranging in mouth opening from 0.024 to 100 m^2) and comparisons between acoustical measurements and net samples will be presented at the WG52 symposium.

It was reported that preparations for a symposium on the *Assessment of Micronekton Abundance* in Idyllwild, USA, 28 – 30 April 1980 were proceeding. The tentative programme for this symposium is given in Annex VII. As reported earlier, it was expected that WG52 would prepare a monograph on methods for the UNESCO series as well as advising the BIOMASS programme planners.

WG54 *Living Resources of the Southern Oceans* (with SCAR, ACMRR and IABO)

A report from the Chairman on BIOMASS planning activities in 1979 was received (Annex VIII) and the proposed planning activities in 1980 necessary to prepare adequately for the first BIOMASS Experiment (FIBEX) were noted. It was clear that (next to climate research) BIOMASS would be one of the largest programmes in marine science for some years to come. Financing the activities considered necessary to ensure adequate planning of the exercise and processing the results was totally beyond the resources available to the sponsoring bodies, despite the welcome support from IOC and FAO. The SCOR Executive Committee endorsed warmly the scientific value of the proposed programme, which concentrated solely on furthering the understanding of the Antarctic marine ecosystem, and emphasised the urgent need for governments of participating scientists to provide support for planning the collaborative studies. Those governments active in Antarctic affairs were in the process of negotiation of a Convention for the Conservation of Antarctic Marine Living Resources which incorporated an ecosystem approach to the problem. Without the scientific data it would be impossible to evolve effective management.

The SCOR Executive Committee was anxious to take whatever action it could to impress upon governments the needs for effective international planning but considered it more appropriate for any approaches to these governments to be made by SCAR, through its National Committees. It was agreed to convey to SCAR the support of SCOR for any actions SCAR may consider appropriate.

IOC had agreed to provide for FIBEX some financial support, within the limitations of available funds, and practical assistance and advice with data handling problems. A request from IOC for an estimate of support required for FIBEX planning was referred to the Chairman of the working group for attention.

The SCOR Executive Committee considered that the present title of WG54 did not reflect adequately the objective of the BIOMASS programme which was the scientific study of the marine ecosystem and decided to suggest to the other sponsors of the group that the title be changed to *Ecosystem Research in the Southern Oceans.*

IOC had decided to retain its Southern Oceans Group under a new title *IOC Programme Group for the Southern Oceans.* The terms of reference are to be revised and the next meeting will be held in 1981.

WG55 *Prediction of El Niño* (with IAMAP and IAPSO)

The report of the meeting held in December 1978 is given in Annex IX. The proposal of the Chairman to have another full meeting of the group in 1980 was approved and it was suggested that for economic reasons the meeting should be held in Florida, USA. The role of this group in assisting CCCO with respect to studying the ocean influence on the world climate was emphasised.

WG56 *Equatorial Upwelling Processes* (with IAPSO, IAMAP and IABO)

The group plans to have a meeting of its both panels in Seattle, USA, 11 – 14 February 1980. The main items of the agenda will be:

Review of recent (unpublished) results of equatorial upwelling research made during 1976–1979.

- Report of SCOR WG55/El Niño Meeting.
- Report of the 8 – 10 October meeting of CCCO.
- Status of satellite SST Data.
- Status of directory of equatorial upwelling researchers.
- The reviews of equatorial upwelling research at the IUGG/Canberra meeting.
- Review of the biological aspects of the equatorial upwelling.
- Equatorial upwelling Newsletter.
- SCOR WG56 sponsored equatorial upwelling experiment.

Professor W.S. Wooster was requested to transmit to the group the recent resolution of IAPSO concerning the promotion of research on equatorial dynamics together with the request from the SCOR Executive Committee to look into the matter and decide whether wider cooperation or any specific step in this direction should be recommended (see also item 4.1).

Dr M. Vinogradov has writen a review of the ecosystem of the equatorial upwelling for the monograph *Ecosystems of the Oceans* edited by Dr A. Longhurst. It might furnish the basic biological material for the preparation of the review which the WG is intending to issue.

WG57 ***Coastal and Estuarine Regimes*** (with IAPSO, UNESCO and ECOR)

The Chairman of the group submitted a report (Annex X) in which he informed the Executive Committee of the progress with the preparation of eight monographs on *Coastal and Estuarine Regimes*, to be published by The American Geophysical Union. The Group organised a symposium on coastal and estuarine problems at the General Assembly of IUGG in December 1979 with some financial support from UNESCO. Plans of the group to have its next meeting in 1981 were approved.

WG58 ***Arctic Ocean Heat Budget*** (with IAPSO)

The Executive Committee of SCOR welcomed the information that the report of the working group had been published and distributed to National Committees and members of the Executive Committee. It was recognized that the nature of the report and its importance for planning a proposed international Eurasian Basin Experiment (EUBEX) required further elaboration of various aspects of the problem as reviewed in the report.. This could best be done by the group through correspondence on the basis of comments on the report which should be solicited by the Group Chairman in consultation with the President of SCOR and other members of the Executive Committee.

WG59 ***Mathematical Modelling in Biological Oceanography*** (with IABO)

The report of the meeting of the group held in February 1979 is given as Annex XI. It was reported that the material for a UNESCO monograph had been compiled, had

been reviewed by Dr J. Paloheimo and Dr P.B. Tett and that Professor Currie was making a final check before passing it to UNESCO for printing.

The plans of the working group to hold a symposium in 1981 on *Flows of Energy and Materials in Marine Ecosystems: Theory and Practice* were approved and it was agreed to provide up to $3000 towards a planning meeting to be held in 1980.

WG60 ***Mangrove Ecosystems*** (with IABO and UNESCO)

Dr A. Sasekuma (Malaysia) had accepted an invitation to serve on this working group. Dr Steyaert informed the meeting that the group would meet in Fiji or New Guinea in 1980 with support from UNESCO.

WG61 ***Sedimentation Processes at Continental Margins*** (with CMG and ECOR)

Membership has been established as follows:

Dr I.N. McCave – Chairman (UK)

Dr G. Almagor (Israel)
Dr C.S. Hollister (USA)
Dr K.J. Hsu (Switzerland)
Professor F. Sternberg (USA)
Professor C.C. von der Borch (Australia)
Dr F. Werner (FRG)

A report of the activities by the Chairman is given as Annex XII. The groups proposal to increase the membership by four was approved.

The proposal by WG61 to arrange a symposium on *Sedimentation Processes of Continental Margins* as part of the 1982 JOA was commended to the JOA programme planning group although the SCOR Executive Committee doubted whether two full days could be allocated.

It was noted that the WG was actively engaged in preparing a review of existing knowledge of sedimentation processes at Continental Margins and was negotiating for this to be published in the Technical Series of the Woods Hole Oceanographic Institution. These proposals were supported but it was agreed that the working group be asked to request the publishers to provide copies for SCOR National Committees and for a list, to be prepared by the group, of active workers in the field.

Because of their interest in this subject, it was agreed to invite ECOR to be a co-sponsor of this group and to ask the Chairman to keep ECOR informed of all planned activities.

WG62 ***Carbon Budget of the Ocean*** (with IAPSO and IAMAP)

Membership of the group has been established as follows:

Professor E.D. Goldberg – Chairman (USA)

Dr J.M. Edmond (USA)

Dr E. Erikson (Sweden)
Dr R.N. Ginsburg (USA)
Professor F. Millero (USA)
Dr H. Oeschger (Switzerland)
Dr E.A. Romankevitch (USSR)
Dr S.V. Smith (USA)
Dr M. Whitfield (UK)
Dr P.J. Le B. Williams (UK)

A summary by the Chairman of activities in 1979 is given in Annex XIII. It was suggested to UNESCO that, when available, the full report of the meeting in Paris in November 1979, should be published in their series *Technical Papers in Marine Science*. The Chairman of the group reported that as there already existed adequate reviews of the carbon budget of the ocean the working group had decided to consider the possibility of unconventional sinks in the hope that this might stimulate some laboratories to undertake detailed studies of them. The SCOR Executive Committee considered these ideas interesting and hoped that publication of the report would be sufficient encouragement for readers to offer comments which the group might consider by correspondence before September 1980. Then the group might be disbanded.

WG63 ***Marine Geochronological Methods*** (with CMG)

Membership of this group has been established as follows:

Professor W.W. Hay – Chairman (USA)

Dr V. Krasheninnikov (USSR)
Dr I. McDougall (Australia)
Dr N.J. Shackleton (UK)
Dr J. Thiede (Norway)
Dr R.P. Vail (USA)

The work of this group was relevant to CCCO and it was agreed that Dr J. Thiede be asked to effect liaison, being a member of both groups. The Group plans to meet at the International Geological Congress in Paris in July 1980.

WG64 ***Oceanic Atoll Drilling*** (with CMG, IAPSO and UNESCO)

The group has been established with the following membership and terms of reference:

Professor E.L. Winterer – Chairman (USA)

Professor K. Konishi (Japan)
Professor S.O. Schlanger (USA)
Dr D.R. Stoddart (UK)
Professor J. Trichet (France)

'To draw upon all available international and multidisciplinary expertise in order to study the scientific strategies for obtaining as much information as possible from Pacific and Indian Ocean atolls, the advisability of creating an International Atoll

Drilling Programme and the technique and logistical feasibility of such a programme. The working group should conduct most of its business by correspondence.'

Plans of this working group include the organisation of a symposium on *Atolls as recorders of sea-levels and the vertical tectonics of lithospheric plates* at the time of the annual meeting of the Geological Society of America in November 1980. After this the group expects to submit a final report to SCOR.

WG65 ***Coastal Off-Shore Ecosystems Relationships*** (with IABO)

In May 1979 proposed terms of reference for a new SCOR WG were sent to National Committees. There has been general agreement about the need for such a working group and a number of suggestions for minor amendments to the proposed terms of reference received. A number of suggestions for members had been received including two recommendations from Dr J.J. O'Brien for mathematical modellers. The President of IABO had suggested that a Chairman be appointed and the terms of reference and membership be discussed with him.

The SCOR Executive agreed to appoint Dr J.J. Zijlstra as Chairman; Professor Postma agreed to convey to him all the suggestions that had been received and to invite him to discuss further the terms of reference and membership with the President of IABO.

2.3 Committees etc.

SCOR/IOC Committee on Climatic Changes and the Ocean (CCCO)

IOC has accepted SCOR's invitation to co-sponsor this committee.

Membership was established as follows:

Professor R. Revelle, Chairman (USA)

Dr T. Asai (Japan)
Professor E.P. Borisenkov (USSR)
Acad. L.M. Brekhovskikh (USSR)
Dr K. Bryan (USA)
Dr A.E. Gill (UK)
Dr G.P. Kurabatkin (USSR)
Dr A. Longhurst (Canada)
Professor R.W. Stewart (Canada and JOC)
Professor J. Thiede (Norway)
Professor J.D. Woods (FRG and JOC)

Corresponding Members:

Professor A.R. Robinson (WG34)
Professor R. Chesselet (WG44)
Professor D. Lal (WG46)
Professor H. Stommel (WG47)
Professor D.W. Stuart (WG55)
Dr H. Rotschi (WG56)
Dr A. Foldvik (WG58)

Professor E.D. Goldberg (WG62)
Professor J.J. O'Brien (SCOR Scientific Rapporteur on Mathematical Modelling)
Dr R.E. Newell (IAMAP Commission on Climate)
Dr V. Treglos (IOC JWC/IGOSS)
Mr T. Winterfeld (IOC WC/IODE)
Dr A.E. Strong (IOC WG/El Niño)
Dr A. Soergiarto (IOC WG/WESTPAC)

The first meeting was held in Miami from 8 to 10 October 1979, preceded on 1 – 5 October by a JOC–SCOR Planning Meeting on the Pilot Ocean Monitoring Study (POMS) see *SCOR Proceedings* 15 Appendix XIX.

A report of the POMS meeting will be published by the GARP Activities Office; it was thought that CCCO meeting reports could also be appropriately published in a GAO or JSC series if they were suitably identified as SCOR–IOC contributions – perhaps by a different colour band.

CCCO has formed five panels:

1. Liaison with the Joint Scientific Committee (JSC) for the World Climate Research Programme, to develop those oceanographic programmes which will support and strengthen the meteorological programmes.

2. Theory and Modelling of Ocean Dynamics related to problems of Climate Research.

3. Sea Ice Variations – including the effects of bottom water formation.

4. High resolution palaeoclimate of the ocean – concentrating particularly on the past few hundred years.

5. Ecological aspects of oceanic climate.

CCCO plans to convene (jointly with the JSC for WCRP):

1. A workshop on *Experience with long time-series of oceanographic measurements* in 1980 or 1981.

2. A study conference on *The impact of the oceans on climate* in 1981.

The theme of the study conference, as recommended by POMS, would be the development of a statistically explicit description of the oceanic circulation, using dynamical models and all available data sources (hydrographic, bathythermograph, satellite observations etc), paying special attention to the planning of the POMS experiments.

Information on national plans for climate oriented research would be welcomed by the Chairman of CCCO.

The SCOR Executive noted that the JOC had identified the controlling effect of ocean dynamics on the storage and transport of heat and consequently on the processes of exchange with the atmosphere. This was one of the two critical elements in the WCRP (the other concerns cloudiness). Oceanographers therefore have a major role in the WCRP and the POMS proposals indicate that this will involve large-scale experiments lasting several years.

It seems clear that the support of such a large and long lasting programme is beyond the foreseeable resources of SCOR and IOC particularly as Professor J.D. Woods (who was representing the Chairman of CCCO) thought it would be necessary for CCCO panels to meet annually and to be represented at other relevant meetings. If the oceanographic activities were to be pursued as rapidly as their importance to the WCRP demanded there is a need for an international planning staff supported by an Implementation Fund, similar to those established jointly by ICSU and WMO to support GARP, and now the WRCP.

The SCOR Executive therefore asked the President to recommend ICSU to consider concluding an agreement with UNESCO, as the parent body for IOC, for the joint support of the CCCO, on the lines of that supporting the JOC for GARP and the JSC for WCRP.

In the meantime SCOR will contribute as its finance allows as will IOC. It was suggested that IOC might ask its members states to give all the help they can. The SCOR Executive was grateful to the US for its offer of secretarial support for CCCO in 1980 and 1981.

A request from IOC for a workplan of proposed CCCO activities was referred to the Chairman.

Mr Tambs-Lyche said that ICES would be glad to discuss the possibilities for ICES support of CCCO North Atlantic activities at a meeting of the ICES working group on Oceanic Hydrography in March 1980 and at their Bureau meeting in May 1980. A report would be available for the SCOR September meeting.

POMS

The SCOR Executive Committee accepted the recommendations of the POMS planning meeting, as approved by CCCO. It was noted that the main activities in 1980 would be the following:

1. Feasibility study for the proposed Heat Flux Experiment.

2. Design Study for the proposed Global Circulation Experiment.

3. Workshop on *Time Series of Oceanographic Data* (1980).

4. Preparations for 1981 Study Conference on *Impact of the Ocean on Climate.*

5. Planning meeting for North Atlantic POMS (NAPOMS) activities 1980–85.

These activities will be carried out under the direction of the CCCO Panel for Liaison with the JSC for WCRP (Chairman Dr R.W. Stewart) which will report both to the CCCO and to the JSC.

The ICES representative noted that NAPOMs would be a continuation of activites co-ordinated through ICES over 25 years (IGY, Overflow I, Overflow II, MONA) and indicated that ICES might provide the scientific forum, secretarial support and data handling facilities. The need for additional staff at ICES Headquarters for this purpose would be explored.

Review Group for Antarctic Oceanography

A report from the convenor was received (Annex XIV). His proposal to organise an interdisciplinary conference on Antarctic Oceanography in 1982 was approved. It was agreed to suggest to the convenor that this might be incorporated into the JOA. The convenor was urged to continue the *ad hoc* group which might form the nucleus of a group to plan the conference. The cooperation of SCAR should be sought in arranging this conference.

GATE Atlas Editorial Board

A report was received from the Chairman (Annex XV). It was noted that, as advised by the XIV General Meeting of SCOR, the proposed publication would not be called an Atlas but would appear under the title *Physical Oceanography of the Tropical Atlantic During GATE*. IOC and WMO had agreed to support the publication financially and preparation was proceeding well at the University of Miami.

2.4 Proposals for New Working Groups

Energy Fluxes through Food Chains

The President of IABO, having consulted with IABO National Correspondents, has recommended that SCOR does not proceed with the proposals put forward at SCOR XIV for working groups on Energy Fluxes through Food Chains and Benthic Sampling Methods because aspects of these problems will be dealt with by WGs 59 and 65. These suggestions should be borne in mind for reconsideration at a later date.

Oceanic Turbulence

The IAPSO/SCOR/IOC workshop on *Turbulence in the ocean* had proposed the formation of a working group on Turbulence in the Ocean. It was thought that this was an area which could benefit from co-ordination of the kind a SCOR working group can provide but that careful specification of the task was needed. The President agreed to discuss the possibilities with other interested parties and make a proposal in time for the SCOR General Meeting.

Dynamics of the Southern Oceans

The formation of a WG had been suggested by the US National Committee of SCOR. It was thought that as this subject might be appropriate for a special symposium at the JOA in 1982 the proposal should be deferred until then, after which terms of reference and a suitable membership for such a working group might be specified.

Expendable Drifting Buoys

The major contribution to GARP of the drifting buoy programme was recognised. At a recent WMO/IOC Informal Planning Meeting on Drifting Buoy Programmes it had been agreed to recommend to the Executive Committees of WMO and IOC the establishment of an intergovernmental body to further operational aspects of drifting buoys in the future. Professor Tchernia pointed out that although the technique held great potential for oceanographic purposes there were many scientific and technical problems to be resolved before drifting buoys could be used for operational oceano-

graphic programmes. A number of marine scientists were using buoys in their research and he felt that a working group of SCOR could be of great assistance in resolving the problems and to advise on ways in which drifting buoys might be used in the future for oceanographic research provided the necessary development work could be achieved.

It was agreed to invite Dr J. Garrett (Canada) to consider this suggestion, possibly in consultation with others such as Professors Krauss and Tchernia, and Drs Patzert, Stavropoulos, Cresswell and to advise the SCOR General Meeting in September 1980 if there was a useful role for a working group of SCOR and, if so, to propose terms of reference and membership.

2.5 **Executive Committee Reporters**

Professor Charnock agreed to act as Reporter for WG34 and CCCO, Professor Goldberg as Reporter for WG44 and Professor Wooster for WG55.

2.6 **SCOR Scientific Rapporteurs**

Marine Pollution

Dr B.I. Dybern had presented reports on the third meeting of the IOC Working Committee for GIPME, May–June 1979 and a report to the SCOR Executive Committee (Annex XVI). It was agreed to ask Dr Dybern to represent SCOR at the eleventh session of GESAMP which would be held in Dubrovnik from 24 February to 1 March 1980.

Coastal Research

Professor H. Postma gave an oral report on some developments in coastal and estuarine research and referred particularly to the assistance to marine science activities in many countries which could result from the activities of WGs 46, 57, 60 and 65.

Mathematical Modelling

A report from Professor J.J. O'Brien was received (Annex XVII). The SCOR Executive recorded its strong wish that the extremely useful, informal, *Ocean Modelling Newsletter* be continued.

3.0 Relations with Intergovernmental Organisations

3.1 **IOC –Eleventh Session of the IOC Assembly, 1979**

The SCOR Executive Committee was represented at the Eleventh Session of the IOC by the President and, for part of the time, the Executive Secretary. Other members of SCOR had been present as members of national delegations.

Some of the Assembly Resolutions referred to SCOR; these were considered individually.

X1.2 requested SCOR to propose action on the evaluation and presentation of data from the FGGE Oceanographic Programme. This was referred to WG47.

X1.3 agreed to IOC cosponsorship of CCCO – this was welcomed.

X1.8 invites CCCO to include El Niño in its scope. This was endorsed by the SCOR Executive.

X1.9 requested SCOR, with ACMRR, to advise on the composition of the technical advisory group for CINCWI0. A short list of names of scientists from outside the region was provided. It was assumed that Drs Haq and Kitaka of the IOC Secretariat would be familiar with appropriate scientists of the region.

X1.14 SCOR, as a sponsor of FIBEX, was consulted about the support requested. This was referred to WG54.

X1.16 asked SCOR to review the programme for AIA. This would be dealt with at the General Meeting of SCOR if the programme was available by then.

X1.17 requested SCOR to assist in developing a comprehensive plan and project proposals aimed at understanding the marine ecosystem complementary to, and in support of, fisheries research. This was a vast and important project and SCOR nominated Professor Wooster to act as their contact with the IOC Vice-Chairman for Ocean Science. Professor Hempel and Professor Parsons were asked to assist.

X1.28 invites SCOR to review the IOC document IOC/EC–X11/7 on the major directions of its future programme. Dr Voigt agreed to send a copy of this document to each member of the SCOR Executive Committee who were asked to send comments to the President by 31 May 1980.

X1.29 replaces the SAB by a Scientific Review Board (SRB) for which SCOR was invited to designate a member. This was welcomed and a member would be nominated in September, at the General Meeting of SCOR, by which time the members designated by IOC member states would be known.

SCOR Advisory Role to IOC and UNESCO

As had been proposed at the 14th General Meeting of SCOR a draft statement concerning SCORs advisory role was prepared by Professor W.S. Wooster in consultation with the Executive Committee and sent to all the National Committees of SCOR for comment with a circular letter of 27 April 1979. In this circular letter a number of questions were raised with respect to improving scientific advisory services provided by SCOR to IOC. There was no meaningful response to this letter from any of the National Committees, and the Executive Committee of SCOR concluded that, most likely, the real problems in this connection were related to the reassessment by the IOC of its future role and functions which had not yet been brought to a conclusion at the time of the 14th General Meeting of SCOR. The Executive Committee of SCOR expressed its satisfaction with the development which had taken place at the 11th Session of IOC Assembly when the Scientific Advisory Board of IOC had been transformed into a Scientific Review Board of IOC (Resolution XI–29). The committee felt that the new terms of reference of SRB will strengthen interaction between the Commission and SCOR. The Executive Committee, however, instructed the President of SCOR to inform the new Secretary of IOC, Dr Mario Ruivo, of the action taken by SCOR by transmitting to him informally a copy of the drafted statement.

GIPME

The 1979 meeting of the IOC Working Committee for GIPME had requested SCOR (and ACMRR) to promote work on the effects of oil on marine organisms. The SCOR Executive, whilst appreciating the need for such work in this complex field, did not feel that there was any useful action it could take at this time in view of the extensive work being done by a Working Group of ICES under the Chairmanship of Dr A.D. McIntyre (UK) which had culminated in a workshop in Beaufort, USA in February/ March 1979 on *Monitoring of Biological Effects of Pollutants*. The proceedings of the workshop were being prepared by ICES for publication in its series *Rapport et Procès Verbaux*. It was agreed that SCOR should consult further with ICES on this question and invite Dr McIntyre to prepare a statement on what useful actions might be taken by SCOR, and/or other international organisations, for consideration at the SCOR General Meeting in September 1980.

The SCOR Scientific Rapporteur on Marine Pollution had suggested that SCOR might establish some relationship with the reconstituted IOC WC–GIPME Group of Experts on Methods, Standards and Intercalibration (GEMSI). Dr Voigt informed the Executive Committee that the IOC Assembly had instructed the secretariat to develop and broaden the terms of reference for GEMSI and to report to the next Assembly in 1981. No action by SCOR was possible until the terms of reference had been determined but meanwhile Dr Dybern was invited to continue to keep in touch with all GIPME developments.

3.2 UNESCO

Coastal Lagoons

The UNESCO Division of Marine Science planned to organise a Symposium on Coastal Lagoons in Paris in May–June 1981 and invited SCOR and IABO to co-sponsor this Symposium. In view of the importance of, and wide interest in, coastal lagoons it was considered appropriate for SCOR to accept this invitation but before doing so Professor Postma was asked to examine the proposed scientific programme, when it became available, and to advise the President whether or not it was appropriate for SCOR sponsorship. It was suggested that, should UNESCO experience any problems with regard to publication, the *Journal of Estuarine and Coastal Marine Science* might prove an appropriate vehicle.

Photosynthetic Pigments

Dr G.F. Humphrey should be asked to report on progress with rewriting the UNESCO monograph on identification of photosynthetic pigments in seawater.

Phytoplankton Course – Oslo, July/August 1980

SCOR and UNESCO had already agreed to sponsor a second course on phytoplankton for experienced workers at the University of Oslo from 21 July to 9 August 1980. The organiser, Professor G.R. Hasle, had reported that already the University of Oslo had received 32 requests from 19 different countries for application forms. The Division of Marine Sciences of UNESCO had agreed to contribute to the organisational costs of this course but it was unlikely that any funds could be made available for travel and/or subsistance.

UNESCO's Marine Science Programmes and SCOR

In relation to SCORs advisory role to UNESCO, the SCOR Executive Committee suggested that discussion of the scientific problems of importance in areas such as mangroves and coastal lagoons had now been virtually completed and that the activities of the Division of Marine Science in these studies was now advancing towards providing technical co-operation for programmes in developing countries. It might therefore now be opportune to suggest that the Division distinguish between its scientific research and its technical cooperation activities and consider which new directions in the development of marine science should be having their attention. Possible studies which would be of interest to developing countries as well as developed countries were oceanic fronts and ocean climate. The President agreed to discuss this further by correspondence with the Director of the Division.

3.3 ACMRR

Because there were some joint actions with ACMRR requiring attention, the President agreed to write to the President of ACMRR expressing the hope that the latter would participate in the SCOR General Meeting in September 1980.

3.4 ICES

It was agreed that because ICES was a regional inter-governmental body, any formal organisational link with SCOR, which was a global, non-governmental, organisation, would be inappropriate. Nevertheless continued close collaboration was most desirable and as in the past both bodies should be invited to be represented at each others meetings and there should continue to be joint sponsorship of appropriate symposia and working groups. It was agreed that exchange of letters between the two bodies would suffice.

ICES had published in their *Rapport et Proces-Verbaux, vol 173* the proceedings of Symposia S5, S7, S8 and S11 from the 1976 Joint Oceanographic Assembly under the title *Marine Ecosystems and Fisheries Oceanography*.

ICNAF will undertake the printing of the proceedings of the ICES/FAO/ICNAF/SCOR *Symposium on the Early Life History of Fish* which was held in Woods Hole, USA in April 1979, which will be published as volume 178 of the ICES *Rapports et Proces-verbaux series*.

The SCOR Executive Committee offered to co-sponsor an ICES symposium on *The Productivity of Temperate Shelf-Seas* being convened by Dr Zijlstra in 1982 and to assist in the distribution of the first circular by enclosing copies with the next issue of *SCOR Proceedings*.

4.0 Relations with Non-Governmental Organisations

4.1 Affiliated Organisations

CMG

The President of CMG reported on the progress with the new series of the General Bathymetic Chart of the Ocean and it was hoped that publication of the complete series would be complete by May 1982. The charts are available from the Canadian Hydrographic Serivce, at $5 per sheet. Sir George Deacon had found the proofs of the Antarctic sheet (5118) very useful but again stated the need for an Antarctic Polar Projection Sheet to 35° South. Professor Simpson said by the end of 1980 the contours from both the Polar Projection Sheet and The Mercator sheets should be ready for digital storage and retrieval; it should then be possible to meet Sir George's request. A report from CMG is given as Annex XVIII.

IABO

A report on activities of IABO was presented (Annex XIX). IABO expects to publish another issue of *IABO Proceedings* in 1980.

IAMAP

At its assembly in Canberra in December 1979 IAMAP elected Dr W.L. Godson (Canada) as President.

A report to SCOR from IAMAP was received (Anned XX). This report included information about the subjects to be discussed at an IAMAP Assembly in Hamburg in 1981, including a symposium on the role of the ocean in atmospheric chemistry cycles. SCOR agreed to co-operate with IAMAP in the programme for this meeting, inviting Professor Goldberg to provide IAMAP with advice regarding appropriate specialists in oceanic chemistry by corresponding with Professor R.A. Duce. As reported earlier, it was suggested that the SCOR working group 44 symposium might conveniently be associated with this meeting.

IAPSO

At its assembly in December 1979 IAPSO elected Professor D. Lal (India) as its President.

The summary report of the IAPSO/SCOR/IOC Second IDOE Symposium on *Turbulence in the Ocean* was published in December 1979 by UNESCO as IOC Workshop Report No 21. The papers from the Symposium are being edited for publication by Springer Verlag (FRG).

Professor W. Krauss presented a request from Dr J.M. Gieskes that SCOR again consider a workshop on the fluxes and chemistry of particulate matter in the ocean; a suggestion that had first been put forward at the SCOR General Meeting in 1976 and which had been discussed further at the IUGG Assembly in 1979. The SCOR Executive Committee agreed that there had been substantial advances in the study of organic and inorganic particulates and was sympathetic to the proposal but requested a clear statement of the proposed content and location for a workshop for further consideration at the SCOR General Meeting in September 1980.

Resolutions of the IAPSO Assembly in December 1979, Annex XXI; SCOR commented as follows:

Resolution 1: SCOR endorsed the need for long term support for both large and small groups of scientists.

Resolution 4: SCOR noted the IAPSO proposal regarding future symposia to be held between assemblies and awaited further details with interest.

Resolution 5: IAPSO is interested in working with SCOR in organising international programmes on the dynamics of equatorial currents and this was referred to the February 1980 meeting of SCOR WG56 for attention. It was agreed also to pass this resolution to WG47.

4.2 Corresponding Organisations

ECOR

Ir G.A. Heyning reported that ECOR expected to be represented at SCOR General Meeting in September and expressed the hope that SCOR would send a representative to the ECOR General Assembly in London from 6 – 10 April 1980. Sir George Deacon, who is assisting ECOR in organising the scientific programme for this meeting, agreed to represent SCOR.

CMAS (SC)

Dr N.C. Flemming, President of CMAS (SC), which had been recently designated as a corresponding organisation of SCOR, gave an interesting account of some recent activities of his organisation (Annex XXII). The SCOR Executive Committee reminded National Committees and marine laboratories that advice and assistance was available from CMAS (SC) on aspects of scientific diving and that the CMAS (SC) Code of Practice for scientific diving and their standardisation of diver training levels were of great value. It was agreed that it would be useful for SCOR to assist in the compilation of a manual on the application of diving for scientific research and invited Dr Flemming to correspond with the Presidents of CMG and IABO and the Director of the UNESCO Division of Marine Science with a view of submitting a more detailed proposal to the 1980 SCOR General Meeting.

4.3 *ICSU*

In response to an invitation from the Chairman of the ICSU *ad hoc* group on Energy for suggestions on subjects and speakers for the colloquium on Energy to be held at the General Assembly of ICSU in September 1979, SCOR had informed ICSU that none of its current activities were directly relevant although, Tides, Waves and Ocean Thermal Energy Conversion should be in the programme and that SCOR would be pleased to try to assist in identifying suitable speakers if so requested. ICSU's attention was also drawn to the plans for a *UN Conference on New and Renewable Sources of Energy* in 1981 and in particular to the session that will be concerned with ocean energy for which IOC, together with UN Ocean Economics and Technology Division, had established a panel to prepare a programme.

Should ICSU seek further advice from SCOR, it was agreed that SCOR should invite the assistance of ECOR.

ICSU had sought SCOR proposals for specific projects to be included in the UNESCO medium term plan, 1984–1989. After reviewing objective VII of the medium-term plan for 1977–1982 it was urged that the draft for 1984–89 should include an explicit objective encouraging the study of the mechanism of ocean climate and climatic changes, particularly on the economically important timescale of months to decades. Any improvement of ability to foresee climate variations on these timescales would be of great benefit to developed and developing countries alike.

This would enable UNESCO to make an important input to the World Climate Research Programme, which will be a major influence on geophysical science in the nineteen eighties. In particular, since oceanic processes have been identified as major regulators of climate, IOC has a unique opportunity of advancing man's knowledge of the sea and its interaction with the atmosphere, the coast and the seafloor.

If such an objective were included in the next UNESCO medium term plan, ICSU would be able to co-operate with UNESCO and IOC in making an important contribution to the marine aspects of WCRP, as it was doing with WMO on atmospheric aspects (see also item 2.3 of this report).

Since the role of the ocean in climate changes is so important, this was the only objective which SCOR will recommend to ICSU for submission in the next UNESCO medium term plan.

The anniversaries of the Polar Years and the IGY will be taken into account in planning the programme for JOA in 1982; ICSU should be informed.

4.4 ICSU Unions

Professor Goldberg was in correspondence with and hoped shortly to meet Dr E.I. Hamilton, who has been nominated by IUPAC to maintain liaison with SCOR, to discuss how such liaison might best be effected.

4.5 ICSU Committees

Reports were received from the SCOR representative at the 22nd Meeting of COSPAR, May–June 1979, and from COSPAR, Annex XXIII. The main joint activity between the two bodies being the development of plans for *COSPAR/SCOR/IUCRM Symposium on Oceanography from Space*, Venice, Italy, 26–30 May 1980, which are now well advanced and a tentative programme is available. The Chairman of the Steering Committee for the symposium is Dr J.F.R. Gower and Professor Charnock represents SCOR's interests on this committee.

SCOPE

The SCOR Executive Committee considered a circular letter of 20 December 1979 from SCOPE, addressed to SCOPE National Committees and participating ICSU bodies, inviting expressions of interest in a SCOPE proposal to establish a working group on *Methodologies for Detecting and Measuring Chemical Changes in Coastal Zones and for Assessing and Predicting Their Effects*, and in organising a symposium on the subject in

two or three years time. The SCOPE representative on SCOR reported that he had been surprised at the ambitious breadth of the proposal contained in the letter because he had understood that the intention originally had been simply to hold another mussel-watch workshop in a few years time. Professor Goldberg who had organised the mussel-watch three years ago and the meetings at which the proposal for further activities under SCOPE auspices had been developed confirmed that this was also his understanding of the situation.

If, as seemed likely, SCOPE was considering only continuation of the mussel-watch programme and perhaps extending it to a few other organisms, and planning a further workshop on this limited subject, it was agreed that there was no need for SCOR involvement. If, however, SCOPE was seriously considering the wider problems, such as were specified in the letter, SCOR would co-operate in a symposium subject to certain conditions.

Organisations such as GESAMP, GIPME and ICES had already concluded that the measurement of low-level but biologically significant chemical changes in seawater could only be undertaken accurately by the few laboratories possessing the most advanced analytical techniques. Monitoring of chemical residues in the tissues of marine organisms offered the most promising way of measuring pollutant levels and already much international attention was being given to intercomparison of sampling methods and analysis but real difficulties existed in assessing, in meaningful terms, the biological effects of such changes which would have to take into account natural fluctations. Prediction of effects was an even greater problem.

The SCOR Executive expressed doubt as to whether a Working Group of SCOPE, or indeed any ICSU body or group of bodies, could significantly help to advance knowledge in this very large and complex problem. Most of the relevant work was being undertaken by government laboratories and there were already reviews of the scientific problems, such as that of the ICES Workshop on *Monitoring of Biological Effects of Pollution* referred to in item 3.1. It is extremely difficult to assess effects on organisms of chemical changes and work on this can only sensibly proceed on a regional basis by technically advanced laboratories; competent intergovernmental organisations are already working on these problems. SCOR should advise SCOPE not to proceed with the suggestion to form a working group with such wide ranging terms of reference.

On the other hand, a symposium in a few years time could be of considerable value:

1. In explaining to a wider scientific community the problems and complexities of measuring chemical changes in the sea and assessing their effects.

2. In bringing into focus the work that had already been done by Government, mainly fisheries, laboratories.

3. In identifying how small teams of university scientists could contribute.

If SCOPE wished to proceed with such a symposium SCOR would be pleased to assist, the subject being relevant to the interests of some of SCOR's working groups, but it would be essential not to insist on only non-governmental bodies being involved but to solicit the co-sponsorship or collaboration of ICES, GESAMP and the IOC WC–GIPME.

A major element of SCOPE's activities was their project on biogeochemical cycles which includes the studies of the global carbon and nitrogen cycles. SCOPE has recently been reminded that Professor Goldberg continues to serve as the SCOR correspondent for this project.

5.0 Future Meetings

5.1 Fifteenth General Meeting of SCOR, Woods Hole, USA, September 1980

It was agreed, after considerable discussion, that a separate Executive Committee meeting before the General Meeting was not practicable as it would detract from participation in the Congress on the History of Oceanography. The SCOR General Meeting will be held at Woods Hole on the afternoon of Friday 26 September and on Saturday and Sunday 27/28 September. To facilitate the business meeting, the Executive Committee should discuss items of the agenda in the evenings of the History Congress.

As announced previously, the Woods Hole Assembly on current and future oceanography, 29 September to 2 October 1980, will be regarded as the scientific component of the SCOR meeting.

5.2 It was agreed that only one meeting of the Executive Committee might be necessary between September 1980 and August 1982 but that there may be a need for special smaller business meetings such as between the President and Secretariat.

5.3 JOA, Halifax, Nova Scotia, August 1982

The next JOA will be held at the University of Dalhousie, Halifax, Nova Scotia from 2 to 13 August 1982. Mr G.N. Ewing, the Canadian Assistant Deputy Minister for Ocean and Aquatic Sciences, kindly gave an illustrated account of the Dalhousie University and its facilities which were considered to be most suitable for the JOA. There would be accommodation in Halifax for visiting research vessels and it was suggested that the possible convergence of ships might make it possible to undertake some useful co-operative research. It was agreed that ICES be invited to consider organising a scientific programme should this prove practical.

It was agreed that the general organisation of the JOA should be on the lines of that in Edinburgh in 1976 and include general symposia, special symposia and Association meetings. Conflicting subsidiary meetings during the period of the Assembly should be discouraged as should commercial exhibitions although some demonstration by research laboratories might be profitable. Mr Ewing agreed to ascertain whether a Canadian bookseller would be interested in arranging a display of oceanographic books, charts and atlases.

IOC, by Resolution X1–38, agreed to take the initiative in forming a Logistics Committee for JOA; both IOC and the UNESCO Division of Marine Science had included appropriate sums in their financial planning. The establishment of the Logistics Committee will be discussed at a meeting of ICSPRO on 9 February 1980. The SCOR Executive Committee requested that at that time a Chairman be identified and the level of support of FAO and WMO be determined so that, if they so desired, they could be added to the list of supporting organisations that would appear on the first circular.

The establishment of an international Steering Committee to organise the scientific programme was considered and it was agreed that it should consist of a Chairman nominated by SCOR, the Presidents of the four Affiliated Organisations, and representatives of ECOR and the Canadian National Committee for SCOR together with the Chairman of the Logistics Committee. It was agreed that such a committee need not be established until the General Meeting of SCOR in 1980 but by that time it was essential for a definite scientific programme to be presented to SCOR for consideration. The President of SCOR undertook to consult with the Associations and other scientists and to present a proposed scientific programme by September 1980 taking into account the subjects that had already been proposed by National Committees in response to an earlier SCOR enquiry and suggestions that had been received from some working groups of SCOR.

5.4 **International North Sea Symposium – 1981**

A proposal for an international symposium to be held in Hamburg was considered. SCOR expressed interest in the suggestion and agreed in principle to co-sponsor the symposium together with IAPSO, IABO and ICES subject to a detailed proposal being submitted for consideration at the General Meeting in September.

5.5 **Sandy Beach Ecosystem Symposium – 1981**

Professor Simpson submitted a proposal for a symposium to be held in South Africa on sandy beach ecosystems. SCOR expressed interest in the suggestion and agreed in principle to co-sponsor the symposium together with other appropriate organisations subject to a detailed proposal being submitted for consideration at the General Meeting in September.

5.6 A request from Dr M. Clarke (UK) for support for a workshop on the identification of cephalopod beaks from the stomach contents of predators was approved, it being noted that such a workshop could produce useful guidance for BIOMASS as well as a methods manual for wide use.

In closing the meeting the President expressed sincere appreciation to Professor Seibold and the Deutsche Forschungsgemeinschaft, the President of the Christian-Albrechts University, Kiel and to Professor G. Hempel, Insitute für Meereskunde, for the invitation to hold the meeting in Kiel and for the comfortable facilities that had been provided. Special thanks were also expressed to Frau-Kredel and to Frau Dr S. Schnack for their help.

ANNEX I

Twenty Second SCOR Executive Committee Meeting

Participants

Members of the Executive Committee

*Dr K.N. Fedorov	USSR	President
*Professor H. Postma	Netherlands	Past President
*Professor G. Hempel	FRG/IABO	Vice President
*Professor E.D. Goldberg	USA	Vice President
*Professor P. Tchernia	France	Vice President
*Professor H. Charnock	UK	Secretary
*Professor W.S. Wooster	USA	Coopted for relations with other international organisations
*Professor E.S.W. Simpson	IUGS/CMG	Ex Officio
Professor W. Krauss (representing Professor D. Lal)	IUGG/IAPSO	Ex Officio
*Mr G.E. Hemmen	UK/SCAR	Executive Secretary

Other Participants

Sir George Deacon	UK
Mr G.N. Ewing	Canada
Dr N.C. Flemming	CMAS–SC
*Professor K. Grasshoff	SCOPE
Dr V. Hansen	Denmark
Ir G.A. Heyning	ECOR
*Professor J. Krog	IUPS
Dr J. van der Land	Netherlands
Mr H. Tambs-Lyche	ICES
Mr L. O'Quinn	Canada
Professor G. Siedler	FRG
Dr M. Steyaert	UNESCO–OCE
Dr K. Voigt	IOC

*SCOR Members

ANNEX II

STATEMENT OF SCOR INCOME AND EXPENDITURE

(1 January to 31 December 1979)

			$	$
BALANCES 1 JANUARY 1979				
London			8546.78	
Paris			501.04	9047.82
INCOME				
National Contributions:	Arrears	2200.00		
	1979	55400.00		
	Adv. Payment	600.00	58200.00	
Contracts				
IOC Regular Contract 1979 (Final)		2000.00		
UNESCO Regular Contract 1979 (Final)		1000.00		
IOC Regular Contract 1980 (First)		13000.00		
UNESCO Regular Contract 1980 (First)		10500.00	26500.00	
Grants				
From UNESCO Subvention to ICSU		12000.00		
From ICSU		5000.00	17000.00	
Refunds				
Mauritius W/shop 1976 (UNESCO)		3823.69		
WG47 – 1978		1023.53		
WG55 – 1978		1975.23		
GATE Atlas 1978 (IOC)		3899.00	10721.45	112421.45
				$ 121469.27
EXPENDITURE				
Scientific Activities				
Working Groups 10 (78)			2963.65	
42			1308.40	
44			5118.30	
46			6673.10	
47 (78)			83.00	
52			2744.40	
54			8336.60	
56			304.62	
57 (78)			811.56	
59			8512.74	
61			804.04	
62			5295.21	
CCCO			7081.29	
GATE Atlas			938.25	
GATE Symposium (78)			1480.00	52455.16
Representation at other meetings				
IOC–EC			499.27	
IOC XI			2864.83	
IOC/WMO Buoy Mtg			583.20	
GEBCO Guiding Committee			1102.15	
IUGG			16.45	
COSPAR			500.00	5565.90
Publications				
Proceedings Vol. 15			4027.63	
Proceedings Supplement (inc. Postage)			2215.90	6243.53
Administration				16160.56
				80425.15
Balances 31 December 1979				
London			31478.60	
Paris			9565.52	41044.12
				$ 121469.27

ANNEX III

WORKING GROUP 10 (with ICES, IAPSO and UNESCO)

JOINT PANEL ON OCEANOGRAPHIC TABLES AND STANDARDS (JPOTS)

Report from Chairman – J.M. Gieskes

(Reference is made to Annex III of the SCOR Proceedings No. 15)

During 1979 further work has been carried out on the one atmosphere equation of state of seawater, for which small discrepancies were still apparent during the last meeting of the Panel in September 1979. These discrepancies have now been resolved, and at this time final curve-fitting procedures are underway.

Background reports for the definition of salinity and the equation of state are in various stages of completion:

1. The conductivity subgroup (Culkin, Bradshaw, Dauphinée, Lewis, Poisson) has submitted background papers for a special issue of the *Journal of Oceanographic Engineering*. This issue will appear in January or February 1980. It is our intention to investigate the possibility of reissuing these papers as part of a general UNESCO Technical Report, which will encompass both the work on the redefinition of salinity and the equation of state of seawater. A background paper by E.L. Lewis is available.

2. The "Summary of data treatment for the UNESCO high pressure equation of state of seawater," by F.J. Millero, Chairman, T. Chen, A. Bradshaw and K. Schleicher, has been reviewed and is ready for publication as part of the UNESCO report mentioned above.

3. Drs F. Millero and A. Poisson are in the process of completing the final technical report on the one atmosphere equation of state of seawater.

At the *ad hoc* meeting of the WG 10 during the IUGG General Assembly (J. Gieskes, F. Millero, M. Menaché, L. Lewis, A. Poisson), it was decided that both IAPSO and SCOR, as well as UNESCO and ICES, should be approached for acceptance of the definition of "practical salinity" (see Appendix). Subsequently, IAPSO accepted this definition by resolution 6 of its Assembly in December 1979 (see Annex XX).

By the same resolution, IAPSO agreed to abide by the acceptance of the equation of state of seawater by SCOR, which will be submitted to SCOR by April or May 1980. This was deemed important so that this equation of state could be adopted with the least possible delay by the oceanographic community.

We urge SCOR to consider the definition of "practical salinity" and, if the definition is accepted, we urge that a statement be published by the presidents of SCOR, IAPSO and ICES and that henceforth the Practical Salinity should be used by all oceanographers.

Ah Hoc Meeting, Canberra, December 5, 1979

1. As the main item, the state of the technical reports (as presented above) was discussed. This work will be completed by April/May 1980.

2. Dr E.L. Lewis will serve as the liaison between Working Group 10 and SCOR Working Group 51 (evaluation of CTD data). Dr Lewis will give particular attention to a report on the use of bench salinometers, with particular reference to concerns about calibration procedures. Because offsets in calibration of instruments are often linear, the WG 10 members agreed that it would be most advisable to ask the IAPSO Standard Seawater Service to prepare not only a 35.10^{-3} salinity standard but also a 30.10^{-3} salinity standard (Practical Salinity). Dr F. Culkin, Director of the Service, will be approached on this matter.

3. The members present at the *ad hoc* meeting agreed that one more meeting of the panel will be necessary in September 1980 (Victoria, British Columbia, Dr E.L. Lewis, host). During this meeting, remaining thermodynamic properties of seawater, particularly those related to the new equation of state, will be considered:

(a) Entropy of seawater

(b) Heat capacity of seawater

(c) Formulae for adiabatic lapse rate or potential temperature calculations

(d) Speed of sound

As all the above problems are within the expertise of the present working group, we deem it necessary that these matters be considered before a radical change in the composition of WG 10 or its disbandonment are considered. It was considered important to have at least three guests at this meeting: Drs Fisher (Scripps), Bryden (Woods Hole) and Swallow (U.K.).

4. Cooperation with WG 62 (Carbon Budget of the Ocean) has been considered. Dr F. Millero, in his capacity as a member of WG 10 and WG 62, will act as a liaison. It was decided that this subgroup ("Thermodynamics of CO_2 System") should work by correspondence first and that some key members could get together on an *ad hoc* basis during the January Gordon Conference on Marine Chemistry.

Funds set aside by UNESCO for a meeting of the CO_2 working party in 1980 should be spent for the final WG 10 meeting in its present composition. UNESCO has been approached on this matter.

5. The *ad hoc* panel members agreed to support the recommendations of the IAPSO working group on SI units. Dr M. Menaché has done a very careful job in this field, and it was noted that several journals have already made it their policy to insist on the use of SI units in Oceanography.

APPENDIX

Definition of practical salinity, 1978

1. Absolute salinity, symbol S_A, is defined as the ratio of mass of dissolved material in seawater to the mass of seawater. In practice this quantity cannot be measured directly and a practical salinity is defined for reporting oceanographic observations.

2. The practical salinity, symbol S, is defined in terms of the ratio of the electrical conductivity of the seawater sample at 1 standard atmosphere (101 325 Pa) and 15°C to that of a potassium chloride (KCl) solution in which the mass fraction of KCl is $32{\cdot}4356{\cdot}10^{-3}$ at the same pressure and temperature (International Practical Temperature Scale 1968). This ratio, K_{15}, defines practical salinity of the sample according to:

$$S{\cdot}10^{+3} = a_0 + a_1 K_{15}^{1/2} + a_2 K_{15} + a_3 K_{15}^{3/2} + a_4 K_{15}^{2} + a_5 K_{15}^{5/2}$$

$$a_0 = 0.0080$$

$$a_1 = -0.1692$$

$$a_2 = 25.3851$$

$$a_3 = 14.0941$$

$$a_4 = -7.0261$$

$$a_5 = 2.7081$$

$$\Sigma a_i = 35.0000$$

$$2{\cdot}10^{-3} \leqslant S \leqslant 42{\cdot}10^{-3}$$

Supplementary Statement

The standard KCl solution has the same conductivity at 15°C and 1 standard atmosphere as seawater from the North Atlantic of chlorinity $19.3740{\cdot}10^{-3}$ and thus provides continuity with previous salinity scales. It was from measurements made on this water, diluted with distilled water or evaporated by weight, that the data giving rise to the above definition of salinity were obtained. Any oceanic water having a precisely known conductivity ratio of near unity at 15°C and 1 standard atmosphere with the standard KCl solution is a secondary standard for everyday calibration of oceanographic instruments. All seawaters having the same conductivity ratio have the same practical salinity, and chlorinity is henceforth to be regarded as a separate, independent variable in describing the properties of seawater.

ANNEX IV

WORKING GROUP 34 (with IAPSO)

INTERNAL DYNAMICS OF THE OCEAN

Report from Chairman – A.R. Robinson

ı working meeting on *Eddies in Marine Science* was held in Canberra on 12 December. pants included working group members or designated alternates and invited experts.

ı. Robinson
ı. Sarkisiyan (for Fomin)
). Haidvogel
V. Holland
V. Schmitz
. Gould
ι. Clarke (for G. Needler)
ı. Gill
V. Emery
V. Patzert (for R. Bernstein)
I. Bryden

he first draft volume consisting of several chapters and outlines of others was avail- or discussion. Scientific and technical questions were discussed. The table of contents vised and several new authors were suggested.

able of contents and aurthors –

. Introduction, summary, and overview
Allan Robinson

2 Local Dynamics Experiments

a Summary ( )
b POLYGON ( )
c MODE 1 ( )
d POLYMODE James McWilliams
e POLYMODE-synoptic Luch Fomin ( ) ( )

3 Western North Atlantic Ocean

a Gulf Stream system
William Schmitz
b Rings
Phillip Richardson
c Interior
Carl Wunsch
d Lagrangian
Thomas Rossby

4 Eastern North Atlantic Ocean
John Gould

5 Subpolar Gyres and the Arctic Ocean
George Needler

6 Tropical and Equatorial Regions
Gerold Siedler

7 The Indian Ocean
John Swallow

8 The South Pacific including the East Australian Current
Andrew Bennet

9 The South Indian Ocean including the Angulhas Current
Martin Grundlingh

10 The South Atlantic Ocean
John Gould

11 The Southern Ocean
Harry Bryden, ( )

12 Global Summaries and Intercomparisons
William Emery, R. Dickson

13 Eddy resolving general circulation models
William Holland, Albert Semtner, E. Harrison

14 Process and Regional Models
Dale Haidvogel, Brechner Owens, ( )

15 Eddies and Climate Dynamics
Adrian Gill

16 Eddies and Coastal Interactions
( )

17 Eddies and Dispersion including Geochemistry and Pollution
Peter Rhines, William Jenkins

18 Eddies and Biological Processes
M. Fasham, M. Angel, John Gould

19 Eddies and Acoustics
( )

20 Observational Methods and Techniques
Robert Heinmiller

The blanks in the author list will be filled by scientists suggested at the Canberra meeting, who are presently being asked if they are willing to cooperate. Of the nine, six are from the USSR, two from the USA, and one from Canada.

3) Publication plans – Publication possibilities are being investigated. Preliminary inquiries have been made to *Progress in Oceanography* and to two book publishers. Speed, quality, distribution and price are factors. Plans will be presented to the SCOR Executive for approval before being finalized, but no action is required at this time.

4) Schedule – First drafts of all chapters will be distributed to all authors by July 1980. Next draft approximately December, 1980. To be presented at Symposium (item 5 below) and then finalized.

5) Meetings – Working group 34 will organize in conjunction with the final symposium of the US–USSR POLYMODE program a companion general symposium on eddies in marine science based on the above papers, emphasizing a review of a decade of results for non-specialists, global summaries, implications, and applications. (The US–USSR joint POLYMODE organizing committee is, of course, responsible for arranging bilateral joint publication of POLYMODE results and advanced eddy dynamics, and for organizing the final POLYMODE symposium.) Following the symposium, Working Group 34 plans to meet to recommend directions for future research. To enable the symposium to have a broad international participation, a sum of 4000 dollars is requested from SCOR, to supplement money from national sources.

ANNEX V

WORKING GROUP 44 (with IAMAP and IAPSO)

OCEAN–ATMOSPHERE MATERIALS EXCHANGES (OAMEX)

Report from Chairman – Dr R. Chesselet

January 1980

WG 44 (OAMEX) met for the first time in Paris from 14 to 16 November 1979. The newly formed SCOR Working Group No 62 "The Carbon Budget of the Ocean" (Chairman Professor E.D.. Goldberg) had its first meeting during the same week at the same place. This allowed strong interactions between the two Working Groups. The following members attended the WG 44 OAMEX meeting:

J. Prospero (USA), R.A. Duce (USA), S. Tsunogai (Japan), W. Seiler (RFA), V. Korzh (USSR), E. Goldberg (USA), R. Chesselet (France)

From WG 62, Drs Eriksson and Smith took an active part in several discussions.

During the 5 sessions, several topics of great importance in OAMEX related problems were approached:

(a) Sea salt aerosols: bubbles and the surface micro-boundary layers,

(b) Mineral aerosols,

(c) Particulate organic carbon,

(d) Metals,

(e) Gases,

(f) Remote sensing techniques,

(g) Uses of radionuclides for the OAMEX problems.

The final report of this meeting will include:

1 – A note on the problems of the photochemistry at the sea-air interface. An invited key-note address on this problem was delivered by Professor Joussot-Dubien,

2 – A note on the present state of research in USSR on OAMEX–related problems by Dr Korzh.

A general recommendation was:

That an air-sea interaction workshop be held in 1982 to emphasize those areas which so far have received inadequate attention at other assemblies but which are attracting a fair amount of research activity.

Direct flux measurements of gases and particulates through the air/sea interface.

Remote sensing techniques to measure concentrations and movements of materials at the air/sea interface.

Photochemical processes at the air/sea interface.

Microbiological processes at the air/sea interface.

Efforts will be directed towards the evaluation of regional and global fluxes of materials to and from the ocean.

OTHER RECOMMENDATIONS

Mineral aerosols

(1) Studies of mineral aerosols should be carried out in those ocean regions that might be expected to be most susceptible to such inputs. In designing these experiments, an effort should be made to schedule periodic (or, if possible, continuous) measurements over a complete seasonal cycle.

(2) In those areas where intensive mineral aerosol transport is occurring on a large scale, measurements should be extended over several years to ascertain if there is any significant year-to-year variability that might be related to changes in weather (or, over a longer term, climate).

(3) Studies of the chemical and mineralogical composition of dust should also include measurements aimed at characterizing the solubility and sorptive properties of the material.

(4) Measurements should be made of the removal of dust to the ocean by precipitation. Unfortunately, at present, there does not appear to be any readily useable method for measuring the dry deposition rate of aerosol particles to the ocean surface. The development of a suitable technique should have a high priority.

(5) The source areas for mineral aerosols should be accurately located and identified on a global scale. The possibility of using remote sensing techniques should be investigated. In this regard, infra-red satellite photographs have been shown to be especially useful in regions that are relatively free of clouds.

(6) In regions identified as being major sources, a large scale multi-disciplinary study should be carried out with the following objectives:

(a) To measure the chemical, mineralogical and physical characteristics of the soils (especially as a function of size) as compared to these same characteristics of the dust,

(b) To determine the nature of the physical and chemical processes responsible for the formation of the wind-erodable fraction of the soils,

(c) To perform micrometeorological studies of dust generation,

(d) To ascertain if land use has had a significant impact on the wind erodability of the soils,

(e) To develop a dust storm climatology for the region.

These studies bear on both the natural and the anthropogenic aspects of dust transport because it is clear that in some regions the mobility of soils has been greatly affected by man's activities. Thus, it is conceivable that these studies could be carried out in conjunction with other land-use studies and soil mapping and conservation programs.

(7) Programs to study the wind transport of soil aerosols to the oceans should be designed with the assistance of meteorologists who have a good knowledge of the region being considered. The complexity of atmospheric motions is such that a simplistic approach could lead to erroneous expectations and conclusions.

Particulate organic carbon

(1) Efforts should be directed toward determining the chemical form and quantitative flux of organic substances from the ocean to the atmosphere and the evaluation of gas/particle exchange processes in the marine atmosphere.

(2) Methods to distinguish between marine and continental sources for atmospheric organic carbon should be developed.

Metals

(1) Natural sources for atmospheric trace elements should be evaluated carefully. Georaphical and temporal variations should be determined for such sources as crustal weathering, biomass burning, volcanoes and vegetation. The mechanisms by which certain trace metals are enriched on particles produced by bursting bubbles in the ocean should be evaluated. Of particular importance is the determination of the nature of the apparent association of these metals with surface active organic material and its seasonal variability.

(2) The physical form of trace metals (particle vs vapor) in the marine atmosphere should be determined, as should the trace metal particle size distribution. For the latter, particular care should be given to assure that discrimination against the larger particles is avoided. If vapor phases are found, their chemical form should be determined.

(3) Every effort should be made to collect contamination-free precipitation samples over the ocean at different times of the year. New and imaginative research is required to properly assess the role of dry deposition of particulate trace metals to the ocean surface.

(4) The extent to which seawater dissolves trace metals present in aerosols over remote marine areas should be determined.

Gases

In order to obtain more accurate data on the exchange rates of gaseous constituents at the air-sea interface, the chemical, physical, biological, photochemical and oceanographic

processes involved in the air-sea exchange of the individual constituents have to be better understood. More information is urgently needed on:

(a) the influence on air-sea interchange of microbial processes in the surface microlayer. This program should include field measurements and laboratory experiments, studying the dependency of the source and sink strengths of these processes on the environmental parameters such as wind speed, sun radiation intensity, surface water temperature, nutrient content, oxygen concentration, etc, .

(b) the chemical, photochemical, physical and catalytical processes occuring in the surface microlayer and the sea surface enhancing and/or altering the flux rates through the air-sea interface,

(c) the photochemical reactions taking place in the atmospheric laminar boundary layer, which alter the composition and concentration of gases,

(d) the exchange mechanisms in the ocean surface waters. More studies, both in the field and in the laboratory, should be carried out to determine the dependency of the exchange rates on the wind speed, type of waves, etc.. Particular emphasis should be given to studies of the influence on the air-sea interchange, of the entrainment of bubbles into the water, e.g. hydrocarbons, trace metals. Exchange rates should also be determined using tracers others that radon or noble gases, e.g. biospheric gases,

(e) the spatial and geographical distribution as well as the temporal variations of the organic surface microlayer,

(f) the geographical distribution of the film thickness, especially in areas with high biological activities.

Furthermore, the present stagnant film model has to be improved and modified for application to reactive gases. New methods should be developed for the direct measurements of fluxes of atmospheric constituents at the air-sea interface.

Remote sensing techniques

The use of remote sensing techniques to determine the atmospheric functions of gases and particulate and their fluxes into and out of the oceans is just beginning but holds great promise and should be extended. Already UV laser induced fluorescence is able to give a measure of organic substances in the surface water of the ocean. It may be possible by Roman scattering techniques to measure carbonate and bicarbonate ions in surface waters in the very near future.

ANNEX VI

WORKING GROUP 46 (with ECOR, IAHS, ACMRR, UNESCO, CMG, IAPSO and IABO)

RIVER INPUTS TO OCEAN SYSTEMS

Report of two meetings, Rome, 26 and 30 March 1979

The group met before and after the workshop on RIOS which took place in the FAO headquarters.

1. Review of RIOS Workshop

The Workshop considered the various aspects of river inputs to ocean systems. The meeting was intended to give a better definition and understanding of the processes taking place in the river-estuary-ocean system. There were many important contributions to our understanding of these processes. It was evident that serious gaps exist in our understanding of the role of biological, biochemical and physical oceanographic processes in relation to the geochemical cycles of elements in estuarine and coastal waters and the part they play in determining the end products finally discharged into the sea. Information on the rates of processes, often influenced by biological factors, is especially lacking.

It was felt that the substantial programme of presentations had left insufficient time for discussion of individual papers. There was also some criticism of the fact that several authors had failed to comply with their remit from SCOR WG 46 to provide review in their individual fields, and that these authors should be asked to expand their papers for publication to include a review.

2. Publications Arising from the Workshop

It was agreed that the publication of material from the Workshop should include: (1) the papers presented; (2) the rapporteur papers; (3) the regional reviews of RIOS research. The Proceedings will comprise (1) and (2) with a preface by WG 46 incorporating the Group's recommendations; Dr Burton would write participants forthwith, requesting the submission of revised papers, upto fifteen pages total, by the end of May and give requisite editorial information. The position would be reserved to use the extended abstract if no other submission is received. Members of WG 46 will referee papers. The preparation of the final manuscript will be carried out by the Steering Committee for the Review and Workshop, with assistance from a technical editor employed for the purpose.

The Rapporteur Papers, to be edited by Mr Griffiths (IOC), would be revised on a similar time scale allowing the rapporteurs time to see the revised presentations under (1). Rapporteurs would be asked to justify statements not directly supported by the main text of the papers.

The regional reviews, under an umbrella title reflecting their content, will be put out in essentially their present form, allowing revision within three months. Dr Gordeev's papers will be translated, and additional coverage provided by Mr Storrs (USA), Dr Orren (South Africa) and Dr Tundisi (Brazil). These regional reviews will be issued in a rapidly produced and widely available form by IOC.

The Working Group requested Dr Burton to study various publication possibilities once the manuscripts for the Proceedings had been assembled.

3. Recommendations arising from the Workshop

The comprehensive and far-reaching scientific discussion during the Workshop indicated conclusively that our knowledge of river inputs to ocean systems and the ultimate fate of such inputs to the oceans remains incomplete. There is currently a tendency and a potential to produce large amounts of information and scientific data in all phases of RIOS activities. It is obvious that such data acquisition should be undertaken in the light of better understanding of physical, chemical and biological processes, and the need still remains to understand the basic processes before deciding on the type and extent of investigations. Among other factors and processes it was noted that climate plays a significant role in controlling inputs to the oceans via different mechanisms. Atmospheric inputs to the oceans were recognized clearly as a mechanism worthy of greater scientific study in fulfilling the scientific objectives of the RIOS programme. Participants in the Workshop recognized that estuaries vary widely from place to place and there was a need to delineate principal estuary types and to define the reasons for the differences between them.

It was noted that research on RIOS was being pursued principally by developed countries. Clearly there is a need to consider the requirements of developing countries in this field. In particular, it was thought appropriate that RIOS work be included in the development of regional seas programmes, and that suitable RIOS training components be included in such programmes.

SCOR WG 46 adopted the following key recommendations arising from the Workshop:

(i) International organizations such as SCOR, UNESCO, IOC and UNEP, should urge member countries to promote scientific studies of rivers, their estuaries and the adjacent coastal waters, and, wherever possible, encourage international cooperation in these activities.

(ii) These sceintific studies should, wherever appropriate, be incorporated into the UNEP Regional Seas Programme and be used as vehicles for training and technical assistance to developing countries in the study and evaluation of river inputs to ocean systems.

(iii) RIOS Workshops should be held approximately every two years in regions being covered by the UNEP Regional Seas Programme. The purpose of these Workshops would be to evaluate the state of the art in RIOS and the needs in the particular region for scientific environmental studies of RIOS.

These Workshops should be of a more specialised kind, smaller and focused on particular aspects of RIOS, such as river compositions, estuarine mixing, microbiological aspects, etc. or have a marked regional emphasis. It seems appropriate to link the latter with UNEP but perhaps we should consider other possibilities for specialized process-oriented workshops. (see footnote)

(iv) Current approaches to data-gathering on river and estuarine waters and river inputs to ocean systems should be considered by SCOR WG 46 with the objective of developing specific scientific criteria on the most appropriate manner in which data for RIOS purposes should be collected. With respect to this the

Working Group recommends the creation of an *ad hoc* group under SCOR WG 46 with the following participants: J.A. Da Costa, K.R. Dyer, V.V. Gordeev, A. Lerman, M. Meybeck and S.O. Stanley – the last named to serve as Chairman.

(v) It was suggested that a worthwhile activity to be undertaken by WG 46 would be the preparation of a book on the state of knowledge in RIOS. Such a book might require one to two years to write. Dr Eisma was asked to develop this idea further and make his detailed recommendations to the group.

(vi) In the regional reviews, a conspicuous gap is a review for the American sub-continent. Mr P. Storrs kindly agreed to arrange to have a review paper written on the subject.

(vii) To develop an experimental programme. This could involve either (or both) investigations on estuaries identified as suitable for particular studies (e.g. geo-chemically interactive systems with high river inputs of iron and dissolved organics) and/or estuaries of particular significance in global terms.

Footnote to recommendation iii.

The emphasis to date in the UNEP Regional Seas Programme has been on problems of marine pollution. It is clear that there is a need for development of scientific information related to river inputs to the oceans and that WG 46 could contribute significantly in this area. This possible role was discussed with the UNEP representative, Mr Richard Helmer. He noted that there was no impediment, in principle, to such co-operation, but reminded the Working Group that the Regional Seas Programme Activity Centre worked principally through UNESCO on river input aspects of the UNEP programmes (e.g. MED-IX in the Mediterranean), and UNEP would expect UNESCO to make appropriate use of Working Group 46 in the development and execution of UNESCO's joint programmes with UNEP.

WG 46 is envisaged as playing primarily a catalytic role in organizing activities under (iii). The WG could through its workshops assist in coordinating such efforts, bringing workers together for exchange of information and techniques, and generally helping to ensure that national resources are used to maximum effect.

ANNEX VII

ASSESSMENT OF MICRONEKTON

SCOR WG 52 Symposium

Idyllwild USA 28 to 30 April 1980

Tentative programme

Euphausiids/Shrimps

Abundance and biological characteristics of euphausiids revealed by various sampling and detection methods	T. Nemoto
The use of mouth opening/closing rectangular midwater trawls for the study of the vertical distribution of micronketon	A. de C. Baker and M.R. Clarke
Assessment of the abundance and variability of biomass of sergestid shrimps	M. Omori and W. Hamner
Quantitative estimates of euphausiid distribution and biomass determined by high acoustic frequencies	R.E. Pieper
Micronekton sampling using a new multiple-net sampler, the BIONESS, M conjunction with a 120 KHZ sounder	D. Sameoto
Multi-frequency acoustical methods for quantitative assessments of euphausiids	C. Greenlaw and R.K. Johnson
Comparison of various nets and acoustical methods for estimating abundance of euphausiids in northern Norway	W.G. Pearcy T. Pommeranz C. Greenlaw
Methods for krill assessment on the FIBEX surveys	O.A. Mathisen

Fishes

*Review of quantitative, non-closing net sampling techniques for assessing flying fishes and epipelagic micronekton	N.V. Parin and N. Kashkin
Quantitative assessment of the vertical distribution of fishes with codened opening/closing devices	W. Pearcy
Estimation of population parameters of micronekton with towed nets of different sizes and with purse seines	T.A. Clarke
Acoustical methods for quantitative estimation of the abundance of mesopelagic fishes: procedures, problems, prospects	W. Friedl and R.H. Love
Assessment of population abundance by echo integration	R.E. Thorne

Amplitude and frequency domain acoustic assessment of epipelagic (0–200 m) schooling fishes; review of methods, sampling design, problems and potentials for progress	P.E. Smith and D.V. Holliday
Cephalopods	
Quantitative net sampling techniques for pelagic cephalopods	C.F.E. Roper and J. Wormuth
A review of the methods and problems of quantitative assessment of *Loligo opalescens*	G.M. Cailliet
A preliminary approach to stock assessment of *Todarodes pacificus* Steenstrup by larval abundance	T. Okatani and T. Watanabe
Quantitative assessment of squids by means of jigging surveys	M. Murata

* unconfirmed

ANNEX VIII

WORKING GROUP 54 (with SCAR, ACMRR and IABO)

LIVING RESOURCES OF THE SOUTHERN OCEANS

BIOMASS PROGRESS REPORT

(December 1979)

by Sayed Z. El-Sayed

Meetings of BIOMASS Technical Groups

Data Statistics and Resource Evaluation (Chairman, G. Newman)

The Group stressed the need for data base and exchange systems for the BIOMASS Programme. It was agreed that these necessitate a plan for procurement of adequate facilities and support and standardization of methods of measurement and data reporting. The Group concluded that a Data Centre for the duration of BIOMASS is essential. Recommendations in four categories were made by the Group with respect to data base and exchange systems, hydroacoustical studies, resource evaluation and management strategy.

Methods (Chairman, D.J. Tranter)

This Group has identified the manuals or leaflets that will be needed to describe methods to be used in BIOMASS, ranging from acoustic estimation of krill and aerial censuses for birds to techniques for aging Antarctic fishes. The Group recommended standardization of data processing and planned close liason with the chairman of the TG on Data Statistics and Resource Evaluation for development of data sheet formats. The Group expressed a need for a common plankton sorting centre for FIBEX.

Programme Implementation and Coordination (Chairman, G. Hempel)

Much of the discussions of the Technical Group and the contents of its report were concerned with the planning of the multiship acoustic survey for krill. There are good practical reasons for this, because this is the part of FIBEX that involves the greatest degrees of international cooperation, and therefore needs to the most planning. However, to ensure that emphasis on the krill survey did not detract from the importance of other activities, the Group of Specialists has re-stated the components of FIBEX (see below).

Activities of the BIOMASS Working Parties

Acoustic Krill Estimation (Chairman, O.A. Mathisen)

This Working Party considered a large number of technical questions that should be examined before a large scale acoustic survey for krill is carried out. One major need was for calibration; accordingly a short calibration course for those expecting to participate in the urvey was held in Horten, Norway, in September 1979.

Krill Biology (Chairman, J. Mauchline)

This Working Party has carried on its work by correspondence. Considerable progress has been made in determining: the nets that should be used (though the use of a single standard net in all circumstances will not be feasible); the length measurements to be made; the definition of maturity stages; the determination of population structure; and methods of studying swarming behaviour (which might include the study of swarming in other euphausiid species in more accessible locations).

Fish Biology (Chairman, D. Sahrhage)

Following a recommendation of the January meeting, a Workshop on Age Determination of Antarctic Fishes was held 28 to 31 August 1979, in Cambridge, U.K. Material for a methods manual was prepared.

Physical and Chemical Oceanographic Observations (Chairman, A. de C. Baker)

This Group has also worked by correspondence. Two aspects had been addressed: first, a few basic physical and chemical observations were identified that should be made during any biological study in order to enhance the value of the biological observations; second, the Working Party identified some major oceanographic problems, among them one that required attention in order to help tackle the biological questions – the patterns of water circulation on different scales.

Seabird Ecology

The Group of Specialists has welcomed a recommendation from the first planning meeting for an International Survey of Antarctic Seabirds (ISAS) that the ISAS planning committee be considered as a working party within the BIOMASS structure.

Meeting of the Group of Specialists on Living Resources of the Southern Oceans, Kradow, Poland, 26–28 September, 1979

FIBEX (First International BIOMASS Experiment) 1980–81: Outline of Major Activities

The BIOMASS Programme, initiated in 1976, envisaged three major types of activity: seagoing experiments and surveys, shore-based experiments and year-round observations, and data analysis and modelling. While a variety of research activities contributing to BIOMASS objectives have been in progress since 1976 the major activity has been directed toward planning for FIBEX which will take place in the austral summer of 1980–81. The major feature of FIBEX will be the simultaneous deployment of a large number of research vessels in a multi-disciplinary study of the krill populations and their environment in the west Atlantic and in two smaller areas in the western Pacific areas. It is envisaged that the following programmes will contribute to FIBEX.

A 25 day multiship krill acoustic survey in the western part of the Atlantic sector with supporting parallel studies in the eastern Atlantic/Indian and Pacific sectors in February 1981 with the aim to estimate the abundance of krill in the survey area and so assess the feasibility of echo surveys for krill stock assessment.

Accompanying observations of the acoustic survey. As far as possible these will include: estimation of phytoplankton abundance (studied by under-way fluorescence measure-

ment); primary production (noon station); mixed layer depth (XBT's underway, STD at station); sampling of krill, other zooplankton and ichthyoplankton (RMT 1 8 and bongos); observations on abundance and distribution of krill predators (birds, seals and whales).

Meso- and small-scale patch studies of krill swarming behaviour. These studies, which would follow a patch for 7–10 days, will start after the conclusion of the acoustic survey.

Relationship between krill drift and water movements using data from satellite monitored drifting buoys.

Multiship fish population studies.

Oceanographic surveys designed to elucidate features of importance to krill distribution, behaviour and life history.

Shore-based field and laboratory studies. These will include studies of krill feeding behaviour and physiology, fish studies, bird and seal population dynamics and trophodynamics, near-shore studies of water column processes (primary and secondary production, nutrient cycling, decomposition processes).

BIOMASS Data Centre

The Group confirmed the importance of establishing a BIOMASS Data Centre for the duration of the BIOMASS Programme. Australia has shown particular interest in this proposal.

SCOR WG 52 on Estimation of Micronekton Abundance

The activities of this Working Group, including its Workshop on Assessment of Micronekton 28 to 30 April in Idyllwild, California, USA, are of great relevance to BIOMASS, and the Group welcomed the progress being achieved.

Workshop of Cephalopod Beaks

At the Krakow meeting the Group considered a proposal to hold a workshop on the identification of cephalopod beaks. In the absence of any practical method of direct sampling of cephalopods in the Antarctic, the examination of beaks in the stomachs of predators is one of the best methods of studying this important group of animals. The proposed workshop was therefore strongly welcomed.

Funding for Meetings

BIOMASS-related meetings and activities will require substantial funding. The Group of Specialists therefore iterated its recommendations made at the Kiel meeting regarding support from SCAR, SCOR, other appropriate international organizations, and the Antarctic Treaty governments. The need for a full-time BIOMASS Secretariat was again strongly stressed.

Schedule of BIOMASS-Related Meetings

The Group discussed at some length the meetings of various groups that had been proposed. The proposals were closely scrutinized to reduce the number to the minimum considered essential to ensure the effective implementation of FIBEX.

Financial support other than from SCAR and SCOR

The USA has generously supported the Convenor in 1979 and has provided most of the finances for the production of BIOMASS reports. The balance has been met by SCAR. The Norwegian Department of Fisheries generously supported the BIOMASS calibration course.

Assistance with travel of some participants in meetings has been provided by IOC and FAO.

WORKING GROUP 55 (with IAMAP and IAPSO)

PREDICTION OF EL NIÑO

Summary report of Meeting, San Francisco, 4–8 December 1978

This third meeting of WG 55 consisted of three group sessions (totalling some 9–10 hrs), several private meetings involving 2–3 committee members, plus attendance at sessions on climate modelling, NORPAX, remote sensing and general oceanography held during this period in connection with the Meeting of the American Geophysical Union. WG 55 members Lagos, Namias, Newell, O'Brien, Rountree, Stuart, and Wyrtki were present. During the group sessions, WG 55 was assisted by the following: David Enfield, David Halpern (representative of WG 56), Elmer Reiter, William Patzert, Tim Barnett, plus Bill Billing and Jane Hsiung (associates of Professor Newell).

Emphasis was given to hearing the view-points of WG 55 members not present at the earlier meetings. This led to extremely good interaction between the members and a better appreciation of the overall problem and the expertise the various members have to bring to bear on the charge of WG 55.

Status of Previous Actions of WG 55

After a lively discussion, the definition of El Niño arrived at during the Las Palmas meeting was confirmed as the appropriate working definition for WG 55's charge of examining possible prediction schemes and indices. The WG agreed on the need to clarify how long (i.e., for how many months) the temperature anomaly must exceed 2°C in order to be classified as an El Niño. For this purpose Lagos is to provide the WG with a printout of the Peruvian Coastal Station sea surface temperature (SST) data (means and anomalies).

At the Las Palmas meeting WG 55 recommended archiving of satellite SST data, on a daily bases, for tropical oceans especially the Pacific. The need for such a data base was discussed including the likelihood that El Niño is reflected in SST and atmospheric changes on a global bases. As a result, a specific recommendation on data was made (see below).

Updating of El Niño Related Activities

Lagos and Wyrtki briefed WG 55 on the October 1978 meeting – in Lima – of ERFEN III and the first session of the Joint IOC/WMO/CPPS Working Group on Investigations of El Niño. WG 55 considered the continuance of ERFEN (Regional Study of the El Niño Phenomena) to be important for the prediction, verification, and physical understanding of El Niño.

Wyrtki reported on the activities of WG 47 – Oceanographic Programmes during FGGE, and Halpern on WG 56 – Equatorial Upwelling Processes. WG 56 has sent to NOAA their request for archiving of daily satellite SST data for all tropical oceans.

Wyrtki reported that as part of NORPAX the shuttle program (aircraft and ships) would continue for 16 months from February 1979 to May 1980.

As a part of the Oceanographic program of NOAA, the Eastern Pacific Ocean Climate studies (EPOCS) in equatorial upwelling in the region of 120°W has been approved. EPOCS will run for several years.

It was too early to discuss the nature of the post–IDOE and post–FGGE oceanographic programs in the Pacific. The WG was hopeful that data critical for forecasting and understanding El Niño will continue to be gathered.

A general scheme for prediction of the SST anomaly field from the SST anomalies themselves was presented by Bill Billing. This was based on modelling the time series associated with the most important modes of variation in the field. An example was given of hindcasts using first order autoregressive model fits to the time series.

Tim Barnett presented results of his studies using linear prediction methods involving ocean-atmosphere variables.

Wyrtki discussed his ideans concerning El Niño occurrence. Central to Wyrtki's hypothesis is the build-up in the sea level in the Western Equatorial Pacific due to anomalously strong S–E trades.

Summary of Prediction Models

Rountree, O'Brien and Stuart led the discussion of what has been done via dynamic modelling of El Niño. Generally, modelling efforts have been of a non-interactive type largely examining the effect of sea surface temperature anomalies (SSTA) on atmospheric evolution or of atmospheric anomalies on the ocean but generally not of a real feedback nature. At the Las Palmas meeting WG 55 said modelling should produce simulation runs to: (1) give a better understanding of the physics of El Niño; (2) guide the selection of basic indicators (predictors) and hence to guide the observations needed (when and where) to obtain input values for prediction schemes and to help document El Niño events.

Future Directions for WG 55

WG 55 had considerable discussion of what has been accomplished so far and what were the logical next steps to be taken. Besides having arrived at a workable definition of El Niño plus the specific recommendations concerning data and modelling the following tasks were set forth:

1. Clarify the definition of El Niño especially regarding how long $\Delta T \geqslant 2°C$ must occur.

2. Commission a summary paper on The status of the El Niño phenomena.

3. Identification, verification, and evaluation of prediction schemes and indices.

4. Arrange for an El Niño session (directed toward prediction schemes and emerging research) at an appropriate International Symposium.

Item 1 will be studied by the members upon receipt, from Lagos, of a printout of the monthly means and anomalies of SST for the Peruvian Coastal Stations.

To accomplish item 3, all persons or groups preparing El Niño indices and forecasts are to send information and forecasts to the Chairman (Stuart), who will distribute the materials to all WG 55 members for confidential evaluation of the scheme and forecast. The problem of verification seems straightforward now that we have a specific definition of El Niño. However, prompt flow of the SST data for the Peruvian Coastal Stations is important.

WG 55 Recommendations

Data:

Recognizing that El Niño is a climate type problem and as such long term data banks are necessary we recommend the following:

1. That existing stations measuring sea level in the tropical Pacific be maintained and that there be a doubling of coastal stations measuring sea level along the Pacific coast of South America.

2. That basic satellite sea surface temperature (SST) data be archived on a once a day basis for the tropical Pacific Ocean on a grid ¼° lat. X 1° long. from 5°N to 15°S. However since there is good evidence that El Niño causes and/or forecasting may be related to the world wide SST, we recommend that the satellite data be archived for the *tropical* Atlantic and Indian Oceans and on a looser grid (say 1° lat. X 1° long.) for all the world's oceans. Since remote sensing techniques change with time and are a function of the atmosphere, we recommend that what is archived is the basic calibrated SST sensor data along with appropriate atmospheric sensor data.

3. That the important collection and mapping of SST be continued and expanded.

4. That an appropriate data center(s) be designated to oversee that the data so important for the understanding and eventual prediction of El Niño continue to be collected, archived, and distributed.

Modelling:

Such low frequency fluctuations as El Niño are unlikely to be forecasted via real time interactive Ocean-Atmosphere numerical models. However numerical models can be quite useful for simulation runs designed to reveal the physical mechanism of El Niño thereby possibly leading to better, more complete, indices and in guiding the required observational network.

Non-Interactive Ocean Models:

Testing of Wyrtki's 1975 Hypothesis: First design an ocean model which can be spun up to a reasonable annual cycle. Then test the sensitivity of the simulation to variations in the imposed wind stress in particular to the strengthening of the Pacific Trade Winds and the subsequent relaxation (weakening) of the Pacific Trade Winds.

Non-Interactive Atmosphere Models:

Test such a model's response to sea surface temperature anomalies (SSTA) in particular to those SSTA which have been observed to occur within three months *before* development of an El Niño. The objective of these experiments is to find if such SSTA generate weaker easterlies than are generated with climatological SST.

Interactive Ocean-Atmosphere Models:

Employ such models to investigate the evolution of SSTA specified in the initial conditions. The purpose being to investigate which SSTA are conducive to development of Eastern Pacific SSTA. Furthermore WG 55 is interested in any simulations which show interannual variations in the Eastern Tropical Pacific.

WORKING GROUP 57 (with IAPSO, UNESCO and ECOR)

COASTAL AND ESTUARINE REGIMES

Report from Chairman – B.J. Matthews

The activities of the working group in 1979 have concentrated on two areas: (1) convening the Interassociation symposium number 4, at the IUGG General Assembly in Canberra, Australia and (2) developing publication plans for a monograph series on coastal and estuarine dynamics.

The IUGG Symposium on Problems of Coastal and Estuarine Zones was held 11–12 December 1979 and was co-sponsored by IAMAP, IAPSO, IAHS and CMG. The three convenors, Professor B.J. Noye, Dr N.S. Heaps and Professor J.B. Matthews are all members of the working group. The symposium was divided into four parts:

(a) the dynamical interaction of the sea-breeze with coastal waters,

(b) the dynamics of large lakes,

(c) physical processes in estuaries, and

(d) processes and their modelling in coastal seas.

The titles of the sections demonstrates the interdisciplinary nature of the symposium. The interactions between meteorology, hydrology, physical oceanography and coastal engineering was very fruitful. The interdisciplinary interaction was something the working group has tried to foster in partial fulfillment of its founding precepts. The section on physical processes and their modelling is also directly related to our objectives. Some numerical models were reported in which a concerted effort had been made to provide compatible verification data. There is still much progress to be made in numerical model verification and the working group feels that advances both in computational techniques and field data acquisition should be sufficiently advanced by the next Joint Oceanographic Assembly to warrant a symposium on the topic. We therefore propose that SCOR support a symposium devoted to modelling of coastal and estuarine systems with emphasis on related observational data including both satellite and sea truth observations.

Progress has been made through the year on our publication project. Support for the production and publication has been found. One or two commercial houses were interested in the project as well as non-profit scientific associations. We had originally intended to produce a single book. However, as the discussions progressed, it became apparent that a series of books was more appropriate. It would be easier to prepare three or four chapters for publication in a monograph than twenty or thirty chapters simultaneously in a single volume. The W.G. felt that a single volume could be produced after the first eight monographs have been published by editing and revising key chapters from the monographs.

UNESCO agreed to support our project by providing funds to help working group members meet in conjunction with the IUGG meeting in December 1979. At the W.G.

meeting in Canberra we agreed to accept the offer of the American Geophysical Union (AGU) to publish the monograph series. We chose AGU as publisher because a monograph series already exists as a high quality hard cover series with many many standing orders, because AGU offered the best subsidy to defray publication costs and because the targeted retail price is about U.S. $10 per volume. The working group was particularly anxious to keep the price to as low a level as possible to make the publications widely available. The objectives of the monograph series is to provide a summary of the present state of knowledge of physical processes of estuarine and coastal regimes. It will be aimed at a wide scientific audience including sedimentologists, coastal engineers, marine biologists, geochemists as well as physical oceanographers.

The editorial, review and publications details were developed at the W.G. meeting in Canberra. Editors for the first eight volumes were chosen. Seventy authors have agreed to contribute and will work in small groups under the guidance of the volume editor. All papers will be reviewed before the production of photo-ready copy. The volumes will be published once they are reviewed and will be in preparation simultaneously. It is hoped that this procedure will speed the publication process. The volume editors are members of the working group and will work cooperatively. It is hoped that additional funds can be obtained to allow the contributors to each volume to meet together at least once during the manuscript preparation phase. This could be in conjunction with a scientific meeting.

Since the working group was founded at the IUGG Assembly in Grenoble in 1975, a report was presented to the IAPSO participants in the IUGG Assembly in Canberra in 1979. The publication of the monograph series has now become the major work of the working group. We suggest that when this task is completed, probably by the next IUGG general assembly, the working group be disbanded or reconstituted with a new set of goals.

WORKING GROUP 59 (with IABO)

MATHEMATICAL MODELS IN BIOLOGICAL OCEANOGRAPHY

Report from Chairman – K.H. Mann

WG 59 met at the Bellairs Research Institute, Barbados, February 19–24, 1979. The purpose of the meeting was to complete compilation of a state-of-the-art review "Mathematical Models in Biological Oceanography" which is to be published by UNESCO in the series Monographs on Oceanographic Methodology. A report of the meeting was submitted during May 1979 (see below).

Drs Mann, Piatt and Ulanowicz met in Darmouth, Canada in July 1979 to fill gaps in the contributions from members and advance the editorial process. The manuscript was completed in early September, and by arrangement with the SCOR publications officers, Mr R.I. Currie, was sent to Dr J. Paloheimo, Toronto, for review. Dr Paloheimo's comments were received and considered in early December, and the manuscript was forwarded to Mr Currie.

Future plans are focussed on the desire to hold an international meeting in 1981 on "Flows of energy and materials in marine ecosystems: theory and practice". The strongest conclusion of our review was that we have abundant data on biomasses in the ocean but far too little on fluxes between biomass compartments. This places a severe limitation on our ability to make predictive models in biological oceanography. We consider that there should be a major international meeting to review methods of measuring fluxes and results so far achieved. We considered various suggestions that the meeting be a special session of some larger meeting, but concluded that the subject justifies an independent meeting.

The working group has been active in seeking financial support for a meeting in 1981, but so far has received no firm promises. For a truly representative international meeting we consider that about $30,000 is required to cover organisation and contributions towards expenses of invited participants. WG 59, while recognizing the financial stringencies of the present time, recommends that SCOR endorse the holding of such a meeting and make every effort to commit funds for a meeting in 1981. An allocation of part of that sum, say $3,000, during 1980 for an organizational meeting would be a step in the right direction.

Report of the second meeting of SCOR/IABO W.G. 59

on mathematical models in biological oceanography

Barbados 19 to 24 February 1980

The following members were present: K.H. Mann, Canada, Chairman; T. Platt, Canada, Vice-Chairman; J.M. Colebrook, U.K.; M.J. Fasham, U.K.; G. Radach, F.R.G.; D.F. Smith, Australia; R. Ulanowicz, U.S.A.; F. Wulff, Sweden.

The following members were unable to attend: J. Field, S. Africa; V. Menshutkin, U.S.S.R.; M. Vinogradov, U.S.S.R.

Dr J. O'Brien (previously, Chairman of WG 49) was invited to attend, and accepted. At the last minute he was prevented from attending, by a severe snowstorm. The working group welcomed the nomination of Dr E. Hagen, G.D.R. as corresponding member.

Review of the state of the art of modelling in biological oceanography

The working group members each made a good contribution to the meeting by submitting draft material according to the scheme prepared at the first WG meeting and duly approved by SCOR. During the meeting 19–24 February, 1979, the contributed material was reviewed, modified, extended, and rearranged according to a new outline. A copy of the outline, together with the concluding statement, is submitted.

Dr T. Platt accepted the task of coordinating and editing the review, since the chairman, Dr K.H. Mann is on sabbatical leave.

The working group *recommends* that the review document comprising some 250 pages of typescript be submitted for publication in the UNESCO series, Monographs on Oceanographic Methodology.

Chapters II, III and IV are in an advanced state of preparation, but Chapter I is lacking several sections. In order to bring this chapter to a state of readiness, the working recommends that a sum of about $400 be provided to enable Dr Ulanowicz, U.S.A. to meet with Dr Platt in Canada in May or June. During the time they are together, they intend to fill the remaining gaps and edit the total manuscript for submission, through the working group chairman and the SCOR Executive Committee member for publications.

Future plans

The strongest conclusion of the working group was that there is a need for biological oceanographers to focus more attention on the measurement and understanding of ecological fluxes. This view will be made more explicit when our review is published.

It would appear that a natural sequel to our present activities would be to promote a symposium on the theme of ecological fluxes in the sea. We therefore *recommend* to SCOR that WG 59 undertake to find support for, and organize, a symposium under the title *"Flows of energy and materials in marine ecosystems: theory and practice"*.

Allowing one year for publication and a further year for dissemination of our review, we suggest that a target date for such a meeting should be 2 ½ years ahead: during the second half of 1981.

ANNEX XII

WORKING GROUP 61 (with CMG and ECOR)

SEDIMENTATION PROCESSES AT CONTINENTAL MARGINS

Report from Chairman – Dr I.N. McCave

On two occasions we have had meetings of a subset of the W.G.: McCave met with Shu and Werner, at the International Association of Sedimentologists' North Sea meeting in September 1979, and with von der Borch and Almagor at the I.U.G.G. Assembly in December. Unfortunately several members were unable to get to the Canberra meeting. As a result of these meetings we have clarified some of our objectives, obtained a lengthened, more realistic, timetable, proposed additions to the working group and are proposing a major symposium at JOA 1982 in Halifax.

Review The review of existing knowledge is going to take longer than originally anticipated partly because of increased committments by members of the W.G. and partly because of our proposed expansion of the W.G.. We anticipate the work continuing through to 1981. New elements that need to be incorporated are (a) an outline of the geological structure and morphology of margins as an introduction, and (b) more explicit consideration of the role of carbonate (and silica) production and dissolution in shelf, slope and rise sedimentation. We already have a review of geotechnical properties and slope stability from G. Almagor and several other contributions are anticipated in the next year.

Membership We propose that the memsbership of the working group be increased by four. C. von der Borch will prepare the introductory review of structure and morphology, but we need another member to examine the historical record of sedimentation processes on continental margins to be found in cored sediments taken by the Deep Sea Drilling Project. We also need a carbonate sedimentologist to review production and dissolution, principally of carbonates but also of opal, an expert on sedimentation in submarine canyons and one on the interpretation of high-frequency seismic data.

Meetings It would be valuable if the W.G. could meet in the second half of 1981 to frame its recommendations and finish off the review. A suitable venue has not yet been identified. We wish to propose that the work of the group should culminate in 1982 with a symposium on Sedimentation Processes at Continental Margins at the Joint Oceanographic Assembly to be held in Halifax. The time is suitable because the United States HEBBLE project and (if it goes ahead) the Shelf Sediment Dynamics Program will have completed 3 years work. The German workers in SFB 95 "Interaction Sea-Sea Bottom" should also be able to provide summaries of the advances made in their project. We see the symposium as a forum where workers in sediment dynamics both in shallow and deep water can come together. To avoid clashing sessions, two days of meetings will be necessary.

We would like an early approval of this proposal in principle, because it will involve some expenditure on the part of SCOR. The completion of our review will also have some associated costs for reproduction, though at present the W.G. is uncertain as to whether to adopt an institute internal report format or whether to publish the review as a book.

ANNEX XIII

SCOR WORKING GROUP 62 – THE CARBON BUDGET OF THE OCEANS

Report from Chairman – E.D. Goldberg

The Working Group had its first meeting in Paris, France on 12, 13 November 1979. Members in attendance were M. Whitfield (UK); F. Millero (USA); H. Oeschger (Sweden); S.U. Smith (USA); P.J. LeB. Williams (UK) and E.D. Goldberg (USA), Chairman. Absent were J. Edmond (USA) and E.A. Romankevitch (USSR). In addition, some members of Working Group 44, which was meeting the following two days, attended our sessions: R. Chesselet (France); J. Prospero (USA); R.A. Duce (USA); S. Tsunogai (Japan); W. Seiler (Federal Republic of Germany). The "back to back" meetings proved especially rewarding to Working Group 62 which gained substantial inputs from this procedure. Clearly, such a tactic is successful where Working Groups have some common interests.

The carbon budget of the earth is of great concern to many scientists today, especially those concerned with the fate of the man-mobilized carbon dioxide to the environment through fossil fuel combustion and through the destruction and burning of terrestrial biomass. There are several recent volumes and many recent papers dedicated to formulation of models of the carbon budget; the oceans play a significant role in all such models. The Working Group recognized that reviewing the present literature or rewriting the conventional wisdom on the role of the oceans in the carbon budget would not be especially fruitful. Instead they posed the questions "What are other sinks for carbon in the ocean that may be significant and which have been over-looked or played down?", "What measurements should be made to evaluate the importance of such sinks?" and "What ancillary measurements might be made to more clearly define the ocean's role in the carbon cycle?"

Inasmuch as the Report of this meeting has not been reviewed by the Committee Members, I will outline what appear to be possible recommendations of the group.

A. *Elemental carbon as a sink.* The annual burning of biomass has been estimated to range from 5 to 9 billion tons per year. As a consequence, between 0.1 and 1.5 billion tons of elemental carbon (soot) are produced. The historical records of such burnings, may be found in coastal marine sediments. Thus, the measurement of elemental carbon in anoxic sediments (i.e. those where valid geochronologies can be established in the absence of bioturbation), would assist in more closely approximating the extent of this sink. The amounts of such burnings (present day ground truth) may be found in satellite pictures of the earth and such a possibility should be investigated. Finally, the development of simple techniques for the analyses of elemental carbon are urgently needed.

B. *Seaweed as a CO_2 sink.* Seaweed ecosystems, including algal bed and reef as well as estuarine ecosystems, with turnover times of about a year warrant assessment as a sink. It is argued that very little of this seaweed enters the food web; much probably becomes deposited in sediments. Further, the seaweed, if it moves out to deep waters and is consumed there, can act as a transfer in moving CO_2 from the mixed layer into deeper waters. Finally, these seaweeds may substantially reduce the CO_2 pressure in the overlying atmosphere. The global inventory of the present extents of algae and seagrass (perhaps obtainable by a combination of remote sensing techniques with some ground truth measurements) is urgently needed, as well as any evidences of historical

changes, which might be found in air-photograph archives and in the literature. Further, the data on biomass and productivity should be re-evaluated to obtain global values. The fate of seaweeds should be determined to ascertain if they are an effective carbon sink.

C *Inorganic responses of the ocean to increases in atmospheric CO_2.* Assessments were made on what basic data are needed to more quantitatively understand the impact of increasing P_{CO_2} upon the inorganic reactions involving carbon. Basic data which appear to be inadequate today include solubility constants for calcium carbonate minerals, especially at low temperatures and high pressures. Dissolution rates of calcite and aragonite, the rates of hydration and dehydration of gaseous CO_2, and in particular the degree of undersaturation required before calcium carbonate dissolution can occur at significant rates. The uptake of carbon dioxide in active downwelling areas can be developed with studies involving transient tracers, carbon dioxide measurements and nutrient balances, all made at the same time. The role of calcium carbon at dissolution as a sink for carbon dioxide was addressed. A few select monitoring sites should be established in temperate and high latitude shelf seas and in the open ocean to attempt to follow any oceanic uptake of excess CO_2. Finally, theoretical and field studies should be undertaken to establish the extent to which rapidly downwelling waters are able to affect significant changes in the depth of the lysocline.

D *Tracer studies of atmosphere-ocean exchange.* In order to formulate models for the ocean uptake of carbon dioxide, the ages of different water masses are essential. The frequency distribution of such ages can perhaps be obtained by carbon-14, tritium and argon-39 studies. These studies should be initiated immediately.

E *The history of the atmospheric carbon dioxide content.* Also essential to ocean/atmospheric modelling is the content as a function of time of the atmospheric carbon dioxide content. Measurement of the carbon dioxide content of permanent ice sheets in Antarctica and Greenland indicate levels during the last glaciation of around 200 ppm, compared with Holocene levels of 300 ppm. To extend this information, attempts to find carbon dioxide oscillations in the oceanic sediments should be sought. Combining ice and sediment data may be most rewarding in understanding the role of the oceans in controlling the atmospheric carbon dioxide content.

ANNEX XIV

SCOR AD HOC REVIEW GROUP FOR ANTARCTIC OCEANOGRAPHY

Report from Convenor, Professor T.D. Foster

December 1979

During the past year the convenor has kept in touch with the other members of this group by correspondence, telephone, and meeting on an individual basis. There did not appear to be any new projects developing that would require SCOR help, with the possible exception of Polex South. Two large physical oceanographic projects, International Southern Ocean Studies (ISOS) and International Weddell Sea Oceanographic Expedition (IWSOE), are both having their last field programs in 1980, though their data analysis efforts may continue for two or more years. BIOMASS is planning their first international field program (FIBEX) for 1980, and SCOR Working Group 54 is actively involved in this effort. Research projects in Antarctic oceanography that are proceeding along disciplinary lines are generally well organized and need little help from SCOR. Interdisciplinary projects, especially those that involve interaction between the physical and biological sciences, are much more difficult to organize. SCOR could play an important role in stimulating such projects since SCOR includes all disciplines.

An important step in facilitating interaction between the physical and the biological sciences and in helping to eliminate mutual suspicion and distrust would be to bring scientists together in an international Antarctic oceanographic conference. We discussed the proposed conference at the Southern Oceans Symposium held as part of the IUGG meeting in Canberra in order to ascertain interest on the part of physical, chemical, and geological oceanographers for an interdisciplinary conference. Since there seems to be some interest among the physical scientists, we are not exploring interest with the biological scientists. 1982 continues to seem to be a good year for holding the proposed interdisciplinary conference.

GATE ATLAS EDITORIAL BOARD

Report from Chairman – Dr F. Ostapoff

Through the arrangements of SCOR and IOC, Dr Bubnov, USSR, visited Miami in January, 1979 to provide the editors with a full set of graphs of the USSR oceanographic data set. The editorial board acknowledges with great satisfaction the support obtained from SCOR and IOC making Dr Bubnov's visit possible.

During the year, the Atlas concept somewhat changed to a synthesis of the GATE observational material in context with the climatological mean in order to place the GATE results into proper prospective. As a result, the following title for the "Atlas" was adopted "Physical Oceanography of the Tropical Atlantic during GATE".

At this time, the following goals have been established:

25 January 1980 – all figures will be drafted and figure captions completed

1 February 1980 – draft introduction completed and submitted to Editorial Board for review

1 March 1980 – Copy editing and review accomplished

15 April 1980 – Type-setting accomplished

May, 1980 – Paste-up accomplished and begin printing the edition of 1500 hard-bound copies

– Abolishment of the Editorial Board

Acting on the recommendation by JOC XV, Dubrovnik, April 1979 no volume 2 for the B/C-Scale is being planned because the data set is not suitable for such a presentation.

ANNEX XVI

MARINE POLLUTION AND SCOR

Report by Dr B.I. Dybern

SCOR Scientific Rapporteur on Marine Pollution

The general awareness of marine pollution problems and the damage which pollutants may cause to marine life and human marine activities is still increasing on the whole. This awareness is in many cases due to the practical importance of many coastal waters for fishery, aquaculture and recreational activities. Pollution studies often involve highly advanced techniques for reliable analysis of, e.g., seawater and toxic substances in biological material. Unfortunately the increasing costs seem to have to a great extent impeded the favourable development of marine pollution investigations and abatement measures of the last few years. The training of personnel from developing countries is still too inadequate, which makes these countries lag far behind the industrialised ones.

The primary interest of SCOR is not pollution studies. The interests of SCOR and of Groups working with pollution problems however often touch each other. Thus several members of SCOR Working Groups are taking part in GESAMP activities. And there is a certain pressure on SCOR, eg from IOC/GIPME, to help with research at least partly falling within the marine pollution research frame. In view of the necessity to have pollution studies carried out on a great number of items and in view of the failure of other bodies to deal with many of them I suggest that SCOR take a positive attitude to such requests whenever possible, especially regarding development of methods.

I also suggest that more pollution studies then up to now are included in the work of SCOR Working Group 46 and 60, since knowledge of the influence of pollutants in the sensitive areas of estuaries and mangroves still is scarce but extremely important.

I suggest that SCOR continue actively to support the ICES/SCOR Working Group on the Study of the Pollution of the Baltic (WCOR WG42). The SCOR input is extremely important not the least because it gives the possibility of mixing people within the ICES sphere with other researchers around the Baltic. It also gives the possibility of including valuable basic research in the activities. The results from the Baltic may also be of interest for other SCOR Working Groups.

Items from the IIIrd meeting of the IOC WC–GIPME
May–June, 1979

It is evident that there are great overlappings between IOC/GIPME on one hand and the Regional Seas Programme Activity of UNEP on the other. This was especially underlined by a letter from the Director of the UNEP Programme, Dr S. Keckes, to Mr D. Scott, Secretary of IOC.

An intercalibration exercise (chlorinated hydrocarbons and trace metals) will be arranged at the Bermuda Biological Station in early 1980, from the beginning as a joint undertaking by IOC, WMO and UNEP. WMO, in a telex, declared that they in the future will concentrate their efforts in the marine field on the air/sea interface exchange. Marine pollution 'per se' will not attract so much attention. The representative of UNEP was not

especially enthusiastic for the intercalibration exercise but said that UNEP in any case probably could give some contribution to it. IOC will thus be the leading agency and seeks co-operation with ICES.

The Working Committee of IGOSS had suggested to set up a global oil monitoring system. The Working Committee of GIPME considered this be premature for several reasons.

During a discussion of national contributions several Delegates complained of the bad co-ordination between UN Organisations, frequently sending out questionnaires with greatly the same questions, thus increasing the workload for national bodies and institutions.

A new review on the state of health of the oceans will be made by a special group set up by GESAMP. The WC of GIPME wishes to be represented on this group.

Questions Particularly related to SCOR

There are mainly two items in which SCOR may be involved:

a. In connection with the discussions on regional programmes, especially that of the Caribbean Sea, it was pointed out that studies on effects of oil pollution would be important, and it was suggested that SCOR and AMMRR be invited to promote work in this field. SCOR will probably be approached by IOC in this question.

b. The new GEMSI will consist of members from the old GEMSI *plus* others. The composition will vary from meeting to meeting, depending on what items are to be discussed. SCOR may be invited to nominate a representative in the group (or may even request IOC to allow a representative to be nominated). – I think the work carried out in some of the SCOR Working Groups, especially nos: 42, 44, 46 and 59, is very relevant to future activities within GEMSI and that it, therefore is of high priority for SCOR to be represented on GEMSI.

MATHEMATICAL MODELLING

Report for 1979 by

Professor J.J. O'Brien, SCOR Scientific Rapporteur on Mathematical Modelling

This is a brief report for 1979. The *Ocean Modelling* newsletter is being published at a regular rate of eight times a year. It seems to be a useful mechanism for rapid exchange of physical modelling results, since most of the relevant journals are experiencing lengthy delays in publishing papers. Costs are rising and SCOR is requested to continue endorsement in order to enhance US–ONR support.

Progress in Oceanography plans to publish some of the papers from the SCOR Workshop on Fronts, Brest. The editors expect receipt of the papers in early 1980. *Progress in Oceanography* has also indicated interest in publishing the SCOR WG58 report on the Arctic Ocean Heat Budget in a revised format which removes previously published work. Drs Foldvik and Aagaard have declined at this time. An inquiry from Professor Robinson, WG 34 to publish the volume on mesoscale eddies is being considered.

This rapporteur was unable to meet with WG 59 due to severe weather conditions at the start of meeting and with CCCO due to a conflict with a US–USSR symposium on upwelling ecosystems. The reports from these meetings indicate that appropriate modelling is being considered.

The U.S. will have two new equatorial physical oceanographic research programs in the early 1980's; PEQUOD in the Pacific (contact Dr D. Moore, Hawaii) and SEQUAL in the Atlantic (contact Dr E. Katz, Lamont). In connection with these experiments, there exists an informal EQUATORIAL THEORETICAL PANEL composed of *all* interested modellers. The panel meets at least once a year. The first 1980 meeting is in Tallahassee on 29–30 April, 1980. An interested scientists should contact Dr Dennis Moore at Department of Oceanography, University of Hawaii, 2525 Correa Road, Honolulu, HI. 96822. The panel is *not* affiliated with any national or international organization. It acts to stimulate intellectual activity amongst interested scientists. Any scientist with interest in physics at the equator may be a member.

The SCOR Executive is reminded to include a modeller on any new SCOR working group such as the proposed WG65 Coastal–Offshore Ecosystems.

In 1980, this rapporteur will continue to interact with SCOR WG55, 56 and 59 and CCCO. There does not seem to be a strong rationale for any new SCOR working group on modelling at this time.

COMMISSION FOR MARINE GEOLOGY

Report to SCOR, 1979

1. *Membership*

Professor Ed Goldberg (USA) has filled the position left by Bruce Heezen's death. About thirty national correspondents have been recruited in IUGS member countries.

2. *Relations with other ICSU and Intergovernmental bodies*

2.1 *SCOR*

CMG was represented at the SCOR meeting early in 1980 by E.S.W. Simpson. It has advised SCOR in the running of Working Groups, 46, 53, 61 and 63, and has expressed an interest in Working Groups 62, 64 (see other parts of this Proceedings for information on Working Group activities).

Working Group 63 on Marine Geochronological Methods is a new Working Group. The recommendation from CMG for this Group stems from a reconsideration of recommendation 8 of the 1976 Mauritius Marine Geoscience Workshop. Although Working Group 53 on Evolution of the South Atlantic has been disbanded, the topic now constitutes a symposium at the 26th International Geological Congress, Paris, 7–17 July, 1980.

2.2 *IOC/IHO Guiding Committee for GEBCO*

The sixth meeting of the Guiding Committee was held under the chairmanship of E.S.W. Simpson in Ottawa, 21–23 May 1979.

The Committee approved a comprehensive Summary Report from which the following salient points have been extracted.

(a) The GEBCO Undersea Feature Terminology has been published in the journal Marine Geophysical Researches, vol 4, no. 3 (1978).

(b) In addition to Sheets 5.01 (Barents Sea), 5.02 (North-west N. Pacific), 5.03 (North-East N. Pacific), 5.04 (North Atlantic), 5.05 (North-West Indian and Mediterranean), 5.06 (South-West N. Pacific), and 5.12 (Northern S. Atlantic) which have been published, the following sheets have been compiled, critically reviewed, passed for draughting and are now at various stages of the final production line in Ottawa: 5.11 (North-Eastern S. Pacific), 5.17 (Arctic) and 5.18 (Southern Ocean).

(c) The Committee strongly recommended to IOC and IHO that digital data banks of bathymetric information be encouraged in two stages:

- data should in future be stored and made available in digital computer-readable format, including identification of source and fidelity, and

- as experience is gained and resources become available the IHO data bank and existing national archives for data should also be converted to computer readable format with a view, inter alia, to having a complete digital data library available for future revision of GEBCO.

The seventh meeting of the Joint Guiding Committee will be held in Monaco, 6–8 October 1980.

2.3 *IOC Central Editorial Board for Geological/Geophysical Atlases of the Atlantic and Pacific Oceans*

Acting on the advice of SCOR and CMG, the IOC has accepted an offer from the USSR to undertake a project of preparing and publishing Geological/Geophysical Atlases of the Atlantic and Pacific Oceans and has appointed a Central Editorial Board under Editor in Chief G.B. Udintsev (USSR). The Central Editorial Board met for the first time in Ottawa, 17–19 May 1979, and the Atlantic Atlas is scheduled for completion in 1984 to be followed a year later by the Pacific Atlas. The Editorial Board will meet again in Monaco, 9–11 October, 1980.

2.4 *CGMW*

A meeting of the CGMW Working Group on Sea-Floor Geological Maps was held in Paris, 28 May, 1979 and attended by E.S.W. Simpson and R.A. Scrutton. The extension of the geology to the limits of the African 1:10 million sheet was considered and broad agreement was reached on a legend. Individual scientists are now making data compilations for their offshore areas of interest. A final legend for marine areas and a data compilation will be made at the 26th IGC, Paris, 1980.

2.5 *CCOP*

Dr E. Davin has continued to keep CMG informed of progress by CCOP and specifically the SEATAR programme.

3. *CMG Sponsored or Co-Sponsored Symposia*

3.1 *"Reunite Gondwanaland"*

This workshop was CMG sponsored and held in Johannesburg, 3–6 July, 1979. The results of the meeting are to be published in an up-to-date reconstruction of Gondwanaland.

3.2 *17th IUGG General Assembly*

CMG has been able to sponsor financially the following meetings held in Canberra in the period 2–15 Decembr 1979.

"Acoustic stratigraphy of the Deep Ocean" with IAPSO
(Convener: W.B.F. Ryan)
"Fluxes and chemistry of Particulate Matter in the Oceans" with IAPSO
(Convener: J. Gieskes)
"Continental Margins of the Indian Ocean" with ICG

(Convener: C.C. von der Borch)
"The Origin and Nature of the Southern Ocean" with IUGG/IAPSO
(Convener: Sir George Deacon)
"Tectonics of the South West Pacific Margins" with ICG
(Convener: W. Johnson).

3.3 *26th International Geological Congress*

CMG has agreed to co-sponsor (financially, if possible) the following symposia to be held in Paris in the period 7–17 July, 1980:

Colloquium C.3. *"Geological of Continental Margins"*
(Conveners: R. Blanchet, L. Montadert)
Colloquium C.4. *"Geology of Oceans"*
(Conveners: J. Debyser, X. Le Pichon, F. Vine)
Section S.06. *"Marine Geology, Sedimentology, Sedimentary Petrography"*
(Conveners: G. Boillot, M. Vigneaux, E. Seibold)
especially part S.06. 2.5, *"Evolution of the South Atlantic"*
(Conveners' E.S.W. Simpson, D. Needham).

3.4 *3rd Joint Oceanographic Assembly*

This will be held in Halifax, Nova Scotia in 1982. CMG will be sponsoring or co-sponsoring symposia at this assembly.

4. *Heezen Memorial Volume*

CMG and Lamont-Doherty Geological Observatory have made progress with John Wiley Inc. in the preparation of the volume. The volume will contain 20 pages and publication in late 1980 or 1981 is anticipated.

5. *Catalogue of International Geological/Geophysical Cruise Inventory*

CMG is making a renewed effort to encourage data collecting institutions to make use of this joint IOC/CMG Inventory. March 1979, World Data Centre A, Oceanography published a catalogue of data on file up to September 1974. This showed that the system was at that time only used by the larger research groups. Through the network of CMG national correspondents smaller research groups will learn about the system.

ANNEX XIX

INTERNATIONAL ASSOCIATION OF BIOLOGICAL OCEANOGRAPHY

Report on some activities of interest to SCOR

(1) Professor Roy T. Tsuda, Dean of Biology, University of Guam, has been appointed Chairman of the IABO Coral Reef Committee. He replaces Dr Frank Talbot (Australia). Professor Tsuda convened a meeting of the IABO Coral Reef Committee at the time of the Pacific Science Associations' Committee on Coral Reefs in September 1979 in Khabarovsk (USSR). The 4th International Coral Reef Symposium will be held in Manila (Philippines) 18 to 22 May 1981.

(2) Dr John R. Beers (USA) is planning to hold a workshop on marine planktonic protozoa. IABO will sponsor the organization of this meeting and tentative plans are to hold the meeting in 1981.

(3) IABO will co-sponsor an international symposium with N.S.F. (U.S.A.) and N.S.E.R.C. (Canada) on Controlled Experimental Ecosystems to be held at the Institute of Ocean Sciences, Sidney, B.C., August 13–15, 1980. Participation is by invitation; for further information contact Dr T.R. Parsons, Department of Oceanography, University of British Columbia, Vancouver, B.C., Canada, V6T 1W5.

(4) Dr M.V. Angel (U.K.) has been appointed IABO's representative on IUCN's Commission on Ecology.

(5) The International Seaweed Association (ISA) will hold its 16th International Symposium in Sweden during 1980. For further information contact Dr M.S. Doty, Department of Botany, University of Hawaii, 3190 Maile Way, Honolulu, Hawaii, 96822.

(6) In the absence of sufficient financial support from the International Union of Biological Sciences, the IABO Executive are grateful for support from UNESCO during 1980.

ANNEX XX

INTERNATIONAL ASSOCIATION OF METEOROLOGY AND ATMOSPHERIC PHYSICS

Report to SCOR

The major activity in IAMAP since the last report to SCOR has been preparation and conduct of the IAMAP sessions and participation in IUGG Symposia at XVII IUGG, Canberra, December 1979.

IAMAP Sessions of interest to SCOR included:

The 100,000 Climatic Oscillation. In this session, paleoclimatic experts discussed, among other matters, the role of the Milankovic theory of earth-orbital/solar energy input variation and the effect on the earth's climatic regime. Discussions included that of the paleo-ice sheets and their responses to solar variations, and some other matters that could be related to oceanic behaviour at these times also.

IAMAP took the lead in organizing the IUGG Symposium on the Chemical Evolution of the Earth's Oceans, Atmosphere and Crust, and participated in organizing symposia on Sea Level, Ice Sheets and Climate; Ocean-Atmosphere Boundary Layers; Coastal and Estuarine Zones. All of these were in cooperation with IAPSO.

Plans for the near future include:

1981 Assembly at Hamburg – first draft of the program includes topics of interest to IAPSO and SCOR:

Role of Oceans in Atmospheric Chemistry (e.g., SCOR WG 44)

Radiation Transfer in the Oceans and Remote Sensing of Ocean Properties

Fluctuations in the Tropical Atlantic (including upwelling) (WG 56?)

Diagnostics of 1–3 month climate forecasting methods – a workshop to discuss methods, data bases, etc., with a view to organizing, in cooperation with the JSC and WMO a two-year test program of experimental forecasts and verifications, using standardized or agreed-upon information and verification. This will be an effort to study the status of methods and assess at this early stage sensitivities to assumptions, data bases, etc. This is not an attempt to institute any kind of pilot program!

JOA, Halifax

IAMAP has discussed with IAPSO collaboration on a symposium on the Southern Oscillation, El Niño predictions, modelling of ocean-atmosphere coupling.

ANNEX XXI

INTERNATIONAL ASSOCIATION FOR THE PHYSICAL SCIENCES OF THE OCEAN

Resolutions adopted at plenary session, 13 December 1979

1. Long-term research

The Association notes the increasing proportion of marine science funding going to solution of practical problems, in spite of the fact that many fundamental problems are still poorly understood. It therefore stresses the continuing importance both of long-term support for fundamental research and of support for both large and small groups to provide diversity of ideas.

The resolution is directed to National Committees, SCOR and UNESCO.

2. Delays and difficulties arising from legal requirements

IAPSO notes that unnecessary delays arising from legal requirements may seriously hinder marine research of world-wide importance directed towards problems of climate, fisheries, navigation and natural disasters. It therefore directs the attention of international, governmental and scientific organisations to the deleterious effects on marine research caused when the legal requirements of coastal states are not handled promptly by the authorities proposing or the country conducting the research, or by the coastal country.

The resolution is directed to the National Committees and IOC.

3. The continental shelf

The Association urges that to avoid serious confusion an expression other than continental shelf be used in law of the sea discussions to denote the oceanic zone contiguous to land masses when the meaning extends far beyond that long established in oceanography.

The resolution is directed to the Drafting Committee of the Law of the Sea Committee.

4. Increase in number of IAPSO sponsored symposia

Noting the great success of the recent IAPSO/SCOR supported Liege symposium on ocean turbulence, the Association urges that further symposia be held between Assemblies, as finances permit. Suggested subjects are theoretical aspects of certain oceanographic studies, elaboration of perspectives for new directions for research and discussion of results of research work.

The Association further urges that in each such case, an overview paper be prepared.

This resolution is directed to IAPSO Executive and SCOR.

5. Equatorial and Tropical Zone Dynamics

The dynamics of the equatorial and tropical zones provides one of the most interesting problems of oceanic and atmospheric physics, as is evidenced by the GATE expeditions.

International co-ordination may be desirable for certain programmes on equatorial current dynamics. This Association is prepared to work with SCOR in organizing international programmes on the dynamics of equatorial currents, and in assisting information exchange, should it be requested by several countries.

Directed to National Committees and to SCOR.

6. *Endorsement of definition of practical salinity and Equation of state of sea water*

IAPSO appreciates the work of the Joint Panel on Oceanographic Tables and Standards on the definition of a practical salinity scale and of the equation of state for sea water. It accepts their proposal for the practical salinity scale and agrees to support a final decision by SCOR on the acceptance of the defining equations for the equation of state which will be passed on to SCOR before April 1980.

IAPSO urges that arrangements be made, in conjunction with other interested bodies, to ensure the orderly and simultaneous adoption of the new equations as soon as practicable thereafter.

This resolution is directed to the National Committee, SCOR, UNESCO, ICES, and editors of journals.

7. *IAPSO Secretarial Support*

Recognizing the importance of IAPSO to the oceanographic community and the need to support the Secretariat.

Noting, with appreciation the support provided by the U.S. Office of Naval Research, the National Science Foundation and the National Oceanic and Atmosphere Administration over the past four years.

Recommends the continued financial support for the Secretariat.

The resolution is directed to the USA National Committee.

8. *Permanent Service for Mean Sea Level*

Recognizing the singular importance of long time series of oceanographic data sets, such as those provided by the Permanent Service for Mean Sea Level at Bidston, to studies within the framework of the World Climate Research Programme, particularly those future programmes related to climatic change and the ocean.

Noting that the Service is now receiving financial support from the United Kingdom.

Welcoming the decision of the Intergovernmental Oceanographic Commission to provide substantial financial support for the Service in the biennium 1981–82.

Recommends that the financial aid provided for the Service by the Federation of Astronomical and Geophysical Services (FAGS) be continued at least at the current level of U.S. $5,000, and preferably be raised to U.S. $ 10,000 in cognisance of continuing cost inflation.

The resolution is directed to IUGG, FAGS and the UK National Committee.

9. Symbols, Units and Nomenclature Report

IAPSO, having carefully considered the report of the IAPSO Working Group on Symbols, Units and Nomenclature in Physical Oceanography, adopts the first part, with minor modifications, of the draft report on the use in the physical sciences of the ocean of the International Systems of Units (SI). IAPSO urges the scientific community to use henceforth this system so as to ensure greater uniformity in the reporting of oceanographic data.

IAPSO expresses its gratitude to the Working Group and in particular to Mr M. Menache for the large effort which went into this report. IAPSO urges a speedy completion of part two of the SUN report which will serve as a guideline to the use of uniform symbols and corresponding units within the SI system.

The resolution is directed to National Committees and editors of journals.

10. Data from Drift Buoy Program

IAPSO recommends that some new method be found for the financing of the position-finding and data transmission associated with the NIMBUS-ARGOS system, such that individual Institutes and research groups are required to pay not more than incremental costs when making use of the system.

The resolution is directed to the National Committees of France and USA.

11. IAPSO expresses deep gratitude to its retiring President,

Dr R.W. Stewart, for his devoted and effective work for the Association over the past four years.

12. Satellite altimetry of the ocean surface

Noting the impressive, though limited results achieved by satellite altimetry on GEOS-3 and SEASAT-1, IAPSO draws attention to the great potential of this new technique for estimating barotropic components of geostrophic currents and tides in the open ocean, given also a continued improvement in measurements of the oceanic geoid.

Congratulates the organization responsible for the recent successes with satellite altimetry, and encourages them and others vigorously to advance plans for further developing the technique and launching new altimeter satellites.

Recommends that plans for launching satellites for this purpose during the 1980s should be co-ordinated internationally to optimize the value for dynamical oceanography.

The resolution is directed to the National Committees.

CONFÉDÉRATION MONDIALE DES ACTIVITÉS SUBAQUATIQUES
WORLD CONFEDERATION OF UNDERWATER ACTIVITIES
SCIENTIFIC COMMITTEE
CMAS (SC)

Report from President – N.C. Flemming

January 1980

Introduction

Diving science in the present context does not mean the physiology and medicine of diving. Nor does it mean the use of divers to support the launch and recovery of oceanographic equipment and submersibles, though that may be very important. What is meant is the conduct of oceanographic experiments or purposive observations by manned intervention underwater.

Role of scientific diving

Ideal examples of underwater science are the various experiments in which electronic measuring devices have been attached to benthic fauna *in situ* by Dr R. Earll and others, or the observation of internal breaking waves using dye tracers by Professor John Woods, or the measurement of energy flow in kelp forests by Dr Peter Zoutendyk and others. Diving science is not big science, in the sense of many projects and programmes discussed by SCOR. Most diving science is conducted in small groups and the equipment is relatively cheap.

Scientific diving on appreciable scale is carried out in many hundreds of marine institutes and university departments. Thirty countries are members of the CMAS Scientific Committee, and a survey has been carried out of the numbers of divers in different classes of qualification. Scientific diving groups were asked to list the number of divers who were professional research workers, research students studying for post-graduate degrees, or undergraduates or amateur divers employing diving in research projects. Replies so far have been received from Germany, Italy, Sweden, New Zealand, Australia, Holland, Austria and Britain. The totals are as follows: professional research workers 570, post-graduate research students 1,275, students and amateur scientists 1,470, making a total of 3,315. It is estimated that there are probably at least 2,000 scientific divers in all these categories in California alone, and as many more in the rest of the USA. If Canada, France, South Africa, and Japan were added to the figures, the total must be in the range of 7,000 – 10,000 and figures are still not available from the USSR or Eastern Europe.

Scientific divers work in groups of usually 3 – 10 divers at a time on small projects, and 90% of the work is in coastal, continental shelf seas, or estuarine waters, with much of the work related to fisheries or shellfish production. Diving has been carried out in all oceanic conditions from the Antarctic to the Arctic, in the Tropics, the Dead Sea, the Baltic, Great Lakes, and other water bodies.

CMAS Scientific Committee

The Confédération Mondiale des Activités Subaquatiques is the body linking the National Federations of self-contained divers in 55 countries. It is entirely non-political, and non-governmental. The CMAS Scientific Committee was formed at a meeting in Cuba in 1970. The most important achievement of CMAS has been the standardisation of training grades in almost all the affiliated countries where self-contained diving is practised. A system of equivalent training grades is operated, and plastic certificate cards are issued which are valid in all countries with CMAS Federations.

There are three principal committees in CMAS. The Technical Committee is concerned with training standards, equivalent ratings, new diving techniques, equipment design, and safety; the Scientific Committee encourages co-operation between diving marine scientists and diving scientific students on a world-wide basis, and furthers the development of new experimental techniques, publishing the results in biannual symposia; the Sports Committee encourages competitive activities.

The Scientific Committee has membership from 30 countries and has run a series of international symposia. The next scientific symposium is at Heriot-Watt University, Edinburgh, in September 1980. During 1980 a new certificate will be introduced called the "CMAS Scientific Diver". This qualification will be issued to applicants who can demonstrate that they are legally entitled to work as scientific divers in employment in their country of origin. The card will thus permit scientific divers to work in laboratories in most countries of the world. It will guarantee their basic diving training, their affiliation to a place of learning or research, their insurance status, and their medical condition.

Scientific programme

(1) Edinburgh Symposium of Scientific Diving, September 14th – 18th 1980, Heriot Watt University.

(2) Symposium entitled "Submerged Quaternary Land-Sea Bridges, and Human Occupation of Submerged Shorelines", to be held at Scripps Institution of Oceanography, October 26th – 30th 1981.

(3) June 1980, Study of Algal Reef Mortality in the North Adriatic, directed by A. Stefanon.

(4) Monitoring of effects of tourism on northern Red Sea coral reefs, directed by R. Earll.

(5) Support for national and international underwater conservation groups, and supervision of underwater marine parks.

(6) Half-day seminar on scientific diving to be held at the Joint Oceanographic Assembly, Halifax, August 2nd – 13th, 1982.

Legislation and diving codes

The CMAS Scientific Committee and its national member organisations have been very active in fighting against restrictive and unsuitable legislation designed to control diving. In many countries the accident rate of commercial and industrial diving has stimulated restrictive legislation which had inadvertently been applied to scientific diving.

The safety record in scientific diving is exceptionally good. CMAS is now conducting a more detailed survey, but examples of safety record can be given as follows:– the last fatality to a scientific diver in Britain was in 1960; there is no recorded fatality to scientific divers in California; good records appear to exist in Holland, Sweden, New Zealand, and South Africa. We believe that self-discipline and peer-group review is the best way to maintain safety, and accordingly the CMAS Scientific Committee are publishing an International Code of Practice for Scientific Diving. The Code will contain brief reviews of the legislative situation in the principal countries in which scientific divers are likely to work.

Conclusions

CMAS Scientific Committee can assist and advise laboratories in any country, both in the training and safety aspects of running scientific diving, and on underwater experimental methods. Bibliographies of relevant literature can be provided. Diving is a relatively cheap form of research, and is particularly suitable for application in coastal waters and by developing countries.

Relations with SCOR

i) Close relations should be maintained between CMAS Scientific Committee and SCOR Working Group 57 on coastal and estuarine research.

ii) CMAS Scientific Committee is available to advise laboratories or national committees on safety and administration of scientific diving.

iii) CMAS Scientific Committee can provide advice concerning the involvement of divers in the formation, maintenance, and policing of submarine parks.

iv) CMAS Scientific Committee would like to propose a joint activity with SCOR to prepare a manual of underwater scientific methods.

COMMITTEE ON SPACE RESEARCH (COSPAR)

Report to SCOR

In the past twelve months, COSPAR has nearly completed its re-organization. Working Group 6 has been transmuted into Commission A: Space Studies of the Earth's Surface, Meteorology and Climate. Sub-Commission A–1 is charged with covering the field of meteorology and climatology of the lower atmosphere, including the fundamental physical processes in the ocean. Dr J.F.R. Gower (nominated by SCOR to effect liaison with COSPAR) has been working closely with this Sub-Commission.

Sub-Commission A–1 is now working on design considerations for satellite systems to observe ocean properties needed for climate research. We are doing this in close association with the ICSU–WMO Joint Scientific Committee for the World Climate Research Program.

A meeting of specialists is being arranged for the end of March 1980 at the European Centre for Medium Range Weather Forecasting, Reading, UK, at which ocean observations will be included in discussions of satellite systems for the next decade for climate research. Included in plans for the COSPAR/SCOR/IUCRM Symposium, Oceanography from Space, Venice, 26–30 May 1980, just prior to the COSPAR Budapest meeting, will be specialist workshops on several oceanographic topics for which satellite observations will make contributions: sea surface temperature altimetry, bouy data relay, surface wind stress, eddy studies, etc.

FUTURE MEETINGS OF SCOR

and affiliated organizations

Date	Place	Meeting
1980		
11–14 February	Seattle	WG56 Equatorial Upwelling Processes
20–22 February	Copenhagen	WG42 Pollution of the Baltic
6–10 April	London	ECOR General Meeting
28–30 April	Idyllwild, USA	WG52 Symposium on Estimation of Micronekton abundance
7–9 May	Motupore, Papua New Guinea	WG60 Mangrove Ecosystems
26–30 May	Venice	COSPAR/SCOR/IUCRM Symposium on Oceanography from Space
4–6 June	Paris	WG54 – BIOMASS Programme Implementation Gp
11–13 June	Paris	WG47 – Atlantic Ocean Panel
16–18 June	Wormley	North Atlantic POMS
22–27 June	Wormley	WG47 – Indian Ocean Panel
7–17 July	Paris	WG63 Marine Geochronological Methods (at Int. Geological Congress)
21 July – 9 Aug	Oslo	University of Oslo/UNESCO/SCOR Phytoplankton course for experienced workers
11–15 August	Goteborg	X Int. Seaweed Symposium. (Int. Seaweed Assoc – affiliate of IABO)
13–15 August	Sidney, BC	IABO/NSF/NSERC Symposium on Controlled Experimental Ecosystems
– August	La Jolla	WG47 – Pacific Ocean Panel
1–5 Sept	Sidney, BC	WG10 Oceanographic Tables and Standards
22–26 Sept	Woods Hole	Woods Hole Symposium on History of Oceanography and SCOR Executive Meetings

26–28 Sept	Woods Hole	SCOR XV General Meeting
29 Sept – 2 Oct	Woods Hole	Woods Hole Symposium on Current and Future Oceanography
? November	?	WG64 Symposium on Atolls as recorders of sea levels and the vertical tectonics of lithospheric plates (at Geological Society of America Annual Meeting.)
To be arranged	To be arranged	UNESCO/SCOR/IABO Symposium on Coastal Lagoons
"	"	WG55 – Prediction of El Niño
"	"	WG59 – Planning Meeting for 1981 Symposium
"	"	CCCO Workshop on long term-series oceanographic measurements

Other activities in 1980 of CCCO and WG54 are not detailed in this list.

1981

April	?	WG47 – Final FGGE Workshop
?	Warnemunde	WG51 – Evaluation of CTD Data
18–22 May	Manila	Fourth Int. Coral Reef Symposium (IABO)
17–28 August	Hamburg	IAMAP Assembly: inc. the Role of the ocean in atmospheric chemistry cycles.
To be arranged	To be arranged	JSC/SCOR Study Conference on The Impact of the Ocean on Climate
"	"	WG34 – Symposium on Eddy Dynamics (at final 'POLYMODE' Symposium)
"	"	WG57 – Coastal and Estuarine Regimes.
"	"	WG59 – Symposium on flows of Energy and Materials in marine ecosystems: Theory and practice

1982

2–13 August	Halifax, Nova Scotia	Joint Oceanographic Assembly and XVI General Meeting of SCOR
To be arranged	To be arranged	ICES/SCOR Symposium on Temperate Shelf Seas

ABBREVIATIONS

ACMRR	Advisory Committee on Marine Resources Research (of FAO)
AIA	Atlantico – Ibero – African region
AGU	American Geophysical Union
BIOMASS	Biological Investigations of Marine Antarctic Systems and Stocks
BOSEX	Baltic Open Sea Experiment (1977)
CCCO	Committee on Climatic Changes and the Ocean
CPPS	Comisión Permanente del Pacifico Sur
CINCWIO	Cooperative Investigation on the North and Central Western Indian Ocean (IOC)
CMAS (SC)	Confédération Mondiale des Activités Subaquatiques, Scientific Committee
CMG	Commission on Marine Geology (of IUGS)
COSPAR	Committee on Space Research (of ICSU)
CTD	Conductivity Temperature Depth
ECOR	Engineering Committee on Oceanic Resources
EPOCS	Eastern Pacific Ocean Climate Studies
ERFEN	Estudio Regional del Fenómena 'El Niño'
EUBEX	Eurasian Basin Experiment
FAGS	Federation of Astronomical and Geophysical Services (of ICSU)
FAO	Food and Agriculture Organization of the UN
FATE	FGGE Atlantic Tropical Experiment
FGGE	First GARP Global Experiment
FIBEX	First BIOMASS Experiment (WG 54)
GAO	GARP Activities Office
GARP	Global Atmospheric Research Programme (of WMO/ICSU)
GATE	GARP Atlantic Tropical Experiment
GEBCO	General Bathymetric Chart of the Ocean
GEMSI	Group of Experts on Methods, Standards and Intercalibration (of GIPME)
GESAMP	Group of Experts on Scientific Aspects of Marine Pollution
GIPME	Global Investigation of Pollution in the Marine Environment
HEBBLE	High Energy Benthic Boundary Layer Experiment
IABO	International Association of Biological Oceanography (of IUBS)
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
ICNAF	International Commission for the Northwest Atlantic Fisheries
ICSPRO	Inter-Secretarial Committee on Scientific Programmes related to Oceanography
ICSU	International Council of Scientific Unions
IDOE	International Decade of Ocean Exploration
IGOSS	Integrated Global Ocean Station System
IHO	International Hydrographic Organization
IOC	Intergovernmental Oceanographic Commission
IOC/EC	IOC Executive Council
IODE	International Oceanographic Data Exchange (Working Group of IOC)
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)
IUTAM	International Union of Theoretical and Applied Mechanics

IWSOE	Internal Weddell Sea Oceanographic Expedition
JOA	Joint Oceanographic Assembly (1976)
JOC	Joint Organizing Committee for GARP
JPOTS	Joint Panel on Oceanographic Tables and Standards (WG 10)
JPS	Joint Planning Staff for GARP
JSC	Joint Scientific Committee for WCRP
MODE	Mid-Ocean Dynamics Experiment
MONA	Monitoring of the Overflow in the North Atlantic
NAPOMS	North Atlantic POMS
NCAR	National Centre for Atmospheric Research (USA)
NOAA	National Oceanographic and Atmospheric Administration (USA)
NORPAX	North Pacific Experiment
OAMEX	Ocean-Atmosphere Materials Exchanges (WG 44 of SCOR)
ONR	Office of Naval Research – USA
PEQUOD	Pacific Equatorial Ocean Dynamics
RIOS	River Inputs to Ocean Systems
POLYGON	USSR mid ocean multimooring experiment
POLYMODE	USSR/USA Joint mid ocean experiment
POMS	Pilot Ocean Monitoring System
SEQUEL	Seasonal Equatorial Atlantic Experiment
SCAR	Scientific Committee on Antarctic Research (of ICSU)
SCOPE	Scientific Committee on Problems of the Environment (of ICSU)
SIO	Scripps Institution of Oceanography (USA)
SRB	Scientific Review Board of IOC
SST	Sea Surface Temperature
SSTA	Sea Surface Temperature Anomoly
STD	Salinity Temperature Depth recorder
SUN	Standards Units and Nomenclature
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO-OCE	Unesco Division of Marine Sciences
WC	Working Committee (of IOC)
WCRP	World Climate Research Programme
WESTPAC	Western Pacific
WDC	World Data Centre
WMO	World Meteorological Organization

Supplement to SCOR Proceedings

SECOND AMENDMENT

July 1980

Page 9 Delete Professor C. Junge, replace with
Dr W.L. Godson,
Atmospheric Environment Service,
4905 Dufferin Street,
Downsview, Ontario, Canada.

Delete Dr R.W. Stewart, replace with
Professor D. Lal,
Physical Research Laboratory,
Navrangpura,
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10 Delete Professor C. Junge, replace with
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Tel: Toronto (416) 667 4919
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Professor D. Lal,
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Telex: 012397
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AHMEDABAD

11 Canada: Delete Dr L.M. Lauzier, replace with
Mr L. O'Quinn,
c/o Canadian Committee on Oceanography,
240 Sparks Street, Ottawa,
Ontario K1A 0E6, Canada.

Page 12 India:
Delete Dr Y.P. Rao, replace with
Dr S.Z. Qasim,
Director, National Institute of Oceanography,
Dona Paula - 403004,
Goa, India.

14 Philippines:
Amend address of National Committee to:
National Committee on Marine Sciences,
Att: Mr Pedro F. Abella,
UNESCO National Commission of the Philippines,
Ministry of Foreign Affairs,
Manila, Philippines.

15 USA National Committee to read "Ocean Science Board"
(instead of Ocean Affairs Board).

17 National Membership, India:
Delete Dr Raghu Prasad, and add Dr S.Z. Qasim

18 United Kingdom:
Delete Professor J.E.G. Raymont, replace
with Dr A.S. Laughton

19 Delete Dr R.W. Stewart, replace with
Professor D. Lal

Delete Professor C. Junge, replace with
Dr W.L. Godson

21 Insert Dr W.L. Godson (2-IAMAP)
Atmospheric Environment Service,
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Page 22 Professor K. Hasselmann: amend address to:
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23 Delete Professor C. Junge

Lal: Add 2-WG46 and IAPSO

Insert Dr A.S. Laughton,
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25 Delete Dr Raghu Prasad

Add: Dr S.Z. Qasim,
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Delete Professor J.E.G. Raymont

26 Delete Dr R.W. Stewart

27 Add Dr J.J. Zijlstra,
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28 Delete Dr R.W. Stewart, replace with
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Ahmedabad 380 009, Gujarat, India.

Delete Professor C. Junge, replace with
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IAMAP - Change Physiology to Physics

Page 30 Amend Dr J.J. O'Brien's address to:
Meteorology Annex
Florida State University, Tallahassee,
Florida 32306, USA.

33 Delete Dr R.W. Stewart, replace with
Professor H. Charnock

35 Delete Professor C. Junge, replace with
Professor E.D. Goldberg

37 Dr P.J. Hisard - Change Ivory Coast to
France.

41 Delete Professor C. Junge, replace with
Professor W.S. Wooster

48 Amend Milero to Millero

49 Delete Dr H. Erlenkeuser
Add Dr I. McDougall - Australia

51 Add: Chairman Dr J.J. Zijlstra
Netherlands Institute for
Sea Research,
P.O. Box 59,
Den Burg - Texel, Netherlands.

52 Delete Dr R.W. Stewart as Executive Reporter,
replace with Professor H. Charnock.

54 Delete Professor W. Duing

62 Delete Mr D.P.D. Scott, replace with
Dr M. Ruivo

19 Add - URSI - Dr J.R. Apel

20 Add - Dr J.R. Apel, Director,
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