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SCOR Proceedings, Volume 29

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REPORT OF THE THIRTY-FIRST EXECUTIVE COMMITTEE MEETING OF SCOR

Institute of Oceanology, Academia Sinica
Qingdao, China
Tuesday, September 28 through Thursday, September 30, 1993

1.0 INTRODUCTION

1.1 Opening

The President of SCOR, Professor I.N. McCave, opened the thirty-first meeting of the Executive Committee. It took place at the Institute of Oceanology of the Academia Sinica in Qingdao, China from September 28 to 30 1993. He welcomed all the participants (see Annex 1), especially Drs. R. Allyn Clarke and S. Krishnaswami who were attending a SCOR meeting for the first time as the newly-appointed coopted members of the Executive Committee. He thanked the Chinese SCOR Committee for its invitation to SCOR to hold this meeting in Qingdao. Professor McCave also noted his pleasure at meeting Dr. C.K. Tseng and others who had initiated the discussions that led to China becoming a member of SCOR in 1985.

Professor McCave introduced the Director of the Institute of Oceanology, Dr. Qin Yunshan, who was elected Chairman of the Chinese SCOR Committee at its meeting on September 27. Dr. Qin welcomed the participants to his institute. Recalling that SCOR, as the leading non-governmental organization in marine science, has made many important contributions to the field, Dr. Qin expressed his best wishes for the success of the Executive Committee meeting.

During the first afternoon, the Executive Committee meeting adjourned to hear a series of presentations on current research activities in the Chinese oceanographic community. These included:

Wang Pinxian, Tongji University, Shanghai:
"West Pacific Marginal Seas: Environmental significance in glacial cycles"

Ning Xiuren, Second Institute of Oceanography, SOA, Hangzhou:
"Some results on plankton ecology with special reference to phytoplankton productivity"

Hu Dunxin, Institute of Oceanology, Academia Sinica, Qingdao:
"Ocean Circulation in the Western Pacific and its role in climate"

1.2 Approval of the Agenda

The participants reviewed the Draft Agenda for the meeting which was distributed by the Executive Director and approved it with the addition of a discussion of the Commission on Environmental and Analytical Chemistry of the International Union of Pure and Applied Chemistry under item 6.2. The Agenda was then adopted as given in Annex 2.

1.3 Report of the President of SCOR

Professor McCave noted that the activities of the past year have included both the large programs of SCOR and its smaller working groups. The Joint Global Ocean Flux Study (JGOFS) is now fully mature with several major field studies under way in the current year. The SCOR/IOC program on Global Ocean Ecosystem (GLOBEC) Dynamics has had a very busy year with several meetings of planning groups. Their reports will form the basis for the GLOBEC Science Plan. The Chairmen of both of the Scientific Steering Committees for these important SCOR programs participated in the Executive Committee meeting.

The development of the Global Ocean Observing System (GOOS), and in particular of appropriate scientific planning mechanisms for GOOS, has occupied the Officers of SCOR in the period since the XXI General Meeting. However, a Memorandum of Understanding on the establishment of a Joint Scientific and

Technical Committee for GOOS has now been signed between the Sponsoring Organizations (the Intergovernmental Oceanographie Commission, the International Council of Scientific Unions, and the World Meteorological Organization). The MOU recognizes SCOR as the main scientific advisory body to the IOC and the principal organization for oceanography within ICSU. Accordingly, SCOR is to be consulted in scientific matters relating to GOOS and in decisions on the Joint Scientific and Technical Committee. Professor McCave expected that the whole question of the relationship between SCOR (and the scientific community which it represents) and GOOS would be a major topic for discussion at this Executive Committee meeting. The Officers have agreed that it is also necessary to better define the relationship between SCOR and the IOC and between SCOR and the major ocean programs (such as WOCE and TOGA) of which it is no longer a co-sponsor.

The coopted member of the Executive Committee with responsibility for membership development, Dr. Krishnaswami, has initiated a number of new membership enquiries, and several of these may yield results soon. Approaches regarding SCOR membership have been made to Venezuela, Uruguay, Oman, and Ireland among others, and efforts are under way to revitalize the existing SCOR Committees in Egypt, Portugal and Turkey. At this meeting, Dr. Gil Jacinto will present an application for readmission to SCOR of a newly established SCOR Committee in the Philippines.

The financial situation of SCOR has improved over the past year; this is largely because several anticipated working group activities have not taken place as planned. Arrears in membership dues dropped significantly during the past year to a level that is lower than it has been for many years. On the other hand, new sources of income have not yet been identified as had been hoped following the XXI General Meeting. The new Strategic Planning Committee established last year will meet here in Qingdao.

Professor McCave concluded, expressing the belief that SCOR is in "good heart" and that the various points he had just made bode well for the future of the organization.

1.4 Appointment of a Finance Committee

The Executive Committee meeting approved the appointment of the *ad hoc* Finance Committee as required by the Constitution. It was Chaired by Professor John Field (South Africa) and included Dr. Ian Jones (Australia), Dr. Colin Summerhayes (UK) and Professor Hong Huasheng (China). The Committee's report was presented under Agenda Item 3.3.

2.0 SCIENTIFIC ACTIVITIES

Many SCOR Working Groups are cosponsored by the Intergovernmental Oceanographie Commission of Unesco. SCOR gratefully acknowledges the support for some of the activities described here from the IOC, in particular for WGs 89, 93, 96, 98 and 101. Support for these and other SCOR activities is also received from the International Council of Scientific Unions, the Royal Society and the US National Science Foundation.

The Secretary of SCOR introduced this portion of the meeting by raising some general issues relating to the operation of SCOR Working Groups. Noting that they are a major raison d'être for SCOR, Professor Rothschild posed several questions:

- Do the Working Groups address the major issues in contemporary marine science? Are any important fields being overlooked?
- Are they concerned with topics that really require international collaboration?
- Can the processes of proposing, establishment and management of Working Groups be improved?
- Should more methodological problems be addressed?
- How can communication with the broader oceanographie community about the objectives of SCOR and its Working Groups be developed?

Recognizing that Working Groups must evolve from the needs expressed by the wider scientific community, Professor Rothschild requested the Executive Committee to consider these points during its deliberations. He drew attention to the existing Objectives and Procedures for SCOR Working Groups as published in the *SCOR Handbook* and proposed that they be adhered to more meticulously. In particular, he emphasized the need for Executive Committee Reporters to fulfil their functions more rigorously and for more publicity for the achievements of Working Groups and their final products, perhaps through a newsletter.

2.1 Arising from Former Working Groups

2.1.1 WG 75 Methodology for Oceanic CO_2 Measurements

Attention was drawn to the final report of SCOR WG 75 which was published as No. 65 in the series *Unesco Technical Papers in Marine Science*. Many of the recommendations of the Working Group have been taken up in the design and implementation of the JGOFS/WOCE global oceanic CO_2 survey.

2.1.2 WG 76 Deep Sea Ecology

Professor Stromberg reported that the final report of this WG has been accepted for publications in the *Marine Ecology Progress Series*.

2.1.3 WG 78 Determination of Photosynthetic Pigments in Seawater

While progress toward completion of the methodological monograph has been slower than hoped, the final product will be a much more comprehensive and complex volume than originally thought. The meeting agreed that the editors should be encouraged to keep to their proposed schedule (Dr. Mantoura has been contacted by the Publications Officer), although some concern was expressed that too little time has been allowed for review of the final manuscript.

2.1.4 WG 80 Role of Phase Transfer Processes in the Cycling of Trace Metals in Estuaries

The effort to complete the final report of WG 80 has continued in correspondence. Difficulties were reported by the Chairman, Dr. Whitfield, in gathering together a full set of contributions from the members and the deadline for submission of an outline report to *Marine Chemistry* was missed. A renewed effort has been made to collect the outstanding contributions and to up-date those received with a view to submitting the final report to UNESCO for publication in the series *Technical Papers in Marine Science* before the end of 1993.

2.1.5 WG 83 Wave Modelling

The Chairman, Dr. Komen, reported that in April 1993 a first complete draft of the 500 page manuscript for the final report was circulated. The title has been changed to "Dynamics and Modelling of Ocean Waves", as this was considered more appropriate, but this change did not affect the contents. It was also decided to have one more review of the manuscript, even if this would delay the publication. The aim was to make text more consistent and to resolve a number of important open issues. These concerned:

- the correct scaling parameters for wave growth (U10, Ugeostrophic or u_*)
- the role of air/sea temperature difference on wave growth
- the validity of Miles type approaches
- the formulation of whitecapping theory
- the occurrence of scintillation in swell

Intensive correspondence has led to a significant improvement of the group's understanding of these topics. It is hoped that the manuscript will be ready for publication soon. The report will appear in 1994.

The Chairman was given approval by the meeting to change the previous publication arrangements and to conclude an agreement with Cambridge University Press. The Publications Officer will discuss the

details of this new arrangement with Dr. Komen, including the possible purchase by SCOR of a number of copies at a special price and their disposition.

2.2 Current Working Groups

2.2.1 WG 86 Ecology of Sea Ice (with SCAR and AOSB)
In the past year, the Chairmanship of WG 86 passed from Dr. Cornelius Sullivan to Professor Stephen F. Ackley, due to Dr. Sullivan's assuming the directorship of the US National Science Foundation's Office of Polar Programs. An additional paper to the two previously undertaken by the Working Group (published in *Polar Biology* in 1992) was accepted for publication in *Deep Sea Research*. Authored by Ackley and Sullivan, the paper is a review of the relationships between the physical processes in sea ice that result in several of the observed biological habitats within the ice. This effort completes the published reviews on the terminology and methods, global significance, and physical-biological relationships that were first outlined by the working group.

While WG 86 has not met during the past year, through joint membership, two of the Working Group's members are participating in the sea ice activity of the initiative on Global Change in Antarctica that has been undertaken by SCAR. The WG 86 may regard these global change activities as the implementation "arm" of many of its recommended studies to further elucidate the role of Sea Ice Ecology in the Polar environment, with potential impact on Global Change.

The last scheduled activity of WG 86, to organize a workshop or symposium on Sea Ice Ecology, is in preliminary stages of development. Several venues and possible support for this activity have been discussed and plans will be finalized over the coming year.

In view of its concern at the rather extended period of relative inactivity of WG 86, the Executive Committee agreed that these plans should be presented in some detail at the SCOR General Meeting in 1994.

2.2.2 WG 89 Sea Level and Erosion of the World's Coastlines (with IOC)
Professor McCave reported on the progress with the completion of the final report of WG 89. His report was supplemented by information from Professor Healy who is a member of the WG.

The Working Group has decided to write a detailed final report for submission to an established publisher. In many respects, the sequence of chapters planned parallels the sections of an article published by WG 89 in the *Journal of Coastal Research* in 1991, expanding them with more detailed considerations and reviews of each topic. The first draft of this report is hoped to be completed by various sub-groups for each chapter by the end of 1993 and the complete manuscript will be reviewed by the WG in early 1994. In addition, the WG has decided to add a series of invited contributions in order to make the overall report more complete.

The Executive Committee Reporter (McCave) will contact the Chairman of WG 89, Professor Komar, about the publication of this final report. Note was taken of an earlier offer of IOC support; this offer needs to be clarified, especially if the report is not actually published in an IOC report series.

2.2.3 WG 92 Ocean/Atmosphere Palaeochemistry
The Executive Committee considered the following report from Dr. Eric Sundquist, Chair of WG 92:

"During the past year I have continued WG 92's efforts to find funding and venue for an interdisciplinary workshop on interactions between marine sediments and atmospheric CO_2. These efforts included a proposal for a session at the Fourth International CO_2 Conference and continuing discussions regarding cosponsorship by the Ocean Carbon Committee of the U. S. National Research

Council. The CO_2 Conference proposal apparently was never seriously considered [by the Organizing Committee]. Plans for a meeting with the Ocean Carbon Committee have been subject to changes in the Committee's agenda.

"It is clear that the kind of joint meeting sponsorship suggested by the SCOR Executive Committee cannot occur simply at the initiative of WG 92. There is too large a mismatch between the required and available funds. The workshop was conceived because we saw a need to bring together certain groups who would not otherwise meet. By definition, such a grouping will not occur by adding a session to an existing meeting unless sufficient funds are available to support travel for those who would not otherwise attend the meeting. We have been unable to arrange for sufficient funds.

"Because the Executive Committee had agreed that the proposed meeting would be our final activity, there does not seem to be any reason to disagree with Nick McCave's suggestion of last year that the group be disbanded.

"The Revelle symposium currently under consideration by the Ocean Carbon Committee might still be a unique and appropriate opportunity for joint sponsorship by SCOR. I understand that some SCOR support was provided for Committee activities during the last year. I hope that opportunities for future cooperation will be explored by direct discussions involving the SCOR Secretariat rather than WG 92.

"I wish to thank SCOR for its support and to express my sincere regret that we were unable to organize the desired meeting."

The Executive Committee accepted this report with regret. It agreed with the suggestion that SCOR should be formally associated with the symposium in memory of Roger Revelle and instructed the Executive Director to investigate this with the staff of the Ocean Studies Board of the U.S. National Research Council (which serves as the US SCOR Committee).

2.2.4 WG 93 Pelagic Biogeography (with IOC)

Professor Rothschild introduced the preliminary report of a meeting of WG 93 which had just taken place in Amsterdam. In general the Executive Committee agreed that the Working Group should be encouraged to publish the papers prepared by its members as well as the manual on pelagic collections and the glossary which it has also prepared. Some concern was expressed that the WG should ensure that its terms of reference are fully addressed by the completion of its next and final meeting in 1995. This meeting will be held at the conclusion of the second International Conference on Pelagic Biogeography. The Executive Committee Reporter will communicate these concerns to the Chairman of WG 93 and will request that detailed plans and a budget for the 1995 meeting be presented to the SCOR General Meeting in 1994.

2.2.5 WG 94 Altimeter Data and in situ Current Observations (with IOC)

The XXI General Meeting accepted the recommendation of WG 94 in its report that the Chairmanship be rotated. The person suggested declined to accept the task due to the pressure of other activities in the field which seemed to be addressing many of the same issues. These include the scientific groups associated with the analysis of results from the TOPEX/Poseidon and ERS-1 satellites. Several individuals, including the present Chair, Dr. Zlotnicki, expressed the view that these groups were addressing many of the same issues which were to concern WG 94. In discussions with Dr. Zlotnicki, and the Executive Committee Reporter, Robin Muench, it was agreed to canvass the members of the WG as to the need for continuing WG 94 and their views on a new Chair. The results of this canvas were presented by Allyn Clarke on behalf of Dr. Muench. He noted that the majority of the WG 94 members agreed that the science groups associated with the two satellite programs are indeed providing a forum for discussion of some of the topics which should have been addressed by WG 94. The question of how best to use altimeter data in relation to

the *in situ* data is not being addressed, but with the satellite data only just becoming available, it may be some time before this problem is tractable.

The Executive Committee agreed with Dr. Clarke's suggestion that WG 94 be disbanded and that in the future SCOR should be prepared to consider a proposal for a WG or a workshop on the topic of the assimilation of altimeter data into ocean models.

2.2.6 WG 95 Sediment Suspension and Sea Bed Properties

Dr. Kuznetsov introduced the report of the first meeting of WG 95 which took place in October 1992. The group identified six topics on which it is preparing extended documents for discussion at a second meeting to take place in early 1994 in Neuchatel. These are:

- Review of mathematical modelling of resuspension and sediment mixing
- Use of tracers in the study of resuspension
- Microbial processes in the benthic nepheloid layer
- Animals in the benthic nepheloid layer
- Biodeposition and resuspension
- Review of geological/ecological monitoring of the near-bottom layer

The Publications Officer was asked to assist the WG in defining its final product. It was also agreed that the 1994 meeting of WG 95 should be its final meeting.

2.2.7 WG 96 Acoustic Monitoring of the World Ocean (with IOC)

The second meeting of WG 96 was held in Brest in June 1993, once again in conjunction with an international symposium on Acoustic Thermometry of Ocean Climate. The SCOR Working Group met to discuss strategies and evaluate opportunities for international collaboration. The Symposium addressed several aspects of acoustic monitoring, as identified under the Terms of Reference for this Working Group. A summary of titles of the presentations is given in Annex 3, together with the recommendations approved by the WG 96 meeting.

The Executive Committee was impressed with the activities carried out by WG 96. At the same time, several members were concerned that WG 96 was embarking on a long-term task in its close association with the development of the ATOC program and that its terms of reference were not being adequately addressed by WG 96. These are:

- To study the existing methods of large-scale acoustic tomography of the ocean and identify those which can benefit from international collaboration.
- To evaluate the opportunities for international collaboration in the use of acoustic techniques for monitoring global climate change in the ocean.
- To assess other methods and theories relating to investigation of the ocean by means of observations of sound propagation over long distances.
- To prepare a report to SCOR on the scientific prospects for large-scale acoustic tomography.

While the planning of ATOC may satisfy the first two terms of reference, the group did not appear to have plans to address the others. Accordingly, the Executive Committee urged the Chair of the WG to submit to the SCOR Secretariat a more detailed justification for the meeting it wishes to hold in Hobart in October 1994, in relation to its unfulfilled terms of reference. It was felt that this meeting should lead to the conclusion of WG 96's activities and that the funds allocated for the 1994 meeting should not be made available unless plans for this meeting and the final activities of WG 96 are presented to SCOR.

Finally, the WG was urged to separate the process of the implementation of ATOC from its SCOR mandate. In particular the needs of the Global Ocean Observing System and the Global Climate Observing System for ATOC were noted and the WG should consider forging links to these activities so that an ATOC system can be appropriately designed to respond to the requirements of GOOS and GCOS.

2.2.8 WG 97 Physiological Ecology of Harmful Algal Blooms (with IOC)

The first formal meeting of WG 97 was to take place in October 1993 in conjunction with an international conference on Toxic Marine Phytoplankton. The Executive Committee Reporter, Jarl Stromberg, noted that the group intended to use this meeting to draft a proposal to NATO for funding for a major workshop in 1994. This would supplement the SCOR support and permit a substantial meeting to be organized. The WG 97 Chair, Don Anderson expected that the larger meeting, and the resulting publication, would be the final activities of WG 97. However, there was some concern expressed that NATO is discontinuing its support for certain types of scientific meetings and the Executive Committee recognized that other sources of funding may have to be explored. It was agreed that if Dr. Anderson felt it necessary after the forthcoming meeting, the membership of WG 97 might be revised in consultation with Jarl Stromberg.

2.2.9 WG 98 Worldwide Large-scale Fluctuations of Sardine and Anchovy Populations (with IOC)

The formation of WG 98 was approved by SCOR in late 1992. It became apparent after the SCOR General Meeting that the establishment of WG 98 had, in fact, formalized an existing group of individuals who had already held several informal meetings on this topic. This had lead to some confusion over the final membership of WG 98 which the Executive Committee requested be clarified by the Reporter, Brian Rothschild, in discussions with the Chairman, Daniel Lluch Belda. The group should be encouraged to begin its formally assigned tasks with a meeting in 1994 and to ensure that the terms of reference are addressed. Professor Rothschild noted the interest and involvement of other organizations such as FAO and IOC.

2.2.10 WG 99 Linked Mass and Energy Fluxes at Ridge Crests

Professor McCave reported that Martin Sinha (UK) accepted SCOR's invitation to Chair WG 99 following the SCOR General Meeting. His report to the Executive Committee meeting proposed a final membership list for the WG and it was agreed that the group should be encouraged to begin its work immediately with a meeting in 1994. Many of the WG members are involved with the InterRidge program and it is hoped that WG 99 will not require full financial support from SCOR.

2.2.11 WG 100 Sediment Coring for International Global Change Research

Professor Nick Pisias agreed to Chair WG 100 which was established at the SCOR General Meeting. The terms of reference of WG 100 are:

- To coordinate international efforts to collect good quality piston cores, Kasten cores and box cores from the world ocean suitable for collaborative studies of global change over the geologically recent past as required by the PAGES and JGOFS components of the IGBP.

- To advise on the description, curation and sampling of these cores and on protocols for the distribution of samples for specialist analysis.

- To promote the construction of a data base of available deep sea core material providing enough information to promote the efficient use by the international scientific community of existing, as well as new core material.

- To promote the increasing use of non-destructive tools for obtaining high resolution logs of deep-sea sediment cores.

A report from the WG 100 Chair requested approval to hold its first meeting for two days just before

the AGU meeting in San Francisco in December 1993. This was granted on the condition that the group carry out some preparatory work in correspondence in advance of the meeting and that this first meeting focus on the terms of reference assigned by SCOR.

This point was stressed because several members of WG 100 have been involved in the development of a proposal for a new International Marine Global Change Study (IMAGES) which will be part of the Past Global Changes Core Project of IGBP. The report from the WG 100 Chair proposed that IMAGES be jointly sponsored by SCOR and PAGES and that WG 100 become a preliminary planning group for the program. Several SCOR Committees indicated their support of this suggestion. A brief prospectus for IMAGES appears in Annex 4. The Executive Committee agreed with this proposal so long as the original tasks assigned to WG 100 are addressed, the two activities being very closely linked. Future support of WG 100 will be shared with PAGES.

Finally it was agreed that Jan Backman (Sweden) and Cam Nelson (New Zealand) should be invited to become Corresponding Members of WG 100.

2.2.12 WG 101 Influence of Sea State on the Atmospheric Drag Coefficient (with IOC)

The Executive Committee Reporter for WG 101, Tomio Asai, introduced this item. The WG held its first meeting in June 1993 at Avignon. It developed a schedule for its remaining activities which includes a second meeting in 1994 and a workshop in 1995 which would be the final activity of the group. Users of information about sea surface drag were identified; they include climate modellers, wave modellers, coastal engineers, remote sensers, etc. WG 101 is preparing a list of experiments needed to resolve problems associated with sea state and atmospheric drag. It agreed that a final expression for drag over the ocean will need to be expressed in a number of forms of increasing sophistication or accuracy. Some users who need information on large space and time scales will need a simpler expression that, say, researchers working on gas fluxes across the sea surface.

2.3 Committees and Panels

Editorial Panel for the Ocean Modelling Newsletter

The Newsletter has been published on behalf of SCOR since 1976 as a result of the activities of SCOR WG 49. Issue No. 99 was distributed in July 1993, however, the future of the Newsletter and alternative venues for its publication are now under review since the US Office of Naval Research has announced its intention to discontinue funding for the Newsletter. The readership is being surveyed with regard to various options including commercial publication. The Executive Committee agreed that no further action was required at this time.

Scientific Steering Committee for the Joint Global Ocean Flux Study

A detailed written report from the JGOFS SSC is given in Annex 5 and supplemented the presentations made by the Executive Committee Reporter, Jarl Stromberg, and the Vice-Chairman of JGOFS, Professor John Field. The SSC met twice since the last SCOR General Meeting; in Taipei in October 1992 and in Carqueiranne, France in September 1993. A new JGOFS Core Project Scientist, Professor Hugh Ducklow (USA) has been appointed to fill the vacancy left by Dr. G.T. Evans who returned to his position in Canada following a three year secondment.

Professor Field noted that the period between these meetings has been very active with field programs under way in the Equatorial Pacific, Southern Ocean and Arabian Sea process studies. These are the current "intensive" JGOFS studies. Spatially "extensive" studies include the ongoing global oceanic CO_2, pigment and optical surveys being conducted in collaboration with the WOCE Hydrographic Program and preparation for the use of the ocean color data which will become available following the launch of the SeaWIFS ocean color sensor in 1994. Temporally "extensive" studies are being conducted at four JGOFS time series stations; near

Bermuda, Hawaii, the Canary Islands and off Kerguelen.

A scientific plan for a JGOFS Continental Margins program is being developed by a joint Task Team with the IGBP Core Project on Land-Ocean Interactions in the Coastal Zone. This should be published early in 1994. The JGOFS Data Management Task Team has made progress towards practical methods for data exchange using spreadsheets. The Task Team on Global Synthesis and Modelling met following the JGOFS SSC meeting in France and is developing themes for a major international JGOFS Modelling Workshop to be held in 1994 or 1995. The international protocols for the JGOFS Core Measurements have been undergoing a major review and will be ready for use at a JGOFS training workshop in Mombasa in November and for publication by the IOC in early 1994. The Indian Ocean Planning Group members provided instruction at the training workshop in which twenty-five scientists from the region were familiarized with some of the core measurement methods. The IOPG met in Mombasa as well and furthered plans for the Arabian Sea study which will be fully implemented during 1994. The North Atlantic Planning Group held a workshop in Warnemünde in April 1993 at which plans for the final field effort of the JGOFS program were laid. This return to the North Atlantic will build upon the scientific insight gained during the 1989-90 North Atlantic Bloom Experiment with which JGOFS began. The JGOFS SSC has agreed that the international Implementation Plan should be updated biennially and the first revision of the Plan is now under way.

Noting that the SCOR General Meeting in 1992 recommended that a review of JGOFS be undertaken by SCOR in 1995, Professor Field reported that such a review would also be required by IGBP and suggested that this be done jointly by the two sponsors of JGOFS. The Chairman of IGBP, Peter Liss, agreed that this review should be an open process and that it could be achieved through the organization of a major conference open to the entire scientific community. He reported that IGBP would develop its procedures for review of its Core Projects at its Officers meeting in October and encouraged cooperation between the SCOR Officers, IGBP and the JGOFS Executive in the review and evaluation process. It was agreed that the Past-President, Jarl Stromberg, should take the lead in organizing this review for SCOR. The approach suggested by the Executive Committee was that he consult with the JGOFS Executive and the IGBP to appoint reviewers and to initiate plans for a JGOFS Conference to be held in 1995 which would result in a report to the SCOR Executive Committee meeting later that year.

Lastly, the Executive Committee received nominations from the JGOFS SSC to fill vacancies in its membership which would be created by the completion of the terms of several members at the end of 1993. Trevor Platt's term as Chair of the SSC would expire and the SCOR Officers had already agreed in consultation with the IGBP that he should be replaced by John Field (South Africa). In turn, Professor Field will be replaced as Vice-Chairman by Dr. Liliane Merlivat (France) whose term of membership will be extended through 1996. Several other membership changes were discussed pending the agreement of IGBP. The membership of the JGOFS SSC as of January 1, 1994, is given in Annex 5.

SCOR/IOC Scientific Steering Committee for Global Ocean Ecosystem Dynamics

The discussion of GLOBEC was introduced by Dr. Allyn Clarke, the Executive Committee Reporter. He stated that the period since the SCOR General Meeting has seen a focus on the development of an initial science plan for GLOBEC. There have been a number of meetings (see below) and their reports contain many scientific recommendations which must be condensed into a manageable program. Dr. Clarke sought clarification that the time and space scales selected for GLOBEC studies be appropriate for the resolution of variability in marine populations.

The Chairman of GLOBEC, Brian Rothschild, reported on the activities of the past year. GLOBEC-International has established a research strategy articulated in the GLOBEC Core Program (GCP) (GLOBEC Report No. 1). The GCP provides a framework in which international, national and regional programs can be linked toward a common goal of understanding zooplankton dynamics in a physical and ecosystem setting. The GCP is evolving into separate but coordinated activities. Several working groups met during the first half of 1993 to develop different aspects of the GCP and to prepare for the full

implementation of GLOBEC-International. To date, six scientific planning meetings have taken place:

1. First international GLOBEC planning meeting (Chair, B. Rothschild, March 31-April 2, 1992)
2. GLOBEC.INT working group meeting on Population Dynamics and Physical Variability (Chair, D. Cushing, February 1-5, 1993).
3. GLOBEC.INT working group meeting on Sampling and Observational Systems (Chair, T. Dickey, March 30-April 2, 1993)
4. GLOBEC.INT working group meeting on Cod and Climate Change (Chair, K. Brander, June 7-11, 1993)
5. GLOBEC.INT working group meeting on Southern Ocean Planning (Chair, J. Stromberg, June 15-17, 1993)
6. GLOBEC.INT working group meeting on Numerical Modelling Sampling and Observation Systems (Chair, A. Robinson, July 12-14, 1993)

The reports for these meetings have been published by SCOR in the GLOBEC Report Series.

The GLOBEC Core Program is being developed along two lines. The general scientific approach is being generated by four working groups: Population Dynamics and Physical Variability, Numerical Modelling, Sampling and Observational Systems and GLOBEC Prudence.The resulting scientific focus will be applied to specific ecosystems, the other line of GLOBEC investigation.

The Population Dynamics and Physical Variability Working Group is charged with problem definition and the development of population dynamic, behavioral, and trophodynamic mathematical and conceptual models. Recommendations for both biological and physical process studies were developed at the first working group meeting in February, 1993. The Numerical Modelling Working Group met in July, 1993 and has been charged with incorporating zooplankton population dynamics models into physical fields. The Sampling and Observation Systems Working Group will be expanding the use of modern technologies in estimation of parameters related to zooplankton population dynamics and physical processes. These estimates are critical to the success of both the Population Dynamics and Physical Variability and Numerical Modelling Working Groups. GLOBEC Prudence will be reviewing historical data for its applicability to GLOBEC problems and will be making previously unavailable data accessible through modern data management techniques. This is an essential part of determining the variability of ecosystems and assessing the impacts of global climate change on both biological and physical mechanisms.

The development of the scientific approach so far suggests that the direction of the GLOBEC.INT mission will be achieved along two avenues. The first involves the population dynamics of zooplankton (*sensu latu*) and is fairly straight forward. The second involves the development of coupled numerical models and observation systems which will involve a significant planning effort and international cooperation.

The idea of coupled numerical physical/biological models and observation systems is associated with the ideas that originally motivated GLOBEC. These involve developing a capability to nowcast and forecast population dynamics of zooplankton in a physical setting in order to better understand the major ecosystem types (as defined by Karl Banse). These nowcasts and forecasts have important applications in global-change issues and fisheries. Such a system would be designed in the context of modern data assimilation and interpolation schemes. It would involve sampling theory considerations and evaluation of cost effectiveness in its design. It would rely heavily on advances which have been made in acoustic and optical sampling and image identification.

The modelling/observation system would be flexible and modular and therefore be deployable in the major ecosystem types (e.g. spring bloom, HNLC, upwelling, etc.). It would be aimed at estimating realistic physical and biological fields with mesoscale resolution because these are thought to be the most energetic

(and hence, variable) physically and most demanding of density dependent compensatory processes biologically. The regional working groups of GLOBEC: ICES/GLOBEC Cod & Climate Change, Southern Ocean, PICES/GLOBEC Subarctic Pacific, and the currently forming Upwelling Systems are developing scientific plans for their regions to which this modelling/observation system would be applied. It is expected that the system will also be used to address key areas of interest within the national programs.

The modelling/observation system description is, at this point, fairly general. This is because the configuration of this system and its components will require careful analysis; evaluation of feasible configurations; and cost effectiveness. It seems that there is broad scientific support for the development of such a coupled modelling/observational system. It will be a major topic for discussion at the GLOBEC Scientific Steering Committee meeting in January, 1994 and at the GLOBEC Strategic Planning Conference which will be held in the environs of Paris in April, 1994. These activities will be followed in six months time by an implementation meeting.

The potential links between GLOBEC and the IGBP will be considered once the GLOBEC Science Plan has been completed. Jarl Stromberg (who is a member of the GLOBEC SSC) noted that some aspects such as modelling and data management are particularly important for interactions with other programs. At the same time, the Executive Committee felt that the GLOBEC SSC should take great care to avoid overlaps with existing IGBP Core Projects.

IGBP/SCOR/WCRP ad-hoc Working Group for the Global Ocean Euphotic Zone Study

The President introduced this item, recalling the discussion of the GOEZS planning process at the XXI General Meeting of SCOR in 1992. At the time, it was agreed that while GOEZS planning might proceed, it ought not to be implemented while JGOFS is still under way.

The Chair of IGBP, Peter Liss, recalled that GOEZS was originally proposed by IGBP and that a joint IGBP/SCOR *ad hoc* working group had been established in 1991 to begin developing a plan for GOEZS in accordance with the agreement between SCOR and IGBP in relation to the planning of the oceanic component of IGBP. The Working Group is now also sponsored by the World Climate Research Program. GOEZS is conceived as a program to examine the workings of the oceanic upper layer, its exchanges with the atmosphere and the relationship of these processes to climate change. It combines the disciplines of physical and biological oceanography with meteorology and is intended to build upon the results of WOCE and JGOFS which are expected to be completed in the late 1990s.

The GOEZS working group met in Southampton in June 1993 and a brief, incomplete report of its discussions was presented to the IGBP Scientific Committee a few days later. The SC-IGBP had substantial concerns about the proposed timing of GOEZS and did not give approval to further planning activities at that time. Professor Liss noted that the IGBP Officers were to meet in October 1993 and would give further consideration to the best way to proceed with GOEZS planning. This might include the convening of a small writing group to develop a detailed scientific prospectus for the proposed program, perhaps leading to a larger planning conference in a year or two.

The SCOR Executive Committee endorsed the suggestion that the GOEZS working group should continue with IGBP as the lead organization. It was agreed that the timing of GOEZS in relation to other programs needs to be very carefully defined and that collaboration among the various modelling communities is important.

2.4 Links between Global Programs in Oceanography

An evening discussion was held between the SCOR President and Past President and those at the meeting who represented major international programs. The included Prof. P. Liss (IGBP), Prof. B.J. Rothschild (GLOBEC), Dr. R.A. Clarke (WCRP and WOCE) and Prof. J. Field (JGOFS). The theme of this

discussion concerned the scientific and managerial links between these programs with special reference to SCOR. For those programs closely related to SCOR (e.g. JGOFS and GLOBEC), the channels of communication are good. For those where SCOR's connection is less close (e.g. WOCE, WCRP, IPCC), there is a greater potential for getting lines crossed. The SCOR Officers will take every opportunity to minimize misunderstandings and duplication of scientific effort in the oceanographic components of these programs.

2.5 Proposals for New Working Groups

2.5.1 The Role of Wave Breaking on Upper Ocean Dynamics

This proposal was submitted by the Australian SCOR Committee and introduced by Allyn Clarke and Ian Jones.

Even to the casual observer, wave breaking is a widespread phenomenon on the wind driven sea surface. Wave breaking contributes unique characteristics to the boundary layers on either side of the air-sea interface, yet despite its fundamental character and strong influence on upper ocean dynamics and air-sea interaction processes, reliable prediction and quantification of the occurrence and dynamical consequences of wave breaking remains an elusive goal. The IUTAM Breaking Waves Symposium held in Sydney in July 1991 revealed a very strong scientific interest in this area, and there was a strong consensus expressed during the panel discussion for the need to coordinate future theoretical and observational research efforts.

The proposal stated that a SCOR Working Group would offer an excellent platform for coordinating a critical mass of leading modellers, theoreticians and experimentalists to highlight the shortcomings of our present scientific knowledge and propose future research directions, with the goal of advancing our ability to develop more realistic predictive models for upper ocean dynamics, that reliably reflect the influence of wave breaking.

In the discussion which ensued, it was agreed that the WG should be established as WG 103, under the leadership of Dr. Michael Banner (Australia). The group would be expected to work in correspondence during the first year and to hold its first formal meeting after that. The group should not broaden its mandate to include issues of air-sea exchanges, in particular the role of bubbles in these processes. The main problem to be addressed is that of momentum flux.

WG 103 will have the following terms of reference:

- To hold a workshop to review the present status of our knowledge of wave breaking on the wind driven sea surface and quantification of its dynamical implications for upper ocean dynamics.
- To examine the implications of existing modelling an observational data, and formulate strategies for future incisive modelling and experiments.
- To prepare an authoritative report to SCOR on the status of our present understanding of wave breaking and its importance on upper ocean processes, and a projection of the needs for future theoretical and observational research directions on breaking ocean waves.

The proposed membership list along with additional nominations received from national committees was forwarded to Dr. Banner who will finalize the membership of WG 103.

2.5.2 Effects of Direct CO_2 Disposal into the Oceans

This proposal was submitted by the Chairman of former SCOR WG 75. It was considered in preliminary form at the XXI General Meeting which agreed that it should be revised to take into account two international meetings on this topic held in the first half of 1993.

Professor Asai introduced the revised proposal, noting that the disposal of CO_2 in solid or liquid form into the ocean is considered by some to be one promising way of reducing the increasing emissions of CO_2 from fossil fuels into the atmosphere. In recent years some countries such as Germany, UK, the Netherlands and Japan have intensified studies of the technology for direct oceanic CO_2 disposal from thermal power plants and some international symposia and workshops have been held to examine the problems primarily from the engineering aspects of CO_2 disposal. However, possible effects on the ocean environment, varying from local and regional, to the global scale, are poorly known. The chemical, geological, biological and physical interactions of different forms of CO_2 as solid, liquid or saturated CO_2 solution int he oceans are uncertain. The proposal suggested a review of the possible modes of interaction and their consequences on the marine environment as well as the identification of the gaps in knowledge required to make an assessment of the viability of direct disposal of CO_2 in the ocean.

The Executive Committee felt that the proposal did not clearly define the scientific questions which remain to be addressed following the two international meetings in 1993. There were also concerns expressed that the proposal appeared to be a request to SCOR to conduct an environmental assessment. If there were a specific suggestion to dump CO_2, then it would be more appropriate for SCOR to assist an intergovernmental agency by providing scientific advice. Many of the issues involved may require intergovernmental discussions. In addition, it was felt that the proponents of any ocean dumping activities should provide the financial support for the necessary studies. The U.S. SCOR Committee felt that the scientific knowledge underlying the problem was already quite well known.

In conclusion, it was agreed that SCOR should not take action on this proposal until either the scientific questions were clarified or a concerned agency requests assistance.

2.5.3 Comparative Salinity and Density of the Atlantic and Pacific Ocean Basins

This proposal was received from the Chairman of the US WOCE Steering Committee, Worth Nowlin, on behalf of concerned scientists in the WOCE community. It was presented by Allyn Clarke who stated that the task proposed, while important, is a relatively simple one which could be undertaken in correspondence amongst a small group of individuals who might need a single meeting to finalize their recommendations.

Substantial errors have been introduced in modern salinity measurements because the effect of some of the non-conservative concentrations is not taken into account. Brewer and Bradshaw (1975) have calculated the effect of variations of alkalinity, total carbon dioxide, and silica content upon the conductance-salinity-density relationship. They show that salinity measurements in the deep North Pacific Ocean require a correction of 0.015 parts per mil, giving a correction of density calculations of about +0.012 in sigma units. Millero et al. (1978) have compared measured with calculated densities for waters from the North Pacific Ocean and shown comparable density differences for deep waters. The correction in the deep North Atlantic would be smaller.

For studies requiring the comparison of salinities or densities over small spatial areas the range of the offsets may be small, and they have probably not led anyone astray. For large-scale and ocean-to-ocean studies, however, the offsets are quite significant.

Comparisons of the salinity and density of the North Atlantic, where these non-conservative concentrations are low, with the North Pacific or far South Atlantic, where they are high, can be substantially distorted. Studies of the salinity and density fields, either descriptive or by diagnostic modelling, can give misleading results due to this problem. The large set of salinity measurements based upon conductivity now available, and those in progress now, should be adjusted to account for these offsets. The data on alkalinity, total carbon dioxide, and silica now available in the World Ocean are probably adequate for preparing a program for correction of measurements as a function of their depth, latitude, and longitude.

It was agreed to establish WG 102 and to invite Dr. F. Millero (USA) to Chair the group which will have the following terms of reference:

- To quantify the errors in salinity, as presently measured, and in calculated density due to the non-conservative relative concentrations of alkalinity, total carbon dioxide, and silica content in sea water.

- To devise a methodology for correcting salinity for these effects so that salinity can be used as a global tracer and density can be more accurately calculated globally.

In addition to Dr. Millero, the following individuals were to be invited to join WG 102:

Peter Brewer	USA
Arthur Chen	China (Taipei)
Alain Poisson	France
Peter Saunders	UK
Oleg Mamayev	Russia

2.5.4 Double Diffusion

This proposal, developed by the Russian SCOR Committee and submitted late to the 1992 SCOR General Meeting, under the title of "Laboratory Modelling of Ocean Processes", was considered to have too broad a mandate. The proposal was sent back to the Russian Committee for substantial revision with a narrower focus on double diffusion. However, the revised proposal was not available at the time of the Executive Committee meeting.

2.5.5 Coral Reefs and Global Change

This proposal was considered in detail by the XXI General Meeting which gave it a fairly high priority for action by SCOR. However, it was agreed to delay a final decision in view of a number of other ongoing international activities. The following letter to the Executive Director was received from the suggested Chairman, Robert Buddemeier, requesting a further delay of one year in action on this proposal, due to the rapid pace of developments in this field:

> "I am writing to thank you and the Committee for your previous advice and communications on the subject of the proposed Working Group on Coral Reefs and Global Change, and to offer my recommendations for your consideration at the 1993 meeting.
>
> "The colleagues with whom I have consulted feel as I do -- that the establishment of such a Working Group is ultimately needed and will be a very useful SCOR activity. However, formulation of a working group at the present time would probably be premature, and I am requesting that you consider postponing action until 1994 without prejudice to the basic concept.
>
> "My reasons for this are both administrative and scientific. At the level of program and agency activities, I note that the Global Task Team on Coral Reefs and Climate Change (sponsored by UNEP, IOC, ASPEI, and more recently, IUCN) is now concluding its reporting activities. A methods manual entitled "Monitoring Coral Reefs for Global Change" has been published as Reference Methods for Marine Pollution Studies No. 61 by the UNEP Regional Seas Program, and IUCN has produced a related but not identical document with the same title. The final report of the Task Team has been drafted and is scheduled for production early in 1994; IUCN is preparing a more popularly-oriented summary of that report for distribution this Fall. Although the Task Team report will offer little new information not found in the recent scientific literature, its focus on the impacts of global change on human uses of reef resources is novel and will provide some new perspectives.

"In addition to concluding and placing on record the primary work of this Task Team, the coming year should also resolve whether the various programs of reef monitoring that have been proposed will actually eventuate. My own opinion is that progress has been disappointingly slow, that most of the activity has been by NGOs and informal consortia rather than by government agencies and interagency groups, and that if we do not see some pulling together and catalysis of the effort within the coming year, we should not expect that coordinated global monitoring will contribute substantially to our understanding of reefs and climate change. This should affect the charge to any Working Group that is formed.

"In terms of scientific activities, I feel that the field of coral reef research (especially as it relates to global change) is in a period of great flux, and that directions will be much more obvious a year from now. I offer the following, necessarily personal, assessments.

"First, as a result of the workshops and reviews conducted over the past two years, there have been several new foci of attention developing within the field of coral and reef research. The most important, in my opinion, is the present emphasis on the taxonomy of zooxanthellae (the symbiotic algae that inhabit reef corals) and the implications of the recognition that a diverse range of symbioses with a variety of characteristics may be possible. If early reports of multiple symbioses within what has previously been regarded as a single species of coral are upheld, the critical subjects of adaptation, environmental responses, and evolutionary fitness will have to be viewed from a completely new perspective. I suspect that this is the case, and am confident that within the course of a year the outlines of the new paradigm will have taken shape.

"Second, progress in at least two areas of climatic research has been faster than anticipated by the conservative estimates of the original IPCC report. One of these is the development of regional climate change scenarios and of related oceanic modelling; movement in these critical areas has been sufficiently rapid so that it should soon be possible to agree on some credible local and regional hypotheses for global change. The second is the discoveries in paleoclimate fluctuations, which have significant implications for the nature and rates of change that reef ecosystems may have survived in the past.

"None of these developments have yet been thoroughly assimilated by the scientific community, yet all of them will have profound implications for the formulation of a Working Group. I feel that a year from now the dimensions of these issues will be sufficiently clear that an effective Working Group can be formulated and will be able to play a major leadership role in identifying critical issues and focusing efforts.

"If you agree with me in this assessment I will look forward to receiving your comments and advice so that I may prepare a definitive proposal for your 1994 meeting. I will be happy to entertain questions at any time."

The Executive Committee agreed that the proposal could be delayed for an additional year, but no longer, since other important topics will also require consideration.

2.5.6 Impact of Fisheries Harvest on the Stability and Diversity of Marine Ecosystems

The Canadian Committee for SCOR was to revise this proposal which had been considered by the XXI General Meeting, following the appearance of a relevant ICES report. Dr. Thompson stated that this revision had not yet been completed and no further action on the proposal was taken.

2.5.7 Wave Energy Conversion

This proposal was received from the Chairman of the Argentine Committee for SCOR. The Executive Director forwarded it to ECOR for comment since it is primarily a technological or engineering topic. The Executive Committee examined the proposal and agreed that this action was appropriate.

2.5.8 Sea Level and Muddy Coasts

Terry Healy announced the intention on the New Zealand and Chinese SCOR Committees to develop a proposal on this topic for consideration in 1994.

2.6 General Issues Relating to SCOR Scientific Activities

The meeting returned to a discussion of the general issues relating to SCOR Working Groups and the proposal process which were introduced by the Secretary. He reminded the meeting of the general purpose of SCOR Working Groups as defined in the Objectives and Procedures:

> A working group of SCOR is created to stimulate or focus interest in a particular field of research. Since working groups must be limited, the choice of field must be rigorously selected and may be chosen for a number of reasons, such as:
>
> > That a particular subject will benefit significantly from international study, or when it is desirable to plan a collaborative activity, such as a field experiment or laboratory exercise.
> >
> > When it is timely and profitable to review a particular field.
> >
> > When it is desirable to resolve, compare or standardize particular instruments and techniques.
> >
> > When the advice of SCOR is requested and when this calls for an "in depth" study by specialists.
> >
> > When it is necessary to meet special needs of the scientific community by stimulating intergovernmental action.

These guidelines should be referred to when proposals are considered. The Executive Committee hoped that they would also serve to stimulate proposals of the highest possible scientific quality from a variety of new sources.

Professor Rothschild presented a number of recommendations which he felt would strengthen the SCOR Working Group mechanism:

- a newsletter or bulletin should be published which would make the Objectives and Procedures (currently published only in the *SCOR Handbook*) more widely known.
- the Executive Committee should more actively encourage the development of working group proposals, perhaps generating topics for proposals itself.
- proponents of new working groups could be invited to give scientific presentations on the relevant topic when the proposal is under consideration by SCOR.
- the process of establishing working groups once they are approved should be quicker than at present.
- correspondence between working group Chairs and the Executive Committee Reporters should be

encouraged

- deadlines for working group reports should be established and more rigidly enforced. They should focus on the response of each working group to its terms of reference.

- working group Chairs should be invited to present lectures at SCOR meetings before each group is disbanded.

- a new SCOR newsletter (see elsewhere in this report) should publicize working group activities and achievements.

In general it was agreed that SCOR needs to be more proactive in dealing with its working groups and proposals for new ones. Publication of a SCOR newsletter may help in this effort, but SCOR Committees must also accept responsibility for the dissemination of information and reports which they receive from the Secretariat. National newsletters could also be used to distribute information on SCOR activities. An *ad hoc* group (Rothschild, Krishnaswami, Summerhayes) was identified to look into these points in more detail.

Later in the meeting it was agreed that the Secretariat should produce a two page informational newsletter on a semi-annual basis. This would be distributed to SCOR Committees who would be asked to undertake the responsibility for its distribution within each country. It could also be made available in appropriate electronic formats with very little additional effort. Working Group Chairs and Executive Committee Reporters will be expected to contribute items for this newsletter.

3.0 ORGANIZATION AND FINANCE

3.1 Membership

The Executive Director informed the meeting of the following changes in SCOR membership since the XXI General Meeting:

Australia:
Dr. Michael Banner, Dr. Ian Jones and Dr. John Parslow were recently elected as Nominated Members of SCOR by the Australian SCOR Committee.

Bangladesh:
The Secretariat has been informed that the Nominated Members from Bangladesh are now Dr. A.K.M. Nazrul-Islam, Mr. M. Monirul Hoque and Dr. A.M. Choudhury.

Denmark:
The Danish Committee on Oceanology has appointed Dr. Merete Reuss, Dr. Peter Koefoed Bjørnsen and Dr. Birger Larsen to be its Nominated Members of SCOR.

France:
The Nominated Members of SCOR from France are Professor Pierre Lasserre, Dr. Laurent Labeyrie and Mr. Roland Schlich.

Sweden:
Dr. Leif Anderson has replaced Professor B.O. Jansson as a Nominated Member.

The SCOR Membership Officer, Dr. Krishnaswami, reported on his efforts to make contacts with individuals in countries which are not members of SCOR. These include Colombia, Ireland (application pending), Kenya, Oman, Philippines, Ukraine, Uruguay, Venezuela, Viet Nam. In addition, attempts have been

made to re-establish contacts with the SCOR Committees in Turkey and Spain. Efforts to encourage the creation of a new SCOR Committee in Portugal have not been successful.

In the coming year, Dr. Krishnaswami intends to focus on increasing SCOR membership in the Gulf States and in Southeast Asia. The Executive Committee agreed that emphasis should be placed on activities in the field of coastal science and that the existing SCOR brochure should be supplemented and up-dated with a two page information bulletin. The Secretary of SCOR will assist Dr. Krishnaswami in the production of this item.

Dr. Gil Jacinto, representing a newly re-constituted Committee for SCOR in the Philippines, made a presentation about the status of marine science in his country. The former SCOR Committee (its membership had been terminated at the XXI General Meeting) was primarily governmental, had not been active for some time and had failed to encourage the active participation of scientists from the Philippines in ongoing programs like WOCE and JGOFS. Accordingly, a new Committee has been established in order to bring together individuals in institutions with real interests in oceanography. These include the universities, government agencies (Mines and Geoscience Bureau, Council for Aquatic and Marine Resources Development, etc.) and the private sector (Philippine Association of Marine Science). Dr. Jacinto mentioned that the current strengths in the Philippine marine science community are in the areas of marine biology, ecology and aquaculture, but that expertise in other disciplines is growing since all of the students obtaining advanced degrees overseas are returning to the country.

The Executive Committee unanimously approved the re-admission of the Philippines to SCOR.

In the discussion of this item it became apparent that one obstacle to membership in SCOR for developing countries may be the perception that the focus of SCOR is on deep water oceanography while smaller nations must, of necessity, concentrate on their coastal seas. It was noted, however that the JGOFS/LOICZ Continental Margins Program will concentrate on the Southeast Asian region and that SCOR will undertake to increase its involvement in coastal oceanography (see item 3.4.2).

3.2 Publications Arising from SCOR Activities

The Executive Director presented the following list of publications arising from SCOR activities since September 1992:

UNESCO Technical Papers in Marine Science

No. 64 Coastal Systems Studies and Sustainable Development. Proceedings of the COMAR Interregional Scientific Conference. UNESCO, Paris. 21-25 May 1991. Co-sponsored by UNESCO, UNEP, SCOR, IABO.

No. 65 Methodology for Oceanic CO_2 Measurements. Final Report of SCOR Working Group 75.

IOC Workshop Report Series

No. 80 Programme on Harmful Algal Blooms. IOC-SCOR Workshop on Programme Development for Harmful Algal Blooms. Newport, Rhode Island, USA. 2-3 November, 1991.

No. 84 Workshop of Atlantic Ocean Climate Variability. Moscow, Russian Federation. 13-17 June, 1992.

IOC Technical Series

No. 40 Oceanic Interdecadal Climate Variability. Prepared for the Joint IOC-SCOR Committee on Climate Changes and the Ocean by the Ad Hoc Study Group on Oceanic Interdecadal Climate Variability.

SCOR/IOC CCCO Publications (including WOCE and TOGA)

WOCE - WOCE Core Project 2, Report of the Fifth Meeting CP2-5, 13-15 April 1992. Hamilton, Bermuda. WOCE Report No. 86/92.

WOCE/TOGA Surface Velocity Programme Planning Committee, Report of the Fifth Meeting, SVP-5, 6-8 April 1992. WOCE Report No. 87/92.

WOCE - WOCE Hydrographie Programme, Report of the Tenth Meeting WHP-10, 6-8 May 1992. La Jolla, CA. WOCE Report No. 89-92.

WOCE - Results of an Oxygen/Salinity Comparison Cruise on the R/V Vernadsky. July 1992. Woods Hole, MA. WHP Report WHPO 92-3. WOCE Report No. 93/92.

WOCE - Report of the Eighteenth Meeting of the Scientific Steering Group. Texas A & M University, 12-14 May 1992. WOCE Report No. 94/92

WOCE - North Pacific WOCE Workshop. University of British Columbia. 27-28 April 1992. WOCE Report No. 95/92.

WOCE - Core Project 1. Report of the Fifth Meeting. University of British Columbia. 29 April - 1 May 1992. WOCE Report No. 96/92.

WOCE - WOCE Hydrographic Programme. Report of the Eleventh Meeting. Bundesamt für Seeschiffart und Hydrographie, Hamburg. 26-28 October 1992. WOCE Report No. 97/93.

WOCE - Report of the Fifth Meeting of the Data Management Committee. Bundesamt für Seeschiffart und Hydrographie, Hamburg. 28-30 October 1992. WOCE Report No. 98/93.

WOCE - TOGA/WOCE XBT/XCTD Programme Planning Committee. Report of the Second Meeting. WMO, Geneva. 21-23 October 1992. WOCE Report No. 99/93.

WOCE - Summary of Resource Commitments. Progress in Ocean Modelling, Satellites, Sea Level, Moored Arrays, Floats. Drifters, WHP, XBTs, Facilities. WOCE Report No. 100/93.

WOCE - Numerical Experimentation Group. Report of the Seventh Meeting. Urchfont Manor, Wiltshire, UK. 2 September 1992. WOCE Report No. 101/93.

WOCE - Workshop of WOCE Data Assimilation. Held at Urchfont Manor, Wiltshire, UK. 2-4 September 1992. WOCE Report No. 102/93.

WOCE - Report of the Nineteenth Meeting of the WOCE Scientific Steering Group. James Rennell Centre for Ocean Circulation, Chilworth, UK. 26-28 January 1993. WOCE Report No. 103/93.

WOCE - WOCE Data Management: Data Sharing Policy and Practices, Data Assembly and Analysis Centres, Satellite Data Availability and Data Information Unit. WOCE Report No. 104/93.

The WOCE Handbook (4th Edition). WOCE Report No. 105/93.

WOCE - WOCE Upper Ocean Thermal Data Assembly Centres Coordination Group. Report of the Fourth Meeting. CSIRO Marine Laboratories, Hobart, Australia. 5-6 April 1993. WOCE Report No. 106/93.

WOCE - Newsletter No. 13, October 1992. and WOCE - Newsletter No. 14, June 1993

Report of the Joint Meeting on JSC-CCCO Working Group on Air-Sea Fluxes and the WOCE Surface Layer Scientific Panel. 21-25 October 1991, Reading, Berkshire.

Report of the Third Session of the Joint JGOFS-CCCO Panel on Carbon Dioxide. 6-10 April 1992. Monterey, CA., USA.

Report of the Fourth Session of the Joint CCCO-JSC Ocean Observing System Development Panel, 17-19 March 1992, Southampton, U.K.

Report of the Fifth Session of the Joint CCCO-JSC Ocean Observing System Development Panel. 21-23 July 1992. Seattle, WA., USA.

Report of the Sixth Session of the Joint CCCO-JSC Ocean Observing System Development Panel. 10-13 November 1992. College Station, TX., USA.

Report of the Seventh Session of the CCCO Indian Ocean Climate Studies Panel. 24-28 August 1992. Bangalore, India.

Report of the Tenth Session of the CCCO Pacific Ocean Climate Studies Panel. 9-12 June 1992. Tokyo, Japan.

ICSU/WMO/IOC/SCOR TOGA Scientific Steering Group. Report of the Eleventh Session. 6-10 July 1992, St. Peter, Barbados, W.I. ITPO Publication No. 7.

WCRP - Scientific Concept of the Arctic Climate System Study. Report of the JSC Study Group on ACSYS, Bremerhaven, Germany, 10-12 June 1991 and London, UK, 18-19 November 1991. WCRP-72. WMO/TD No. 486.

Scientific Rationale for Recommending Long-Term. Systematic Ocean Observations to Monitor the Uptake of CO_2 by the Ocean - Now and in the Future. OOSDP Background Report No. 2. Prepared by Liliane Merlivat and Alain Vézina for the Joint CCCO-JSC Ocean Observing System Development Panel. September 1992.

Surface Conditions and Air-Sea Fluxes. OOSDP Background Report No. 3. Prepared by Robert A. Weller and Peter K. Taylor for the Ocean Observing System Development Panel. February 1993.

Interim Design for the Ocean Component of a Global Climate Observing System. Prepared by the Ocean Observing System development Panel. February 1993.

JGOFS Publications

Deep-Sea Research Part II. J. D. Milliman, (Ed.) Topical Studies in Oceanography: Pergamon Press. JGOFS: The North Atlantic Bloom Experiment. H.W. Ducklow and R. P. Harris (Guest Eds.) Volume 40. No. 1/2, 1993.

The Joint Global Ocean Flux Study Implementation Plan. Published jointly as JGOFS Report Series No. 9 and IGBP Report No. 23.

The Joint Global Ocean Flux Study Southern Ocean Study. September 1992. JGOFS Report No. 10.

The Reports of JGOFS Meetings held in Taipei, October 1992. Seventh Meeting of the JGOFS Scientific Steering Committee. Global Synthesis in JGOFS - A Round Table Discussion. JGOFS Scientific and Organizational Issues in the Asian Region - Report of a Workshop. JGOFS/LOICZ Continental Margins Task Team - Report of the First Meeting. JGOFS Report No. 11.

GLOBEC Publications
Population Dynamics and Physical Variability, Report of the First Meeting of an International GLOBEC Working Group. St. John's College, Cambridge University. February 1-5, 1993. GLOBEC Report No. 2.

Sampling and Observational Systems. Report of the First Meeting of an International GLOBEC Working Group. IOC, UNESCO Headquarters, Paris. March 30-April 2, 1993. GLOBEC Report No. 3.

GLOBEC International Newsletter, Vol. 1, No. 1. April 1993.

Publications Arising from other SCOR Subsidiary Bodies
Marine Hydrothermal Systems and the Origin of Life. *Origins of Life and Evolution of the Biosphere* Special Issue (Volume 22, Nos. 1-4. 1992), N. G. Holm (Guest Ed.).

Marine Hydrothermal Systems and the Origin of Life. Dr. N.G. Holm (Ed.) Report of SCOR Working Group 91. Kluwer Academic Publishers, Dordrecht. 242pp.

Publications Arising from Other SCOR Activities
SCOR Proceedings, Volume 28. Report of the XXI General Meeting of SCOR. Göteborg, Sweden, September 15-17, 1992.

Ice Covered Seas and Ice Edges. Physical, chemical and biological processes and interactions. Proceedings of the 22nd International Liège Colloquium on Ocean Hydrodynamics. J.C.J. Nihoul and S. Djenidi (Eds.) Elsevier, Amsterdam-London-Tokyo, 1992.

Ocean Modelling Newsletter - Nos. 95 through 99 were published during this period.

The Publications Officer, Professor Terry Healy, reported that he had sent a letter to all Working Group Chairs reminding them that publications must suitably acknowledge the support of SCOR. He introduced a draft publications policy which will be further developed for discussion at the XXII General Meeting in 1994:

- Each Working Group is expected to publish the results of its activities.
- In general, SCOR expects that each Working Group will identify the financial support necessary for its own publication.
- Each publication arising from SCOR Working Group activities must carry appropriate acknowledgement of SCOR and, where possible, include the SCOR logo.
- The SCOR Executive Committee should review each Working Group's publication plan at its mid-life point.
- If practicable, a copy of each publication resulting from SCOR-sponsored activities should be distributed to each Committee for SCOR.

- When SCOR subsidizes a publication, the distribution of SCOR copies should be restricted to a mailing list of the Committees for SCOR and the Executive Committee (i.e. about 60 copies).

Publication Guidelines

- If the Working Group task is directed to methods and techniques, publication as a *Unesco Technical Paper in Marine Science* is appropriate and ensures wide distribution.

- Where the task of the Working Group incorporates research, a "special issue" of a mainstream scientific journal is appropriate.

- Where the task of the Working Group involves extensive review, then production of a reference text is appropriate.

- For guidance on publications matters, Working Groups should work through the SCOR Publications Officer (see Executive Committee).

3.3 Finance

The Chairman of the *ad hoc* Finance Committee, John Field, presented the Committee's report. It had reviewed the current state of SCOR finances including the audited statements for the previous fiscal year (1992), and estimates for 1993. The Committee was also responsible for drafting a budget for 1994 activities and a recommending new levels of membership contributions for 1995.

The final (post-audit) financial statement for 1992 appears in Annex 6. Professor Field made a detailed analysis of the actual and projected trends in income and expenses for the years 1992 through 1994. In general, these are expected to remain relatively stable. A major observation of interest to the meeting was that the large-scale programs are supported entirely from "tied" or dedicated sources of income such as specific grants from ICSU and the U.S. National Science Foundation. This was felt to be desirable so as not to jeopardize support for the traditional SCOR Working Group; in a sense, SCOR provides a conduit for funding support of the planning activities for the large international programs like JGOFS and GLOBEC.

The *ad hoc* Finance Committee made four recommendations:

- that the year end balance should always be at least $30,000 in order to ensure a base of support for activities early in the following year
- the salary of the Executive Director should be reviewed before the 1994 General Meeting
- outstanding membership contributions should be written off after a period of five years. This would coincide with the termination of the membership of any country which is five years in arrears as specified in SCOR's regulations.
- there should be a 5% increase in membership contributions for the year 1995.

Professor Field presented a budget for 1994 which assumed a beginning balance of $65,000 and the sum of $18,700 being held in the JGOFS Special Fund. To these amounts would be added income from membership contributions ($175,000 if all are paid) and grants and contracts ($361,000) for a total of $620,200. The budget predicted expenditures of $85,000 on current Working Groups, $131,000 on JGOFS, $66,000 on GLOBEC and $20,000 set aside for possible meetings of newly-established working groups. Expenses such as the General Meeting, travel awards to oceanographers from developing countries and publications will total $118,000 in 1994 and administrative costs, including salaries will be about $143,000. This would leave an acceptable year end balance of $38,500, not including the funds held in the JGOFS Special Fund.

The Executive Committee accepted this report and its recommendations and thanked the *ad hoc* Finance Committee for its effort.

A Strategic Planning Committee was established by the XXI General Meeting to investigate means of broadening the financial base of SCOR and potential new sources of funding. The members of this Committee are the President and Secretary of SCOR, Tomio Asai (Japan) and Ian Jones (Australia). A preliminary report of the Committee's discussions was presented by Ian Jones who noted that each year good proposals for SCOR initiatives must be rejected because of a lack of funds. As seen above, membership dues provide only a small fraction of the total SCOR budget and most other income is tied to specific programs. This situation is reducing the flexibility of SCOR to respond to new needs in its fields of interest.

The Strategic Planning Committee has adopted two goals: to propose methods of substantially increasing the "untied" funding of SCOR; and to propose methods of substituting new funds for existing activities, thereby releasing untied funds. The Committee has agreed to focus on the search for new sources of financial support to SCOR which seemed likely to provide more than $100,000 over a three year period. The Secretariat will be charged with the continuing search for lesser amounts. Dr. Jones noted that increased membership income, either through new members or increased dues to reflect inflation, would have only a small impact on overall income. Private foundations and new government sources of grants and contracts offer the best hope for increased income. The Strategic Planning Committee will raise the issue of an endowment fund for discussion at the General Meeting in 1994. Members of the Committee will explore specific funding opportunities in their own regions (e.g. Japanese private foundations, the European Community, etc.).

Finally, Dr. Jones reiterated the need for an updated brochure or newsletter to assist in this effort.

3.4 Other Organizational Matters

3.4.1 Appointment of a Nominations Committee

In preparation for election of Officers at XXII General Meeting it was agreed to appoint a Nominations Committee to be chaired by the Past-President, Jarl Stromberg and to include one member from Asia, one from the southern hemisphere and one from the Americas. The terms of the three Vice-Presidents expire at each General Meeting. Two incumbents (Dr. A. Kuznetsov and Professor T. Asai) are not eligible to be re-elected. The third (Professor T. Healy) is eligible to be nominated for an additional two year term. The Executive Director will invite all SCOR Committees to submit nominations for consideration by the Committee well in advance of the General Meeting.

3.4.2 ICSU Review of SCOR

As part of a routine ICSU process, the operations and scientific activities of SCOR were reviewed by an ICSU Panel during 1992. The XXI General Meeting received a preliminary oral report of this review from the Panel Chair, Professor Olof Tandberg. The final report became available a few months later and was reviewed for the Executive Committee by Jarl Stromberg. The Review Panel was positive about SCOR's Working Group mechanism and the efforts to maintain an appropriate balance between the Working Group activities and the large-scale, long-term global programs. It also commended SCOR for its continuing internal review of its own activities and for the manner in which it dealt with the issue of large oceanographic meetings following the Joint Oceanographic Assembly in 1988.

The Panel encouraged SCOR to increase its level of involvement in coastal oceanography as this field is of growing importance to many smaller nations and developing countries in particular. It recommended a radical re-examination of SCOR's publication policy in order to bring the results of SCOR activities more forcibly to the attention of the world scientific community. Finally, it recommended that there be increased turn over in the SCOR Executive Committee, possibly by limiting the eligibility of the Vice-Presidents for re-election to two terms rather than three.

The meeting instructed the Executive Director to thank ICSU for this report and to note that the various issues raised are being taken up by SCOR. It was recognized that changes in the terms of Executive Committee members would require a revision of the SCOR Constitution. Ian Jones (Australia) will work with the Executive Director to prepare a discussion paper on this matter in advance of the 1994 General Meeting. Similarly, Terry Healy will convene a small group (Healy, Krishnaswami and Summerhayes) to discuss the "radical change in publication policy" and to make recommendations to the next General Meeting.

3.4.3 Proposal for a SCOR Medal

The Secretary introduced the suggestion that a SCOR Medal be created and awarded to honour individual achievement in oceanography, noting that this would, at the same time, enhance the visibility of SCOR. A lengthy discussion ensued with a wide range of views being expressed. It was agreed that a detailed discussion paper which sets out the full range of views on the topic should be prepared by Professor Rothschild for the President who will send it to all SCOR Committees for comments in preparation for the XXII General Meeting.

4.0 GLOBAL MONITORING AND OBSERVING SYSTEMS

Information was presented by the President, the Executive Director and other participants who are familiar with current efforts to develop global systems for monitoring climate (Global Climate Observing System - GCOS) and the oceans (Global Ocean Observing System - GOOS). This is being carried out by various intergovernmental organizations in cooperation with the scientific community through ICSU.

In particular, GOOS is being sponsored by IOC, WMO and UNEP. An IOC Intergovernmental Committee for GOOS (I-GOOS) has been charged with the implementation of GOOS. At the same time, negotiations have been carried out between IOC, WMO and ICSU which have resulted in the signature of a Memorandum of Understanding on the sponsorship of a Joint Scientific and Technical Committee for GOOS (J-GOOS). The MOU recognizes the importance of SCOR's involvement, both as the lead organization for marine science within ICSU, and as the primary Scientific Advisory Body to IOC. Thus members of the SCOR Executive Committee, especially the President, Past-President and the Secretary, have been actively involved in the discussions about the establishment of J-GOOS. SCOR had been asked to assist in the identification of possible J-GOOS members and during the Executive Committee meeting a large number of nominations were advanced for future consideration by the J-GOOS cosponsors. The President took this list with him for further discussions during the ICSU General Assembly which immediately followed the SCOR meeting. The consensus of the Executive Committee meeting was that the sponsors of J-GOOS should be urged to keep the Committee somewhat smaller than the size foreseen in the MOU and that the Chairman of J-GOOS plus a four person Executive should be charged with much of the routine business of the Committee between its meetings. The MOU provides for two representatives to J-GOOS from each of the sponsoring organizations and ICSU had invited SCOR to identify one of its representatives. It was agreed that this should be Dr. Allyn Clarke of Canada. The first meeting of J-GOOS is planned for the first quarter of 1994.

Readers of this report who are interested in detailed information on GOOS are encouraged to contact the GOOS Support Office at the IOC Secretariat.

5.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

5.1 Intergovernmental Oceanographic Commission

The Fourth Vice-Chairman of the IOC, Dr. Su Jilan, reviewed a report which had been prepared for the Executive Committee meeting by the IOC Secretariat. It appears in Annex 7.

In addition to various items already discussed (e.g. GOOS, WG 97, JGOFS, GLOBEC, etc.), Dr. Su reported that the IOC Study Group on Development, Operations, Structure and Statutes (DOSS) is engaged in an effort to increase income to IOC and to improve the effectiveness of its national contacts and the geographical representation on the IOC Executive Council. The IOC report also notes the interest of the Commission in SCOR WGs 89, 93, 96, 97, 98 and 101 and the involvement of SCOR in its coastal oceanography program. It also touches upon the need for the marine scientific community to be more active in influencing policy makers and to ensure that proper recognition is given to the importance of the role of the ocean in changing climate, resource issues and so on.

Finally, the IOC Secretary, in his report to SCOR, suggested a meeting between representatives of the two organizations in the near future to "further discuss and develop appropriate continued dialogue and interaction."

A separate report from the Chairman of the IOC/IHO Guiding Committee for the General Bathymetric Chart of the Ocean (GEBCO), Sir Anthony Laughton, notes the continuing involvement of SCOR in this activity. The SCOR representative to the Guiding Committee is the current Chairman. He reported that the main task currently before GEBCO is the continuing effort to complete the digitisation of the Fifth Edition of the charts and making it available in CD-ROM format. This will be the basis for a GEBCO Digital Atlas which, it is hoped, will become the accepted international digital data base for bathymetry.

In the discussion which followed Dr. Su's presentation, various views were expressed. In general, it was agreed that SCOR-IOC interactions might best focus on the creation of an "alliance and partnership" which would be most effective if it can be channelled towards a small number of cooperative efforts. For example, one might be the provision of high quality scientific input to the IPCC assessment process. These issues will be taken up in discussions with the IOC Secretary in the near future.

5.2 World Meteorological Organization

Although no representative was able to attend the Executive Committee meeting, a written report from WMO presented information on observing systems, drifting buoys, remote sensing, IGOSS, and TOGA issues for the information of the Executive Committee. This appears as Annex 8. The meeting accepted the invitation of WMO to cosponsor the Final TOGA Conference to be held in 1995. This meeting, the third in a series of TOGA scientific conferences (1984, 1990) which have been cosponsored by SCOR, will mark the formal completion of the TOGA program.

5.3 International Council for the Exploration of the Sea (ICES)

A detailed report on ICES activities of interest to SCOR is reproduced in Annex 9. The Executive Committee took particular note of the effort to produce a manual on zooplankton methodology which would be very important for the GLOBEC program. While involvement of SCOR in this effort has been requested, it is not clear what form this should take. The Executive Director was instructed to contact the editors of the manual to obtain more information. Cosponsorship of ICES meetings, production of a new Zooplankton Methodology Manual.

5.4 North Pacific Marine Science Organization (PICES)

The representative of PICES, Dr. Dunxin Hu, reviewed the emerging structure of the organization which is less than two years old. It has established a Science Board and four subsidiary Committees (Biological Oceanography, Fishery Science, Marine Environmental Quality and Physical Oceanography and Climate). A number of working groups have been established on more specialized topics (e.g. Subarctic gyre, Dynamics of small pelagic fish in coastal ecosystems, etc.) A developing PICES program in the subarctic Pacific is likely to form one of the regional components of GLOBEC.

6.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

6.1 International Council of Scientific Unions

The ICSU Review of SCOR was discussed under an earlier agenda item. The President went directly from the Executive Committee meeting to the ICSU General Assembly (October 4-8, Santiago, Chile) in order to represent SCOR there. Issues of concern to SCOR for the ICSU meeting included discussions on GOOS, relations with IUPAC (see below) and supporting the application of ECOR for an associate membership in ICSU.

6.2 ICSU Unions and Committees

Reports were requested from all ICSU bodies which have representatives to SCOR. Matters of interest in the reports received were drawn to the attention of the meeting.

Scientific Committee for the International Geosphere-Biosphere Programme

The Chairman of IGBP, Professor Liss, noted that many items of mutual interest had already been dealt with during the meeting. He strongly encouraged SCOR to become more actively involved in ensuring appropriate oceanographie input to the ongoing IPCC Science Assessment effort (Intergovernmental Panel on Climate Change).

The question of SCOR participation in the IGBP Core Project on Land-Ocean Interactions in the Coastal Zone was raised, particularly in view of the ICSU Review Panel's recommendation that SCOR should increase its involvement in the field of coastal science. Peter Liss was asked to transmit SCOR's interest in this topic to the LOICZ Steering Committee and to indicate SCOR's willingness to be of assistance, perhaps by establishing new working groups on topics relevant to the LOICZ program. Following the discussion under item 2.6, SCOR would be prepared to consider proposals for Working Groups from such a source.

Scientific Committee on Antarctic Research

The Past-President and Executive Director had a brief opportunity to participate in a meeting of SCAR's Group of Specialists on Global Change and the Antarctic in Cambridge early in 1993 while they were attending a GLOBEC meeting. They presented information on the planning for both the JGOFS and GLOBEC Southern Ocean programs. The linkages between the SCAR GLOCHANT activity and IGBP have not yet been clarified, according to Professor Liss, although it was hoped that this would occur in the near future.

Scientific Committee on Problems of the Environment

A report from SCOPE referred primarily to the activities of the SCOPE/UNEP Carbon unit in Hamburg which has a program on particle flux in the ocean. This project was nearing completion and its final meeting was about to take place at the time of the Executive Committee meeting. The lack of coordination of this activity with JGOFS was regretted and will be communicated to the SCOPE Secretariat, especially in view of the possible proposals for future activities in this field mentioned in the report.

Special Committee on the International Decade for Natural Disaster Reduction

Information provided by the Chairman of IDNDR, Sir James Lighthill, showed that of the projects under consideration which may have interest to SCOR, the Special Committee has decided to focus on Tropical Cyclone Disasters. Readers of this report may contact the SCOR Secretariat for a copy of the detailed report which had been prepared for ICSU by the SC-IDNDR.

International Union of Pure and Applied Chemistry

Professor Lu Xiankun made a presentation on behalf of IUPAC, and in particular of its Commission on Environmental Analytical Chemistry. He conveyed the interest of IUPAC in appropriate collaboration with SCOR. Members of the Executive Committee were informed of a number of IUPAC projects in the field of

marine chemistry and it was remarked that SCOR programs often need expertise on high quality chemical analysis. Various possibilities for links between IUPAC and SCOR were discussed. The consensus was that IUPAC were to form a specific Commission for Marine Chemistry, this new body might become an Affiliated Organization of SCOR. The President agreed to discuss this with the Secretary-General of IUPAC, Professor den Boef, during the forthcoming ICSU General Assembly.

World Climate Research Program

WCRP is now being sponsored by IOC in addition to the WMO and ICSU. A brief report referred to the new CLIVAR (Climate Variability) program of WCRP which has two major foci:

Interannual variability (TOGA follow-on)

ENSO and other seasonal to interannual climate variations; predictability in general and effective prediction of ENSO.

Monsoon circulations (largely atmospheric circulation processes in which the upper ocean intervenes weakly through local or non-local SST anomalies).

Tropical/extra-tropical interactions ("teleconnections") mediated by the atmospheric circulation.

Interdecadal to centennial variability

Externally-forced climate change (mainly the "prediction" of the response to anthropogenic forcings such as the increase in greenhouse gases, aerosols, etc., but including the impact of volcanic eruptions, fires, etc.).

Thermohaline processes (generally less than global scale) in all ocean basins.

Large-scale ocean circulation variability (exploratory monitoring and "open-ended research" to loosely address the second objective of WOCE).

The CLIVAR Steering Group has not yet formulated its approach to the last topic. It has agreed that a major climate research program on the role of the ocean and decadal to centennial variability could not proceed without at least initiating some ocean observing projects which would eventually provide long time series of important indicators of changes in world ocean circulation. One suggestion is to organize an open scientific conference on the Role of the Ocean in Decadal to Centennial Climate Variability in late 1994 or 1995. This would provide a forum for the oceanographie community to express views on recommended scientific strategies for CLIVAR and to formulate specific proposals.

The report from Dr. Morel of the WCRP Secretariat noted that CLIVAR will encourage a coupled atmosphere-ocean-ice modelling program which will bring together aspects of the follow-on to TOGA as well as the global-scale ocean/climate variability concerns addressed within WOCE. This CLIVAR modelling program, it is hoped, may bridge the gap between TOGA and WOCE ocean science and provide an effective means to take into account feedbacks through the atmospheric response to ocean circulation changes.

6.3 Affiliated Organizations

International Association for Meteorology and Atmospheric Physics

A letter has been sent to the SCOR Secretariat from the President of IAMAP, Professor Hoskins, indicating that IAMAP will not send representatives to SCOR meetings in future unless specific items necessitate it. He suggests that IAMAP may nominate members for new working groups relevant to its interests. The Executive Committee agreed that in future, only issues (such as Working Group proposals) of direct relevance to IAMAP interests should be sent to Professor Hoskins.

6.4 Corresponding Organizations

Engineering Committee on Oceanic Resources

The President noted that he had been asked to support the application of ECOR for scientific associate status in ICSU. This was discussed briefly by the Executive Committee which agreed that a positive letter on this matter should be sent to the President of ECOR

7.0 FUTURE MEETINGS

7.1 Twenty-second General Meeting of SCOR

At the XXI General Meeting the Chairman of the Canadian SCOR Committee, Jeff Thompson, offered a tentative invitation to SCOR to hold this meeting near Victoria, BC. This offer was subsequently confirmed and was accepted by the President. The XXII General Meeting will take place during the week of October 17, 1994. It was agreed that the scientific component of the meeting should be a symposium on some aspect of GLOBEC science, to be planned by the GLOBEC SSC jointly with the Canadian SCOR Committee. There should also be two or three scientific talks on topics arising from SCOR Working Groups during the meeting itself.

7.2 Thirty-second Executive Committee Meeting and Future Meetings of SCOR

This meeting should take place during September/October 1995. Offers to host the meeting in Cape Town or in Townsville, Australia were received from John Field on behalf of the South African SCOR Committee and from Ian Jones for the Australian SCOR Committee. The Executive Committee accepted these invitations with appreciation and agreed to defer the decision on the location of the 1995 meeting until a later date.

With regard to future SCOR meetings, it was agreed that the XXIII General Meeting in 1996 should take place in the United Kingdom in order to mark Professor McCave's last year as President of SCOR. This might take place at the new Oceanography Centre in Southampton which will open in 1995. Gil Jacinto made a tentative offer to host the thirty-third Executive Committee meeting in the Philippines. Note was taken of an offer from the Netherlands SCOR Committee to host the 1996 General Meeting; if acceptable to Dr. Mook, this will be taken up for the XIV General Meeting in 1998.

7.3 Other meetings of interest to SCOR

A list of meetings of interest to SCOR, including those for which SCOR cosponsorship has been requested was presented:

SCOR sponsorship was approved for the following meetings. In general SCOR will provide travel grants for a few scientists from developing countries wishing to attend these meetings:

- PORSEC '94 - the 7th Australian Remote Sensing Conference. Melbourne, Australia, 1-4 March 1994.
- The Coastal Ocean in a Global Change Perspective. 26th International Liège Colloquium. May 2-6 1994. Liège, Belgium. SCOR cosponsorship is conditional upon appropriate acknowledgement of SCOR support and on the inclusion of the SCOR logo in the resulting publication.
- The Oceanography Society Pacific Basin Meeting. Honolulu, July 19-22, 1994. This meeting is intended to provide an international science and policy forum for the major international global change programs taking place in the Pacific Basin: JGOFS, WOCE, TOGA, TOGA/COARE, RIDGE and ODP.

- The South Atlantic: Present and Past Circulation. Bremen, Germany, August 15-19, 1994. SCOR cosponsorship of this event was approved by the 1992 General Meeting.

- ICES Symposium on Zooplankton Production - Measurement and Role in Global Ecosystems Dynamics and Biogeochemical Cycles. Plymouth, UK, 15-19 August 1994. SCOR sponsorship of this meeting was discussed at the 1992 General Meeting, although a formal request had not been received. In the meantime, the convenors did formally request sponsorship and special funds have been provided to SCOR by the US National Science Foundation for support of this event.

- Optical Oceanography Symposium. September 1994, Villefranche. Cosponsorship was approved by the 1992 General meeting. The dates have since been changed from 1993.

- Coastal Change '95. The IOC has requested SCOR cosponsorship of this event which will take place in Bordeaux, France from 6-10 February, 1995.

- 1995 International TOGA Conference. Third in a series (1984, 1990), this Conference will mark the completion of TOGA. It will be held between mid-March and mid-May in Melbourne or Sydney, Australia.

- Inter-Ocean Exchange of Heat, Water and Particulates. Capetown, South Africa. March 1994.

The following meetings may be of interest to SCOR Members; additional information about any of them is available from the SCOR Secretariat:

- Sixth SCAR Antarctic Biology Symposium. Venice, Italy, May 30 - June 3, 1994.

- IAPSO Summer School on Physics of Ice Covered Seas. Helsinki, Finland. June 1994.

- International Symposium on Global Change in Asia and the Pacific Regions. August 8-10, 1994, Beijing, China.

In closing the meeting, the President expressed the gratitude of all members of the Executive Committee and other participants to their Chinese hosts for their provision of the meeting facilities and for their hospitality. He especially welcomed the opportunity to renew old friendships during the visit to China and to Qingdao in particular.

ANNEX 1 - List of Participants

31st Executive Committee Meeting of SCOR

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ANNEX 2 - Agenda

THIRTY-FIRST EXECUTIVE COMMITTEE MEETING OF SCOR
Institute of Oceanology, Academia Sinica
Qingdao, China
Tuesday, September 28 through Thursday, September 30, 1993

1.0 OPENING

The Executive Committee Meeting will open at 9:00 AM on Tuesday, September 28 in the Institute of Oceanology, 7 Nanhai Road, Qingdao.

1.1 Opening Remarks and Administrative Arrangements
Local hosts, McCave, Gross.

1.2 Approval of the Agenda
McCave.

1.3 Report of the President of SCOR
The President will briefly review activities since the XXI General Meeting (September 1992).
McCave.

1.4 Appointment of an ad hoc Finance Committee
The Constitution requires that a Finance Committee be appointed at every SCOR meeting. It should review the administration of SCOR finances during the previous fiscal year (1992) and the current year. It also works with the Executive Director to draw up a budget for the next year's activities based on the decisions taken during the meeting. The Committee will report under agenda item 3.3.
McCave.

2.0 SCIENTIFIC ACTIVITIES

The Secretary of SCOR, Brian Rothschild, will introduce this portion of the Executive Committee Meeting with a discussion on the scientific Working Group and Committee mechanisms as a means of furthering SCOR's objectives and encouraging scientific excellence. Responsibilities of Executive Committee Reporters.

2.1 Arising from Former Working Groups

2.1.1 WG 75 Methodology for Oceanic CO_2 Measurements
Final report published as No. 65 in the series *Unesco Technical Papers in Marine Science.*
Gross.

2.1.2 WG 76 Deep Sea Ecology
Publication of final report. The Editor of *Progress in Oceanography* has been contacted about this report.
McCave, Stromberg.

2.1.3 WG 78 Determination of Photosynthetic Pigments in Seawater
Progress towards completion of methodological monograph. Report from the editorial group.
Stromberg.

2.1.4 *WG 80 Role of Phase Transfer Processes in the Cycling of Trace Metals in Estuaries*
Publication of final report.

Gross.

2.1.5 *WG 83 Wave Modelling*
Publication of final report is expected under a contract with Kluwer in Fall of 1993.

Healy, Asai.

2.2 Current Working Groups

2.2.1 *WG 86 Ecology of Sea Ice* (with SCAR and AOSB)
Dr. Steve Ackley (USA) has assumed the Chairmanship, replacing Neal Sullivan who has assumed a new position. An international symposium, originally scheduled for 1994 is now proposed for 1995.

Stromberg.

2.2.2 *WG 89 Sea Level and Erosion of the World's Coastlines* (with IOC)
Report of final meeting. Plans for publication of final report.

Healy.

2.2.3 *WG 92 Ocean/Atmosphere Palaeochemistry*
Report from the Chairman, Eric Sundquist. Plans for an international symposium in 1993-94.

McCave.

2.2.4 *WG 93 Pelagic Biogeography* (with IOC)
Report of the third meeting of WG 93, Amsterdam, August 30 - September 1 1993.

Rothschild.

2.2.5 *WG 94 Altimeter Data and in situ Current Observations* (with IOC)
The XXI General Meeting accepted the recommendation of WG 94 that the Chairmanship be rotated. The individual suggested declined to accept the responsibility due to the pressure of other activities in the field which seemed to be addressing many of the same issues. In discussions with the first Chairman, Victor Zlotnicki, and the Executive Committee Reporter, Robin Muench, it was agreed to canvass the members of the WG as to the need for continuing WG 94 and their views on a new Chairman.

Clarke.

2.2.6 *WG 95 Sediment Suspension and Sea Bed Properties*
Report of first meeting (September 1992), plans for future activities.

Kuznetsov.

2.2.7 *WG 96 Acoustic Monitoring of the World Ocean* (with IOC)
Report of second meeting of WG 96 held in June 1993. Membership changes. Plans for an international program of Acoustic Thermometry of Ocean Climate.

Su.

2.2.8 *WG 97 Physiological Ecology of Harmful Algal Blooms* (with IOC)
Report on activities. The first formal meeting will be held in France, October 1993 in conjunction with the International Conference on Toxic Marine Phytoplankton. WG 97 will draft a proposal for a NATO Workshop to be held in late 1994 or early 1995 as its final activity.

Stromberg.

2.2.9 *WG 98 Worldwide Large-scale Fluctuations of Sardine and Anchovy Populations*
Report on the establishment of WG 98 and preliminary activities, including an informal meeting in May 1993.
Rothschild.

2.2.10 *WG 99 Linked Mass and Energy Fluxes at Ridge Crests*
Report on the establishment of WG 99.
McCave.

2.2.11 *WG 100 Sediment Coring for International Global Change Research*
Report on the establishment of WG 100.
McCave.

2.2.12 *WG 101 Influence of Sea State on the Atmospheric Drag Coefficient*
Report on the establishment of WG 101 and its first meeting in Avignon, June 1993.
Asai, Jones.

2.3 Committees and Panels

2.3.1 *Editorial Panel for the Ocean Modelling Newsletter*
The future of the Newsletter and alternative venues for its publication are under review since the US Office of Naval Research has announced its intention to discontinue funding.
Gross.

2.3.2 *SCOR/IGBP Joint Global Ocean Flux Study Scientific Steering Committee* (with IOC)
JGOFS activities since September 1992. Membership changes. Mid-life review of JGOFS by SCOR. Other JGOFS issues. The JGOFS SSC is holding its Eighth Session in France two weeks before the SCOR Executive Committee meeting. The report will include items arising from the JGOFS meeting and will be introduced by the JGOFS Vice Chairman, John Field.
Stromberg, Field.

2.3.3 *SCOR/IOC Scientific Steering Committee on Global Ocean Ecosystem Dynamics*
GLOBEC activities since September 1992. Development of the GLOBEC Science Plan. It is proposed to present this to a SCOR/IOC GLOBEC Strategic Planning Conference in Paris during the first half of 1994. Links of GLOBEC to IGBP.
Clarke, Rothschild.

2.3.4 *IGBP/SCOR/WCRP Working Group for the Global Ocean Euphotic Zone Study*
Report of a meeting in Southampton, June 1993. Links to JGOFS and GLOBEC. Cosponsorship by WCRP. Further development of plans for GOEZS as a potential Core Project of IGBP.
Clarke, Liss, Gross.

2.4 Links between Global Programs in Oceanography
The meeting will be informed of plans for a meeting to be held between representatives of SCOR, IGBP, WCRP, etc. which will discuss the scientific and managerial links between the ongoing and planned large-scale programs in oceanography (JGOFS, WOCE, GLOBEC, GOEZS, etc.).
McCave, Rothschild, Liss.

2.5 Proposals for New Working Groups

As it considers this Agenda item, the Secretary will invite the Executive Committee to examine the WG proposal process and how it might be improved.

Rothschild.

Two proposals were circulated to SCOR Committees for comments on August 4:

2.5.1 The Role of Wave Breaking on Upper Ocean Dynamics

Submitted by the Australian SCOR Committee.

Clarke, Jones.

2.5.2 Effects of Direct CO_2 Disposal into the Oceans

This proposal was submitted by the Chairman of former SCOR WG 75. It was considered in preliminary form at the XXI General Meeting which agreed that it should be revised to take into account two international meetings on this topic held in the first half of 1993. The revised proposal has been circulated to SCOR Committees (August 4).

Asai.

2.5.3 Comparative Salinity and Density of the Atlantic and Pacific Ocean Basins

This proposal was received from the Chairman of the US WOCE Steering Committee, Worth Nowlin, on behalf of concerned scientists in the WOCE community. It has been endorsed by the Chairman of the US Committee for SCOR and was circulated to other SCOR Committees on August 20.

Clarke.

The following proposals were either tabled for further development at previous SCOR meetings, or were received too late for circulation to SCOR Committees:

2.5.4 Double Diffusion

This proposal, developed by the Russian SCOR Committee and submitted late to the SCOR General Meeting, under the title of "Laboratory Modelling of Ocean Processes", was considered to have too broad a mandate. The proposal was sent back to the Russian Committee for substantial revision with a narrower focus on double diffusion. The Secretariat has been informed that the revised proposal is forthcoming, but it was unavailable for circulation at the time of preparing this Agenda.

Asai.

2.5.5 Coral Reefs and Global Change

This proposal was considered in detail by the XXI General Meeting which gave it a fairly high priority for action by SCOR. However, it was agreed to delay a final decision in view of a number of other ongoing international activities. A document from the suggested Chairman, Robert Buddemeier, will be presented in which he requests a further delay of one year in action on this proposal, due to the rapid pace of developments in this field.

Healy.

2.5.6 Impact of Fisheries Harvest on the Stability and Diversity of Marine Ecosystems

The Canadian Committee for SCOR was to revise this proposal following the appearance of a relevant ICES report. The revised proposal had not been received as this Agenda was prepared, but will be presented if it is available for the Executive Committee meeting.

Rothschild.

2.5.7 Wave Energy Conversion

This proposal was received from the Chairman of the Argentine Committee for SCOR. The Executive Director forwarded it to ECOR for comment since it is primarily a technological or engineering topic. The Executive Committee should examine the proposal to determine if this action was appropriate.

Gross.

2.6 General Issues Relating to SCOR Scientific Activities

The meeting will return to the general issues relating to SCOR Working Groups and the proposal process which were introduced by the Secretary.

Rothschild.

3.0 ORGANIZATION AND FINANCE

3.1 Membership

The Executive Director will introduce a document summarizing changes in SCOR Nominated and Representative Members since September 1992. Dr. Krishnaswami will report on new membership initiatives. The meeting will receive an application for admission of a newly re-constituted Committee for SCOR in the Philippines. Status of Invited Members. Other membership issues.

Krishnaswami, Gross, Jacinto.

3.2 Publications Arising from SCOR Activities

The Executive Director will present a report on publications arising from SCOR activities since September 1992. The Publications Officer, Terry Healy, will report on current publications issues. He and Brian Rothschild will introduce suggestions for a SCOR Newsletter and a Directory of Marine Scientists.

Healy, Rothschild, Gross.

3.3 Finance

The Chairman of the *ad hoc* Finance Committee will review the current state of SCOR finances and will present a budget for 1994 activities and a recommendation regarding levels of membership contributions for 1995.

Report of the Strategic Planning Committee established by the XXI General Meeting to investigate means of broadening the financial base of SCOR and potential new sources of funding.

Finance Committee, McCave, Jones.

3.4 Other Organizational Matters

3.4.1 Appointment of a Nominations Committee in preparation for election of Officers at XXII General Meeting, 1994. The terms of the three Vice-Presidents expire at each General Meeting. Two incumbents (Dr. A. Kuznetsov and Professor T. Asai) are not eligible to be re-elected. The third (Professor T. Healy) is eligible to be nominated for an additional two year term.

McCave.

3.4.2 ICSU Review of SCOR

The XXI General Meeting received a preliminary report from the Chairman of the ICSU Panel to review the activities of SCOR. The final report will be introduced and the meeting will be invited to consider its recommendations.

Stromberg.

3.4.3 Proposal for a SCOR Medal

The Secretary will introduce a suggestion that a SCOR Medal be created and awarded to honour individual achievement in oceanography.

Rothschild.

4.0 GLOBAL MONITORING AND OBSERVING SYSTEMS

Information will be presented on the development of global systems for monitoring climate (Global Climate Observing System - GCOS) and the oceans (Global Ocean Observing System - GOOS) by various intergovernmental organizations in cooperation with the scientific community through ICSU. What is the appropriate role for SCOR in this overall effort? See also item 5.1.

Clarke, Su, Rothschild and others.

5.0 RELATIONS WITH INTERGOVERNMENTAL ORGANIZATIONS

5.1 Intergovernmental Oceanographic Commission

Issues arising from the Seventeenth Session of the IOC Assembly. The meeting will receive the final version of the Memorandum of Understanding relating to the scientific and technical planning for the Global Ocean Observing System which is being signed by IOC, ICSU and WMO. Status of planning for GOOS. Establishment of the IOC/ICSU/WMO Joint Scientific and Technical Committee for GOOS. Joint activities of IOC and SCOR and relations between the two organizations.

Su, McCave, Rothschild, Gross.

5.2 World Meteorological Organization

A written report from WMO presents information on observing systems, drifting buoys, remote sensing, IGOSS, and TOGA issues for consideration by the meeting. SCOR is to be invited to cosponsor a Final TOGA Conference to be held in 1995 or 1996.

5.3 International Council for the Exploration of the Sea (ICES)

Report on ICES activities of interest to SCOR. Cosponsorship of ICES meetings, production of a new Zooplankton Methodology Manual.

Rothschild.

5.4 North Pacific Marine Science Organization (PICES)

Report on PICES activities of interest to SCOR.

Hu.

6.0 RELATIONS WITH NON-GOVERNMENTAL ORGANIZATIONS

6.1 International Council of Scientific Unions

Issues for the ICSU General Assembly (October 4-8, Santiago, Chile). SCOR will be represented by the President.

McCave.

6.2 ICSU Unions and Committees

Reports have been requested from all ICSU bodies which have representatives to SCOR. Matters of interest will be brought to the attention of the Meeting.

Gross or other representatives.

Scientific Committee for the International Geosphere-Biosphere Programme

Evaluation and Review of IGBP and its Core Projects. Review of the relations between SCOR and

IGBP with regard to the oceanic components of the IGBP. Other IGBP issues. See also previous agenda items 2.3 and 2.4.

Liss.

Scientific Committee on Antarctic Research
Committee on Space Research
Scientific Committee on Problems of the Environment
International Union of Pure and Applied Chemistry

6.3 Affiliated Organizations

Reports have been requested from the following organizations and matters of interest will be brought to the attention of the General Meeting. The Presidents may also present verbal reports as *ex officio* members of the Executive Committee.

International Association for Biological Oceanography
International Association for Meteorology and Atmospheric Physics
A letter has been received from the President of IAMAP, Professor Hoskins, indicating that IAMAP will not send representatives to SCOR meetings in future unless specific items necessitate it. He suggests that IAMAP may nominate memhers for new working groups relevant to its interests.
International Association for the Physical Sciences of the Ocean
Commission for Marine Geology

6.4 Corresponding Organizations

Reports have been requested from the following organizations and matters of interest will be bronght to the attention of the General Meeting.

Arctic Ocean Sciences Board
Engineering Committee on Oceanic Resources
Confederation Mondiale des Activités Subaquatiques (Scientific Committee)

7.0 FUTURE MEETINGS

7.1 Twenty-second General Meeting of SCOR

At the XXI General Meeting the Chairman of the Canadian SCOR Committee, Jeff Thompson, offered a tentative invitation to SCOR to hold this meeting near Victoria, BC. This offer was subseqnently confirmed and was accepted by the President. The XXII General Meeting will take place during the week of October 17, 1994. The Executive Director will present information on her discussions with the local organizers. The Executive Committee meeting will be invited to consider topics for the scientific component of the meeting.

Gross.

7.2 Thirty-second Executive Committee Meeting of SCOR

Preliminary consideration should be given to the date and location. SCOR Committees are requested to consider hosting this event.

7.3 Other meetings of interest to SCOR

The Executive Director will present a list of meetings of interest to SCOR, including those for which SCOR cosponsorship has been requested.

Gross.

8.0 OTHER BUSINESS

ANNEX 3 - Report of WG 96
ACOUSTIC MONITORING OF THE WORLD OCEAN

Following an international symposium on Acoustic Thermometry of Ocean Climate, held at IFREMER, Brest, 20-22 June, 1993, the SCOR Working Group met to discuss strategies and evaluate opportunities for international collaboration. The Symposium addressed several aspects of acoustic monitoring, as identified under the Terms of Reference for this Working Group. A summary of titles of the presentations is appended, together with a report of a meeting of the Indian and Southern Ocean subgroup.

Recommendations:

1. SCOR WG 96 identifies as a matter of high priority the need to examine the potential for and practical implementation of acoustic thermometry measurements of ocean climate in the Atlantic Ocean. The Working Group has requested that Dr. John Gould strike a subgroup to investigate an Atlantic ATOC program under the following terms of reference:

   (1) That it be assumed that two long-life (>10y), moored sources/receivers will be deployed, one at Bermuda and one at the Azores. (In the event that good reasons be found for alternate sites, these may be pursued, provided first that the Bermuda/Azores sites are adequately investigated.)

   (2) That the measurement of larger scale, lower frequency ocean climate variability (ambient and greenhouse) be considered as a primary goal.

   (3) That the coupling of such larger scale features to tomographic studies of more regional processes be considered as an important component.

   (4) That the potential use of U.S. airforce and navy facilities be included in this study in addition to the sites for ATOC sources/receivers.

   (5) That the potential links between ocean climate modelling and ATOC measurements be considered.

   (6) That the ATOC Atlantic effort be coordinated with other on-going ocean research efforts. The ATOC effort is to commence in the 1995 time frame.

   The subgroup is asked to report back to SCOR WG 96 by 1 January, 1994.

2. WG 96 recognizes the current European Community research and development activities in the fields of Marine Science and Technology and of Environment, and encourages active support of (1) research projects in the EC countries, and (2) international collaboration related to acoustic thermometry of the oceans, in particular in the Arctic regions and in the Atlantic.

3. That a western Pacific subgroup be formed to encourage collaboration among the nations of this area and participation in the Pacific ATOC program. (It is noted that a joint experiment is planned for 93/94, which will be of great value in this regard.)

4. That a plan be elaborated for an Indian Ocean extension to ATOC's Pacific demonstration network. In order to take advantage of the early availability of a cable-laying ship (and 20-30 miles of suitable cable) in the eastern Indian Ocean the Working Group has considered where to place an acoustic source which could be powered by this cable. It appears from A. Forbes' studies of the Indian, Southern and South Pacific connections with the ATOC Pacific network that a source located off

Cape Leeuwin in Western Australia could provide the optimum extension of coverage. This extension would depend heavily on the availability of a new source, presently uncommitted to the Pacific network. The proposed use of a source of alternate technology (magnetic) in conjunction with the Pacific network sources would also provide a valuable medium-term comparison of performance and reliability. The Working Group proposes to conduct trans-Indian, -Southern and -South Pacific Ocean propagation studies between Cape Leeuwin and South Africa, India, Tasmania, New Zealand and Tahiti/Raratonga. A 'shot-test' should be conducted, and source site surveys made using the resources of the member nations of the Working Group, in preparation for the laying of cable early in 1994, and the deployment of a source following as soon as is feasible. This proposed plan would be greatly aided by the use of a number of autonomous 'simple' ATOC receivers as proposed below.

5. In light of the concern about the necessity for detailed vertical structure measurements, that the development of relatively inexpensive autonomous receiving stations is identified as an urgent requirement for ATOC, so as to allow timely and economic deployment of multiple detection capability in many locations where it is impractical to employ cabled receivers.

6. That every effort be made to carry out an Arctic Feasibility Test in 1994, employing a Russian source with Canadian and US listening stations. That efforts be made to take advantage of proposed European commitment to the Nansen drifting station for Arctic ATOC studies.

7. That a regular and informal communication of ATOC news be provided to participating scientists through electronic mail as far as possible.

8. The Working Group takes note of the potential application of permanent acoustic sources as an important element in a global-scale float program, and encourages explorations of the potential of such sources for float positioning and float tomography.

9. That the Working Group accept A. Forbes' invitation to meet next at CSIRO, Hobart, in October, 1994. It is noted that this meeting will come at an important stage in the overall program, in that initial Pacific ATOC measurements will be available.

International Symposium on Acoustic Thermometry of Ocean Climate
IFREMER, Brest, 20-22 June, 1993

Presentations

Arthur Baggeroer
Vertical line arrays and the spatial aspects of detecting an ocean warming signal

Leif Bjorno
ATOC-ARCTIC: a proposal submitted to the European Community CAN-MAST and ENVIRONMENT Programs

Geoff Brundrit
ATOC - feasibility - Ascension-Capetown

Nikolai Dubrovsky
Acoustical monitoring using a high resolution data processing technique

Andrew Forbes
Acoustic thermometry of the Indian and Southern Oceans

Harley Hurlburt
A global-scale, eddy-resolving ocean monitoring and prediction system with potential application to acoustic thermometry

David Hyde
Definition of the ATOC Pacific network: acoustic variability issues
Ann Kerr
ATOC data management
James Mercer
ATOC acoustic network design
Peter Mikhalevsky
Acoustic thermometry of Arctic Ocean climate: plans and status
Uwe Mikolajewicz
Acoustic detection of anthropogenic climate changes
Walter Munk
HIFT and ATOC
C. S. Murthy
Acoustic Field of the Northern Indian Ocean
Iwao Nakano
Giant magnetostrictive 70Hz source for ATOC project
David Palmer
Tropical Atlantic network design considerations
Mark Slavinsky
The peculiarities of the north-western region of the Pacific Ocean as part of the ATOC network
Robert Spindel
ATOC source technology and future small receivers
Chris Tindle
New Zealand site survey and acoustic test
Alex. Voronovich
Long vertical arrays and their applications in the acoustical monitoring of the ocean
Peter Worcester
Vertical line array receivers for the ATOC program
Carl Wunsch
Large-scale modelling in the ATOC context
Renhe Zhang
Some considerations on deploying a receiving system near Taiwan Island

ANNEX 4 - WG 100 and the IMAGES Program

There is now abundant evidence that significant natural variations in the ocean and climate system have occurred on time scales of oceanic and cryospheric processes. On time scales of tens to hundreds of thousand years (glacial to interglacial time scales) changes in the distribution of solar radiation due to the earth's orbital parameters (the Milankovitch hypothesis) has provided an important external forcing to the climate system. While the response to this forcing can be documented in a wide variety of oceanic and climate records, the processes which result in the sensitivity of the climate system to this forcing are still largely unknown. However, it is clear that internal feedback mechanisms, including natural variations in atmospheric greenhouse gases, play a crucial role in controlling the sensitivity of the climate system to external forcing.

Combined with our intellectual development there have been new technological developments which allows the international scientific community to be poised to take the next major step in improving our understanding of the global climate system, and especially, the role the ocean plays in controlling long term climate variability. The developments include: significant improvements in our ability to map the sea floor and, using high resolution acoustic techniques, image the sediment cover of the ocean floor, significant improvement in our ability to document, using continuous non destructive analysis techniques very high resolution variablity in marine sediment records; significant improvements in high resolution dating techniques and advanced analytic instrumentation that allow rapid, high precision analysis of geochemical parameters which provide new methods to extract quantitative estimates of past ocean properties.

During the past few years several international workshops have been held by the paleoceanographic community to define major global change questions that can only be answered through the study of the marine geologic record of climate. As part of this report we include the documents from three of the workshops as appendices. Here we focus attention on those of the main issues they identify which fall within the remit of PAGES stream II.

The over-riding IMAGES science issue is to quantify climate and chemical variability of the ocean on time scales of oceanic and cryospheric processes; to determine its sensitivity to identified internal and external forcings, and to determine its role in controlling atmospheric CO_2.

Under this major scientific objective, IMAGES proposes to co-ordinate a global program to collect and study marine sediment records to address two fundamental questions:

- *How have changes in ocean circulation, ocean chemistry, and biological activity interacted to generate the observed record of atmospheric pCO_2 over the past 300 ky?*
- *How have changes in surface ocean properties controlled the evolution of global heat transfer through the deep and surface ocean and so modified climate?*

These major issues can only be achieved through the examination of the records preserved in ocean sediments,by a well designed coordinated effort of sampling analysis, and data assimilation. At least 50 dedicated oceanographie expeditions will be necessary over the next decade to collect appropriate sediment samples and supporting data.

The program contains six major elements:

1- **Field programs:** For retrieval of the samples an data necessary for studying the natural variability of the oceanic system over the last several hundred thousand years with the necessary spatial resolution. They must be carefully designed to address IMAGES objectives with a geographical array

of stations. Combined water property and sediment samples are critical for the interpretative work. Sea floor mapping and sediment imaging at high resolution is highly desirable to optimally locate the sampling stations.

2- Coring capabilities: To extend the possibility of sediment coring in high sedimentation rate areas, so as to provide sufficient temporal resolution. Obtaining sufficiently long sediment cores is essential for adequate sampling of the last several thousand years deposits. At the present only ship (French Marion Dufresne) has capability to take longer than 50 meters sediment cores adequate for IMAGES objectives. The high analytical demand for samples requires large sediment volumes. Additional coring to sample the sediment water interface is a necessity for further development and calibration of oceanographic proxies.

3- Analytical facilities: To allow the acquisition of the necessary large quantity of data. New analytical facilities are necessary for the development of high resolution stratigraphy and chronology as well as for the documentation of rapid climatic variability. Although some essential analytical facilities are widely available (e.g. stable isotope mass spectrometry), other are available only in very few centers. It will be necessary in some cases to set up new facilities, and in others to support a facility at such a level that it can provide sufficient data for international demand.

4- Proxy development: To improve our ability to quantify past ocean characteristics. The first order parameters which need to be quantitatively estimated are temperature, salinity, sea ice, the carbon system (alkalinity, pCO_2, carbonate saturation) and biological activity. Some of the proxies are better developed than others, but further improvements are mandatory. This needs sampling of the water, sediment and sedimenting particles. To fully document the variability of the ocean properties, further proxies will have to be developed.

5- Stratigraphy and chronology: A prerequisite for placing the results in a global temporal framework. Oxygen isotope records and high precision radiometric chronologies (AMS ^{14}C and U/Th are the base for the global chronostratigraphy. Key recent development as continuously acquired records of sediment properties (e.g. density, magnetic remanent intensity, color reflectance) hold great promise in the development of high resolution chronostratigraphy (down to centuries). It is essential also to improve methods for correlations between the ocean, continent, and ice paleorecords.

6- Sample and data management: To optimize the investigative efforts. It is essential that deep sea sediment cores are adequately curated so that they can both be efficiently used on the short term and for further sampling as the program develop and new techniques are evolved. Conservation techniques should be available to provide long term conservation of cores. Conservation management procedures should allow access of core samples to the international community.

The rate at which paleoclimate data is being generated will continue to increase rapidly. It is essential in this program that the data are managed, archived and made freely available in an efficient and timely manner. The IMAGES objective will only be achieved if each field and analytical program is organized in such a way that many different investigators using different techniques are involved from the beginning and work parailel rather than a small proponent group taking priority for their own techniques.

The IMAGES Steering Committee will:

-monitor the progress of research within the IMAGES objectives, and recommend initiatives and prioritizations.

-promote

-international coordination in the planning of field programs
-interaction with the paleoclimatic community within the PAGES framework
-use of models for data assimilation and interpretation
-efficient sharing of analytical facilities
-intercalibration of the analytical techniques which are necessary to achieve IMAGES Objectives.
-optimal data management and distribution to the international community.

-set standards, following SCOR mandate to Working Group 100, for:

-coring and sample acquisition, such as water and surface sediment samples during cruises.
-core archival and curation
-routine data acquisition by non-destructive methods during coring expeditions
-sample sharing and availability for the international scientific community.

-exchange of information on existing cores at regional repositories and provide a distribution point for reporting the availability of new core samples and supporting field data.

ANNEX 5 - Report from the Joint Global Ocean Flux Study
to the
31st Executive Committee Meeting of SCOR
By: Professor Hugh Ducklow, JGOFS Core Project Scientist, and
Elizabeth Gross, JGOFS Executive Secretary

The JGOFS Scientific Steering Committee has met twice since the last report to SCOR: in Taipei from October 19-24 1992, and again in Carqueiranne, France from September 9-11, 1993. This report presents information on JGOFS activities during that period.

The past year saw a large amount of scientific activity in JGOFS as Phase I of the Southern Ocean Process Study was nearing completion, the Equatorial Pacific Process Study continued into its third field season, and the results of the pilot phase of the Arabian Sea Process Study were being assessed. In addition, the JGOFS-WOCE Global CO_2 Survey moved into full implementation with 10 cruises, and activities continued at the Bermuda and Hawaii Time Series Stations. New time series operations were begun by France-JGOFS at Kerguelen in the Southern Ocean and by Germany in the Canary Islands in the eastern subtropical north Atlantic. Thus JGOFS is actively implementing all field operations described in its Science and Implementation Plans. Cruise operations are summarized in the table appended. Over 40 process study and survey cruises and approximately 36 time series cruises have been completed in the past 12-18 months. A brief sketch of scientific highlights is given in the following narrative.

The scientific highlights of the year for JGOFS were in the Equatorial Pacific, where the intensive phase of the Process Study were nearing completion, and the Southern Ocean where major new insights were gained in a series of cruises. During mid to late 1992, the El Niño conditions which had prevailed during the earlier phases of the EQPAC process study waned, allowing comparison of El Niño and non-El Niño conditions in the open central Pacific. The USA survey cruise on the RV THOMAS THOMPSON encountered a massive accumulation of phytoplankton in a convergence zone near 2°N. Subsequent observations on the benthic cruise in November-December revealed that diatom-dominated phytodetritus covered the bottom from 5°S to 5°N, echoing similar findings in the NABE study.

In the first major field season for the JGOFS Southern Ocean study, although results are still being evaluated from the programmes, several key achievements and advances have already emerged:

1. The mapping of spatial and temporal variability of air-sea CO_2 exchange has been enhanced considerably in areas of the Southern Ocean which were previously data-sparse. Areas which are particularly well covered are those between the southern continents and Antarctica, parts of which are implicated in major CO_2 flux by ocean colour imagery.

2. Significant advances have been made in our understanding of the role of the seasonal sea-ice zone in the Southern Ocean in determining the magnitude and spatio-temporal variability of carbon sequestration within this major part of the SO (approximately 50% of the area south of the Polar Frontal Zone). In particular, two intensive process studies have yielded a much greater understanding of the sequence of biogeochemical events associated with spring ice melt, and have pointed to the complex interactions between hydrographic and ice-edge structure.

3. Factors likely to control primary production in the Southern Ocean have been addressed in several process cruises. Iron limitation has been investigated, along with more critical examination of the impact of vertical mixing and of grazing. Understanding of the impact of UV-B is beginning to emerge.

4. Often through effective collaboration with WOCE investigations, the biogeochemical role of fronts within the Southern Ocean is being unravelled.

5. Despite formidable logistic difficulties, time-series and other long-term sites are being established.

As an indication of the current level of scientific activity, the JGOFS Core Project Office has collected the following information on national JGOFS cruises and on the WOCE cruises which have also contributed to the JGOFS global oceanic CO_2 survey. The CPO is establishing a data base for the routine collection of such cruise information.

Table 1. JGOFS process, CO_2 survey and time series cruises, May 1992 -September 1993.

Region	Dates	Project/Object	Vessel	Nation
Atlantic 20 N	May-June 92	EUMELI 4	L'Atalante	France
Atlantic 20 N	December 92	EUMELI 5	L'Atalante	France
Atl. transect to Morocco	Sept-Oct. 92	bio-optics, ocean/atmos S cycle	Hudson	Canada
Atl. transect to Morocco	May-June 93	bio-optics	Hudson	Canada
Scotian Shelf/Slope	May 93	Benthic proc.	Needier	Canada
Gulf. St. Law.	July 92	Biol. prod'n	Fogo Isle	Canada
Gulf St. Law.	Aug-Sept 92	Biol. prod'n	Fogo Isle	Canada
Gulf St. Law.	Sept-Oct 92	Biol. prod'n	Fogo Isle	Canada
Gulf St. Law.	Dec. 92	Biol. prod'n	Hudson	Canada
Gulf St. Law.	May-June 93	Biol. prod'n	Fogo Isle	Canada
Gulf St. Law.	July 93	Biol. prod'n	Parizeau	Canada
South; Aus to Ant	Oct 1992	Australia 1	Aurora Australis	Australia
South; Aus to Ant	March 1993	Australia 2	Aurora Australis	Australia
South; Aus to Ant	May 1993	Australia 3	Aurora Australis	Australia
South; Aus to Ant	Aug 1993	Australia 4	Aurora Australis	Australia
58E, 40-55S	March-May 1993	ANTARES1 (France)	Marion Dufresne	France
South; 4-14W, 67S	austral autumn 1992	ANT X/3	Polarstern	Germany

South; 6W, 47-60S	Nov-Dec 1993	ANT X/6	Polarstern	Germany
South; Bellingh'n	Nov-Dec 1993	Sterna 92	Discovery	UK
South; Bellingh'n	Nov-Dec 1993	Sterna 92	James Clark Ross	UK
South; Aus to Ant		Japan	Shirase	Japan
South; SA to Ant	Jan-Feb 1993	South Africa 1	Agulhas	South Africa
South; SA to Ant	April-May 1993	South Africa 2	Agulhas	South Africa
Bermuda	1992-3 (> 12 cr)	Time Series	Weatherbird II	USA
Hawaii	1992-3 (12 cr)	Time Series		USA
Australia N shelf	April 92	GASPS	Franklin	Australia
Eq Pacific 147 E	July 92	EQPAC	Franklin	Australia
Eq Pacific 155 E	November 93	EQPAC	Franklin	Australia
Eq Pacific 140 W	Sept-Oct 92	EQPAC	Thompson	USA time series
Eq Pacific 140 W	Oct- Dec 92	EQPAC	Thompson	USA benthic
Eq Pacific 140 W	January 93	EQPAC	Wecoma	USA trap recovery
E. China Sea	September 93	MASFLUX		China
Atlantic 7N	Feb-Mar 93	WOCE CO_2	L'Atalante	France
Atlantic 5S	Jan-Feb 93	WOCE CO_2	L'Atalante	France
Gulf of Aden /Somali Current	Jan-Feb 93	NL-JGOFS	Tyro	Netherlands
Indian WOCE I6	Jan-Mar 93	WOCE CO_2	Dufresne	France
Pacific 165E	Aug-Sept 92	WOCE CO_2	Vickers	USA
Pacific 165E	Sept-Oct 92	WOCE CO_2	Vickers	USA
Pacific Fiji-NZ	Sept 92	WOCE CO_2	Knorr	USA
Pacific Bering-Tarawa	July-Aug 93	WOCE CO_2	Thompson	USA
Pacific Tarawa-Fiji	Aug-Sept 93	WOCE CO_2	Thompson	USA
Pacific 35-65 S	Oct-Nov 92	WOCE CO_2	Knorr	USA
Pacific 53-33S	Oct-Nov 92	WOCE CO_2	Knorr	USA
Pacific 72-50S	Nov-Dec 92	WOCE CO_2	Discovery	UK
N. Pacific	Feb 93	Gas exchange	Tully	Canada

N. Pacific	Sept-Oct 92	Biol. prod'n /fluxes	Tully	Canada
N. Pacific	Feb 93	Biol. prod'n /fluxes	Tully	Canada
N. Pacific	May 93	Biol. prod'n /fluxes	Tully	Canada
Vancouver Is. cont. shelf	June 93	nutrient transport etc.	Tully	Canada
Atlantic 47N, 20W	May 92	trap recovery	Keldysh	Germany
Atlantic 47N, 20W	May-June 93	BIOTRANS	Heinke	Germany
Atlantic 47N, 20W	June-July 93	BIOTRANS	Poseidon	Germany
20 W, Irish Sea	Aug-Sept 93		Meteor	Germany
Pacific 175 E	Aug-Oct 92	N Pac C Cycle	Hakurei-Maru	Japan
Pacific 179 E	Oct-Nov 92	Ocean fluxes	Hakuho-Maru	Japan
East China Sea	Feb-March 93	MASFLUX	Kaiyo	Japan
45 S, 174 E	June-July 93	NZ JGOFS	Lavrentyev	New Zealand
South./Kerguelen	1992-3 (12 cr)	ANTARFIX		France

A number of international JGOFS Task Teams and Planning Groups have met in 1993. The North Atlantic Planning Group met in Warnemünde in April and began to develop a scientific plan for a process study in the North Atlantic whose objective will be:

> to reduce the uncertainties in the estimates if the size of the carbon sink in the North Atlantic. This is to be achieved by improving our understanding of biogeochemical and physical processes regulating the uptake of atmospheric CO_2.

It is intended that this process study will be the last in the JGOFS program, taking place in 1998 and that it will take advantage of the understanding and results gained from the 1989-1990 North Atlantic Bloom Experiment (NABE) as well as other regional studies. A detailed report of this meeting is available from the JGOFS CPO.

The JGOFS Data Management Task Team met at the British Oceanographie Data Centre in May under its new Chairman, Dr. Roy Lowry. The group reviewed the status of the international NABE data set and considered that a number of useful data products could be assembled within the coming year for distribution to the science community. The international JGOFS SSC has placed a very high priority on finding the resources required to assist with truly international data management in addition to the various ongoing national activities. A report from the Data Management Task Team is available from the JGOFS CPO.

The JGOFS SSC places a great emphasis on issues of Global Synthesis, recognizing that the truly global estimates of oceanic carbon fluxes and other parameters important to JGOFS can only be obtained through the internationally coordinated effort. Nations can only participate in two or three of the regional

process studies at most; the incomplete list of cruises for one year provided above is impressive. The most important function of the international program is to provide the means for integration of the results of these national activities towards the international objectives. A round table discussion on the topic of global synthesis in JGOFS took place in conjunction with the SSC meeting in Taiwan in 1992. The SSC meeting in Carqueiranne included a series of lectures on this theme as well. Following the recent SSC meeting, the first meeting of a newly-established Task Team on Global Synthesis and Modelling took place. The report of that meeting is not yet available.

The level of interaction with other IGBP Core Projects has increased during the past year through the work of two JGOFS Task Teams. The JGOFS/LOICZ (IGBP Core Project on Land-Ocean Interactions in the Coastal Zone) Task Team on the Continental Margins, established in 1991 held its second formal meeting immediately after the recent JGOFS SSC meeting. It is in the process of completing a science plan for JGOFS/LOICZ work in the coastal and shelf seas. This interaction results from the needs of both programs to understand horizontal boundary fluxes of carbon and sediment transport across the continental shelf.

With the International Global Atmospheric Chemistry Program of IGBP, the JGOFS/IGAC Task Team on Biogeochemical Air-Sea Transfers has been established this year and will hold its first meeting in December. This arises from the joint JGOFS/IGAC NATO ARW on the topic. Some IGAC field work has been done on JGOFS cruises in the Equatorial Pacific. The interaction results from the need for better understanding of exchanges at the air-sea interface.

The JGOFS Indian Ocean Planning Group which is responsible for the scientific planning of the Arabian Sea Process Study, will meet in Mombasa, Kenya in November. A two week training course in the methods for the most important JGOFS Core Measurements has been organized with support and assistance from the IOC, members of the Planning Group will serve as instructors in the course which will have about 25 participating scientists from the region. An urgent need for an international coordinator for the Arabian Sea Process Study has been identified and an effort is underway to find the necessary resources for this.

Membership:

The current membership of the JGOFS SSC is given on the following page. SCOR has agreed that membership decisions will be taken in consultation with IGBP. In June, the IGBP requested a nomination for the Chair of JGOFS, in view of the fact that the term of the current Chairman, Dr. Trevor Platt, will expire at the end of 1993. The JGOFS Executive discussed this and subsequently sought the approval of the President of SCOR. Accordingly, Professor John Field (South Africa) was nominated as the incoming Chairman of JGOFS. This nomination has been endorsed by the SC-IGBP and the JGOFS SSC. With regard to the other forthcoming vacancies on the JGOFS SSC, substantial discussion took place at the meeting in Carqueiranne and the JGOFS Executive then agreed on a list on nominations to be presented for consideration by SCOR at its Executive Committee meeting. The individuals were to be contacted by Professor Field who will address this issue at the SCOR meeting.

Evaluation and Review of JGOFS:

The JGOFS SSC was informed that the SCOR General Meeting had agreed that a review of JGOFS should be conducted in 1995. At the same time, IGBP is beginning to consider an internal evaluation of its Core Projects. The SSC recognized the value of such reviews for itself as well as for its sponsors and considered various means of conducting such an evaluation. The incoming Chairman will present some suggestions from the SSC to the SCOR Executive Committee - the general consensus was to organize a scientific conference with carefully selected invited speakers presenting the status of our understanding of the oceanic carbon cycles in the late 1980s, overviews of the achievements of JGOFS and how they contribute to the JGOFS global synthesis, poster presentations of detailed results and external reviewers selected in consultation with the sponsoring organizations. The IGBP has already defined its evaluation and review process in some detail and the JGOFS SSC urged SCOR and IGBP to collaborate in this process.

JGOFS SSC Membership to December 1993

NAME	NAT.	1988	1989	1990	1991	1992	1993	1994	1995
Brown	USA			E	E	E	E	E	
Buat Menard	France								
Burkill	UK								
Chen	Taipei						E	E	
Dandonneau	France								
Emerson	USA								
Field	S. Afr.				V	V	V		
Handa	Japan								
Krishnaswami	India								
Leinen	USA								
Lisitsyn	Russia								
Merlivat	France								
Parslow	Austral.								
Platt	Canada				C	C	C	* P	
Priddle	UK								
Siegenthaler	Switz.								
Smetacek	FRG								
Willebrand	FRG								

C = Chairman V = Vice-Chairman P = Past-Chairman E = Executive
* = Chairman's term ends Dec. 31 1993

ANNEX 6 - Final Financial Statement, 1992

In US dollars

BALANCE 1.1.92	42,959.93
FUNDS HELD IN JGOFS SPECIAL FUND	13,745.65
INCOME	
Membership *1	166,885.00
IOC Contracts	24,000.00
ICSU grants	51,500.00
NSF grant/travel awards	73,893.16
NSF grant/geosciences	92,635.29
UK subvention	18,835.81
IGBP contribution	15,000.00
New Contributions to JGOFS Special Fund	4,957.26
Canada "Green Plan"	8,403.36
USA special contr'n	25,000.00
Gain on exchange	827.59
Misc.income	60.01
TOTAL INCOME	481,997.48
TOTAL CASH + INCOME	538,703.06
EXPENSES	
Science programs	
WG 78	9,777.09
WG 83	1,952.56
WG 89	13,799.04
WG 95	8,839.62
WG 96	10,163.04
CCCO	31,000.00
JGOFS	106,411.63
GLOBEC	21,444.76
GOEZS	1,384.32
Total, science programs	204,772.06
Related activities	
Exec. Cttee. Meeting	774.31
General Meeting	14,576.66
Publications	9,441.27
Travel Awards	73,982.30
Representation	8,307.90
Total, related activities	107,082.44
Administrative	
Salaries & benefits	73,369.71
Communication	6,682.57
Audit	5,318.33
Office equipment	3,614.44
JHU overhead	13,049.74
Bank charges	365.01
Miscellaneous	3,308.89
Total SCOR Administrative Expense	105,708.69
Uncollectible Membership Contributions	17,491.00
TOTAL EXPENSES	435,054.19
BALANCE 12.31.93 *2	84,945.96
JGOFS SPECIAL FUND 12.31.93	18,702.91
TOTAL CASH + EXPENSES	538,703.06

ANNEX 7 - Report from the Intergovernmental Oceanographic Commission

Cooperation between IOC and SCOR during 1992/93.

INTRODUCTION

This short report is to provide summary information on IOC-SCOR interaction and co-operation together with specific interests of IOC in eertain SCOR activities. The attached list of titles of the twenty resolutions adopted at the Seventeenth Session of the IOC Assembly (Paris, UNESCO, 25 February - 11 March 1993) points out the major ongoing or forthcoming initiatives of IOC. Additional background on IOC action is made available in the "Annual IOC report for 1992", in the "Quo Vadis IOC" document (Report of the ad hoc Study Group on IOC development, Operations, Structure and Statutes) and in the Report of the recent IOC Assembly.

The 27th session of the IOC Executive Council is schedule to take place in Paris, France, from 5 to 13 July, 1994.

OVERVIEW

(i) **IOC Development, Operations, Structure and Statutes (DOSS)**

Following the adoption (March 1993) of several recommendations of the DOSS Study Group, IOC has now started to analyze the responses received from Member States on those recommendations which require additional consultation, in particular the proposals concerning an IOC Pledging System, the revision of IOC Statutes and rules of procedure and the issue of geographical representation of the Executive Council.

If justified, prior to the next session of the IOC Executive Council, in October 1994, a preparatory meeting will be arranged, open to all Member States, to consider these proposals on the future of the Commission.

The IOC Assembly, in resolution SVII-16, also accepted the offer of the Portuguese Government to support and host an "International Conference on oceanography, ocean services and related aspects", (Lisbon, 7-12 November 1994), bearing in mind also the foreseen follow-up to the 1992 UN Conference on Environment and Development (UNCED).

(ii) **Global Ocean Observing System (GOOS)**

Following the signature, earlier this month, of the Memorandum of Understanding between IOC, WMO and ICSU on the co-sponsorship of the Joint GOOS Scientific and Technical Committee (J-GOOS), the first session of the J-GOOS is under preparation for the first quarter of 1994. SCOR as the principal ICSU body responsible for matters relating to ocean research, and, at the same time, the principal Scientific Advisory Body to IOC, shall be involved in the scientifically based design and planning for GOOS as agreed in the above-mentioned MOU.

(iii) JGOFS, WCRP, LOICZ, GLOBEC, IGBP and other cooperation

- Under final preparation is a set of JGOFS measurement methodology protocols within the framework of the GIPME programme. An IOC Training Course on Ocean Flux Monitoring in the Ocean will be held in Mombasa, Kenya, from 15 to 27 November 1993 with the support of Germany.

- At the Intergovernmental Meeting on the World Climate Programme in Geneva, (14 to 16 April 1993), the adopted "Statement on the Climate Agenda" recognized that several subjects are important to both the national and international programmes, namely: Work in support of IPCC, FCCC and Agenda 21; Capacity building; the Global Climate Observing System; Seasonal and interannual climate prediction; Priority setting and co-ordination among programmes. On an interim basis, and Advisory Panel, drawn from the international organizations concerned with WCP associated programmes, is

being established to provide guidance and advice to all aspects of the preparation of an integrated proposal (to be presented to governments of the climate relevant parts of respective programmes which contribute to the "four new thrusts": Essential services in support of sustainable development; Improved predictions of climate and climate change over periods ranging from seasons to centuries from advances in climate related science; Advances in climate observing systems in all its aspects; and Response strategies to reduce the vulnerability of society through the assessments of how climate variations and change impact on economic and social activities.

- With regard to the final formulation of the "Land-Ocean Interaction in the Coastal Zone" (LOICZ) programme and its forthcoming implementation, IOC would like to confirm its readiness for co-operation, since both LOICZ and JGOFS represent programme activities dealing with the continental margins and will provide better understanding, assessment and predictive capabilities.

- IOC is supporting the development of the Global Ocean Ecosystem Dynamics (GLOBEC) activities through the Joint Steering Committee and through five working groups on "Physical Variability and Population Dynamics", "Sampling and Observation Systems", "Cod and Climate Change", "Numerical Modelling" and "Southern Ocean GLOBEC" and through the 1994 Strategic Planning Conference in Paris.

- As regards other initiatives and programmes under the International Geosphere-Biosphere Programme (IGBP), IOC would welcome further dialogue, interaction and co-operation because of the many links with IOC programmes and regional activities including capacity building, and the need for co-operation in the follow-up to UNCED and activities related to the conventions on climate and biodiversity.

- In addition to the continued involvement of IOC in the SCOR WG 97 and the harmful algal blooms issue (the second session of the JOINT IOC-FAO ad hoc Panel on Harmful Algal Blooms will take place in Paris, France, from 14 to 16 October 1993) and in the interdisciplinary coastal oceanography aspects, of special interest for ongoing IOC programme actions is the work of existing SCOR working groups 89, 93, 96, 98 and 101.

CONCLUSIONS

The established Commission on Sustainable Development (CSD) which held its first session at UN Headquarters in New York (14-25 June 1993) decided to make an overall review and appraisal of Agenda 21 in the coming years. In this respect it is important that, at national levels, the marine scientific community helps to convince decision-makers, governmental or resource institutions and the public of the required increasing knowledge of the oceans and all kinds of seas in order to provide scientific facts and assessments which help to guide proper management and use of the ocean, the coastal zone and marine living and non-living resources. IOC, therefore would very much welcome, later in 1993, an officers/secretariat consultation with SCOR to further discuss and develop appropriate continued dialogue and interaction.

ANNEX 8 - Report from the World Meteorological Organization

1. The following paragraphs summarize briefly the activities undertaken within WMO during the past year which may be of interest to SCOR. This summary covers essentially the marine programme and TOGA. It is assumed that activities relating to WOCE, GCOS and GOOS will be reported through other channels (e.g. the IOC Secretariat, etc.).

Global Ocean Observing System and Global Climate Observing System

2. The WMO Commission for Marine Meteorology, at its eleventh session (Lisbon, April 1993), recommended that WMO should accept the offer of the IOC Assembly for WMO to co-sponsor the Intergovernmental Committee for GOOS (I-GOOS). This recommendation was accepted by the WMO Executive Council in June 1993. This co-sponsorship of I-GOOS, together with the nearby-finalized Memorandum of Understanding (IOC/WMO/ICSU) on scientific and technical planning for GOOS, means that WMO is now effectively a full co-sponsor of GOOS. WMO contributes 50% of the time of one professional officer to the GOOS Support Office in Paris; will contribute at least SFR 100,00.-to the GOOS Trust Fund for 1994/95; and will also support GOOS work through the WMO Secretariat and the GCOS Project office in Geneva. Discussions have already been held between WMO and the GOOS Support Office on future modalities in GOOS planning, on co-ordination mechanisms among existing ocean-related bodies and on the establishment of an ad hoc panel for the GOOS Services Module.

Drifting Buoys and other ODAS

3. The Data Buoy Co-operation Panel (DBCP) held its eighth session in Paris in October 1992. The following status of drifting buoy activities supported by the panel may be noted:

(a) The steady rise in deployments of drifting buoys has continued. In June 1993, the total number of active buoys was 1096, compared with 983 in June 1992. Of this total nearly 54% reported in real-time over the Global Telecommunication System (GTS). The substantial increase in GTS data is largely due to the Surface Velocity Programme (SVP) of the World Ocean Circulation Experiment (WOCE) and the Tropical Ocean and Global Atmosphere Programme (TOGA) in conjunction with the efforts of the technical coordinator of the panel to obtain authority for the release of buoy data on the GTS. Data reception performance through the Argos system has remained at the 1991 level with about 50% of global data available to users within two hours of satellite receptions. Phase one of the joint project with CLS/Service Argos to introduce a new GTS processing chain became operational in January 1993;

(b) The quality of the buoy data exchanged over the GTS has significantly improved through the implementation (in January 1992) of a new operational quality control procedure designed by the technical coordinator of the panel and operated through an electronic mail bulletin board;

(c) The panel has continued to support the development of a pressure sensor for installation on WOCE SVP drifters. Operational trials began in late 1992 with the involvement of several panel members. A successful combined meteorological and oceanographic drifter has been developed by a panel member. This buoy measures sub-surface temperatures to a depth of 150 m, air pressure, sea surface temperature and wind speed and direction;

(d) The European Group on Ocean Stations (EGOS) was the first panel action group. The panel assisted directly on the establishment of the International Arctic Buoy Programme (IABP), which became a second action group and is contributing to the preparatory work for an International Antarctic Drifting Buoy Programme and a South-West Indian Ocean Programme;

(e) Future activities are focusing on the implementation of the last phases of the Argos GTS processing

chain, an attempt to establish an action group for a possible South Atlantic Buoy Programme, various co-ordination activities, as required, and continuing other quasi-operational activities. The annual report of the DBCP for 1992 is available from the WMO or IOC Secretariats.

Ocean Remote Sensing

4. A WMO/IOC Technical Conference on Space-based Ocean Observations took place in Bergen, Norway, from 6 to 10 September 1993. The co-sponsorship of this conference by SCOR and the valuable support provided to enable three developing country scientists to attend to present papers is very much appreciated. Other co-sponsors included NOAA, ESA, the American Meteorological Society, the Royal Meteorological Society, ICES and the Canadian Remote Sensing Society. Full proceedings of the conference will eventually be published by WMO.

5. The WMO CMM, IGOSS and IODE of IOC have jointly established a working group on ocean satellites and remote sensing. This group is concerned primarily with preparing comprehensive information and guidance on the availability and operational application of data from ocean satellites and other ocean remote sensing.

Integrated Global Ocean Services System (IGOSS)

6. The operational IGOSS data circulating on the GTS increased in recent years. In 1992 an estimated total of 42,225 BATHY messages (temperature versus depth profiles using expandable bathythermographs) and 2623 TESAC messages (temperature, salinity and conductivity measurements taken with conductivity/temperature/depth equipment were exchanged over the GTS through the IGOSS system. In some data centres the IGOSS BATHY data set represents over 30 per cent of the total archived bathythermography observations. Approximately 270 ships (both research vessels and merchant ships) contributed to the collection of IGOSS data in 1992. A total of 15 countries actively participated, with six countries transmitting TESAC data. This is a significant improvement over previous years and hopefully indicates renewed interest in the acquisition of these data. One of the major achievements of IGOSS during the past year is the work of the Task Team on Quality Control Procedures for Automated Systems in analyzing and revising the existing expendable bathythermography (XBT) full rate equation. A scientific paper prepared by the task team on the results of their XBT fall-rate study will be submitted for publication late this year or early in 1994.

7. The major objective of IGOSS is to provide information on the physical properties of the ocean at various depths. In terms of variables these are temperature, salinity and current at different depths and at the surface of the ocean. Products prepared and distributed within the IGOSS framework are not expected to duplicate those under the WMO marine meteorology programme but are to complement them. A sample of IGOSS global and regional products is compiled and published in an IGOSS Products Bulletin, as a service to the scientific community and international programmes. The IBP now appears regularly, on a quarterly basis, with publication taking place within two months of the validity date for the products appearing in the bulletin.

Tropical Ocean and Global Atmosphere (TOGA) Programme

Coupled Ocean-Atmosphere Response Experiment (COARE)

8. The field phase of COARE, the four month Intensive Observing Period (IOP) from 1 November 1992 to 28 February 1993, was outstandingly successful. COARE operations involved some 1200 people from 20 nations, 700 days of ship operations, over 400 aircraft missions, 11,500 upper-air soundings and the deployment of 20 moored buoys with varying instrument packages. The weather and the ocean response provided a broad spectrum of conditions, including a noteworthy westerly wind burst for two weeks in the middle of the IOP. The instrumentation used to observe these phenomena represented a major advance on that which had been available for GATE (1974), the previous major experiment of this type. Preliminary analyses suggest that COARE data will lead to important new scientific insights.

TOGA Modelling Activities

9. The final report of the TOGA Numerical Experimentation Group (NEG)'s tropical ocean model annual cycle intercomparison was prepared by Dr. T. Stockdale and published as WMO Technical Document No. 5454 (WCRP-79) -"Intercomparison of Tropical Ocean GCMGs". Six groups (one each in Australia, Germany, Japan and UK and two in the USA) are participating in the TOGA NEG's coordinated ENSO prediction study which has been extended beyond the two periods originally chosen 1974/75 and 1986/88) to include 1992/3.

10. The TOGA Monsoon Numerical Experimentation Group (MONEG) convened a meeting in New Delhi, India in January 1993 to review recent results in the simulation and prediction of Monsoons. The report of this meeting has been published as SMO Technical Document No. 546 (WCRP-80) "Simulation and Prediction of Monsoons: Recent Results". TOGA MONEG is organising a major International Conference on Monsoon Variability and predictability in Trieste, Italy, 9-13 May 1994.

TOGA Observing System in the Post-TOGA era

11. Key elements of the TOGA Observing system such as the moored and drifting buoy and VOS/XBT programmes, are prime candidates to be operated on a long-term basis as part of national contributions to the IOC's Global Ocean Observing System (GOOS). With TOGA ending at the end of 1994, however, there is a risk that some TOGA-related national ocean observing programmes could be cut off or curtailed before the advent of GOOS. Following the recommendation of the Intergovernmental TOGA Board at its meeting in April 1993, letters signed jointly by the Secretary-General of WMO and the Secretary of IOC have been sent to the heads of relevant agencies in each of the eighteen nations represented on the Board, requesting that their contributions to the TOGA observing system be maintained after 1994, without a break in continuity. The responses have been encouraging.

TOGA conference - SCOR Sponsorship

12. Consideration is being given to organizing a major international "Final TOGA Conference" in either 1995 or 1996. When a firm proposal has been formulated, it is intended to invite SCOR to be a co-sponsor of this conference. Following the precedent of the TOGA conference in 1990, it is hoped that SCOR would agree to make travel awards to marine scientists from developing countries who would not otherwise be able to participate in the "Final TOGA Conference", drawing on funds allocated by the US National Science Foundation for this purpose.

ANNEX 9 - Report from the International Council for the Exploration of the Sea

Advisory Committee on the Marine Environment

An important element of ICES activities over the past decade has been the work of its two Advisory Committees, the Advisory Committee on Fishery Management (ACFM) and the Advisory Committee on Marine Pollution (ACMP). The latter Committee has primarily addressed issues relevant to the marine chemical aspects of marine pollution, and responded to questions set to it by pollution Regulatory Commissions such as the Helsinki Commission (HELCOM), and the Oslo-Paris Commissions (OSPARCOM). Such a role for the Committee remains a very important one, but ICES has recently recognised the growing demand for broader based scientific advice on man's impact on the environment, which requires an increased inter-disciplinary and multi-disciplinary focus. Consequently, ICES has now disbanded its SCMP and created a new Committee, the Advisory Committee on the Marine Environment (ACME) with much broader terms of reference than the old ACMP. Membership of this Committee is based on nominees from each ICES Member Country, and the Chairmen of the relevant Scientific Standing Committees of ICES (Hydrography, Biological Oceanography, Marine Environmental Quality, Shellfish, and Mariculture). ACME has recently held its first meeting at which it dealt with the agenda of the old ACMP, which was primarily concerned with a scientific evaluation of the 1993 Quality Status Report (QSR) of the North Sea Task Force(NSTF). This report is shortly to be presented to Ministers of countries bordering the North Sea. The ACME also considered its future terms of reference and agenda, which will focus on questions concerning the North Atlantic and adjacent seas (excluding the Mediterranean). Areas of concern will include (a) advice on anthropogenic impacts on marine ecosystems, (b) advice on the protection of species and habitats, including the introduction of new species, (c) advice on monitoring and assessment, and (d) initiation and coordination of interdisciplinary marine research.

Measurement of Primary Production

Following on from the highly successful ICES Symposium on the "Measurement of Primary Production from the Molecular to the Global Scale" in 1992 which was partly supported by SCOR, the ICES Working Group on Phytoplankton and Management of their Effects and the ACME have further considered the establishment of a standard ^{14}C method for the monitoring of primary production. A proposed method aimed at achieving better comparability of measurements has now evolved, and this has been tested in the Indian Ocean as part of the JGOFS programme. Although some questions still exist, the way now seems set to commence a detailed evaluation exercise accompanied by a timely release of the technical specifications of the new incubator. The ACME endorsed the development of this new method, and advises that the development of the new incubator method should be linked to the simultaneous establishment of a database for primary production data.

Phytoplankton and Algal Blooms

Presently ICES deals with phytoplankton issues via its Working Group on Phytoplankton and Management of their Effects, and the Study Group on the Dynamics of Algal Blooms. The forthcoming Statutory Meeting will discuss a possible rationalization of these two groups, taking into account the growing importance of issues related specifically to harmful algal blooms. The Study Group has now formulated plans for regional inter-disciplinary studies in areas which are subject to recurrent occurrence of harmful phytoplankton where a background knowledge of hydrography and phytoplankton ecology already exists. The areas under investigation are the Gulf of Maine, Skagerrak/Kattegat and Iberia. The Study Group has also been evolving its plans in close consultation with the physical oceanographers and modellers on the ICES Working Group on Shelf Seas Oceanography. To further develop understanding of the harmful algal bloom phenomena, these two Groups plan to hold two Workshops during the spring and summer of 1994. These Workshops will (a) inter-compare *in situ* growth rate measurements (with IOC), and (b) investigate the application of modelling to studies on the population dynamics of harmful algal blooms. In the context of these issues, ICES notes with interest the work of the SCOR Working Group 97 on the Physiological Ecology of Harmful Algal Blooms.

I-GLOBEC

ICES, along with IOC, SCOR and PICES,now co-sponsors the International GLOBEC (I-GLOBEC) programme. The main interface between ICES and I-GLOBEC will be its newly established Working Group on Cod and Climate Change, which grew out of the former Study Group on Cod Stock Fluctuations. The new Working Group held its first meeting in Lowestoft, England in early June, and will formally report to ICES at this year's Statutory Meeting scheduled for Dublin, Ireland in late September. The Working Group report will be issued simultaneously as a GLOBEC report and as an ICES report. Preliminary conclusions from its first meeting will also be presented during the ICES Symposium on Cod and Climate Change, which will take place in Reykjavik, Iceland in August 1993.

A number of GLOBEc participants attended the Working Group meeting, which was well represented by a large cross-section of expertise, including a number of numerical modellers. This bodes well for an important objective of the Working Group which is to examine ways to explicitly incorporate numerical population models of species of particular interest with spatially resolved ecosystem models in which other species are represented by a relatively small number of aggregated functional groups.

The inter-disciplinary objectives of ICES involved in I-GLOBEC is being carefully monitored by its Inter-Committee Recruitment Group, membership of which includes the chairmen of all of the ICES environmental and fisheries Committees.

Spatial and Temporal Integration

ICES established at its 1992 Statutory Meeting a Study Group on Spatial and Temporal Integration. This was the result of the recognition that the move from small-scale, process-oriented understanding of growth and mortality to a population level understanding as being of key importance to future developments in the modelling of recruitment processes. Such integration is seen as being a major barrier separating modelling activities from field falsification, and is a problem at the very heart of not only fish recruitment research but also of ecosystem research and modelling in general.

ICES is grateful to SCOR for the offer of co-sponsorship of this group, especially as its tasks could best be addressed by a group which additionally included participation of academics and scientists from outside the ICES geographical area and sphere of activities. The group met in Glasgow, UK in mid-June 1993, and will report to the 1993 Statutory Meeting.

Manual on Zooplankton Methodology

The Study Group on Zooplankton Production continues to make progress in the development of an updated Manual on Zooplankton Methodology which is designed to replace the 1968 edition of the UNESCO/SCOR/ICES Monograph on Zooplankton Sampling. The Secretariats of ICES and SCOR are considering the possibility of this new Manual also being a joint initiative of these three bodies. At its meeting earlier this year, the Study Group prepared a detailed contents list, with a provisional list of authors. It also made plans for a series of workshops to examine zooplankton biomass and production methodology, as well as to provide material for the new Manual. Amongst topics to be covered in the Manual include sampling and experimental design, sampling of zooplankton, biomass and abundance, acoustical methods, optical methods, feeding, growth, metabolism, behaviour, population dynamics, and modelling. The Study Group expects this Manual to be ready for publication in 1995.

Ecosystem Effects of Fishing Activities

ICES notes the interest of SCOR in the work of its Study Group on the Ecosystem Effects of Fishing Activities. This Study Group, whose first report has been published as an ICES *Cooperative Research Report,* has now been elevated to a fuil Working Group. It is not scheduled to meet until early 1994 when it will develop the use of broader-based indices of impact, such as diversity indices, and evaluate methods of assessing

the impact of ground- fish fisheries on benthos. It will also consider the attributes of possible indicator species for the evaluation of long-term impact of fisheries, and develop a design and planning framework for establishing and monitoring closure areas to fishing.

GODAR

As a result of conclusions of an Ocean Climate Data Workshop in early 1992, IOC (with the support of CEC, ICSU and ICES) has created the Global Oceanographic Data Archaeology and Rescue Project (GODAR). This project is endeavouring to augment the historical oceanographie digital archives by seeking out and recovering manuscript and digital ocean data not yet in the digital ocean databases accessible to the world research community. ICES, as the organization primarily responsible for the collection and management of most of the data collected in the first part of this century, has been playing a very active role in this project. In particular, it has worked very closely with Dr. Syd Levitus and his tam at WDC-A Oceanography, and many "lost" data sets have been acquired. There is still much to be done, not least for recent decades. For this period, many marine scientists may be surprised to learn that less than 10% of collected data are routinely made available to the National and World Data Centres for Oceanography. Thus, the support of all scientists, including those involved in the activities of SCOR, are required to ensure the success of GODAR.

Forthcoming ICES Symposia

Plans are now underway for two ICES Symposia approved at the 1992 ICES Statutory Meeting. One of these, "Zooplankton Production - Measurement and Role in Global Ecosystems Dynamics and Biogeochemical Cycles" is being co-sponsored by SCOR. The Symposium, which is to be held at the University of Piymouth, England from 15-18 August 1994, will be convened by Mike Reeve (USA) and Heine-Rune Skjoldal (Norway). They will be assisted by R. Harris (UK), T. Kiørboe (Denmark), J. Gamble (UK) and E.S. Poulet (France).

The second symposium to be approved is "The Changes in the North Sea Ecosystem and their Causes: Arhus 1975 Revisited". This will be held in Arhus, Denmark in July 1995, and will be convened by Niels Daan (Netherlands) and Kathy Richardson (Denmark). The original Arhus Symposium on this topic was considered as a benchmark, but much work had been done since 1975. Although the "North Sea" appears in the title, it is not intended that the Symposium be restricted to the North Sea, although it would be the focus.

ANNEX 10 - Acronyms and Abbreviations

ACFM	Advisory Committee on Fishery Management (of ICES)
ACME	Advisory Committee on the Marine Environment (of ICES)
ACMP	Advisory Committee on Marine Pollution (of ICES)
ACSYS	Arctic Climate System Study
ANTARFIX	A French JGOFS Time Series Station near Kerguelen Island
AOSB	Arctic Ocean Sciences Board
ARW	Advanced Research Workshop
ASPEI	Association of South Pacific Environmental Institutions
ATOC	Acoustic Thermometry of Ocean Climate
BATHY	Temperature/depth profiles
BIOTRANS	German time series station at 47°N, 20°W
CCCO	Joint SCOR/IOC Committee on Climatic Changes and the Ocean
CLIVAR	Climate Variability (a project of WCRP)
COARE	Coupled Ocean-Atmosphere Response Experiment
CPO	Core Project Office
CSD	Commission on Sustainable Development
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
DOSS	Study Group on Development, Operation, Structure and Statutes (IOC)
EC	European Community
ECOR	Engineering Committee on Oceanic Resources
EGOS	European Group on Ocean Stations
ENSO	El Niño - Southern Oscillation
EQPAC	Equatorial Pacific Ocean Process Study of JGOFS
EUMELI	Eutrophic, Mesotrophic, Oligotrophic (a French JGOFS study)
FAO	Food and Agriculture Organization
FCCC	Framework Convention on Climate Change
GCOS	Global Climate Observing System
GCP	GLOBEC Core Program
GEBCO	General Bathymetric Chart of the Ocean
GLOBEC	Global Ocean Ecosystem Dynamics (SCOR, IOC, ICES, PICES)
GLOCHANT	Global Change in Antarctica (a SCAR group)
GODAR	Global Oceanographic Data Archaeology and Rescue Project (ICES)
GOEZS	Global Ocean Euphotic Zone Study
GOOS	Global Ocean Observing System
GTS	Global Telecommunications System
HAB	Harmful Algal Blooms
HELCOM	Helsinki Commission
HNLC	High Nutrient, Low Chlorophyll
I-GOOS	Intergovernmental Committee for GOOS (IOC, WMO, UNEP)
IABO	International Association for Biological Oceanography
IABP	International Arctic Buoy Program
IAMAP	International Association for Meteorology and Atmospheric Physics
IAPSO	International Association for Physical Sciences of the Ocean
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IDNDR	International Decade of Natural Disaster Reduction
IGAC	International Global Atmospheric Chemistry Program (IGBP Core Project)
IGBP	International Geosphere-Biosphere Program (ICSU)
IGOSS	Integrated Global Ocean Services System

IHO	International Hydrographic Organization
IMAGES	International Marine Global Changes Program (PAGES/SCOR)
IOC	Intergovernmental Oceanographic Commission
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
IUPAC	International Union of Pure and Applied Chemistry
IUTAM	International Union of Theoretical and Applied Mechanics
J-GOOS	Joint Scientific and Technical Committee for GOOS (IOC, WMO, ICSU)
JGOFS	Joint Global Ocean Flux Study (IGBP Core Project)
LOICZ	Land-Ocean Interactions in the Coastal Zone (IGBP Core Project)
MONEG	TOGA Monsoon Numerical Experimentation Group
MOU	Memorandum of Understanding
NABE	North Atlantic Bloom Experiment (of JGOFS)
NATO	North Atlantic Treaty Organization
NEG	Numerical Experimentation Group (TOGA or WOCE)
NGO	Nongovernmental organization
NSF	National Science Foundation (USA)
OOSDP	Ocean Observing System Development Panel
OSPARCOM	Oslo-Paris Commission
PAGES	Past Global Changes (IGBP Core Project)
PICES	North Pacific Marine Sciences Organization
SC-IGBP	Scientific Committee for the IGBP (ICSU)
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SeaWIFS	Satellite Wide Field Sensor for ocean color
SOA	State Oceanic Administration (China)
SSC	Scientific Steering Committee
SVP	Surface Velocity Program (WOCE)
TESAC	Temperature, Salinity and Conductivity measurements
TOGA	Tropical Ocean - Global Atmosphere program (WCRP)
TOPEX	Ocean Topography Experiment - TOPEX/Poseidon satellite
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNESCO	United National Educational, Scientific and Cultural Organization
WCP	World Climate Programme (WMO)
WCRP	World Climate Research Programme (WMO, ICSU, IOC)
WG	Working Group
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment (WCRP)