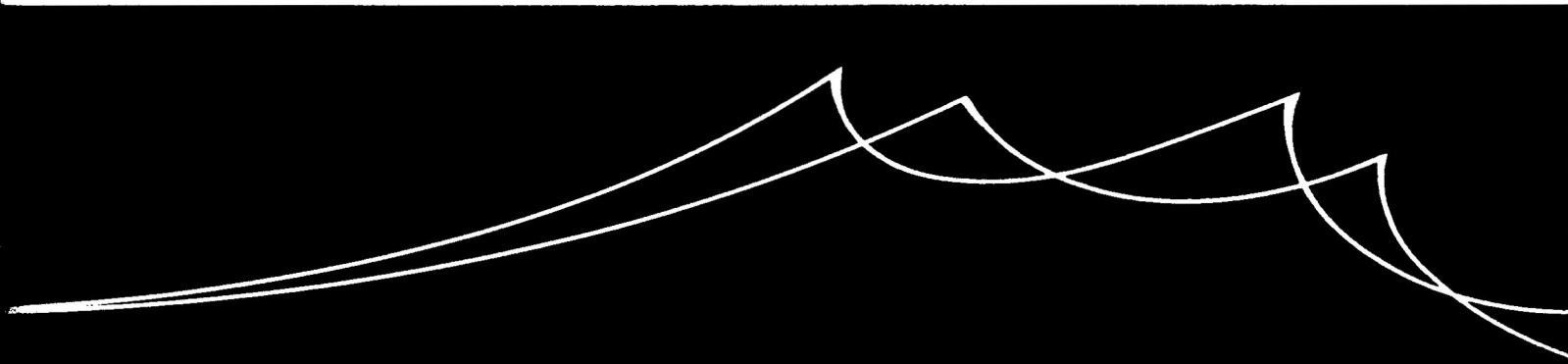
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH



proceedings
volume 4

INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

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INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS

PROCEEDINGS
OF THE
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

Volume 4

5 September 1968
La Jolla, California

SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

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PROCEEDINGS
of the
SCIENTIFIC COMMITTEE ON OCEANIC RESEARCH

Report of the Ninth General Meeting
La Jolla, 17 - 21 June 1968

The Ninth General Meeting of SCOR was held at the Scripps Institution of Oceanography, La Jolla, 17-21 June 1968, with the President, Captain Luis Capurro, in the chair. A business meeting on 17 June was followed by the Symposium on Scientific Exploration of the South Pacific during the next three days. On 21 June, the Executive Committee met to complete action on items referred to it during the General Meeting. A list of those who attended the General and Executive Meetings is given in Annex I. The agenda used in the former meeting serves as an outline for the report which follows.

On the evening of 17 June, the Directors of the Scripps Institution of Oceanography, the Institute of Marine Resources and the Institute of Geophysics and Planetary Physics, all of the University of California, offered a reception followed by a dinner which was addressed by Dr. Edward Wenk, Executive Secretary of the U.S. National Council on Marine Resources and Engineering Development. On Wednesday evening, a banquet in honor of SCOR was addressed by Ambassador Donald L. McKernan, Special Assistant for Fisheries and Wildlife to the United States Secretary of State. These and other social events were supported financially by Bendix Marine Advisers, The Bissett Berman Corporation, Convair division of General Dynamics, Hydro Products Division of Dillingham Corporation, Ocean Science & Engineering, Inc., Ryan Aeronautical Company and Westinghouse Ocean Research Laboratory. The U.S. National Academy of Sciences also contributed toward meeting these expenses.

The following message was received from Hubert Humphrey, Vice-President of the United States of America:

> "As Chairman of the National Council on Marine Resources and Engineering Development, I am pleased to welcome the Scientific Committee on Oceanic Research of the International Council of Scientific Unions to La Jolla. I extend my very best wishes for a profitable meeting which will further advance international science in the interest of all nations.
>
> The oceans touch the shores of many lands, and in recent years SCOR has set the pace in catalysing international cooperative research endeavors to understand the oceans. The International Indian Ocean Expedition, the International Cooperative Investigation of the Tropical Atlantic, and the Cooperative Study of the Kuroshio have been milestones in oceanic progress.
>
> Now we are setting new goals for ocean exploration. President Johnson recently proposed that all nations -- large and small -- join in an historic and unprecedented adventure, an International Decade of Ocean Exploration for the 1970's, to extend our knowledge, to develop our resources, and to strengthen international understanding. We look to SCOR and the Intergovernmental Oceanographic Commission to provide the guideposts which will chart our course as we extend our efforts to probe the mysteries of the sea.
>
> I wish you every success in your meeting and look forward to receiving reports from our Academy of Sciences on further steps toward scientific explorations of the sea."

1.0 ORGANIZATION AND FINANCE

1.1 REPORT OF THE SECRETARY

It was noted that volume 4 of the Proceedings, containing a report on the present meeting, would be complete in a single number, since no further meetings are scheduled in 1968.

Professor Stewart reported that publication of papers from the 1966 Symposium on Variability was imminent, proofs having been received from "Progress in Oceanography" where the papers are being published.

National academies and equivalent bodies, and interested unions, have nominated members for the period beginning 1 January 1968; the present membership is given on the inside front cover. The desirability of increasing national membership was discussed, in view of SCOR's responsibilities as an advisory body to UNESCO and IOC. Even in IOC, membership does not include all countries concerned with marine scientific problems, and in less than half of the IOC member countries are there national committees of oceanic research affiliated with SCOR. With the increasing responsibility being assumed by SCOR with regard to international oceanography, its membership should be more representative of countries with scientific groups participating in such activities. It was agreed that the new Executive Committee should attempt to increase national membership, through correspondence with marine scientists and organizations in non-affiliated countries, and through visits where desirable.

1.2 BUDGET

An estimate of SCOR finances for the present year (through 30 June) is given in Annex II. The U.S. National Academy of Sciences has made available an additional $5,000 in 1968 to cover expenses in connection with the South Pacific Symposium. Funding appears to be sufficient for the present level of activities.

2.0 WORKING GROUPS

As decided during the 1965 Executive Committee meeting in Rome, the tenure of all working groups expires at the time of each General Meeting, when the report of each group is considered. A list of working groups still active, or to be activated at the close of the present meeting, is given in Annex III.

With regard to the final report of WG 13, on Zooplankton Sampling Methods, it was learned that UNESCO expects publication by October 1968.

Professor G. Hempel, Chairman of the former WG 18, on Biological Data, was asked to visit the U.S. National Oceanographic Data Center after the present meeting in order to discuss problems of biological data exchange.

2.1 REPORT ON EXISTING GROUPS

WG 10. Oceanographic Tables and Standards (with ICES, IAPSO and UNESCO): The report of the last meeting of this group, 4-5 October 1967, has recently been published by UNESCO (Technical Papers in Marine Science, No. 8). In a discussion of the present status of this problem, it was considered desirable to replace the group with an Editorial Board for the "International Oceanographic Tables". The Executive Committee was instructed to discuss this with the other sponsoring organizations, and to work out with them the terms of reference of such an editorial board.

WG 15. Photosynthetic Radiant Energy (with UNESCO and IAPSO): Sea trials were carried out by members of this group aboard R/V Ellen B. Scripps in the Gulf of California during the period 29 April - 22 May 1968: a report of this work is given in Annex IV. Travel expenses for participants and freight charges were met by the three sponsoring bodies. The importance of this work, the contribution of the WG Chairman, Mr. Tyler, to its success, and the generosity of the Scripps Institution of Oceanography in providing the ship were recognized with appreciation. It was decided to keep the group constituted for the purpose of writing the report of this experiment. The representative of UNESCO stated that his organization would continue to support the group at the same level. Mr. Steele has resigned from the group, and it was agreed that the membership should be somewhat changed before the next sea trials, proposed for 1969 or later, could be carried out. In this connection, Professor Dietrich stated that R/V Meteor would be working near the Canary Islands in the period February-April 1971, and that one week of ship time could be made available for such work during that period. Other possibilities should also be explored. It was agreed that the problem should be reexamined at the next Executive Committee meeting.

WG 19. Micropaleontology of Bottom Sediments: It was agreed that this group would be continued only as an Editorial Board for the Proceedings resulting from the September (1967) meeting. Dr. Funnell reported that this publication (by the Cambridge University Press) is scheduled for early in 1969 and would consist of a book of about 700 pages.

With regard to Working Group recommendations passed to the International Union of Geological Sciences, there has been established, within the IUGS Commission on Stratigraphy, a new Working Group for the period 1968 - 1972 with the following task:

"Small specialist groups should meet to exchange views and research material and, if necessary, carry out joint field and laboratory research with the purpose of (a) clarification of zone boundaries and sequences, and (b) isotopic dating and application of paleomagnetic data to biostratigraphically zoned sequences of strata."

Professor Bolli has been named Chairman of this "Working Group for a Biostratigraphic Zonation of the Cretaceous and Cenozoic as a Basis for Correlation in Marine Geology."

WG 21. Continuous Current Velocity Measurements (with IAPSO and UNESCO): The following interim report, dated 20 May 1968, was received from the Chairman, Dr. John Swallow:

> "The data collected during the current meter intercomparison experiment in R/V Gosnold in July 1967 has been edited and is being analyzed at Woods Hole. G. Siedler has been working on the data from a closely spaced vertical array of instruments all of the same type (Geodyne), and it is proposed that some

of the same methods of analysis be applied to the intercomparison data. It seems desirable that this analysis should be done before plans are made for a further intercomparison experiment. We should like to have your support in thinking of planning a second intercomparison in the summer of 1969. For this purpose, and for further consideration of the results of last year's experiment, it may be desirable for the group to meet later this year when the data analysis has reached a suitable stage.

The working group wishes to encourage intercomparison of current meters by anyone who may have a suitable opportunity. One example of such intercomparisons made outside the group's activity was the inclusion of close-spaced pairs of current meters (Bergen, Braincon, Plessey) in five moorings laid by R/V Discovery during October-December 1967. These yielded a total of 33 days of comparisons between pairs of current meters, and 27 days of comparisons between meters and neutrally buoyant floats at the same nominal depths."

Dr. Maxwell reported that a meeting of the group later this year at Woods Hole would be welcomed and that R/V Gosnold could be made available again for further field trials when deemed necessary. The generous support of the Woods Hole Oceanographic Institution was acknowledged with appreciation. It was agreed to continue the Working Group with the same membership and terms of reference.

WG 23. Zooplankton Laboratory Methods (with UNESCO): This group held its first meeting, under the Chairmanship of Dr. Vagn Hansen, at the Smithsonian Institution in Washington on 25-30 March 1968; a summary report with interim recommendations on fixation and preservation procedures for use aboard ship and in the laboratory or depository and for biomass determination is given in Annex V.

During the present meeting, an ad-hoc group of biologists, under the chairmanship of Professor Hempel, was formed to consider other recommendations of the Working Group (along with other biological problems referred to later). On the basis of their comments, the following actions were taken:

1. The approach taken by the Working Group was applauded, and it was decided that the draft report should be revised and edited for publication in the Proceedings (see Annex IV).

2. The Working Group had recommended that comparisons be made between parallel collections stored in IOBC and in individual laboratories. These comparisons should be made by specialists who have worked on the national IIOE collections of the donor institutions. National collections proposed include those in Moscow, Kiel, Wormley, La Jolla, Washington, Tokyo and Cronulla. It was decided that Dr. Vagn Hansen should be asked to initiate these comparisons by correspondence, and to visit the institutions concerned if necessary. Dr. Hansen will be asked to keep in close contact with Drs. Beers, Steedman and Tokioka during this work.

3. Drs. Fleminger and Flügel were encouraged to continue and to expand their investigations on morphological structures and indicators for description and measurement of the state of preservation of fixed and preserved plankters. The results of these investigations should be widely distributed.

4. The Working Group had recommended that Dr. Steedman and the Smithsonian Institution carry out comparative studies of fixation and preservation methods, including new reagents that might serve as stable preservatives. It was agreed that these investigations should be encouraged, and that SCOR should provide such assistance as is practicable to facilitate this work.

5. The Working Group had also recommended preparation of a manual on zooplankton fixation, preservation and storage, and holding of a workshop on these topics. It was decided that these proposals should be reviewed by the Executive Committee after completion of Dr. Steedman's work.

6. SCOR agreed with the Working Group recommendations that Drs. Beers and Vagn Hansen should further discuss the problems of biomass determination in correspondence, and that Drs. Beers and Kimor should correspond on the problems of fixation and preservation of microplankton.

7. Substantial progress on the investigations referred to above is essential before further action can be taken, and it was agreed that the WG would not need to meet in 1969. In the meantime, Dr. Hansen was encouraged to take the necessary steps to develop and coordinate the necessary research program. Status of the work would be reviewed at the Executive Meetings in 1969.

WG 24. Estimation of Primary Production under Special Conditions (with IBP/PM): The first meeting of this group is scheduled to be held in Southampton, 30 July - 1 August 1968. It was agreed to continue the group with its present membership at least until the report of that meeting is prepared.

WG 25. Nutrient Chemistry: This group met in La Jolla on 15-16 June, 1968; the report is given in Annex VI. The principal recommendation was that the ICES Sub-Committee (of the Hydrographical Committee) on Chemical Analysis of Sea Water, be asked to conduct an intercalibration experiment on a large scale, involving the independent analysis of samples of known concentration by a considerable number of institutions, each using its own methods. SCOR National Committees and associated institutes should be urged to give increased attention to this important problem and to cooperate in activities of the ICES group.

This recommendation was approved; the representative of ICES, Professor Braarud, indicated that acceptance of this task by ICES was likely. Professor Sugawara reported that his laboratory could furnish the samples; assistance by SCOR or by the laboratories concerned would be required in meeting the expense of shipping samples. It was agreed that the Executive Committee should consult with ICES on the details of arrangements and on the assistance desired from SCOR should the proposal be accepted. Proper statistical design of the experiment was considered essential, and the Executive was instructed to propose addition of a statistician to the ICES group for this purpose. It was also agreed to discharge WG 25 with appreciation for the useful contribution they had made toward solution of this ancient problem.

WG 26. Implementation of UN Resolution on Resources of the Sea (with ACMRR and WMO/AC): The work of this group was recognized in the report of the UN Secretary-General "Marine Science and Technology: Survey and Proposals" (ECOSOC E/4487 of 24 April 1968) in which it is stated (p. 79):

"266. The Secretary-General proposes that the General Assembly recommend to the IOC and the United Nations organizations concerned the preservation and strengthening of this principle of seeking independent expert advice and to arrange, in particular, for a continuation of the work started by the joint ACMRR/SCOR/WMO(AC) Working Group in the identification of specific scientific problems which require expanded international cooperation. The IOC, as well as the United Nations organizations concerned, would then be better able, in developing the expanded program, to assign priorities and propose means of attacking the problems so identified."

A further task for this group was also suggested at the 8th Meeting of the IOC Bureau and Consultative Council; the matter is further discussed under items 2.2 and 3.1.

WG 27. Deep-Sea Tides (with IAPSO and UNESCO): It is not anticipated that this group will meet again in the near future. In view of the long-term nature of the problem, as well as its basic scientific importance, it was decided to continue the group with its present membership.

WG 28. Atmosphere-Ocean Interaction (with IAMAP and IAPSO): At its last meeting, the Executive Committee decided to join IAMAP and IAPSO in sponsorship of the existing Joint Committee on Atmosphere-Ocean Interaction, as recommended by the IOC Working Group on Ocean-Atmosphere Interaction (Lucerne, 27-28 September 1967). The Secretary was instructed to negotiate terms of reference and membership with appropriate officers of the other sponsoring bodies. During these negotiations, it appeared that IAPSO and IAMAP, especially the latter, had not formally agreed to SCOR participation. In addition, it appeared that IAMAP Statues did not provide for formation of a joint committee with an ICSU Scientific Committee. Action has now been taken by IAMAP to request IUGG approval for such joint action. During the present meeting, it was agreed to continue negotiations, after IUGG approval has been granted, in the hope of achieving an effective mechanism for dealing with international scientific cooperation in studies of interaction at this important ocean boundary.

2.2 CONSIDERATION OF NEW GROUPS

Biological Variability

It was noted that the IOC Group of Experts on Ocean Variability recently constituted by the IOC Bureau and Consultative Council (see Annex VII), because of its responsibility towards the Integrated Global Ocean Station System (IGOSS), consisted primarily of physical scientists. At the same time, it was recognized that variability in biological systems had considerable scientific and practical importance and that there existed opportunities to include biological measurements in observational systems designed primarily to monitor physical changes in the ocean. Accordingly it was decided to establish a new working group (WG 29), on Continuous Monitoring in Biological Oceanography, with the following terms of reference:

> Using the outcome of various relevant working groups of SCOR and other organizations, to review critically the present status of devices for (a) continuous observation of parameters such as pigments, particles, transparency, submarine irradiance, primary production, nutrients, and (b) continuous or intermittent sampling of organisms, and to list suitable techniques and instruments for such measurements. The WG would work, where relevant, with the Chairman or rapporteurs of other SCOR WGs.

Subsequently, ACMRR agreed to co-sponsor WG 29 and accepted the proposed terms of reference; UNESCO and IBP/PM will also cosponsor.

Experimental Marine Ecology

The National Committee for the Federal Republic of Germany had suggested consideration of a new working group to promote experimental marine ecology. However, in view of the present activities of IBP and of national and regional bodies, there did not appear to be immediate need for action by SCOR.

Transplantation of Marine Fauna and Flora

The Soviet National Committee had proposed establishment of a "group of experts on transplantation and reconstruction of marine fauna and flora". It was recognized that the scientific aspects of the transplantations, and particularly their biogeographic implications, deserved SCOR's active interest. A compilation of published information on former transplantation experiments and their results, and the establishment of a register of transplantation projects, would be desirable. Because of FAO's activities in this field, however, and of FAO's intentions to discuss the subject during the forthcoming meeting of ACMRR, there did not seem an immediate need for SCOR action. While leaving the initiative to FAO and ACMRR, SCOR would continue to consider appropriate action on relevant scientific aspects referred to it.

Continental Margins

An ad-hoc group of geologists and geophysicists during the present meeting proposed establishment of a working group on "East Atlantic Continental Margins". This proposal was accepted in principal, and Professors Seibold and Emery were asked to propose members and terms of reference for subsequent consideration by the Executive Committee. It was noted that this topic was of interest to UNESCO, IUGS and to the Upper Mantle Program, and these organizations would be asked if they wished to cosponsor the group.

Scientific Aspects of International Ocean Research

Subsequent to the present meeting, ACMRR proposed that WG 26 be replaced by another group to meet the proposals of the UN Secretary-General and requests from IOC (see 2.1 above). This matter is treated in detail in 3.1 below.

3.0 RELATION WITH UNITED NATIONS ORGANIZATIONS

3.1 ADVISORY MATTERS CONCERNING UNESCO/IOC

Expanded program of ocean exploration: During the Eighth Meeting of the IOC Bureau and Consultative Council, a recommendation (No. 8.18) was adopted concerning the development of an expanded, accelerated, long-term, and sustained program of exploration of the oceans and their resources(see Annex VII). Administrative implications of such an expanded program were to be considered in September or October 1968, by a small group of consultants (including a representative of SCOR), Members of the Commission were to submit program proposals before the end of 1968, the next Bureau Meeting would consider these proposals, other international organizations were invited to participate, the IOC Chairman was to inform the United Nations of IOC aspirations, and SCOR, ACMRR and other interested scientific bodies were invited "to give early consideration to the scientific content of such an expanded program."

In a discussion of this recommendation at the present meeting, it was agreed that SCOR should respond positively and that Working Group 26, possibly with some changes in membership, was an appropriate mechanism for cooperation with advisory groups of FAO and WMO on this problem. Comments and suggestions should be invited from National Committees and from the other interested ICSU bodies (IAPSO, IABO and IUGS Commission on Marine Geology). These could be considered by the Working Group at a meeting in the Spring. It was noted that the IOC request for governmental proposals for an expanded program to be submitted before the end of 1968 was unrealistic. Although governments might be able to indicate in broad terms the extent of their interest, detailed proposals would undoubtedly have to await consideration by their scientists.

As noted in Section 2.2 above, this question was discussed at the Fifth Session of ACMRR (Rome. 8-13 July 1968) subsequent to the SCOR Meeting; the SCOR President participated in the discussions and agreed to the recommendation to replace the previous group with a new joint working party (SCOR WG 30) on Scientific Aspects of International Ocean Research. A summary report of the ACMRR discussions is given in Annex VII.

In brief, it was agreed that the group should consist of approximately fifteen members, selected from the fields of marine geology and geophysics, chemistry, physical oceanography and meteorology, and biology and fishery science, in proportions approximately 4:2:4:5; that these members would be nominated in consultation among the officers of SCOR, ACMRR and the appropriate WMO advisory body; that the group should meet in the Spring of 1969 for about ten days; and that the presiding officers of the nominating bodies and representatives of FAO, UNESCO and WMO should participate.

The following terms of reference were proposed:

1. To develop the scientific content of a comprehensive program of international cooperation in exploration and research in the ocean and its resources, taking into account the survey and proposals of the UN Secretary-General in connection with UN Resolution 2172, and also the report on International Ocean Affairs, the existing national and international programs of cooperation in ocean exploration and research, and other relevant programs and reports.

2. To comment on the practical problems of implementing such a program, including priorities and timing, taking into account the likely funds, facilities and personnel required.

The group would report to the appropriate officers of the nominating bodies who would transmit the report with comments to the IOC and to the executive heads of FAO, UNESCO and WMO.

International Directory of Oceanographers: Recommendations of the Warnemünde meeting (see Proceedings, 3 (2): 75) were accepted by UNESCO, and a circular letter inviting lists of oceanographers was sent to SCOR National Committees on 9 February 1968. At about the same time, the UNESCO Office of Oceanography addressed a similar letter to "National Scientific Authorities"; both letters requested that the lists be received by 1 June. By the time of the present meeting, lists had been received from SCOR Committees in 15 countries; it is expected that the remaining lists will be received in the near future. The UNESCO Office of Oceanography has had a good response from other countries not included in the SCOR list.

A discussion of the problems involved in making up these lists indicated that the criteria for inclusion are not completely objective. For example, it is not clear to what extent museum taxonomists working on certain marine organisms should be included. With regard to inclusion of students, the controlling criterion appeared to be that of publication of "scientific papers in this field during the last several years". In listing marine science laboratories, only permanently occupied laboratories should be included. It was agreed that, in the last analysis, national committees would have to evaluate the criteria and decide on who should be included. In order to analyze the magnitude of the problems of definition and criteria faced by the national committees, it was agreed that the Secretary would review and evaluate the lists now received and would report his findings to the Executive Committee and to the UNESCO Office of Oceanography.

Experts on Variability: As requested in IOC Resolution V-20D and after consultation with IAPSO and IABO, SCOR forwarded to the IOC Secretary a list of nominees for membership in the IOC Group of Experts on Variability. Nominations were also made by ACMRR. During the 8th Meeting of the IOC Bureau and Consultative Council (London, 10-14 June) discussions between representatives of SCOR and ACMRR resulted in a list then approved by the Bureau (see Annex VII).

Caribbean Symposium: The UNESCO Office of Oceanography requested SCOR to nominate a U.S. scientist to the Program Committee for the UNESCO/FAO Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions (Curacao, 18-26 November 1968). After discussions with the U.S. National Committee, Professor Eric Krauss (University of Miami) was nominated.

UNESCO/IOC Publications: A representative of the U.S. National Committee reported the concern of that Committee on the distribution of UNESCO and IOC technical publications in oceanography. It appears that these publications are not well known to working scientists in the United States, although they may be available in libraries. It was agreed that discussions would be held with members of the Office of Oceanography to see how the situation could be improved.

Indian Ocean Biological Center: With the appointment of Mr. Tranter as IOBC Curator, there was a vacancy on the IOBC Consultative Committee. Since members of that Committee are appointed by UNESCO upon the advice of SCOR, correspondence was initiated and resulted in the nomination by SCOR (on 8 January 1968) of Drs. B. Kimor, J.E. Smith and G. Hempel. Drs. Kimor and Smith have since been appointed.

Some members expressed the wish for more detailed information about the activities of IOBC, the present status of the collections, the distribution of the materials to specialists, etc. It was noted that the IOBC Consultative Committee had met earlier in the year and that the report of that meeting, when available, might contain the desired information. It is also understood that a handbook of the Center is in preparation. Dr. Panikkar said that the Indian Committee could furnish any specific information required.

The undesirability of a time gap between the terms of international curators was pointed out. In fact, there should be an overlap of at least a month between arrival of the new curator and departure of the old. The UNESCO Office of Oceanography should already initiate recruitment of a successor to the present curator.

Regional Biological Center in Singapore: This Center has been established at the University of Singapore, on the basis of an agreement between the government of Singapore and UNESCO. CSK plankton samples are being sorted at the Center, and UNESCO has proposed to establish some sort of advisory machinery, in cooperation with SCOR.

The initiative of UNESCO in establishing this Center was welcomed. Since CSK samples are being sorted, and since there will accordingly be international collections, there is a need for an advisory body of scientists to assist UNESCO and the director of the Center in planning the work, particularly in connection with handling of the international collection. It was agreed that the IOBC Consultative Committee was an appropriate body for this advisory task. It might be necessary to add one or two members for this purpose. The UNESCO budget should reflect the costs of additional members and meetings.

Marine Geology and Geophysics: The IOC Bureau, during its recent meeting in London, adopted a recommendation (No. 8.19) concerning the Commission's role in marine geological and geophysical investigations (see Annex VII). SCOR was requested to advise on means whereby the Commission could take effective action on various proposals in these fields. During the present meeting, an ad-hoc group of geologists and geophysicists met to consider this problem. A summary of recommendations of this group follows:

IOC should strengthen the geological and geophysical aspects of cooperative studies through the appropriate composition of coordination groups. Consideration should be given to the organization of geological/geophysical expeditions, working groups or symposia. It was noted that the findings of pure science in these fields are certain to benefit future economic exploitation of marine mineral resources. The geological/geophysical atlas of the International Indian Ocean Expedition should be coordinated and published as soon as possible, since the results contained therein will facilitate the planning of future expeditions in the region. The appropriate parts of the "General Scientific Framework" should be revised as necessary with the help of geological and geophysical specialists.

The following specific proposals were considered:

1. A proposal for a SCOR Working Group on "East Atlantic Continental Margins" is discussed above (item 2.2).

2. IOC Resolution V-12 invites members to contribute to the carrying out of trans-oceanic geophysical traverses. The first such traverse is to be initiated in the North Atlantic by the U.S. Coast and Geodetic Survey. The ad-hoc group proposed that SCOR establish a working group on "North Atlantic Geotraverse Program". It was agreed to ask Professor Heezen, Chairman of the IUGS Commission on Marine Geology, to review present activities, including those of the Upper Mantle Program, and to advise SCOR on appropriate action at the next meeting of the Executive Committee.

3. Special attention should be drawn to the geological and geophysical aspects of IOC cooperative projects in the Western Pacific (CSK), Mediterranean and Caribbean.

4. The ad-hoc group had proposed the organization of a symposium on "Satellite Navigation". It was noted that the problem of positioning at sea is of basic importance to most oceanographic investigations. With regard to satellite navigation, however, only the United States of America and the Soviet Union were known to be developing such systems. It was agreed that a review of modern navigational methods should be prepared for the use of oceanographers, and the Executive Committee was asked to consult with UNESCO and IHB to find ways and means of having such a review prepared.

5. The desirability of establishing a "World Ocean Core and Bottom Photograph Index" was discussed. It was recognized that this was an appropriate matter for discussion by the IOC Working Group on Oceanographic Data Exchange, scheduled to meet the week of 23 September in Paris. However, some preparation by specialists before that meeting was desirable, and it was agreed to ask the views of National Committees as well as that of curators of important core and bottom photograph collections.

6. The ad-hoc group pointed out the need for special symposia on topics such as igneous and metamorphic rocks on the sea floor, geochemistry of marine sediments, and sediment transport mechanisms of the deep sea. It was recognized that the organization of such symposia was the responsibility of Associations and other single-disciplinary components of the ICSU system, although it was certainly appropriate for SCOR to comment on their importance. It was agreed to urge the Royal Society of London to consider favorably the proposed symposium on igneous and metamorphic rocks on the sea floor.

Impediments to Oceanographic Research on the Continental Shelf: After a discussion of the increasing impediments to oceanographic research on the continental shelf, it was agreed to send copies of the following statement to SCOR Members and National Committees, with information copies to delegates of "SCOR countries" participating in the meeting of the United Nations ad-hoc Committee on Peaceful Uses of the Sea Bed:

> "Evidence is accumulating that the Convention on the Continental Shelf, now ratified by many maritime nations, is on occasion being applied so as to hinder scientific investigation of the circulation of ocean waters, the biology of the sea floor, the origin and movements of continents, and other problems of considerable scientific importance. Accordingly, SCOR decided to ask its Members, National Committees, and their parent organizations, to urge their governments to adopt liberal interpretations of the articles of this Convention in order to facilitate the carrying out of oceanographic research."

3.2 RELATION WITH FAO/ACMRR

At the suggestion of FAO, arrangements were made for SCOR to be represented at the April meeting of the ACMRR/ICES Working Group on Eastern Atlantic Stocks, by Dr. E. Biester, of Rostock (GDR). No SCOR funds were involved.

During the discussion of relations with ACMRR, it was decided that a member of the SCOR Executive Committee should attend the next ACMRR Meeting(Rome, 8-13 July 1968). At that meeting, SCOR was represented by its President. Actions of interest to SCOR are reported in sections 2.2 (biological variability, and scientific aspects of international ocean research) and 3.1 (expanded program of ocean exploration) of the present report.

3.3 OTHER MATTERS

SCOR was represented at the second meeting of the UN Secretary-General's Group of Experts on Marine Science and Technology (4-8 March 1968) by Professor Roger Revelle. The Secretary-General's report has now been distributed ("Marine Science and Technology: Survey and Proposals" ECOSOC E/4487 of 24 April 1968). It draws heavily on two SCOR documents, the General Scientific Framework and International Ocean Affairs. (see also under WG 26 in section 2.1 above).

4.0 RELATION WITH ICSU AND CONSTITUENT BODIES

4.1 RELATION WITH ICSU

The 12th General Assembly of ICSU, originally scheduled for the week following the SCOR Meeting, has now been rescheduled for the week of 27 September. Matters that could be discussed at that time include the question of ICSU nomination to SCOR membership, now vacant since Professor Postma became the member from Netherlands. In the view of the present meeting, ICSU should be encouraged to nominate a scientist who could participate actively in SCOR affairs for a period of three years, as envisaged in the SCOR Constitution.

Changes in the SCOR Constitution pertaining to duration of periods of office were also discussed. Because of recent changes in statutes, the terms of membership and of office, and the frequency of general meetings, need to be reconciled. The Executive Committee was authorized to develop appropriate revisions for submission to the ICSU General Assembly in September.

4.2 RELATION WITH UNIONS AND CONSTITUENT BODIES

International Association of Physical Sciences of the Ocean

During the XIV General Assembly of IAPSO held in Berne in September, the following resolution (No. 10) was adopted:

"The International Association of Physical Oceanography, cognizant of the growing need for closer, interdisciplinary working contacts in the field of marine sciences, requests the Executive Committee to study, in collaboration with other international organizations interested in oceanography, and to report to the XV General Assembly of the Association on the desirability and feasibility of establishing an International Union of Marine Science (IUMS) which would contain associations dealing with sciences concerned with the ocean, that is, with marine geophysics and geology, marine chemistry, physical and meteorological oceanography, and marine biology; resolves to convene, if practicable, its XV General Assembly jointly with the Scientific Committee on Oceanic Research (of ICSU), with the International Association of Biological Oceanography (of the IUBS), with the Commission on Marine Geology (of IUGS) and with IAMAP, in particular with those sections interested in air-sea interaction problems."

The Secretary of IAPSO reported that the Science Council of Japan had invited IAPSO to hold its General Assembly in Japan, 14-27 September 1970. Since SCOR is now meeting on a two-year schedule, it was agreed to hold the Tenth General Meeting in Tokyo together with IAPSO. The representative of IABO indicated the willingness of that organization to join in this meeting. A joint program committee of the participating organizations should be established.

4.3 RELATION WITH SPECIAL AND SCIENTIFIC COMMITTEES

Scientific Committee on Antarctic Research

The Tenth Business Meeting of SCAR took place on 10-15 June 1968 in Tokyo. Mr. George Hemmen, Assistant Secretary of SCAR, represented SCOR at that meeting; his report is given in Annex IX. SCAR welcomed formation of the IOC Coordination Group on the Southern Ocean, as recommended by SCOR to the Fifth Session of IOC. It was also reported that Proceedings of the SCAR/SCOR/IAPSO/IUBS Symposium on Antarctic Oceanography would be published in September 1968.

Special Committee for the International Biological Program

The SCOR Member of SCIBP, Dr. Oren, attended the IBP General Assembly in Varna, 4-10 April 1968. Although the report of the accompanying meeting of the PM Section is not yet available in final form, correspondence with Dr. Oren and Mr. Glover, Convenor of that section, has indicated the following matters of particular interest to SCOR:

The main emphasis of IBP/PM will be on studies of biological productivity in regions easily accessible to man, including the continental shelves, inshore waters, coastal regions and estuaries. The major themes are:

A. Studies of comparative ecology in different climatic regions.

B. Studies of the actual or potential modification of the marine environment by man's activities.

C. Studies of the cultivation of marine organisms.

D. World-wide studies of selected organisms (including Mytilus and Mugilidae).

Professor Crisp is chairman of a working group preparing a handbook on the benthos; this group will meet in Arcachon 9-11 September 1968. The preliminary version of the handbook will be printed by FAO. At Arcachon, the need for intercalibration of methods in benthos will be discussed.

With reference to marine pollution, it is intended to emphasize the importance of establishing ecological base lines against which actual or potential effects of man's intervention can be measured. Thus there is a need for analyses of variation in natural ecosystems, studies of specific ecosystems before and after pollution, experimental studies of the effects of pollutants on living organisms, and studies of the degradation of organic pollutants by marine ogranisms.

Earlier discussions of the IBP Plankton Statistical Center were reported in Proceedings, vol. 3, no. 1 (pp. 14-15); in the Varna report, this activity is called the New Zealand Plankton Statistical Project. Some financial support is forthcoming from national and international sources, and more is desired. Production of a proposed general handbook on statistical methods should be postponed, although reports of the Project should be published as they become available. The proposals were commended to the attention of international bodies, including FAO, UNESCO and SCOR.

This Project was discussed by the ad-hoc group of biologists at the present meeting. Their recommendation, which was accepted by SCOR, was that SCOR should stimulate the preparation and publication of a review of present methods and ideas on statistical design and analysis of plankton sampling programs. An editor, members of an advisory board, and authors of various chapters were suggested, and the Executive Committee was authorized to take the necessary action to activate this project.

As reported in previous issues of the Proceedings, IBP/PM and SCOR have agreed to sponsor a Symposium on Biological Results of the International Indian Ocean Expedition. Plans for the Symposium are being elaborated by Dr. Humphrey (for SCOR) and Professor Krey (for IBP/PM). Discussions at the present meeting indicated that the Symposium should focus on critical evaluation of the biological work of the IIOE; since the Expedition had a long-lasting effect on the development of marine biological studies in the Indian Ocean, the results of work continued or started after the end of IIOE should also be reviewed. The Symposium should be held in early 1971, possibly in Kiel, and should last for a full five days. UNESCO should be asked to provide for financial support in their 1971 budget. FAO is prepared to co-sponsor the Symposium and to assist with the arrangements. Dr. Humphrey was asked to continue with the preparation, jointly with Professor Krey, of a draft prospectus of the Symposium which could be discussed at the next meeting of the Executive Committee.

5.0 RELATION WITH OTHER INTERNATIONAL ORGANIZATIONS

Prior to the present meeting, the Executive Committee had tentatively agreed to cosponsor the Symposium on the Physical Variability in the North Atlantic, to be held in conjunction with the ICES Statutory Meeting in 1969 in Dublin. The ICES Bureau, meeting in May 1968, decided to appoint Professor Dietrich as Convenor of the Symposium and Chairman of its scientific

organizing committee; SCOR, IAPSO, UNESCO and ICNAF were invited to appoint one member each of that committee. Dates of the Symposium were established as 25-27 September 1969.

It was agreed that SCOR should accept the ICES invitation to participate in this program and to nominate a member of the scientific organizing committee. If possible, a meeting of WG 21 on Continuous Current Velocity Measurements, should be held in Dublin at that time. Also, UNESCO should be encouraged to bring members of the IOC Group of Experts on Ocean Variability to attend the Symposium.

6.0 ELECTION OF OFFICERS

In accordance with provisions of the SCOR Constitution, the following officers were elected:

President:	Professor Warren S. Wooster (U.S.A.)
Retiring President:	Captain Luis R.A. Capurro (Argentina)
Vice-President:	Professor Trygve Braarud (Norway)
	Professor A.S. Monin (U.S.S.R.)
Secretary:	Dr. Klaus Voigt (G.D.R.)

7.0 OTHER BUSINESS

It was agreed that the next meeting of the Executive Committee should take place early in 1969, just before or after the 9th Meeting of the IOC Bureau and Consultative Council. The Executive was authorized to make the necessary arrangements and was requested to notify National Committees as soon as this has been done.

Subsequent to the business meeting on 17 June, the Symposium on Scientific Exploration of the South Pacific was held (18-20 June 1968); the program is given in Annex X. After the formal papers had been presented, there was a general discussion of future oceanographic work in the region; Dr. Deacon led this discussion. The general consensus appeared to be as follows:

There are many exciting problems in the region which are of both general scientific interest and of practical importance. Except for the boundaries of the region, data coverage is inadequate or non-existent. Although there is not yet general support for a large-scale international cooperative program, the efforts of individual laboratories and of regional cooperative projects should be encouraged. There is a particular need for strong, broadly-based oceanographic laboratories in the region.

The offer of the U.S. National Academy of Sciences to publish papers from the Symposium was accepted. Most manuscripts were submitted at the time of the Symposium. It is hoped that publication could be in early 1969.

ANNEX I

SCOR BUSINESS AND EXECUTIVE MEETINGS
La Jolla, 17 and 21 June 1968

List of the Participants

MEMBERS OF SCOR

Professor B. Battaglia (Italy) *
Professor T. Braarud (Norway) *
Sir Edward Bullard (IUPAP) *
Captain L.R.A. Capurro (Argentina) *
Mr. R.I. Currie (IABO) *
Dr. G.E.R. Deacon (UK) *
Professor G. Dietrich (IAPSO) *
Dr. K.O. Emery(IUGS)
Dr. E. Gilat (Israel)
Dr. S. Hayami (Japan) *
Captain R. Herrera (Chile)
Dr. G.F. Humphrey (Australia) *
Dr. C.O'D. Iselin (IGU)
Professor A.S. Monin (USSR) *
Dr. N.K. Panikkar (India) *
Professor H. Postma (Netherlands) *
Professor E. Seibold (Germany,FRG) *
Professor R.W. Stewart (Canada) *
Professor P. Tchernia (France) *
Dr. K. Voigt (Germany,GDR) *
Professor W.S. Wooster (USA) *

REPRESENTATIVES OF INTERNATIONAL BODIES

Dr. A.R. Behnke (IUPS)
Dr. W.M. Chapman (ACMRR/FAO)
Dr. G. Giermann (UNESCO) *
Dr. R.E. Hallgren (WMO) *
Dr. A.E. Maxwell (IAPSO) *
Dr. B.E. Olson (IHB) *
Dr. M. Ruivo (FAO)

OTHER PARTICIPANTS

Dr. R.W. Bader (NASCO)
Professor K. Banse (NASCO)
Dr. A.N. Bogoyavlensky (USSR)
Professor W.V. Burt (NASCO)
Dr. P. Fye (NASCO)
Dr. B.M. Funnell (UK)
Dr. H.R. Gould (NASCO)
Mr. B.V. Hamon (Australia)
Mr. G.E. Hemmen (UK)*
Professor G. Hempel (Germany, FRG) *
Dr. A P. Lisitzin (USSR)
Dr. W.D. Nesteroff (France)
Professor G. Paulik (NASCO)
Mr. H.A. Sievers (Chile)
Professor M.B. Schaefer (USA)
Mr. R.C. Vetter (NASCO)

* attended Executive Meeting

ANNEX II

ESTIMATE OF SCOR FINANCES, CALENDAR YEAR 1968
(1 January 1968 thru 30 June 1968)

BALANCE AS OF 1 January 1968

In Rome	$ 3,916.00 *
In La Jolla	15,301.29 **
	$ 19,217.29

* 1,132.38 in Indian Rupees
** 10,170.88 in Savings Account

INCOME

UNESCO Contract	7,632.90	
National Contributions	10,508.90	
National Academy of Science, contr.	415.16	
Refund, 1967 Executive Expense	238.69	18,795.65
		$ 38,012.94

EXPENSES

Publication		430.00	
Office		1,236.64	
Work Groups			
WG 15	4,322.84		
WG 19	683.20		
WG 21	100.55		
WG 23	2,496.54		
WG 24	1,764.80		
WG 25	1,168.95	10,536.88	
Executive		875.95	
SCOR Symposium, Miscellaneous		4,453.10	17,532.57
			$ 20,480.37

BALANCE AS OF 30 June 1968

In Rome	4,132.38 *
In La Jolla	16,347.99 **
	$ 20,480.37

* 1,132.38 in Indian Rupees
** 10,170.88 in Savings Account

SCOR WORKING GROUPS
MEMBERSHIP AND TERMS OF REFERENCE
AFTER NINTH GENERAL MEETING

WG 15. Photosynthetic Radiant Energy (with UNESCO and IAPSO)

Terms of Reference: To identify exactly what measurement of irradiance is required by biological oceanographers; to recommend apparatus and procedures for measuring the variable defined above.

Members: nominated by IAPSO: J. Tyler, USA (Chairman); N. Jerlov, Denmark. nominated by UNESCO: A.A. Ivanoff, France; Y.E. Ochakovsky, USSR; J. Steele, UK. nominated by SCOR: H.R. Jitts, Australia; Y. Saijo, Japan; E. Steemann Nielsen, Denmark: ex-officio: T.R. Parsons, Canada (Chairman, WG 24).

WG 21. Continuous Current Velocity Measurement (with IAPSO and UNESCO)

Terms of Reference: to design, and propose means of carrying out an intercomparison at sea of the principal current measuring systems now employed for the continuous recording of current velocity on moored stations.

Members: nominated by SCOR: J.C. Swallow, UK (Chairman); K.A. Chekotillo, USSR. nominated by IAPSO: T. Kvinge, Norway; C. Siedler, FRG. nominated by UNESCO: N.P. Fofonoff, USA; B. Shekhvatov, USSR.

WG 23. Zooplankton Laboratory Methods (with UNESCO)

Terms of Reference: To suggest methods for preserving zooplankton samples for taxonomic study and for biomass determination.

Members: nominated by SCOR: V. Hansen, Denmark (Chairman); J. Beers, USA; H. Flugel, FRG; E. Paasche, Norway (Consultant); H.F. Steedman, UK. nominated by UNESCO: B. Kimor, Israel; T. Tokioka, Japan; M. Vinogradov, USSR.

WG 24. Estimation of Primary Production under Special Conditions (with IBP/PM)

Terms of Reference: To review and suggest the best methods for estimating primary production under special conditions, such as those found beneath the polar ice, and the turbid conditions found in estuaries, heavily polluted waters and exceptionally eutrophic or oligotrophic waters.

Members: nominated by SCOR: T.R. Parsons, Canada (Chairman); S. Ichimura, Japan; O. Koblentz-Mishke, USSR. nominated by IBP/PM: S.Z. Qasim, India; P.D.V. Savage, UK.

WG 27. Deep-Sea Tides (with IAPSO and UNESCO)

Terms of Reference: To encourage and assist with the design of instruments for measuring tides on the continental shelf and in the deep sea; to establish criteria concerning precision, sampling times and related considerations; to coordinate the observational programs and ultimately to bring about some uniform analyses of the deep sea data.

Members: nominated by IAPSO: W.H. Munk, USA (Chairman); L.R.A. Capurro, Argentina; G.C. Dohler, Canada. nominated by SCOR: D. Cartwright, UK; J.R. Radok, Australia, T. Teramoto, Japan. nominated by UNESCO: W. Hansen, FRG; M. Eyries, France; S.S. Voit, USSR; W. Horn, FRG.

WG 28. Ocean-Atmosphere Interaction (with IAMAP and IAPSO)

Terms of reference and membership being determined.

WG 29. Continuous Monitoring in Biological Oceanography (with ACMRR, UNESCO and IBP/PM)

Terms of Reference: Using the outcome of various relevant working groups of SCOR and other organizations, to review critically the present status of devices for (a) continuous observation of parameters such as pigments, particles, transparency, submarine irradiance, primary production, nutrients, and (b) continuous or intermittent sampling of organisms, and to list suitable techniques and instruments for such measurements. The WG would work, where relevant, with the Chairman or Rapporteurs of other SCOR WGs.

Members: Membership being determined.

WG 30. Scientific Aspects of International Ocean Research (with ACMRR and WMO/AC)

Terms of Reference: (1) To develop the scientific content of a comprehensive program of international cooperation in exploration and research in the ocean and its resources, taking into account the survey and proposals of the UN Secretary-General in connection with UN Resolution 2172, and also the report on International Ocean Affairs, the existing national and international programs of cooperation in ocean exploration and research, and other relevant programs and reports. (2) To comment on the practical problems of implementing such a program, including priorities and timing, taking into account the likely funds, facilities and personnel required.

Members: Membership being determined.

WG 31. East Atlantic Continental Margins

Terms of reference and membership being determined.

ANNEX IV

REPORT OF SCOR WORKING GROUP 15 ON PHOTOSYNTHETIC RADIANT ENERGY

1968 Sea Trials in the Gulf of California

Sea trials were conducted by WG-15 in the Gulf of California during the period April 29 - May 22, 1968. These sea trials were conducted in accordance with plans formulated by WG-15 during its meeting August 15-19, 1966. The data obtained are directly applicable

to the problems of measuring the radiant energy available for photosynthesis and devising simple instrumentation suitable for use by biologists engaged in research on primary productivity using the simulated in situ C^{14} method.

As planned, only five of the eight members of WG-15 were involved in these sea trials; Dr. Nils Jerlov, who was represented by Dr. K. Nygard and Mr. G. Kullenberg; Prof. Alexander Ivanoff, who was accompanied by Mr. D. Bauer; Dr. Yu Ochakovsky, who was accompanied by M.A. Suslyaev; Mr. Harry Jitts, who was accompanied by Mr. David Lockwood; and Mr. John Tyler, who was accompanied by Dr. R. Smith.

An important and unexpected feature of the sea trials was the keen interest shown in the work by Mexican scientists from the Universidad Nacional de Mexico and the Instituto Nacional de Investigaciones Biologico Pesqueras, three of whom, Dr. Armin Zarur and Dr. Anna Maria Lopez from the Instituto Nacional de Investigaciones Biologico Pesqueras and Alberto Ramirez from the Universidad Nacional de Mexico, participated in the expedition. Mr. Ramirez remained with the expedition for its entire duration.

The specific objectives of the research measurements undertaken during these sea trials were:

1) To intercompare radiometric measurements made with various instruments, many of which had been constructed especially for these sea trials, to intercalibrate the instruments and determine the probable errors.

2) To collect data which would demonstrate the accuracy of estimates of photosynthetic radiant energy based on measurements made with simple instruments employing a restricted bandwidth of wavelengths.

3) To obtain data which would assist in the development of a simple radiometric device suitable for routine use at sea.

4) To test the usefulness and accuracy of the quanta-meter, a concept generated at the 1966 WG-15 meeting, and since developed into a practical instrument by Working Group member N.G. Jerlov.

5) To intercompare photocells, thermopiles and phototubes with respect to their suitability for measuring the total radiant energy available for photosynthesis within the bandwidth 350 to 700 nm.

6) To obtain data which could be used to reveal and/or study any relationship between various biological and physical properties such as temperature, optical transmittance, chlorophyll concentration, primary productivity and radiometric spectra.

7) To obtain data on the diurnal variation of the radiant energy available underwater for photosynthesis.

A large amount of excellent, noise-free data were obtained which are directly applicable to these objectives. In most cases the data were immediately converted to graphical displays in absolute units and were intercompared before the expedition was terminated.

The entire group met in the La Paz office of the Instituto Nacional de Investigaciones Biologico Pesqueras and again on the R/V E.B. Scripps to discuss plans for future research by the Working Group. The subjects discussed and the recommendations of the Working Group are as follows:

Report of the Sea Trials: It was recognized that the unification of the data (taken by five groups from as many different countries, with notes in as many different languages), into a single report, represented an unusual problem. It was also recognized that the difficulties of post-expeditionary communication would also be an obstacle in writing the report of the sea trials.

It was agreed that each W.G. member would send the other members his basic data for information purposes.

It was agreed that the Chairman of WG-15 (Tyler) would be responsible for writing the SCOR report, presenting the scientific results of the sea trials.

Recommendation: It is recommended that WG-15 remain constituted for the purpose of writing the report of the sea trials.

1969 Sea Trials: At the 1966 meeting of the Working Group it was recommended that full-scale sea trials be conducted in June 1969. All members of WG-15 were to participate. A location was suggested, to be between the Canary Islands and the Coast of Africa. From the point of view of the members present, this date and place would still be satisfactory and some have reserved the second half of June for the purpose. However it was felt that in view of the fact that no ship had yet been secured, the time left for organizing the expedition was getting uncomfortably short.

Experience in organizing the 1968 Sea Trials has emphasized the importance of a "back-up" organization, such as the Nimitz Marine Facility, to assist in the myriad of problems associated with the ship, its equipment, and crew, and the transportation of equipment and foreign materials from many countries.

It was agreed that the Working Group would continue to plan for full-scale sea trials.

It was agreed that a "back-up" organization similar in function to the Nimitz Marine Facility at S.I.O. was a necessity.

It was further agreed that the location, per se, was not an essential feature of the full-scale sea trials, nor was the year 1969; but that a high probability of clear sky was essential to obtaining noise-free data.

Recommendations: It is recommended that full-scale sea trials be undertaken for the purpose of collecting additional data and further testing of simple instruments for measuring the total radiant energy available for photosynthesis.

It is recommended that an appropriate individual be chosen to organize the sea trials and that arrangements be made for him to work from a suitable support facility and with a ship that can accommodate 20 scientists for a period of three full working weeks plus sea-travel time to and from the work area. During this time WG-15 should have the exclusive use of the ship.

Publications: Members of the WG present agreed that sufficient progress had been made to warrant the publication of a monograph covering the subject of "Photosynthetic Radiant Energy in the Sea". This monograph would bring together current knowledge of radiant energy and primary productivity in the sea. Some suggested topics to be covered were:

Radiant energy in the sea, including data on radiant energy and attenuation coefficients for types of ocean water.

Instrumentation for measuring radiant energy.

Analytical techniques for determing primary productivity using C^{14}: (in situ and simulated in situ).

Descriptions of equipment for C^{14} work.

Relationship between radiant energy and photosynthesis.

Review of WG-15 reports.

Notation for Optical Oceanography.

Diurnal variation of radiant energy.

Estimates of radiant energy in the sea based on simple measurements at specified wavelengths.

Description and use of quanta meter.

It was suggested that the Chairman (WG-15) act as editor and that suitable sections be assigned to the various members of the Working Group. It was also suggested that at an appropriate time the Working Group should meet to work over the manuscript. Mr. Jitts stated that he would be pleased to act as host to the group at CSIRO.

Recommendation: It is recommended that Working Group-15 undertake the preparation of a monograph as outlined and that arrangements be made to have the manuscript professionally published in book form (perhaps by UNESCO).

It is recommended that Working Group-15 plan to meet to work on the manuscript at an appropriate time and place. The time and place will become evident with progress on the monograph and will be communicated to SCOR by the Chairman WG-15.

J. Tyler

ANNEX V

REPORT OF WORKING GROUP 23 ON ZOOPLANKTON LABORATORY METHODS

Meeting in Washington, 25 - 30 March 1968

The first meeting of WG 23 was held on 25 - 30 March 1968 in Washington, D.C. at the invitation of the Office of Oceanography and Limnology of the Smithsonian Institution. The following persons participated:

MEMBERS: Chairman, V. Kr. Hansen (Denmark); H.J. Flügel (FRG); B. Kimor (Israel); H.F. Steedman (UK); T. Tokioka (Japan); M.E. Vinogradov (USSR).

OBSERVERS: D.M. Damkaer (Smithsonian Oceanographic Sorting Center); D.J. Faber (Canadian Oceanographic Sorting Center); H.A. Fehlmann(SOSC); A. Fleminger (Scripps Institution of Oceanography); N.C. Hulings (Mediterranean Marine Sorting Center); P.A. McLaughlin (SOSC); E.J. Ferguson Wood (Institute of Marine Science, Miami).

A wide range of subjects pertinent to plankton fixation and preservation was discussed

in detail, and agreement was reached on a set of interim recommendations. Brief summaries of several topics, not considered in the interim recommendations, are included in Attachment I. In addition to the discussions, a comparative examination of fixation and preservation methods was carried out through the actual observation of plankton samples from several sources. Prior to this, WG 23 members had been asked to examine critically the state of preserved samples available to them and to make these samples available to the group. Samples were also furnished by the Canadian Oceanographic Identification Centre, Ottawa, Canada; the Oceanographic Laboratory, Edinburgh, Scotland; Indian Ocean Biological Centre, Ernakulam, India; and Smithsonian Oceanographic Sorting Center, Washington, D.C.

A questionnaire on standard methods employed for fixation and preservation of zooplankton samples for taxonomic studies and on biomass determinations had been prepared by the members of WG 23 through correspondence prior to the meeting; this was distributed to about 300 institutions, individuals with current sampling programs, and museums. More than 30% were returned. A preliminary analysis of the replies was made during the meeting.

INTERIM RECOMMENDATIONS ON METHODS OF FIXATION, PRESERVATION AND BIOMASS DETERMINATION

As a result of the group's activities during the meeting a set of interim recommendations on fixation procedures to be used on shipboard (items 1 - 9) on preservation and storage (items 10 - 18), and on biomass determination (items 19 - 24) were adopted. Many of these recommendations will be considered further in future discussions and experimental studies proposed by the Working Group.

Fixation of Plankton

1. Fixation should take place immediately after the catch is taken aboard.

2. Plankton samples to be used for taxonomic studies should be separated into calcareous and non-calcareous specimens prior to, or immediately after, fixation. The separation should be made by techniques, such as the gravimetric methods, resulting in minimal damage to the specimens. Great care should be taken when separating the specimens. The fixation and preservation of non-calcareous plankters should be in a 4% formaldehyde solution made up with the addition of sea water on the site (40%formaldehyde diluted in the ratio of 1:9 with sea water). Calcareous plankters should be preserved by freeze drying, in 70% ethanol or in 4% formaldehyde (as above). 40% isopropanol may be used although it causes heavy shrinkage of the tissue. If the formaldehyde is to be buffered, this should be done carefully and the pH should be checked at very frequent intervals, at least during the first three months and then later at half yearly intervals.

3. The use of buffered formaldehyde is subject to some criticism. Its use is a matter of personal choice and presently can be neither accepted nor rejected. When a buffer is needed or wanted we recommend sodium bicarbonate or calcium carbonate, until future experiments yield a better buffering agent. Sodium borate in excess may have an unfavorable effect.

4. The quality of formaldehyde should be U.S.P. or reagent grade (solutio formaldehydi concentrata) or, eventually, deionized formaldehyde.

5. The fixative should be stored, prior to use, at a temperature of 20° C or less, but still above a few degrees C° in order to prevent polymerization.

6. The sample container should always be filled completely, leaving the minimum volume of air. This reduces the movement of the specimens in the container.

7. Air proof closures should be used.

8. Immediately after adding the fixative and closing the container, the sample should be transferred and kept at a temperature somewhat cooler than sea temperature. This prevents formation of gas bubbles during the period of fixation. The sample should be kept in the dark.

9. Although plastic containers are most practical for field work, the plankton samples should be transferred into glass containers for permanent storage in laboratory or other depository.

Preservation and Storage of Plankton

10. Storage should be in the dark.

11. Ambient temperature variations, both daily and seasonal, should be kept at a minimum.

12. Glass containers with air-proof closures should always be used for long term storage.

13. Ethylene glycol (5-10%) may be added to prevent complete dessication during storage. As a fungus inhibitor, it is preferred to glycerine.

14. For preservation, formaldehyde of the quality described under (4) should be diluted with deionized or distilled water with or without addition of 3.3% NaCl.

15. Volumetric measurements should be made only when essential to the program.

16. Subsampling should be kept to a minimum.

17. Technicians should be thoroughly trained in careful handling techniques.

18. Processing (sorting) centres should be encouraged not to use stains, at least not long lasting ones, to facilitate sorting.

Plankton Biomass Determination

19. For biomass determination, whenever possible,replicate hauls should be taken, one for the purpose of biomass determination only. The use of a single sample for several purposes is not desirable.

20. If only one sample can be obtained, the subsampling should cause a minimum of damage to the plankters, and the time of handling should be kept at a minimum.

21. Measurements should be made as soon as possible after obtaining the sample. If fixation is necessary, the time between bringing the catch aboard and fixation should be kept to a minimum.

22. Sedimentation volume by itself cannot be recommended for biomass determination.

23. When measuring displacement volume, coelenterates and tunicates should be measured separately from the other plankters.

24. For exact chemical analysis freeze-drying appears to be the best preservation method, giving the least alterations in the chemical constituents of the sample.

PROPOSALS FOR FUTURE ACTIVITIES

Zooplankton Fixation and Preservation

As the result of our critical examination of plankton samples from throughout the world we concluded that now is the time to reconsider standard fixation and preservation techniques. This should be done by making detailed tests of the present methods on a range of defined plankton components (see Attachment I). Criteria for quality of fixation and preservation must be developed and defined. Long term effects of preservation should be measured by chemical, histochemical, histological and morphological tests. Electron microscopy would be considered suitable and may be essential.

New reagents which may fulfill the theoretical requirements of a stable preservative, but which so far have not been used for this purpose should be selected and tested. These experiments should preferably be conducted on a world-wide basis so that variation of climatic and other effects may be observed. The WG proposed that such an experimental program be initiated. Dr. Steedman, in his capacity as UK observer on WG 23, referred to a meeting of the British National Committee on Oceanic Research where interest and intention to assist in such a program was clearly expressed. Dr. Fehlmann, representing the Office of Oceanography and Limnology, Smithsonian Institution, expressed the strong interest of his institution in such a project; he was asked to ascertain whether his institution would be willing to accept responsibility for some of the proposed tests and experiments.

For planning and implementation of an experimental program it was recommended that a coordination body within the framework of WG 23 should be established and that Dr. Steedman be invited to be the chairman with Drs. Tokioka and Beers as members.

Zooplankton Biomass Determination

Our interim recommendations for biomass determinations are given above. The suggestion that WG 23 should consider methods for preserving zooplankton material for subsequent biochemical analysis was noted (SCOR Proc., Vol. 3, No. 2, p. 70). The wealth of recent data on changes that occur in plankton material, depending on type of preservation, timing of analysis, etc., was discussed. It was agreed that Drs. Hansen and Beers should discuss these problems and the replies to the biomass questionnaire by correspondence and determine what future action should be recommended.

Micro-zooplankton Fixation and Preservation

The growing need for proper techniques to determine the significance of micro-zooplankton, from both a taxonomic and biomass standpoint, was acknowledged. The small zooplankters such as flagellates, ciliates (including tintinnids), foraminifera, and radiolarians need to be considered separately for research and preservation.

We found that in the absence of Dr. Beers only Dr. Kimor had relevant experience in this field and concluded that no decision should be made at present as to recommendations on detailed procedures nor on the desirability of establishing a SCOR/UNESCO Working Group on micro-zooplankton. Drs. Kimor and Beers were asked to study further the problems relating to micro-zooplankton through correspondence.

Manual on Zooplankton Fixation, Preservation and Storage

We recommend that a manual describing the standards of fixation and preservation should be compiled through the effort of WG 23 and that it should be published in a loose leaf system depending on the successful outcome of the planned experiments. Existing sorting centers should be encouraged to prepare a section on procedures and techniques used at such specialized laboratories. The manual should include a bibliography.

Workshop on Zooplankton Fixation and Preservation

It was concluded that the methods of fixation and preservation used by zooplankton researchers have remained stagnant; even when considering the new efforts made and planned, we are of the opinion that the interest of these technical subjects could be intensified and new ideas brought forward by bringing zooplankton researchers together with scientists dealing with related technical problems from other fields. It was felt that the usual type of symposium was an unsuitable medium for presenting new facts, and that a workshop would be more appropriate. We therefore recommend that a workshop be organized at a suitable time. Specialists in disciplines with problems of fixation and preservation similar to those of the planktologists should be invited to contribute their experience. They should be from such fields as medicine, terrestrial biology, histology, histochemistry, pathology, food technology, etc. The proceedings would enable planktologists to evaluate and eventually to utilize the facts presented. The workshop should not be convened until sufficient information is available; it should be organized at least one year in advance.

Acknowledgements

Sincere appreciation is extended to Drs. I.E. Wallen and H.A. Fehlmann of the Smithsonian Institution, Office of Oceanography and Limnology and their staff for the hospitality and valuable assistance accorded us during the meeting. We are grateful to Dr. A. Fleminger for participating and contributing significantly to the group's activities. We also wish to acknowledge the valued contributions of the observers to our discussions and to thank the various institutions which loaned plankton samples for the comparative studies.

ANNEX V
ATTACHMENT I

OTHER TOPICS DISCUSSED BY WORKING GROUP 23

Criteria for Measuring the Quality of Fixed and Preserved Plankton

It was concluded that well defined criteria for measuring the adequacy of fixation and preservation of plankters are needed. Reports were presented by Drs. Fleminger and Flügel on their preliminary studies of morphological structures as measures for describing the state of plankton preservation. They were encouraged to continue and, if possible, to enlarge the fields of their respective investigations.

It was felt that criteria for recognizing progressive deterioration during long term storage can be found by closer histological and cytological examinations. With the development of such methods it may be possible in short periods to check whether a preservative or method can be used safely for long term storage without waiting decades for a result.

Specific groups of plankters should be accepted as monitors. We recommend six monitors: 1) calanoid copepods, 2) pteropods and Atlanta (heteropod), 3) Foraminifera, 4) chaetognaths, 5) salps and doliolids, and 6) fish larvae. Comparative tests should be made on four types of plankton: 1) fatty crustaceans, 2) non-fatty crustaceans, 3) non-crustaceans, and 4) calcareous plankton. It was decided to refer further details of these problems to our proposed implementation of comparative studies of fixation and preservation methods.

Comparison of State of Preserved Plankton Samples and Recommendations for Continued Studies

The members of the WG 23 carried out comparisons of the state of preservation of plankton in samples collected by R/V "Anton Bruun" during IIOE and stored separately at IOBC and SOSC. In addition, a variety of other samples brought by us were exhibited and studied. Although moderately different views were sometimes expressed regarding the condition of different taxonomic groups in the collection, it was agreed that the comparisons were highly informative since they provided an opportunity to compare material treated in a similar fashion but stored under a variety of climatic and ambient shelf conditions. The comparative studies indicated that it is possible to attribute the causes of improper state of preservation to factors such as 1) fixation made too long after death, 2) too weak formaldehyde concentration used for fixation and/or preservation, 3) duration of sorting too long and combined with a too weak preservative. Extension of these comparisons to the IIOE collections held by other participating institutions may clarify significant aspects of the problem of preservation.

The International Collection of IOBC provides an excellent opportunity to broaden these observations since parallel collections treated in a similar manner on board ship have been maintained partly by the donor institutions and partly by the IOBC. We recommend that these comparisons be made by specialists who have worked on the national IIOE collections of the donor institutions. Approximately ten IOBC samples in generally poor condition from each of the national collections listed below should be compared with available samples collected at similar stations and fixed in a similar manner but stored in the country of the donor institution. Each IOBC sample chosen should be represented by a small aliquot of the archive fraction, a small aliquot of the residue fraction, and by one or more sorted categories, the choice being according to the specialities of the senior investigators who have been examining their IIOE national collection. The specialist should compare the preservation of both external features and prominent internal organs among the taxonomic groups they will consider. Comparisons should be made with the national collections of at least the following national IIOE collections: Institute of Oceanology, Moscow, USSR, R/V "Vityaz"; Institute of Marine Research, University of Kiel, FRG, R/V "Meteor"; National Institute of Oceanography, Wormley, England, R/V "Discovery"; Scripps Institution of Oceanography, La Jolla, USA, R/V "Argo"; Tokyo Fisheries University, Tokyo, Japan, R/V "Umitaka Maru"; "Koyo-Maru", "Oshoro-Maru", and "Kagoshima Maru"; Smithsonian Oceanographic Sorting Center, Washington, D.C., USA, R/V "Anton Bruun".

MISCELLANEOUS NOTES AND REPORTS ON TOPICS UNDER THE TERMS OF REFERENCE OF WG 23

1) Oxidation of Formaldehyde. A proposal by Mr. R.I. Currie to prevent oxidation of formaldehyde in a container by placing a layer of liquid paraffin on the top of the preserving fluid was considered. It was noted that there often are two types of collections, "archives" and "daily use". The former type might be sealed as proposed, whereas this is not practical in the latter type.

2) Narcotization. The necessity of narcotizing specific plankton groups such as siphonophores and ctenophores was discussed. We agreed to refer at present to methods described in publications such as:

G. Tregouboff and M. Rose: Manuel de Planctonologie Mediterraneenne. Tome I, Paris, 1957.

R. Wagstaffe and J. Havelock Fidler: The Preservation of Natural History Specimens 1. Invertebrates, London, 1955.

J. Marr: Some Notes on the Preservation of Marine Animals. J. Cons. Explor. Mer, 28 (1): 121-125, 1963.

3) The International Collections, Indian Ocean Biological Center, Ernakulaum, India. WG 23 noted the draft report of the 6th meeting of the Consultative Committee of the Indian Ocean Biological Center and the resolution on preservation of the IOBC International Collection. It was agreed to draw their attention to the interim recommendations given above on methods of fixation, preservation and biomass determination.

WG 23 will review and report to the UNESCO curator of the IOBC their proposals with regard to Mr. T. Balachandran's report on Experiments of Fixation and Preservation of Zooplankton. (Mr. Balachandran has been allotted the responsibilities of these studies at the IOBC.)

4) Miscellaneous Fixatives and Preservatives. A report was presented on Dr. Beers' tests on plankton fixation in glutaraldehyde and subsequent preservation in 70% ethanol. A preliminary check showed a seemingly wide degree of variability in the state of preservation of the samples. After further study Dr. Beers will report his conclusions.

Dr. Flugel suggested fixation of micro-organisms in glutaraldehyde and post-fixation in a Dowacide solution.

Internal reports from various institutes on the use of Phenoxetol solutions as a preservative and as a medium during sorting and display of specimens were discussed. It was noted that bulk use of Phenoxetol should be considered with some caution.

As for the fixatives, it was concluded that it may be difficult or impossible to find a fixative more satisfactory than formaldehyde but esters may prove better preservatives than aldehydes and alcohols

5) Displacement Volume. Dr. Vinogradov reported on a standard Russian procedure for measuring the displacement volume. Before the measurement is made all specimens untypically large in size for the type of net used, together with post-larvae and older fishes, are removed. Dr. Vinogradov was asked to report to the WG on the improved instrument for measuring the displacement volume and also other relevant information.

6) Microplankton. Dr. Ferguson Wood happened to be at the Smithsonian Institution and he was invited to join this session. He informed us that a U.S. working group on microplankton consisting of Drs. Holmes, Snyder, Norris and himself is studying the problems of microplankton fixation and preservation and will report at a later date. It was also noted that a booklet on phytoplankton methods is planned by ICES.

7) British National Committee of Oceanic Research. Dr. Steedman, member of and observer for the Working Group on Zooplankton Laboratory Methods of the BNCOR, gave a report on its meeting held in February of 1968. WG 23 welcomes the invitation of the British Working Group as to how they can implement or assist the work of WG 23. Dr. Steedman was asked to inform his Working Group of our proposals and to examine future cooperation.

8) International Association of Biological Oceanography. The Symposium on Design and Analysis in Plankton Sampling, of the International Association of Biological Oceanography, IUBS, was noted. We regret that the timing of the Symposium and of our meeting was such that they could not have been held in succession.

ANNEX VI

REPORT OF SCOR WORKING GROUP 25 ON NUTRIENT CHEMISTRY

We have taken our objective to be to consider the possibility of bringing about some measure of uniformity in the methods for the analytical determination of the chemical nutrients in sea water and, if we decide that this can and should be done, to recommend active steps which might accomplish it.

The substances which we have considered to be involved are those conventionally included in oceanographic surveys: inorganic phosphate, nitrate, nitrite, silicate and ammonia. We acknowledge that there may well be other substances involved in the productivity of the sea, but the very fact that there is some question as to the nature of their involvement makes them a separate problem, and we have accordingly limited our consideration to the five first mentioned.

We are aware that this is not a new problem and that other groups have faced the same question as far back as 1935 when a committee was established by ICES under the chairmanship of Hermann Wattenberg, to consider the standardization of methods for plankton nutrients. It may be noted that this committee surveyed the methods then available, but came to the conclusion that it was too early to attempt standardization. At the present time there is another committee of ICES, under the chairmanship of Dr. Klaus Grasshoff, with very nearly the same objective. This group consists of eleven active chemists, in as many different European countries, who are continually carrying out analyses of sea water. To make their work more uniform they exchange their experiences by means of a technical information bulletin issued by ICES. The first of these bulletins has just appeared and its preface contains the following statement:

"Marine chemistry is an expanding science, and this implies an increase of research and survey work in this field. The methods and instruments for sea-water analysis are in a developing stage, and they are, in many cases, far from sufficient. Only practical experience and trials can show whether new methods are suitable and represent improvements. Rapid exchange of experience on new methods and instruments, as well as experiences from intercalibration trials, shall also be among the main purposes of this sheet."

Our survey of current methods for sea-water analysis reveals the fact that for the five nutrient substances with which we are concerned, the present methods are almost without exception colorimetric or spectrophotometric. The universal method for phosphate is the old Deniges reaction ("ceruleomolybdate"), the blue color developed by reduction of the phosphomolybdate complex formed when molybdate and sulphuric acid are added to the sample. Modifications consist of changes in the proportions of reagents, the choice of reducing agent, the time, the temperature and the other conditions under which the reaction is carried out.

The determination of nitrite is one of the simplest and most satisfactory methods, consisting of the formation of a highly colored dye by combination of a coupling agent (such as alpha naphthylamine or, now commonly, N-(1-naphthyl)-ethylenediamine) with the diazo compound formed when the nitrite in the sample is combined with sulphanilic acid or sulphanilamide. This description itself suggests the possible modifications.

Nitrate - long a troublesome factor to analyze - is now universally determined by reduction to nitrite and determination as such. The reducing agent, however, and the conditions under which it is used, are matters of critical choice.

Silicate is determined by a method closely related to that for phosphate. Silicate in the sample forms a yellow complex with molybdic acid (ammonium molybdate plus sulphuric acid) which may itself be measured spectrophotometrically or reduced to a more intense blue

colored compound before measurement of color. While there is latitude for some choice of conditions, the principal choice is whether or not to reduce.

For ammonia there are one or two available color reagents, but they are not altogether satisfactory. A recent suggestion is to oxidize to nitrite and measure as such, but there has been little experience with this method. Old methods involve distillation of some kind and are laborious.

There are various means of making the final measurement in each case. Filter photometers measure the intensity of color in a selected narrow band, while spectrophotometers make similar measurements in still narrower bands, approaching single wavelengths. Numerical results can vary somewhat, depending upon the choice between these two types of instruments. Apparently all present makes of spectrophotometers are equally effective, although this has not been positively confirmed.

Older methods of visual color comparison seem to have been entirely abandoned, although they are available as a last resort.

In any survey of methods from the standpoint of precision we must consider the purpose of our analyses and the use to be made of them. In order to distinguish between fertile and non-fertile areas, for example, a method with an accuracy of, say, two per cent might be satisfactory, while much better precision would be necessary if one were interested in "material budgets", particularly in deep water where differences in concentration are slight. We recognize, of course, the difference between precision, the susceptibility of a method to random errors, and accuracy, the deviation from a true value. It is possible that the recommendation of standard methods should depend upon these considerations.

This brief survey will indicate that at least for the first four of the nutrient substances there is in each case no very fundamental difference in method, but only in rather minor details. However, unless the details are agreed upon results will vary, sometimes considerably. Even when different workers carry out analyses upon the same material by ostensibly identical methods there is sometimes discrepancy in their results which cannot be explained. Reasons for such behavior must be found.

It is our considered opinion that for the nutrients nitrate, nitrite, inorganic phosphate and silicate the development of methods is now sufficiently advanced to offer a hope for uniformity. We do not feel justified as yet, however, in recommending in any case a single, detailed method for exclusive and universal use. This is more particularly true for ammonia, for which available methods are still too uncertain. This situation may well improve, however.

We note a statement in the ICES information bulletin above cited:

"Experience has shown that the single solution method by Murphy and Riley is the best and most suitable phosphate analysis method for routine work at sea".

While this may very well be true, it is nevertheless the opinion of two workers, and others accustomed to some other modification may think it too optimistic. What we need is agreement on such a conclusion.

We therefore suggest and recommend an intercalibration or intercomparison experiment on a large scale, similar to smaller ones which have already been carried out. Uniform samples (probably standard nutrient solutions now available from Japanese sources and whose stability has been proven) should be analyzed independently by a considerable number of institutions, each using its own method. Results might not be conclusive, but at least we would have better information than we now have. If such sample material as this were used it would

not be necessary to collect all workers together or to carry out the project at sea. It must be admitted that certain points in the field procedure would not thus be covered, such as the technique of taking the samples from the sea. Uniformity on these points might well be accomplished by other means.

We believe that further progress toward the standardization of methods, including the planning and administration of an intercalibration experiment such as we have suggested, can only be carried out by an organized group of qualified chemists active in this field. The subcommittee of ICES, already referred to, is in this regard the best qualified one with which we are familiar, although its interest includes other aspects of sea-water chemistry than the analytical determination of nutrients. Since it seems unnecessary and impractical to duplicate the effort, we recommend that SCOR support the activity of this group and ask it to undertake a more intense study and intercomparison of the methods for determination of nutrients, in the hope that such a study may lead to the choice of standardized or recommended methods. We also suggest that SCOR urge its national committees and associated institutes to give increased attention to this important problem and to cooperate in the activities of the ICES group.

We would call attention to the availability of stable standard solutions of all the principal nutrients (from Japan). We believe that the use of these or similar standard solutions is a desirable step in the direction of uniformity of methods.

We issue a strong caution that whatever steps are taken toward uniformity there should be no implied restraint on the search for improvements. Analytical techniques are improving rapidly and it may very well happen that new developments in column or gas chromatography, spectometry, or radiochemistry, for example, will open up new opportunities and more sensitive methods. Automation of analytical methods is developing rapidly and will become more important in large oceanographic operations; provision for this must be made in any directions for analytical procedures.

Finally, we feel that this Working Group has done the exploratory work expected of it and we recommend that it be discharged and the problem be further pursued in the manner suggested.

N.W. Rakestraw

ANNEX VII

SELECTED RECOMMENDATIONS FROM 8th MEETING OF IOC BUREAU AND CONSULTATIVE COUNCIL

LONDON, 10-14 JUNE 1968

8.4 The Bureau, having considered together with the Consultative Council perspectives of further development of the IOC in the light of the proposals made by the Secretary-General of the United Nations under Resolution 2172 (XXI), came to the conclusion that thorough preparatory work is needed in order to formulate in detail the required framework of the future administrative arrangements for the work of the broadened IOC and of its Secretariat. The Bureau decides that this work could best be done by a small group of consultants consisting of the Bureau itself and representatives from SCOR, ACMRR, UNESCO, FAO and WMO. This group should meet in September - October 1968 and produce the appropriate proposals for consideration by the 9th Meeting of the Bureau and Consultative Council in early 1969. These proposals should be made available to the Bureau and Consultative Council not later than 15 November 1968.

The terms of reference of this group of consultants have been approved by the Bureau and the Consultative Council as follows:

(i) To consider in the light of the present understanding of the expanded programme of international cooperation in marine science, as stems from the Report on International Ocean Affairs and Resolutions of the Fifth Session of the IOC, Proposals of the UN Secretary-General and the Programme envisaged in Rec. 8.18, the future workload of the Commission, its subsidiary bodies and its Secretariat;

(ii) To formulate on the basis of (i) above the estimated requirement for means and facilities, including finance, which will be needed to meet the workload associated with the expanded programme;

(iii) To propose details of the administrative structure of the Commission and of its Secretariat, and basic principles of legal, organizational, administrative and financial relationship of the Commission and its Secretariat with the prospective sponsoring organizations.

8.10 The Bureau, having examined with the Consultative Council the lists of names of experts on variability proposed by SCOR/IAPSO/IABO and by ACMRR, and having the benefit of the advice of UNESCO and ICES, decided to invite the following scientists to serve on the IOC Group of Experts on Ocean Variability established under Resolution V-20 D:

Physical variability

Dr. C. Mann (Canada)
Dr. J. Swallow (UK)
Dr. F. Webster (USA)
Dr. Rybnikoff (USSR)
Dr. M. Eyries (France)
Mr. B. Hamon (Australia)

Biological variability

Dr. A. Longhurst (UK/USA)
Dr. M. Anraku (Japan)

Chemical variability

Dr. K. Grasshoff (FRG)

8.18 The Bureau and Consultative Council noted with satisfaction the progress with the short and long-term planning and coordinating of cooperative oceanographic research activities under the auspices and on the initiative of the IOC and observed that approved international programming (CICAR, Southern Ocean, North Atlantic, Mediterranean) covering important areas of the World Ocean will require for implementation much time and considerable effort on the part of the IOC and its member states. The Bureau and Consultative Council also noted with satisfaction the proposal of the Secretary-General of the United Nations that a broadened IOC play the key role in the formulation and coordination of an expanded international programme of oceanic research which will broaden international cooperation as emphasized in UN Resolution 2172 and 2340.

The Bureau and Consultative Council recognized the importance and scientific value of proposals such as the General Scientific Framework for World Ocean Study and long-term re-

search programmes already in existence (e.g. Resolution IOC II-2) and considered the proposal of the USA for an International Decade of Ocean Exploration as a useful initiative for broadening international cooperation.

The Bureau and Consultative Council endorsed the concept of an expanded, accelerated, long-term, and sustained programme of exploration of the oceans and their resources, including international programmes, planned and coordinated on a world-wide basis, expanded international exchange of data from national programmes, and international efforts to strengthen the research capabilities of all interested nations. As initial steps to implement such a programme, the Bureau resolved:

(i) to request the small group of consultants established under Recommendation 8.4 to consider the budgetary and organizational implications for the broadened IOC of such an expanded programme and to report to the Bureau and Consultative Council at their 9th meeting;

(ii) to request that members of the Commission send in before the end of 1968 proposals for such an expanded programme;

(iii) to submit these national proposals to the 9th meeting of the Bureau and the Consultative Council, at which time a working group should be established by the Bureau with the task to prepare proposals for an expanded programme for consideration by the Sixth Session of the IOC in 1969;

(iv) to invite other international organizations concerned to participate in the formulation, development and implementation of such an expanded programme by the broadened IOC;

(v) to request the Chairman of IOC that he inform the Secretary-General of the United Nations that IOC is prepared to play a leading role for the planning, development, implementation, and coordination of such an expanded programme;

(vi) to invite SCOR, ACMRR and other interested scientific bodies to give early consideration to the scientific content of such an expanded programme.

8.19 Noting the proposal concerning a continuing programme in solid earth physics recently presented to IUGG by the American Geophysical Union, the decisions of the CSK Coordinating Group to extend its programme to the field of marine geology and geophysics and the interest of Japan and other countries in conducting cooperative geological and geophysical investigations in the Western Pacific, also noting the recommendation for a programme of research in marine geology and geophysics of the Sunda Shelf as formulated by the Fourth Regional Meeting of Marine Science Experts in East and South-East Asia (Doc. IOC/B-35), recalling Resolution V-12 concerning the Upper Mantle Programme and the project for a Trans-oceanic Geotraverse and in view of the importance attached to the Commission's role in marine geological and geophysical investigations, the Bureau decides:

(i) to request SCOR to advise on means whereby the Commission could take effective action on these proposals;

(ii) to ask the working group referred to in Recommendation 8.18, to consider these concepts and programmes when preparing proposals for an expanded programme of world ocean research and exploration.

ANNEX VIII

EXTRACT FROM DRAFT REPORT

FAO ADVISORY COMMITTEE ON MARINE RESOURCES RESEARCH

ROME, 8-13 JULY 1968

Implementation of UN Resolution on Resources of the Sea and Related Matters

The Committee considered the report and proposals of the Secretary-General of the United Nations regarding an expanded program of international cooperation to assist in a better understanding of the marine environment through science ("EPIC") (contained in UN document E/4437) and the United States initiative for an International Decade of Ocean Exploration (as set out in a report by the National Council on Marine Resources and Engineering Development of May 1966). The relationship between the concepts was examined and the Committee came to the conclusion that the Decade could form an important initial stage of EPIC as well as make a substantial contribution to other activities contemplated in the Secretary-General's report. The Committee considered it essential that this relationship be understood in order to ensure that the two concepts achieved their common purposes and to avoid confusion and conflict.

The Committee gave similar consideration in relation to EPIC to the Marine Productivity Program (PM) under the IBP. It noted that under present arrangements the IBP ends about 1972 and therefore that during the next few years consideration will be given to the question of continuation of activities started under it. The Committee was informed that most, if not all of the projects now planned, or being implemented, in the national PM programs for the IBP could be considered as within the scope of EPIC however that might eventually be defined. It therefore would seem appropriate to take account of the PM programs in the initial formulation of EPIC and to consider the possible continuation of these in the 1970's as an integral part of the first phase of implementation of EPIC.

The Committee noted that in a recommendation (8.18) on this subject adopted at their 8th meeting, the Bureau and Consultative Council of IOC had invited SCOR, ACMRR and other interested scientific bodies to give early consideration to the scientific content of EPIC and the Decade. SCOR at its 9th General Meeting had proposed that the joint ACMRR/SCOR/WMO(AC) Working Group on the implementation of the United Nations Resolution on the Resources of the Sea be convened in the Spring of 1969 to consider these matters. The Committee further noted that the Secretary-General of UN had proposed that work started by the Joint Working Party in the identification of specific scientific problems which require expanded international cooperation be continued.

The Committee was informed that the Director-General of FAO, in line with the views expressed by the Committee on Fisheries, was preparing for participation by FAO in EPIC and in the broadening of the IOC and that he would welcome the views of the Committee on the scientific aspects of preparing and implementing such an expanded program.

The Committee agreed that a joint working party similar to the Joint ACMRR/SCOR/WMO (AC) Working Group on the implementation of the UN Resolution on the Resources of the Sea would be an appropriate body for the task contemplated by the UN Secretary-General, IOC and the Director-General of FAO, but that the membership and terms of reference of the original Joint Group would require modification. Membership should cover the various disciplines that may be involved in an expanded program; approximately fifteen members should be selected from the fields of marine geology and geophysics, chemistry, physical oceanography and meteorology, and biology and fishery science in proportions approximately 4:2:4:5.

The Committee accordingly recommended that for the purpose of assisting in the preparatory actions now going forward a Joint Working Party on the Scientific Aspects of International Ocean Research be established. Its members and officers should be nominated in consultation

among the officers of ACMRR, SCOR and the appropriate scientific advisory body of WMO and designated in accordance with their respective statutes. The Joint Working Party should meet in the Spring of 1969 for about 10 days, preferably at a place favouring undisturbed work, and submit its report promptly to the appropriate officers of the nominating bodies who would have the responsibility for its timely transmission, with comments as may be appropriate, to the IOC and to the Executive Heads of FAO, UNESCO and WMO. The presiding officers of the nominating bodies and representatives of the above agencies should participate in the work of the Joint Working Party and its secretariat should be provided among the several entities concerned.

Noting that the scope of the Secretary-General's proposals for EPIC had not been precisely defined, the Committee recommended that the terms of reference of the Joint Working Party should be as follows:

1. To develop the scientific content of a comprehensive program of international cooperation in exploration and research in the ocean and its resources, taking into account the survey and proposals of the UN Secretary-General in connection with UN Resolution 2172, and also the Report on International Ocean Affairs, the existing national and international programs of cooperation in ocean exploration and research, and other relevant programs and reports.

2. To comment on the practical problems of implementing such a program, including priorities and timing, taking into account the likely funds, facilities and personnel required.

The International Program referred to in the above terms of reference encompasses "marine environment" as in the American usage of this term. It would therefore include, as far as fishery matters were concerned, oceanographic research of relevance to fishery research and development, and also such scientific activities as the identification, measurement and assessment of fish stocks, international aspects of the study of marine animal behaviour, marine ecology and zoogeography in relation to the rational exploitation and improvement of the living aquatic resources. For proper formulation of such a program studies of the kind being undertaken in relation to the marine fishery resource aspects of the IWP had an essential role, and the program should provide for arrangements for a continuing review and updating of IWP-type studies to help in the identification of gaps in knowledge, and recognition of new lines of investigation research calling for international coordination and support. A comprehensive program thus includes the concept of the International Decade of Ocean Exploration in so far as it has yet been defined, important elements of IGOSS and of WWW, and the research activities of the PM Section of the IBP, as well as the World Appraisal of Marine Resources Research as proposed earlier by the ACMRR and the continuation of more fishery resource data appraisal begun in connection with the IWP.

The Committee recognized that the arrangements for formulation and coordination of such a wide program of research comprising both the ocean itself and its resources as defined above would depend upon the eventual determination of the scope of, or the kinds of activities to be included in EPIC, and consequently on the progress of actions for the broadening of the IOC proposed by the Secretary-General of UN as a matter of urgency.

The Committee agreed that an appropriate modification of the IOC statutes for this purpose as suggested by the Secretary-General would be necessary to enable the IOC to serve, by the implementation of EPIC and in other ways, the needs of member states and of the organizations of the United Nations family concerned with promotion and application of marine science. The urgency of this matter had become even greater because of the initiative for an International Decade of Ocean Exploration for which the broadened IOC could provide a suitable international planning and coordination mechanism.

Because the Committee was convinced of the urgency of this matter it welcomed the preparatory actions undertaken by the Bureau and Consultative Council of IOC at its 8th Session and

particularly the Bureau's decision (Recommendation 8.4) on inviting a group of consultants including representatives from ACMRR to consider the future workload of the Commission, its subsidiary bodies and its Secretariat, to formulate requirements in this connection and to make proposals in regard to organizational, administrative and financial matters in this context. The Committee recommended that it should be represented on this occasion by its Chairman or his nominee and by its secretary.

The Committee noted that the International Decade proposal included "the development of improved oceanwide data collection, processing and services" as one of the basic categories of projects that might be undertaken. In the Committee's opinion this category could be taken to include, in addition to relevant programs of the WWW, important elements of IGOSS, the progress in the planning of which, in accordance with the decisions reached at the 5th Session of the IOC, was welcomed by the Committee. The Committee emphasized the key importance of IGOSS for fishery research and development, expressed its readiness to assist in the planning of IGOSS, and recommended this initiative of IOC as one in which FAO should take a very active interest. The Committee considered that the implementation of IGOSS would form a valuable part of EPIC. It therefore hoped that suitable arrangements would be made to ensure adequate financial support for IGOSS.

The Committee, considering the vital importance of effective collaboration between FAO and UNESCO/IOC in the field of marine science and fisheries, appreciating the approaches made to this and by the Director-General of FAO and UNESCO and of the Chairman of IOC, expressed its satisfaction with the joint action by UNESCO and FAO, as set forth in the Aide-Memoire on Joint Action by UNESCO and FAO in the Field of Marine Science and Fisheries of 3 May 1968, and welcomed the steps taken by the Director-General of FAO to implement the Aide-Memoire which provided for early exchange of draft programs and budgets, consultation on planning of IOC activities, the outposting of a senior FAO officer to Paris, UNESCO assistance to FAO activities in documentation and related services and other cooperative arrangements. These measures were designed particularly to contribute towards the strengthening and broadening of the IOC and were subject to review, depending on the progress made in that direction.

The Committee recommended that in the further strengthening of the ties between FAO and UNESCO in this field, closer coordination of the regional activities of the two organizations in marine science should be attained, preferably, as in those of the IOC, on the basis of ocean areas.

The Committee was informed of decisions taken by the Executive Committee of WMO at its recent twentieth session with regard to the strengthening of the marine component of that Organization and its cooperation with other international organizations in the field of marine science and its application. An important decision was the establishment of a WMO Executive Panel on Meteorological Aspects of Ocean Affairs composed of Members who are active in marine matters. Ten Member Governments are invited to designate experts to serve on this Panel; the President of the WMO Commission for Maritime Meteorology was designated by the Executive Committee as an ex-officio expert of the Panel. The Panel is to act as the focal point for all WMO activities relating to meteorological aspects of ocean affairs and, amongst other things, it should effect the closest collaboration with the Working Committee of the IOC on IGOSS to ensure that there is consistency in the planning and implementation of the IGOSS on one hand and of the World Weather Watch on the other. The WMO Executive Committee had also decided that WMO participating through designation of experts in joint working groups of expert advisory bodies (such as the joint ACMRR/SCOR/WMO(AC) Working Group on Scientific Aspects of Implementation of UN Resolution 2172) should be strengthened. Negotiations will be opened with the Director-General of UNESCO regarding the designation of a WMO liaison officer with UNESCO to collaborate with the Secretary of IOC on scientific and technical aspects of oceanographic projects involving meteorology. The WMO Executive Committee proposed that the liaison officer would remain stationed in WMO Headquarters on the understanding that, when specific projects

so require, he would be available to work for short periods of time at the UNESCO Headquarters.

In the view of ACMRR all these actions by WMO are to be welcomed as furthering that development of cooperation and coordination in the field of ocean research which is so essential to securing an improved and sustained yield from ocean resources for the benefit of mankind.

ANNEX IX

REPORT TO SCOR ON THE TENTH MEETING OF SCAR 3-15 JUNE 1968

The Tenth Meeting of SCAR was informed of the discussions on The Southern Ocean that have been held by the SCOR Executive over the past two years and SCAR welcomes the growing interest of SCOR and IOC. SCAR strongly supported the conclusions of SCOR that Antarctic Oceanography must be advanced by means of work on limited objectives and that much concentration is needed on the development of theories and techniques.

As has been reported to SCOR previously, following the SCAR/SCOR/IAPSO/IUBS Symposium on Antarctic Oceanography, Santiago, September 1966, the SCAR working group on oceanography did define three topics that required immediate attention and SCAR established three small groups of specialists to consider what might most profitably be done in these fields. These fields are:

1. The interdisciplinary problems associated with the freezing of sea water (The Pack Ice Zone).

2. Benthos.

3. Bottom water formation.

Work has actually commenced in connection with the last mentioned with the cooperative US/Argentina/Norway/FRG study of the Weddell Sea. Proposals regarding the other two topics are expected in the not-too-distant future, for example, the final report and proposals of the Pack Ice Zone group will be produced during the September 1968 SCAR/IASH Symposium on Antarctic Glaciological Exploration. However, it seems almost certain that while this report will state the requirements for future studies, it will again emphasize the great logistic difficulties of making measurements in the pack ice, and in winter and spring.

It seems likely that the SCAR working group on logistics might be called upon to examine this problem which is common to a number of scientific disciplines and SCOR recognized its importance when proposing terms of reference for the IOC Coordination Group.

SCAR welcomed the formation of the IOC Group and advised SCOR accordingly. It was felt that such a group under IOC could perform a valuable function, particularly with regard to the distribution of information about ongoing and planned activities. It was felt that, provided the group worked within the terms of reference proposed by SCOR and adopted by IOC, considerable benefit to Antarctic Oceanography would result. SCAR expects to continue, in close collaboration with SCOR, to be responsible for the development of marine science programs in Antarctic and with the promotion of scientific discussions when needs arise and will cooperate fully with the relevant Association of ICSU Unions.

The publication of the Proceedings of the SCAR/SCOR/IAPSO/IUBS Symposium on Antarctic Oceanography has unfortunately been delayed. However, these Proceedings are now in page-proof form and publication is expected about September 1968. This will include the main invited papers in full, abstracts of the supporting contributions and summaries of the discussion and recommendations. The selling price will be between $4.00 and $5.00, but a number of copies will be presented to the sponsoring bodies, including SCOR.

At the Tenth Meeting of SCAR, the SCAR permanent working groups on Geology and Solid Earth Geophysics met and it became apparent that there was a growing need for these groups, which have hitherto been concerned primarily with the continent, to seek information from their colleagues in the marine disciplines.

Geologists are nearing the completion of the preliminary geological mapping of exposed parts of the Antarctic and are now looking to the more sophisticated geophysical techniques to provide information about the earth's surface layers beneath the ice.

In order to further the understanding of the geological, climatic and floristic and faunistic histories of the Antarctic land masses and their relationship with the other southern continents and to try to elucidate further the Gondwanaland Theory it is becoming increasingly evident that there is a need for more information about the ocean floor, particularly in the Scotia arc, where the Andes extend to and into the Antarctic continent.

The geology Working Group of SCAR therefore wishes to develop a direct close liaison with SCOR and with CMG of IUGS and any suggestions from SCOR as to how this might best be achieved will be welcomed.

In August 1970 there will be a symposium on Antarctic Geology, which will include geophysics and while the program has not yet been developed, it is almost certain to include marine geology and geophysics, particularly insofar as they relate to the study of the continental land mass. It is not yet clear whether much attention will be given to the relationship with surrounding continents because it is believed that a symposium on Gondwanaland is being planned elsewhere for 1970.

At the present time there is no Secretary of the SCAR working group on oceanography, but all working group matters are being handled through the SCAR Secretariat in Cambridge.

Finally, SCOR might be interested to learn that SCAR agreed to convey to its National Committees the Soviet National Committees' request that SCAR draw attention to the importance of investigations of the inshore waters of the Bellingshausen, Weddell and Lazarev Seas, and of the need for timely transmission of oceanographic data resulting from Antarctic cruises to both WDC-A and to WDC-B.

G.E. Hemmen

ANNEX X

SCIENTIFIC EXPLORATION OF THE SOUTH PACIFIC

Program of the Symposium presented on 18-20 June 1968 during the Ninth General Meeting of SCOR, Scripps Institution of Oceanography, La Jolla, California.

PROGRAM

Introduction	Capt. L.R.A. Capurro, Argentina
Climatology and Meteorology	
General Comments	Prof. A.S. Monin, USSR
Tropical and Mid-latitude	Prof. C.S. Ramage, USA
Physical Oceanography	
General Comments	Dr. B. Warren, USA
Western Boundary Currents	Mr. B.V. Hamon, Australia
Eastern Boundary Currents	Prof. W.S. Wooster, USA
The Chile Current	Mr. H. Sievers, Chile
Equatorial Circulation	Dr. M. Tsuchiya, Japan
Variation of Equatorial Currents	Mr. H. Rotschi, France
Geosciences	
General Comments	Prof. H.W. Menard, USA
Sedimentation and Geochemical Considerations	Dr. A.P. Lisitzin, USSR
Micropaleontology	Dr. B. Funnell, UK
Structure and Morphology	Dr. R.E. Houtz, USA
Biological Oceanography	
General Comments	Prof. G.A. Knox, New Zealand
Primary Production	Dr. O. Koblentz-Mishke, USSR and Prof. S. El-Sayed, USA
Plankton Biogeography and Ecology	Prof. B.M. Bary, Canada
Equatorial Macroplankton	Mr. M. Legand, France
Fish Biogeography and Ecology	Dr. G. Mead, USA
Commercial Fisheries	Dr. H. Kasahara, Japan

ANNEX XI

MEETINGS OF SCOR AND ASSOCIATED ORGANIZATIONS IN 1968

19 - 28 August	Prague	International Union of Geological Sciences; Commission for Marine Geology, International Association of Geochemistry and Cosmochemistry
9 - 14 September	Arcachon (France)	3rd European Symposium on Marine Biology

16 - 20 September	Paris (UNESCO)	IOC WG on legal questions related to scientific investigations of the ocean. 1st meeting.
17 - 20 September	Geneva (WMO)	IOC/WMO Joint Panel of Experts on telecommunication. 1st meeting.
23 - 26 September	Paris (UNESCO)	IOC WG on oceanographic data exchange. 4th meeting.
28 Sept. - 3 Oct.	Paris	ICSU General Assembly
30 Sept. - 9 Oct.	Copenhagen	ICES, 56th Statutory Meeting
October	Paris (UNESCO)	IOC Group of Consultants
18 - 23 November	Koror (Palau Is.)	SCIBP, Symposium on Productivity and Conservation of Coral Reefs
18 - 26 November	Curacao, Netherlands Antilles	UNESCO/FAO Symposium on investigations and resources of the Caribbean Sea and adjacent regions.
25 - 26 November	Curacao, N.A.	IOC CG for Cooperative Investigations of the Caribbean and Adjacent Regions (CICAR)
2 - 4 December	Paris (UNESCO)	IOC WG on training and education in oceanography, 1st meeting.

IN 1969

29 - 31 January	?	SCOR Executive Committee
3 - 7 February	Woods Hole	IOC, 9th Meeting of Bureau and Consultative Council

ABBREVIATIONS

ACMRR	Advisory Committee on Marine Resources Research, FAO
CG	Coordination Group
CICAR	Cooperative Investigations of the Caribbean and Adjacent Regions
CMG	Commission on Marine Geology (of IUGS)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CSK	Cooperative Study of the Kuroshio
ECOSOC	Economic and Social Council, United Nations
EPIC	Expanded Program of International Cooperation
FAO	Food and Agriculture Organization of the United Nations
FRG	Federal Republic of Germany
GDR	German Democratic Republic
IABO	International Association of Biological Oceanography (of IUGS)
IAMAP	International Association of Meteorology and Atmospheric Physics (of IUGG)
IAPSO	International Association for the Physical Sciences of the Ocean (of IUGG)
IASH	International Association of Scientific Hydrology (of IUGG)
IBP/PM	International Biological Programme/Productivity Marine
ICES	International Council for the Exploration of the Sea
ICNAF	International Commission for Northwest Atlantic Fisheries
ICSU	International Council of Scientific Unions
IGOSS	Integrated Global Ocean Station System (of IOC)
IGU	International Geographical Union
IHB	International Hydrographic Bureau
IIOE	International Indian Ocean Expedition
IOBC	Indian Ocean Biological Center
IOC	Intergovernmental Oceanographic Commission
IUBS	International Union of Biological Sciences
IUGG	International Union of Geodesy and Geophysics
IUGS	International Union of Geological Sciences
IUPAP	International Union of Pure and Applied Physics
IUPS	International Union of Physiological Sciences
NASCO	National Academy of Sciences Committee on Oceanography (USA)
R/V	Research Vessel
SCAR	Scientific Committee on Antarctic Research
SCIBP	Special Committee for the International Biological Programme
SCOR	Scientific Committee on Oceanic Research
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WDC	World Data Center
WG	Work Group
WMO/AC	World Meteorological Organization/ Advisory Committee