

SCAR

SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

BULLETIN

ARGENTINA AUSTRALIA BELGIUM
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NORWAY SOUTH AFRICA UNITED KINGDOM
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SCAR BULLETIN

No 25 January 1967

NINTH MEETING OF SCAR, SANTIAGO

20 to 24 September 1966

Present:

President: L. M. Gould.

Vice-President: R. N. Panzarini.

Delegates: Argentina, R. N. Panzarini; Australia, P. G. Law; Belgium, (Observer) M. Steyaert; Chile, E. D'Etigny; France, G. R. Laclavère; Japan, T. Nagata; New Zealand, G. A. Knox; Norway, T. Gjelsvik; Republic of South Africa, S. M. Naude; USSR, G. A. Avsiuk; United Kingdom, G. de Q. Robin; USA, L. M. Gould; IUBS, R. I. Currie; WMO, M. J. Rubin.

Observers: SCOR, L. R. A. Capurro; SCIBP, M. W. Holdgate; IQSY, T. Nagata; COSPAR, H. Wells, ICSU, G. R. Laclavère.

Advisers: Australia, J. S. Bunt; Chile, A. Aguayo, L. Aguirre, J. Araos, N. Bahamonde, J. Bannister, S. Bravo, F. di Castri, H. Etcheverry, A. Forch, O. Gonzalez, W. Hermosilla, R. Herrera, H. Inostroza, G. Mann, A. Mazzei, T. Opazo, A. Ricke, P. Welkner; France, R. Bost, G. M. Pillett, P. E. Victor; Japan, T. Torii; New Zealand, R. K. Dell; Norway, B. Rasmussen; Republic of South Africa, S. A. Engelbrecht, G. H. Oosthuizen, E. M. Van Zinderen Bakker; USSR, A. P. Andriashev, E. Koryakin, Y. S. Korotkevish, M. G. Ravich; United Kingdom, R. I. Currie, P. M. David, V. E. Fuchs, A. Hardy, M. W. Holdgate; USA, A. P. Cray, H. Cornelio, H. M. Dater, H. S. Francis, Jr. S. Z. El-Sayed, D. F. Leipper, M. J. Rubin, W. J. L. Sladen, H. Wells.

Secretary: G. de Q. Robin.

Asst. Secretary: G. E. Hemmen.

Minutes of the Eighth Meeting of SCAR.

The minutes of the Eighth Meeting of SCAR, Paris, 24 to 28 August 1964 were confirmed.

SCAR symposia

Past symposia

(a) The publication of *Antarctic geology*, the Proceedings of the Cape Town Symposium on Antarctic Geology in March 1965, was reported. The Secretary informed the meeting that SCAR had received from the publishers the sum of £144 representing royalties to March 1966 at 10 per cent on 144 copies sold after the first 1000.

SCAR expressed its great appreciation to Dr Adie for all his work in producing this most valuable volume on Antarctic geology.

(b) It was noted that a successful WMO/IAMAP/SCAR Symposium on

Polar Meteorology had been held in Geneva from 5 to 9 September 1966. SCAR expressed its thanks to M. J. Rubin for his part in helping to mount this symposium.

(c) The Secretary reported that he had been in negotiation with the North Holland Publishing Company regarding the publication of the Proceedings of the SCAR/SCOR/IAPO/IUPS Symposium on Antarctic Oceanography, but as this company did not think that sales would exceed 500 copies, they would require from SCAR a subsidy of £4 per page, possibly making a total of 3 to 4 thousand dollars from SCAR. SCAR approved the Secretary's suggestion that the Proceedings of the Symposium be published through the SCAR office, in direct negotiation with a printer, as a SCAR publication.

Future symposium

It was noted that it was proposed to hold a symposium on Antarctic Glaciology in 1967 or 1968 (p 545).

Antarctic Treaty

It was noted that the 4th Antarctic Treaty Consultative Meeting will be held in Santiago from 3 November 1966.

Liaison with other international organizations

SCIBP. It was reported that Dr M. W. Holdgate had represented SCAR at the Second General Assembly of Special Committees for the International Biological Programme, Paris, 6-7th April 1966, and a copy of the statement he had made to SCIBP on behalf of SCAR was received.

IQSY. It was reported that Dr G. de Q. Robin had represented SCAR at the IQSY Assembly, Madrid, 30 March to 3 April 1965, and that Professor T. Nagata had represented SCAR at the IQSY Committee meeting, Belgrade, 26 and 27 October 1966. Professor Nagata presented a report to SCAR on this latter meeting.

COSPAR. It was reported that A. H. Shapley had represented SCAR at the COSPAR Meeting, Vienna, 10-19 May 1966, and his report on this meeting was received.

SCOR. It was reported that G. E. Hemmen had represented SCAR at the 8th meeting of SCOR in Rome, 23 to 27 May 1966, and he reported that at this meeting SCOR had approved a contribution of \$2000 towards the cost of assisting invited scientists to attend the Symposium on Antarctic Oceanography.

IUGS. A report from Dr R. J. Adie on the meeting of the Commission for the Geological Map of the World, Paris, 19 June to 1 July 1966 was received.

It was resolved that SCAR did not consider it appropriate for SCAR to pay annual contributions to another ICSU body and that the invitation that SCAR contribute £50 per annum to the Commission be declined.

IUBS. It was reported that at its first meeting during the International Oceanographic Congress in Moscow in June 1966, the new section on Biological Oceanography of IUBS had appointed R. I. Currie as its Chairman. SCAR congratulated Mr Currie on this appointment.

COWAR. It was reported that, as recommended at VIII SCAR, Professor H. Hoinkes had been invited to represent SCAR on the ICSU Scientific Committee on Water Research (COWAR), but that he had suggested that it might be more appropriate to nominate "the President of ICSI" rather than to nominate him by name. It was agreed that SCAR would prefer to nominate Professor Hoinkes by name, and to reconsider the question of SCAR representation on COWAR at the time he retires as President of ICSI.

IUGG-IASH. It was reported that at the meeting of the officers of the IUGG-IASH Commission of Snow and Ice, Paris, 3 to 4 May 1966, the hope had been expressed that SCAR would soon take initiative in co-ordinating IHD projects in Antarctica. It was noted that Dr U. Radok would be discussing this question with the Secretary of SCAR in the near future, and that some action would result from this meeting.

IHD. G. R. Laclavère presented a statement from J. A. da Costa, Secretary of the Co-ordinating Council of the IHD in the Division of Natural Resources of UNESCO, in which was stated that the principal IHD projects that would be of interest to SCAR were:

- (1) The inventory of perennial and annual ice and snow masses.
- (2) Measurements of glacier variations.
- (3) The combined water, ice and heat balance at selected representative glacier basins.

He further reported that UNESCO was sponsoring a multi-lingual Ice Glossary and it was expected that this would be in the hands of the printers by the end of 1966.

International Whaling Commission. It was reported that the Scientific Committee of the International Whaling Commission had expressed its appreciation to all engaged in the programme of whale observations and had requested that the programme be continued for at least one more year.

SCAR agreed to encourage all nations to continue these observations for a further year and expressed the opinion that the programme would be greatly enhanced if more countries were to participate.

WMO. It was reported that H. R. Phillpot had represented SCAR at the Meeting of the WMO Executive Committee Working Group on Antarctic Meteorology, Melbourne, 23 February-3 March 1966, and that his report was published in *SCAR Bulletin* No. 24.

It was noted that this group had considered many of the SCAR recommendations on Antarctic Meteorology and had agreed to look to SCAR and ICPM for advice on meteorological research in the Antarctic.

M. J. Rubin reported that WMO was sponsoring a symposium on automatic meteorological instrumentation which would include instrumentation for polar regions. He reported also that WMO Commission on Instruments and Methods of Observations had established a Working Group on Observations in Polar Regions.

A statement was received from WMO concerning Executive Committee resolutions which referred to Antarctic meteorology. It was noted that these

resolutions would be submitted to the Antarctic Treaty countries for acceptance and other necessary actions.

II International Oceanographic Congress. A report was received from the SCAR representatives at the II International Oceanographic Congress in Moscow, 30 May to 9 June 1966, Dr M. M. Somov and R. I. Currie.

SCAR expressed its thanks to its two representatives and noted with particular interest the final paragraph of the report which confirmed the need for holding an independent symposium on Antarctic oceanography.

Finance

Statements of Income and Expenditure of SCAR for 1964 and 1965 were received.

SCAR expressed its thanks to ICSU for the trouble that had been taken to extract these figures in view of illness and other difficulties which had affected the ICSU Accounts Department.

A finance Committee to consider, during the IX SCAR meeting, the SCAR financial situation was appointed with the following members: Professor E. D'Etigny, Dr S. M. Naude, G. R. Laclavère (*ex officio* as Treasurer of ICSU).

IAAC/IAMRE

A statement of Income and Expenditure of the ICSU Special Fund for the IAAC was received.

It was noted that in addition to expenditures from the Special Fund, WMO had provided a fellowship and travel allowances to assist Mr Yoshida to work for two years at IAAC.

Statements from W. J. Gibbs and H. R. Phillpot regarding the present status and requirements of IAMRC were received.

SCAR noted the valuable facilities that were being offered at IAMRC for research meteorologists and expressed the hope that all SCAR nations would encourage meteorologists to take advantage of these opportunities.

Working group reports

Reports from the following working groups were received and referred to the Working Group of Delegates for further consideration: Biology, Communications, Geodesy and Cartography, Geology, Geomagnetism, Glaciology, Logistics, Meteorology, Oceanography, Solid earth geophysics, Upper atmosphere physics.

It was noted that the Working Group on Geodesy and Cartography had invited the International Society of Photogrammetry to examine air photographs of Antarctica with a view to identifying disturbances of snow and ice. The working group was particularly commended for its efficiency and excellent organization. The Secretary of SCAR reported the receipt from the working group of a detailed report on cartographic and geodetic activities in the Antarctic over the 5-year period 1960-65, and that means of publishing this report were being investigated.

The development of the Working Group on Glaciology by the establishment of two working committees—one on deep core studies and the other on ice shelf studies—was welcomed. As requested by the working group, SCAR urged National Committees to include their national member of the SCAR Working Group on Glaciology in their delegations to the Assembly of IASH to be held in Berne in September 1967.

The reports and recommendations of the working groups which met during the IX SCAR meeting—Biology, Oceanography, joint Oceanography and Biology, Finance and Delegates and an *ad hoc* Logistics meeting, also of the meeting of the Working Group on Meteorology, Geneva, 9 September 1966—were approved after amendments had been made.

In connexion with the report of the Working Group on Biology, SCAR particularly expressed the hope that the Japanese and Soviet scientists would make available the information gathered during their experimental programmes of cropping of krill.

SCAR agreed that the Working Group on Logistics should undertake the gathering of information about medical emergencies but would itself only consider the logistics aspects. All information of strictly medical or biological nature would be conveyed to the Working Group on Biology.

SCAR requested the Secretaries of the Working Groups on Oceanography and Meteorology to communicate with each other on the question of cross-representation between the two groups.

SCAR adopted the recommendations and comments arising from the SCAR/SCOR/IAPO/IUBS Symposium on Antarctic Oceanography, and agreed to convey them to SCOR, IAPO, IUBS and other interested bodies.

10th anniversary of continuous international scientific co-operation in the Antarctic

(a) It was noted that on Wednesday, 21 September a special ceremony to mark the occasion was to be held at the Hall of Honour of the University of Chile with addresses from the President of SCAR, the ex-President of SCAR, the Chairman of the Chilean National Committee and the Chilean Minister of Education.

(b) It was noted that a special Antarctic exhibition, to which all SCAR nations had contributed, had been mounted in the Central Hall of the University of Chile, Santiago.

(c) Reports on national plans for celebrating the 10th Anniversary were received.

(d) The publication of the *SCAR Manual* was noted.

Future meetings

SCAR was pleased to accept the invitation of Professor Nagata to hold the 1968 meeting in Japan, and it was suggested that late May or early June might be most appropriate.

It was further suggested that the Glaciology Symposium in New Hampshire might be held immediately prior to or after the SCAR meeting.

SCAR agreed that the 1967 Executive meeting might include meetings of the Upper Atmosphere and the new Space Vehicles (p 548) working groups and that the UK or the USA might be appropriate locations. This question was left in the hands of the Executive.

Acknowledgements

In concluding the meeting, the President expressed SCAR's very sincere thanks to everyone who had helped to make the Ninth Meeting of SCAR a great success, to the Instituto Antártico Chileno, the Chilean National Committee, the Universidad Tecnica del Estado and particularly to Contra-almirante J. Araos S., Col A. Forch and Professor E. d'Etigny, Professor N. Bahamonde, Senor Avendaño, Mrs Shaw and the clerical staff.

He also expressed the gratitude of SCAR for the many pleasant social events which had been arranged during the meeting, in particular the reception given by the President of Chile.

ANNEX

Reports and recommendations of working groups

Working Group of Delegates

Function and activities of SCAR

Considerable discussion indicated that smaller countries would find it difficult or impossible to be represented at annual meetings of SCAR. Several delegates felt that annual meetings were necessary to keep SCAR as an efficient organization which contributed to new developments in world science. In particular, meetings every two years resulted in the frequency of some working group meetings dropping to an undesirably low level. The use of specialist subgroups of three or four scientists to discuss and develop plans in specific fields of research was evidently desired by the three working groups which met at IX SCAR. The importance of advice and co-operation from scientists of international unions was stressed. It was felt that this could be achieved by bringing such scientists into new subgroups under SCAR working groups, by more effective and continuous representation of international unions at SCAR meetings, and by requesting certain unions to give SCAR general advice on Antarctic data needed for world-wide research programmes.

In order to finance work of the subgroups and to ensure more effective union participation in SCAR activities, SCAR needed much more financial support which should be requested from ICSU sources, as the essential need was to strengthen the contacts with the unions. The Treasurer of ICSU agreed that a strong case existed for granting such support.

The suggestion that an Antarctic Congress of 200 to 300 scientists be held every four or five years did not receive wide support.

In order that SCAR might benefit from more effective union representation at its meetings, it was agreed to recommend that ICSU be asked to approve alterations in SCAR statutes (*SCAR Bulletin*, No. 1, 1959, p. 7) to conform with the successful formula adopted by SCAR in this matter.

Recommendation IX. General-1. SCAR recommends that the following alterations in its statutes be approved:

(1) Membership. Statute to read: "(b) Scientists nominated by ICSU, and each international scientific union which is federated in ICSU and which desires to participate in SCAR. In order to secure a broad and balanced scientific representation, consultation between SCAR and ICSU shall take place prior to the confirmation of nominations by ICSU."

(2) Constitution. Statute to read: "(f) The national institutions shall pay the expenses of their nominees to attend SCAR meetings. The payment of other travel and per diem expenses for the meetings shall be decided by the SCAR Executive in accordance with the approved budget."

Recommendation IX. General-2. That full SCAR meetings of national delegates and two to four working groups should be held every two years.

Recommendation IX. General-3. That in alternate years, meetings would be held at which the SCAR Executive and some working groups and subgroups would be present. It was expected that the number attending would be of the order of twenty or thirty persons.

Matters arising from the working group reports

Geology. Commission for the Geological Map of the World.

Since Dr Adie had already been given responsibility for the compilation of a map of Antarctic geology and had made considerable progress with this task, two problems remained:

Provision of finance to support the remainder of Dr Adie's work.

Recommendation IX. General-4. That ICSU be approached for support for the completion of the compilation of the map on Antarctic geology or, failing this, that SCAR funds be used to support this work as necessary.

Final printing and production. The SCAR Executive was asked to act as necessary in arranging production. One possibility was that France might offer to print the map, or failing this the possibility of Australian production should be investigated, and if neither possibility eventuates the SCAR Executive was authorized to take necessary action.

Glaciology

Symposium: SCAR welcomed the offer of the US delegate to hold the International Symposium on Antarctic Glaciological Exploration in Hanover, New Hampshire, with the joint support of Dartmouth College and the US Army CRREL. The Secretary of SCAR was asked to inquire whether this proposal would also be supported by the International Commission on Snow and Ice.

Meteorology

International Antarctic Meteorological Research Centre. SCAR noted the changed needs of the centre, especially that younger research meteorologists than were needed by the IAAC would also be welcome at the IAMRC.

Recommendation IX. General-5. That, subject to the concurrence of, and in association with, WMO the opportunity of WMO fellowships providing sufficient support to enable young scientists, at around PhD level, to work at the IAMRC be given more publicity.

SCAR draws the attention of National Committees to the improved possibilities of research at the IAMRC in Melbourne, and urges them to send research scientists to work at the centre.

Recommendation IX. General-6. That assistance from ICSU be sought to provide funds for the maintenance of research activity at the International Antarctic Meteorological Research Centre. Such funds should be used to support, or help support, research scientists from overseas who wished to work at the centre, in particular younger scientists possibly around PhD level.

Students working for higher degrees who use the facilities of the centre should maintain contact with research supervisors in their home University. It was hoped that strong links with research supervisors in the Department of Meteorology, University of Melbourne, might also be arranged.

Recommendation IX. General-7. That a descriptive pamphlet setting out the arrangements and facilities at the IAMRC should be provided (see *SCAR Bulletin* No. 22, 1966, p. 403-05).

Working group membership. Now that the activity of the group is primarily directed to research since operational procedures are being undertaken by the WMO, National Committees were asked to review their membership of the group to ensure that an active research man is appointed.

The future of SCAR Working Groups

Solid earth geophysics

Although the working group was considering disbanding, it was pointed out that very active work in this field was going on in Antarctica, much of which was of importance to the Upper Mantle Project. It was felt that termination of the group would be unwise, and there was only partial agreement with the proposal that the group be amalgamated with the Working Group on Geology.

Recommendation IX. General-8. That, after the review of national representation on SCAR working groups (p 548), which was particularly necessary in the case of the Working Group on Solid earth geophysics, this working group should meet at a SCAR Meeting at which the Working Group on Geology also meets.

Communications

As it was felt that the administrative pattern of radio networks and frequencies had been settled to a large extent:

Recommendation IX. General-9. That membership of the group be reduced to three or four active communication experts, one of whom would be well informed in international procedures. Instead of remaining as a full working group of SCAR, it would be reconstituted as a subgroup to deal with frequency allocations and technical problems associated with the communications schedules under the Working Group on Logistics and would meet with that group. The subgroup would be responsible for checking on the people to whom correspondence should be addressed in each SCAR country. This could be either the national member of the Working Group on Logistics or a communications expert. (See also the formation of a separate working group to consider phenomena affecting radio communications, p 548).

Geomagnetism and Upper atmosphere

Recommendation IX. General-10. That the Working Group on Geomagnetism be disbanded and that the following action then be taken:

Those sections of geomagnetic work concerned with an investigation of the earth's field and its secular changes should be made the responsibility of the Working Group on Solid earth geophysics.

Those questions in geomagnetism that are concerned with the interacting of the earth's field in space with solar radiations, solar winds, cosmic rays, etc should be made the responsibility of the Working Group on Upper atmosphere physics.

Responsibilities of the working groups would then include:

(1) *Solid earth geophysics*: Seismology, gravity, physical vulcanology, magnetism of the earth's interior.

(2) *Upper atmosphere physics*: Aurorae and airglow, cosmic and solar radiations, non-secular geomagnetic variations, ionosphere.

The working groups would be responsible for setting up subgroups as necessary.

In view of Dr F. Jacka's intimation of his desire to resign as Chairman of the Working Group on Upper atmosphere physics, it was agreed to invite Professor T. Nagata to act as Chairman of the new Working Group on Upper atmosphere physics.

It was further agreed that the group required a working secretary to assist Professor Nagata, and that Dr Schlich be invited to serve in this capacity and that accordingly he be co-opted to membership of the group.

Logistics

It was agreed that an active Working Group on Logistics was still desirable, that P.-E. Victor continue as Chairman and F.A.F. Bastin be appointed as Secretary.

Biology, Geodesy and cartography, Geology, Glaciology, Meteorology, Oceanography.

It was recommended that the above working groups continue their activities.

New working groups

Recommendation IX. General-11. That a new working group be formed to study, and make proposals for, the use of space vehicles in Antarctic research. This group would consist of representatives of relevant SCAR working groups such as: Upper atmosphere physics, Meteorology, Glaciology, Oceanography, Geodesy and others. Nominations to this combined group would be the responsibility of working group secretaries.

Recommendation IX. General-12. That a new working group be formed to investigate drift, static and other problems affecting telecommunications.

Dr P. G. Law, Professor E. D'Etigny and H. Wells agreed to provide a statement of the requirements which the Secretary would incorporate in a circular to National Committees seeking the name of experts in this field.

Working groups, liaison with other scientific organizations

Recommendation IX. General-13. That in order that the latest scientific developments and requirements reported to international scientific unions may influence Antarctic development, the Secretary of SCAR was requested to invite secretaries of certain international scientific unions, associations and committees to set up a system for bringing latest developments to the notice of SCAR Working Groups.

The following should be consulted: associations of the IUGG, URSI, IUBS, IUGS, SCOR, COSPAR, COWAR, Inter-Union Committee on Solar and Terrestrial Physics (IUCSTP), Committee on Atmospheric Sciences (CAS), UMC and World Magnetic Survey (WMS) Board.

Recommendation IX. General-14. That SCAR should seek formal representation on IUCSTP and CAS.

Working groups, general

SCAR again draws to the attention of National Committees the need for appointing to SCAR working groups people who are active research workers in the disciplines concerned, and who are able to devote time to assisting with SCAR problems. SCAR considers that, in general, it is undesirable that persons be appointed to working groups merely because of their official positions in their own countries.

Working groups should feel free to set up subgroups of experts to examine any special problems arising from the work of the groups. Such subgroups need not be exclusively drawn from members of the working group; indeed, it would be desirable that some members be co-opted from appropriate ICSU bodies.

It is most desirable that members of subgroups be afforded opportunities to meet and discuss their work. It is considered that work at this level cannot adequately be carried out entirely by means of correspondence. As recommended

at previous meetings of SCAR working groups and subgroups should take every opportunity to meet in association with meetings or symposia in their disciplines convened by other ICSU bodies.

Reports of plans of SCAR working groups

It was noted that annual statements of SCAR plans by each working group were needed in some countries in order to obtain financial support for national programmes.

Recommendation IX. General-15. That all working group secretaries be requested to prepare annually statements of the future plans of the groups in addition to their usual reports of achievements.

National activities

In addition to National Reports circulated at the meeting, the following statements were made:

Australia. Wilkes station is being rebuilt at a site $1\frac{1}{2}$ miles from the present station. Davis station has been closed to finance this rebuilding, which will take three years.

Belgium-Netherlands. It was reported that "Base Roi Baudoin" would be closed during the 1966-67 season for a period of three years. The hope was expressed that it would be reopened when conditions made this practicable.

Japan. Dr T. Nagata, in drawing attention to the reopening of "Syowa" station and to the booklet by M. Muriyama describing the operation, expressed thanks to SCAR generally for moral support in urging that the station be reopened and to the United States and the Soviet Union for specific actions which helped the attainment of this objective.

Netherlands. The availability of Netherlands meteorological personnel and equipment for Antarctic research with other nations was brought informally to the attention of delegates.

New Zealand. A programme of Antarctic research over the next five years has been approved in principle by the Government.

South Africa. Approval in principal has been given by the Government to the establishment of a weather station on Bouvetøya, and it was believed that satisfactory arrangements could be made.

United Kingdom. Halley Bay station is being rebuilt at a site about 4 miles east of the present station.

United States. Difficulties of establishing and operating their "Plateau" station in lat $79^{\circ} 28' S$ long $40^{\circ} 35' W$ were outlined. The research programme at this station will continue for two years. Installation of long wire aerials up to 21 miles in length at "Byrd" were reported. Programmes of transmission schedules for VLF experiments would be made available to any interested parties.

National Reports

Contents

It was felt that the general standard of approximately half the information given in reports was fully satisfactory, and that efforts should be made to bring all the information up to this standard, both by improving sections of national reports which were less satisfactory than others and by bringing all reports up to the agreed standard.

It was noted that in the past some National Reports had been produced

months after the recommended date of 30 June (see *SCAR Bulletin*, No. 14, 1963, p 229-33) and therefore had not reached Antarctic bases in the year of publication. SCAR urges all nations to make special efforts to produce their reports by the appointed date.

Recommendation IX. General-16. That, in future, National Reports include on the cover an indication of the period covered in months rather than seasons as at present.

Recommendation IX. General-17. That, in future, National Reports should also give a brief statement of national activities during the year in which the report is prepared. It should draw attention to new activities started or activities stopped since the previous year.

Recommendation IX. General-18. That informal contact with World Data Centres be established to check how much Antarctic data from studies listed in National Reports was eventually deposited in WDC's for certain appropriate disciplines.

Circulation

The usefulness of National Reports to SCAR to government departments responsible for implementation of the Antarctic Treaty was stressed.

Recommendation IX. General-19. That all National Committees ensure that copies of these reports are forwarded to the relevant government agency in their country. To meet this need, the basic number of reports sent to National Committees is to be increased from 18 to 20.

Recommendation IX. General-20. That each National Committee on Antarctic Research should send two copies of their National Report to the Koninklijke Nederlandse Akademie van Wetenschappen, Kloveniersburgwal 29, Amsterdam.

Officers

Recommendation IX. General-21. It was recommended that, in view of the change of periodicity of the meetings of SCAR, the term of office of President and Vice-President be changed from three to four years. The Executive was instructed to propose to ICSU an appropriate change in the SCAR statutes. It was further recommended to propose to ICSU a change in the constitution to state that Presidents and Vice-Presidents were normally eligible for re-election, but normally should not hold office for more than two terms.

It was agreed to re-elect Contra-almirante R.N. Panzarini as Vice-President for the term 1965 to 1968, and to re-elect Dr L. M. Gould as President for the term 1966 to 1970.

Tenth anniversary of international co-operation in the Antarctic

Recommendation IX. General-22. That in countries where it was not considered practicable to effect much publicity for the tenth anniversary of international co-operation in the Antarctic, SCAR recommends that special efforts be made to use the tenth anniversary of the founding of SCAR in February 1968 as a means of drawing public attention to the achievements of recent years of international co-operation in Antarctic research.

Finance

Professor E. D'Etigny, Dr S. M. Nandé, G. R. Laclavère.

The Finance Committee has examined the statement of income and expenditure for 1964 and 1965. They consider that the cost of administration has been kept very low and commends the secretary of SCAR for this.

It was recommended that:

Recommendation IX. Fin-1. That national contributions be maintained at the present level for the year 1967 and that the sum of \$6000 be set aside from the 1966 budget as a reserve fund to finance the publication of the *Proceedings of the Symposium on Antarctic Oceanography*.

As the IX meeting of SCAR is urging the establishment of small groups of specialists to examine specific scientific problems, it is essential for SCAR to be able to meet the cost of travel to meetings of such groups so that SCAR will be able to select the best scientists regardless of nationality, it is also considered desirable for SCAR to be in a position to finance the attendance at SCAR meetings of representatives of appropriate ICSU constituent bodies under an arrangement agreed by SCAR (*Recommendation IX. General-1.*).

As it is not possible to assess what financial demands might be made on SCAR it is considered advisable to seek support from ICSU of \$10000 in 1967.

Recommendation IX. Fin-2. SCAR requests ICSU to grant up to \$10000 in 1966 to assist SCAR in arranging meetings of groups of specialists in specific scientific topics, and for supporting the attendance of representatives of ICSU constituent bodies at meetings of SCAR.

Recommendation IX. Fin-3. That the proposed budget for 1966 and 1967 be approved.

Recommendation IX. Fin-4. That the ICSU/IAAC Special Fund be renamed the IAMRC Special Fund, and that ICSU be approached for an initial grant of \$5000 to this fund, with the intention that the trustees make grants under conditions approved for the IAAC Special Fund.

SCAR records its gratitude to ICSU for the grants made by the III Executive Committee and the XI General Assembly to the Special Fund for the IAAC and for supporting the attendance of invited speakers to the Antarctic Oceanography Symposium. These actions by ICSU have without doubt been most beneficial to Antarctic science.

It was noted that all loans made by ICSU had been repaid.

Biology

M. W. Holdgate (*Secretary*), J. S. Bunt, N. Bahamonde, G. A. Knox, B. Rasmussen, E. M. Van Zinderen Bakker, W. J. L. Sladen, A. P. Andriashev.

Others in attendance for all or part of the session: P. G. Law, A. Aguayo, J. Araos, H. Etcheverry, W. Hermosilla, F. S., Oyarzún, P. Welkner, R. K. Dell, G. H. Oosthuizen, R. I. Currie, P. M. David, A. C. Hardy, H. S. Francis, S. Z. El-Sayed, D. F. Leipper, L. R. A. Capurro.

*Matters arising from VIII SCAR**Medical emergencies*

The proposal by the Sub-Committee on Human Adaptability Programmes in the Antarctic that SCAR establish a mechanism for the exchange of information concerning medical emergencies was considered.

Recommendation IX. B-1. That (1) since in certain cases professional etiquette must be maintained, it would be wrong to establish a compulsory system of information exchange within SCAR;

(2) however, voluntary exchanges of information should be encouraged, especially where a case presents interesting medical features, ideas which may be useful in a wider context, or experiences which could be of value in avoiding future disasters;

(3) furthermore, where a medical emergency in the Antarctic provides information of value to the profession at large, details should be published in appropriate medical journals.

These points were brought to the notice of the Working Group of Delegates. It was pointed out that advice on medical problems in the Antarctic could already be obtained by bilateral discussion.

Programme in biology

It was agreed not to revise this programme again until after the next Symposium in 1968.

Conservation

Agreed measures for the Conservation of Antarctic Fauna and Flora. (Third Antarctic Treaty Consultative Meeting, 1964).

Specially Protected Species (Annex A).

Specially Protected Areas (Annex B).

Exchange of information under Article XII of the Agreed Measures.

Pelagic sealing and the taking of fauna in the pack ice.

The results of discussions on the above four subjects will be published at a later date.

As a result of the discussion on pelagic sealing and the taking of fauna in pack ice the working group proposed the following recommendation:

Recommendation IX. B-2. That all member nations give high priority to research upon the ecosystem of the zone of floating ice. [See also *Recommendation IX. O-2*; p 558.]

Conservation of oceanic islands

Recommendation IX. B-3. SCAR reaffirms its interest in the oceanic islands of the Antarctic and sub-Antarctic zones, SCAR welcomes the concern now being displayed by the International Biological Programme and the International Union for the Conservation of Nature over these islands as part of a global conservation campaign. SCAR considers that these islands are so closely related

¹ In the *Polar Record*, Vol 13, No 86, May, 1967.

biologically to the Antarctic, and that so much progress has already been made towards their conservation, that it is appropriate for SCAR to continue to play a leading role in this work. The Working Group on Biology of SCAR wishes to be kept informed of all proposals emanating from other international bodies and relating to these islands, and has instructed its Secretary to inform IUCN and IBP accordingly.

Project AQUA

The Working Group on Biology instructed its Secretary to consult Dr E. B. Worthington, Scientific Director of IBP, concerning this project, and then to circularize members who would each consult their National Committee and make proposals.

The working group recognized that fresh-water areas included in an international list of this kind would require consideration for inclusion in Annex B of the Agreed Measures for the Conservation of Antarctic Fauna and Flora.

International Biological Programme

It was agreed that any request from IBP for information about laboratory facilities in the Antarctic should be circulated to National Committees who would have discretion as to which stations they included. The Secretary agreed to consult Dr E. B. Worthington on this matter and to inform working group members accordingly.

The check sheet for IBP Areas was also discussed. It was agreed that a case might be made for completing these for Specially Protected Areas, and certain other well-known or representative sample sites. National Committees will be consulted when requests for the completion of these forms are received, and any such work will be handled nationally.

Human Adaptability Programmes

The Working Group accepted the report of the sub-Committee on Human Adaptability Programmes in the Antarctic. It was agreed that the sub-committee should remain in being as a group of individuals rather than as national representatives.

The working group asked its Secretary to congratulate Dr Edholm upon the achievements of the sub-committee.

Recommendation IX. B-4. That SCAR should convey the proposed programme of the Sub-Committee on Human Adaptability Programmes in the Antarctic—subject to the deletion of the section on psychological studies—to National Committees, who should consult their National IBP Committees on it. It is also proposed that Dr J. S. Weiner, Convener of the HA Section of IBP, be notified of SCAR's approval of this report. Dr Weiner should be reminded that the proposed programme is intended as a guide-line for individual scientists and will be implemented in separate national research programmes, rather than a single SCAR-sponsored project.

Bird banding in the Antarctic

Dr W. J. L. Sladen, Secretary of this sub-committee, gave a verbal report which was warmly received by the working group. A written report will be circulated to working group members and National Committees in the near future.

It was agreed that this sub-committee should continue in being, and that its membership should continue to comprise one representative from each SCAR nation actively engaged in bird banding.

Biological techniques

(Dr W. J. L. Sladen took the chair for this item of the Agenda.)

It was noted that several SCAR biologists were actively concerned with microclimatic studies. Advice on methodology would clearly be valuable. In the present state of knowledge too rigid a standardization of technique should be avoided, but methods should, wherever appropriate, be intercomparable. Contact will be made with the Working Group on Meteorology on this subject, and Dr S. W. Greene, who raised the matter with the working group, will be invited to communicate with colleagues and forward any conclusions or requests to the working group.

Next symposium in Antarctic biology

Recommendation IX. B-5. (1) That a symposium be planned for July or August 1968, the precise date being adjusted to take account of meetings of scientific congresses and ICSU Committees and Unions;

(2) the subject of the symposium should be "The Antarctic Ecosystem". Bi-polar comparisons could be included. New techniques should be emphasized, and an exhibition, arranged in parallel, should demonstrate these. A special section should be devoted to seals;

(3) the location of the symposium must be fixed in relation to the meetings of SCAR;

(4) special efforts must be made to bring to the symposium as many scientists active in Antarctic field work as possible;

(5) the working group instructed its Secretary, Dr M. W. Holdgate, to act as Convener of the Planning Committee. He was instructed to select appropriate members for this committee;

(6) a tentative organizational timetable was adopted.

Marine biology and oceanography

This item was discussed in joint session with the Working Group in Oceanography and a recommendation prepared (p 559).

Role and composition of the Working Group on Biology

The Working Group considered that its activity, and its role as an adviser on Antarctic conservation, was a sufficient justification for its existence. It agreed that, in common with other working groups, it required:

(1) a membership of active scientists committed to the organization and execution of Antarctic research;

(2) sufficiently frequent meetings for personal contacts not to be lost. Correspondence was considered no substitute for discussion.

The group agreed that meetings must be strongly attended if they are to be worth while and that National Committees be urged to send the official, permanent, members of the group to all possible working group meetings. There was no need for such meetings to be held concurrently with those of SCAR. When working group meetings are held at times other than full SCAR meetings, resolutions should be ratified in accordance with the procedure laid down in *Recommendation VIII. General-10 (SCAR Bulletin, No 19, 1965, p 349)*.

The working group considered the biological sections of National Reports to SCAR satisfactory in general, and left its members to effect any obvious improvements on a national basis.

The working group considered the existing mechanisms for consultation between Antarctic biologists to be adequate, provided sufficient working group meetings were held. They believed that symposia provided especially good opportunities for young scientists recently embarked on Antarctic research to meet senior colleagues, and urged National Committees, when allocating funds for travel to such symposia, to devote a part of their resources to men in this category.

The working group considered that a closer contact with certain Arctic biologists would be of value, and that this should be achieved by inviting selected individuals to attend and participate in SCAR symposia, where bi-polar comparison would evidently aid Antarctic research.

Date of next meeting

It was agreed that the working group should next plan to meet in association with the proposed symposium in 1968.

Other business

The Secretary drew attention to two reports, on biological and medical research respectively, received from the Soviet member, and thanked Professor A. P. Andriashev for this information.

The working group noted that Soviet and Japanese scientists were engaged in the cropping of krill (*Euphausia superba*) on an experimental basis, and expressed the hope that quantitative data would be published in the near future. They stressed the importance of Krill in the overall Antarctic marine ecosystem, and reaffirmed the statements made in Paragraph 4, Section 6, on the Symposium on Antarctic Oceanography (p 567).

The working group then considered a proposal from Professor E. M. van Zinderen Bakker that a group of specialists be established on Antarctic Quaternary studies, with membership from the Working Groups on Biology, Oceanography, Geology and possibly Glaciology. It was considered important that

the group should be small and consist of active field workers. The following is the detailed proposal:

Recommendation IX. B-6. The study of the palaeoecology of the Antarctic region is of paramount importance for our understanding of the age, origin and ecology of the present-day flora and fauna of that region, and also for an explanation of the Quaternary palaeoclimates of the Southern Hemisphere in general. Our knowledge of the palaeoecology of the Antarctic region is very limited and only recently more data have become available from palaeobotanical, oceanographical and geological investigation. Contact between researchers in these different fields should be encouraged and stimulated by the formation of a group of specialists on Antarctic Quaternary studies.

The terms of reference of the group should be:

To correlate and calibrate the data which are at present available from stratigraphical studies in the widest sense.

To make a survey of the areas which may be the most rewarding for future research.

To stimulate future multidisciplinary research in this field.

To correlate the data available from the Antarctic regions with results of research carried out in lower latitudes.

Professor van Zinderen Bakker was appointed Convener. The following were discussed as possible members:

Dr N. T. Moar (New Zealand)

Dr D. M. Churchill (Australia)

Dr L. M. Cranwell (Mrs Watson Smith) USA

Dr J. D. Hays (USA)

It was agreed that the Secretary of the Working Groups on Oceanography, Geology and Glaciology should be consulted by the Convener so that they were adequately represented. Professor Andriashev would be asked to propose a Soviet member.

The Secretary thanked the members for their patience and energy in an exceptionally long and trying meeting. He conveyed a special vote of thanks to Sr Nibaldo Bahamonde, the Chilean member of the working group, for the hospitality and outstanding planning of the Chilean National Committee. The meeting was then declared closed.

Oceanography

L. R. A. Capurro, R. I. Currie, P. M. David, R. K. Dell, S. A. Englebrecht, G. E. Hemmen, R. Herrera, H. Inostroza, D. F. Leipper (Secretary), Y. S. Korotkevitch, E. Koryakin, R. N. Panzarini, T. Torii.

Secretary

Dr D. F. Leipper was elected Secretary of the group to replace Dr W. L. Tressler who had resigned.

Membership

It was agreed to co-opt to full membership of the working group in an "ex officio" capacity the SCOR representative on SCAR, currently Capitán L. R. A. Capurro.

Relationship with Working Group on Biology

This topic was discussed both separately and in joint session with the Working Group on Biology resulting in the adoption of the recommendation (p 559). The working group expressed the hope that it would receive a strong lead from the Working Group on Biology on many aspects of biological oceanography.

Symposium on Antarctic Oceanography

The working group considered that the Symposium on Antarctic Oceanography had been a great success particularly in that it had provided an opportunity for scientists of various disciplines to discuss together the problems of their related fields, and it was felt that this would lead to greater cooperation in the future.

The working group discussed the recommendations and comments drafted by the discussion leaders of the six sections of the symposium, and additional points proposed by other participants.

It was agreed to request SCAR to adopt in principle the recommendations and comments arising from the symposium, (p 563-67) and to convey them to National Committees, SCOR, IAPO, IUBS and other interested bodies for consideration and comment. It was further agreed that final revision and summarizing of these recommendations and comments for publication in the symposium proceedings be left in the hands of the editor, R. I. Currie.

SCAR programme

The revised SCAR programme in oceanography, as published in the *SCAR Bulletin No 20*, 1965, p. 619-22 and in the *SCAR Manual*, was noted and endorsed.

In view of the conclusions reached by SCOR at its eighth meeting in Rome in May 1966 on the doubtful value of Standard Sections as international programmes contributing to the study of variability in the ocean, it was agreed that the value of the SCAR standard sections be kept under review but that they be retained in the programme for the time being particularly as they might provide data of value for mass transport studies.

Specific studies

It was noted that the recommendations resulting from the symposium drew somewhat more detailed attention to outstanding problems already broadly referred to in the SCAR programme in Oceanography.

It was agreed that the task now before the Working Group on Oceanography was to stimulate work in specific areas, both by means of examining data already

available and by encouraging programmes of work to study particular problems. It was felt that more effective implementation of the SCAR programme would be achieved by closer liaison with the Working Groups on Biology and Meteorology and other ICSU bodies having interests in common, and by the designation of small groups of specialists selected solely for their personal scientific knowledge. The tasks of such groups to be: to define more precisely the problem areas, and to take steps to improve the co-ordination of, and to expedite pertinent research.

It was recommended that the following topics receive immediate attention:

Antarctic convergence

Recommendation IX. O-1. That the following proposition be submitted to SCOR and the Working Group on Biology:

The SCAR Working Group on Oceanography, having reviewed past and present scientific studies in the Antarctic, considers that every possible effort should be devoted to learning more about the structure, the mechanism, and the biological and other implications of the Antarctic Convergence (polar frontal system). SCAR, therefore, requests that SCOR should consider forming a Working Group on the Antarctic Convergence to advise on what observations and scientific studies could be made to improve our knowledge of the subject. SCAR would be pleased to participate in any appropriate way.

Interdisciplinary problems associated with the freezing of sea water (pack ice)

Recommendation IX. O-2. That there is a need for an interdisciplinary study concentrating on the pack ice; its physical properties including wave transformation and its relationship to the organisms living in and under the ice.

It was recognized that the Working Group on Biology, SCOR and IAPO would be interested in this topic and it was recommended that Dr G. de Q. Robin be invited to act as convener of a small group, to include Dr W. F. Weeks, Dr J. S. Bunt and Professor A. P. Andriashev, to prepare a proposition on the need for interdisciplinary studies in this field for submission to all interested bodies.

The formation of bottom water

Recommendation IX. O-3. That there is a need for particular studies on bottom water formation and the probable interest of IAPO in this topic was recognized.

It was recommended that Professor H. Mosby be invited to act as convener of a small group, to include Professor H. Stommel, to prepare a proposition on the need for particular studies in this field for submission to all interested bodies.

Benthos

Recommendation IX. O-4. That the problems of the benthos of the Antarctic oceans are unique and there is a need for improved co-ordination of studies of oceanic ridges and of work in shallow seas. The probable interest of IUBS in this topic was recognized.

It was recommended that Dr R. K. Dell be invited to act as convener of a small group, to include Professor A. P. Andriashev and Dr G. Savage, to prepare

a proposition on the need for particular studies in this field for submission to all interested bodies.

Joint Meeting of the Working Groups on Oceanography and Biology

Marine biology and Oceanography

The two groups discussed their fields of common interest and inter-relationship and it was agreed:

(a) That no ecosystem is truly divisible, and that this holds particularly in the Antarctic, where virtually all terrestrial organisms depend directly or indirectly upon the sea.

(b) That the fundamental criteria for distinguishing the spheres of responsibility of the two groups of SCAR are that the Working Group on Biology is ultimately concerned with the life system, whereas the Working Group on Oceanography is concerned primarily with the marine environment and the organisms therein.

(c) In practice no firm boundaries can be established, and both working groups of SCAR must continue to discuss many fields of common interest.

Recommendation IX. O and B-1. That to ensure that SCAR maintains a consistent and constructive programme in marine science, and periodic joint meetings and symposia are considered essential and to effect this, it is recommended that the Secretaries of each group receive all documents of the other and that each group nominate one of its members to serve as a full member of the other.

Recommendation IX. O and B-2. That, where problems are common to these, and other working groups of SCAR, groups of specialists should be established, with representatives from all interested parties. Appointment to these groups would be on a basis of individual knowledge, and membership need not be restricted to SCAR nations.

It was further agreed that the recent Symposium in Antarctic Oceanography should provide a stimulus in both biological and oceanographical fields.

Recommendation IX. O and B-3. That examination and any desirable arrangement of the recommendations be undertaken by the Working Group on Oceanography. It was considered that the symposium recommendations should, in the first instance, be communicated to National Committees and others as a separate paper rather than absorbed in any re-statement of SCAR programmes in Biology and Oceanography.

Meteorology

The Working Group on Meteorology met on 9 September 1966, at the conclusion of the Symposium on Polar Meteorology, Geneva.

M. J. Rubin (Chairman), J. Alt, W. Bleeker (observer), J. Boudgouste (observer for L. de la Canal), V. Hisdal, K. Langlo, H. R. Phillipot, J. J. Taljaard, H. H. Lamb, B. Dzerdzeyevskii (for H. Tauber), G. Wada (observer for M. Yoshitake).

The working group reviewed meteorological activities in the Antarctic during the period since its previous meeting. They agreed that the programmes had been developed in accordance with the recommendations of the Eighth SCAR

meeting, that they had resulted in a successful period of scientific research work, that the general understanding of meteorological processes had been advanced and that the IQSY programme in meteorology had been a significant element in this activity.

The Chairman raised the question of the need to continue the SCAR Working Group on Meteorology in view of the establishment of ICPM and the WMO Executive Committee Working Group on Antarctic Meteorology. After full discussion of this question, and recognizing the terms of reference of the ICPM and the special relationship between WMO and SCAR, and between the Antarctic Treaty countries and SCAR, the working group was firmly of the opinion that there still was a need for the Working Group on Meteorology to continue its activities, since meteorology as a research activity otherwise would not be satisfactorily represented in that relationship. One member who was not present expressed a strong feeling, by correspondence prior to the meeting, that the SCAR Working Group on Meteorology could be dispensed with.

The question of additional responsibilities for the working group was raised. The working group felt that it could undertake, in joint activities with other SCAR working groups, the development of increased emphasis on interdisciplinary programmes such as air-sea interaction and heat and mass budget studies. At the outset, the working group felt that this could best be accomplished by calling on an appropriate SCAR working group, e.g. Oceanography and Glaciology, to assign one or more members to the Working Group on Meteorology, and *vice versa*.

Recommendation IX. M-1. The Working Group on Meteorology, noting the need for further interdisciplinary planning and execution of the scientific programmes in meteorology in Antarctica, and considering that relatively little formal mechanism exists within SCAR for developing such programmes, recommends that additional ex-officio representation be provided by appropriate SCAR working groups such as Oceanography, Glaciology and others.

The working group discussed the content and structure of the National Reports, and was of the opinion that the reports as presently prepared do satisfy the needs of the working group.

In respect to the question of data exchange for research purposes, a survey of the members of the working group indicated that the meteorological data are available in most cases on punch cards or in published form. It was recognized, however, that a delay in distributing the data had resulted in a few cases, and that efforts to improve the situation were required.

An item on radioactivity measurements in Antarctica, pending from the previous meeting, was discussed. The Chairman had been in correspondence with the Secretary of the International Commission on Atmospheric Chemistry and Radioactivity on (1) the need for measurements in Antarctica of artificial and natural radioactivity and (2) the need to recommend an observational programme. In the reply it was noted that a certain amount of work has already been carried out by several investigators. Most of the work carried out thus far indicates that the problem of obtaining reliable samples is difficult and complicated, and that good measurements of the low levels of radioactivity in

Antarctica involve skill and experience. The indication was that the work probably could not be carried out successfully as part of a regular observational programme in Antarctica. In view of the above, and considering that the subject was already included in the recommended scientific programme in meteorology, the working group decided to discontinue further discussion of the subject at this time.

Recommendation IX. M-2. The working group, noting that an appropriate item for research had been omitted from its terms of reference, and considering that the item is an important research activity, recommends that atmospheric electricity be added as item C (9) of *Recommendation VIII. M-6.* (SCAR Bulletin No 19, January 1965, p 360-61).

Recommendation IX. M-3. The working group, noting the successful WMO-SCAR-ICPM Joint Symposium on Polar Meteorology and the expressions of opinions of the participants that the papers should be published in one volume, and considering the willingness of the WMO Secretariat to undertake the publications of the proceedings at their expense, recommends that SCAR approves the publication of the Symposium proceedings in one volume of the WMO Technical Note Series. This would rescind (4) of *Recommendation VIII. M-4* (SCAR Bulletin, No 19, 1965, p 360).

The working group considered the report of the SCAR observer to the First Meeting of the WMO Executive Committee Working Group on Antarctic Meteorology, Melbourne, 23 February to 3 March 1966 (SCAR Bulletin, No 24, 1966, p 399-403). The working group noted with appreciation the activities of the WMO, through its Working Group on Antarctic Meteorology, in respect to those items that had been recommended by SCAR to WMO as more appropriately within the WMO area of responsibility. The WMO Working Group: (1) endorsed the SCAR scientific programme in meteorology, (2) welcomed the joint WMO-SCAR-ICPM Symposium on Polar Meteorology, (3) requested the same support for the newly established IAMRC as for its predecessor, the IAAC, (4) recommended the establishment of special observing networks, such as radiation sondes, (5) considered that although it had authority to discuss research, maximum benefit would be achieved through the closest liaison with SCAR and the ICPM, (6) appointed a rapporteur to study the problem of the presentation of published data. In respect to *Recommendation VIII. M-5B* on instruments and methods of observation (SCAR Bulletin No 19, 1965, p 360), it was noted that WMO had established a Working Group on Observations in the Polar Regions, with terms of reference suggested by SCAR.

Recommendation IX. M-4. That the Secretary-General of WMO should be informed of SCAR's appreciation of the decisions taken by the Executive Committee of WMO in respect to Antarctica, and of the hope that relations between the two organizations should continue to be of material benefit.

The working group noted with satisfaction and appreciation the completion by South Africa of the Southern Hemisphere portion of the Dry World Weather Map series. The working group was of the opinion that this map series will be of invaluable help in many aspects of meteorological research in the Southern Hemisphere and in Antarctic. The working group was informed that the South

African Weather Bureau would continue its historical Southern Hemisphere Weather Map Series for the post-IGY period; the daily surface and 500-mb maps will be published in the meteorological publication *Notos*.

Recommendation IX. M-5. That SCAR should thank South Africa for its valuable contribution to research in the completion of the Southern Hemisphere portions of the IGY World Weather Map series, and the continuation of publication of the daily post-IGY map series in *Notos*.

At the Eighth Meeting of SCAR, it was considered that an evaluation of the results of the IQSY programme in Antarctica would be useful for developing future meteorological research plans. In discussing the IQSY programme at its meeting in Geneva, the working group felt that the programme had been too recently concluded for the research results to be evaluated. The working group noted with satisfaction the successful completion of the special meteorological programmes in Antarctica and expressed the hope that the research results would be made known with a minimum of delay. The working group also noted that certain elements of the IQSY programmes, eg zone observations, radiation observations, and the STRAWARM, were being continued.

The working group was informed on the activities of the International Antarctic Meteorological Research Centre in Melbourne (IAMRC), the successor to IAAC. The research activities of IAAC have been enhanced and expanded through the establishment by Australia of the new Southern Hemisphere Analysis Centre which now provides the current meteorological analysis for operational needs formerly provided by IAAC. IAMRC provides the opportunity now for individual meteorologists assigned there to develop their own research projects or to develop collaborative research as desired. The working group appreciated the efforts of Australia to assume the burden of the daily meteorological analysis and welcomes its continued support of the IAMRC by providing the locale, the supporting staff, and the leadership for the research centre. The working group strongly supports the aims of the IAMRC, and recommends the continued support of the centre by SCAR members, ICSU, the WMO and other appropriate organizations, both national and international.

Recommendation IX. M-6. That SCAR should express to all the countries and organizations who supported IAAC sincere thanks for their efforts.

Recommendation IX. M-7. That member countries of SCAR and ICSU should take steps to attach research meteorologists to IAMRC in order that the potential of the centre may be fully exploited.

The working group had no recommendation in respect to its next meeting, but was of the opinion that it could be held at the time of the next SCAR meeting at which time an assessment of IQSY results would be appropriate.

Logistics (*ad-hoc* meeting)

P.-E. Victor (Chairman), G. A. Avsiuk, R. Bost, H. M. Dater, V. E. Fuchs, P. G. Law, R. N. Panzarini, M. Steyaert.

Recommendation IX. L-1. That each member country should send a list of persons concerned with logistics problems to the Secretary from which a general list could be published.

Recommendation IX. L-2. That a continuing exchange of information should take place between the secretary and members of the working group, and *vice versa*.

Recommendation IX. L-3. That the Chairman and Secretary should be free to make the most effective use of information supplied on techniques, emergencies and logistics generally.

Recommendation IX. L-4. That any decision involving the group as a whole must be taken at a meeting at which a quorum of members [number to be decided] is present.

Recommendation IX. L-5. That, before the departure of an expedition into the field, an operation plan should be issued to interested parties. A questionnaire should be issued by the Secretary to National Committees specifying the information required.

Recommendation IX. L-6. That an "accident-prevention" manual should be compiled.

Recommendation IX. L-7. That the working group should meet annually. That travel, publication and other expenses should be covered by a special fund which should be supported by SCAR, and, at a later date, by contributions from members.

Recommendations and comments arising from the SCAR/SCOR/IAPO/IUBS Symposium on Antarctic Oceanography, Santiago, 13-16 September 1966

SECTION 1

Surface and upper layers

Discussion leader: Professor H. Mosby.

The relation between the Antarctic convergence and the mixed water zone needs further investigation, both biological and physical.

The international tide gauge programme needs further support and instrumental development in Antarctic seas.

A shore-based programme of wave recording around the Southern Ocean outside the pack ice belt gives promise of useful applications and should be tested further as a potential tool of synoptic usefulness.

The study of SiO_2 as an indicator of zones of divergence should be investigated further.

The group draws particular attention to the usefulness of magnetic measurements of ocean currents using systems such as GEK.

Attention is drawn to the use of relative radar fixes on icebergs as an aid to current determinations by dead reckoning.

Future biological collecting should tend more to the investigation of particular problems than to routine surveys. Biological problems should be clearly defined at the outset to ensure that the requisite physical and chemical data are collected.

Note should be taken of the rapidly advancing technology associated with spacecraft and the possibility of its adaptation to oceanographic research.

The value of exchange of scientists between oceanographic programmes and the development of co-operative programmes between nations was stressed, particularly when a co-operative effort could bring into action scientific and logistic resources which could not be used by an individual nation acting alone.

SECTION 2

Deep waters

Discussion leader: Professor H. Stommel.

Professor Mosby stressed the particular interest of the physical process that may produce bottom water during freezing of ice in winter, during winter and possibly mostly in the Weddell Sea. The process seems to involve two different physical processes, each of which need more study in order to become clear. First, there is a stability problem arising from the non-linearity of the equation of state, which was first associated with bottom-water formation in a paper by Fofonoff some years ago. Detailed observation of the temperature and salinity structure in the water beneath freezing ice, both within the Weddell Sea and in the deeper ocean outside, would enable us to ascertain how much of a role this stability process may play. Secondly, there is a question of how rapidly bottom water, when once formed in the Weddell Sea, proceeds to flow out and down the continental slope. Professor Mosby presented computational estimates that suggest the major convection out of the Weddell Sea may occur in three to four days, and hence produce currents capable of being measured directly by moored current meters. It is recommended, therefore, that oceanographers attempt to obtain extensive hydrographic data beneath the ice when vehicles suitable for under-ice investigations become available in the Weddell Sea, and also consideration should be given to placing a few recording current meters—over the winter—on the bottom of the mouth of the Weddell Sea in places where the outflow might be expected to occur.

The comparative physical or chemical characteristics of bottom water, also needs investigation:

- (1) in inner shelf depressions (up to 1600 m depth or more), and
- (2) on slopes of continental shelf (more than 500–600 m depth).

There are many differences in physical conditions—in inner shelf depression areas temperature is lower (-1.9), O_2 is lower, etc.

The excellent series of bottom photographs obtained by *Eltanin*—and described by Professor Heezen in Section 3—are of the greatest interest. We hope that in the future someone will be able to make special studies of joint bottom current measurement and bottom photograph—preferably at regular intervals over a tidal cycle—in several different kinds of bottom in order that we can learn more about the interpretation of form of the bottom as an indicator of past bottom current. This would help make more firm the valuable deductions obtained from bottom photographs in general. Knowledge of currents near the bottom seems to be essential in developing the theory of the Antarctic Circumpolar Current, because indications are that the nature of the bottom frictional layer is more important physically in this current than in the oceans further north. Thus it seems logical that those interested in the Antarctic Ocean should support fundamental physical studies of the bottom layer of the ocean in whatever location promises to be a suitable environment, even if the first experimental rigs of current meters and cameras, etc. are at first in temperate latitudes during development of measuring techniques. We foresee a growing interest in the phenomena of the Benthic layer of the ocean, a need to develop new techniques for its study; and it seems quite proper that Antarctic scientists should pioneer in these developments which they need even more than oceanographers in lower latitudes.

Professor Capurro's success in obtaining direct measurements of currents at depth in Drake Passage, and his emphasis on the great importance of Drake Passage in the overall scheme of World Ocean Circulation, inspire us to hope that more intensive series of measurements of deep velocity will be planned and undertaken in Drake Passage. New satellite navigation instruments should become available for this work.

The development of more powerful, longer range, pingers or the Swallow Floats will make tracking easier.

Perhaps some Multiship Surveys, capable of producing synoptic charts of portions of the Antarctic Convergence can be organized in the future. Measurement by bathy-thermograph (BT) and towed electrodes (GEK) would provide the main data for this work.

A number of special proposals and recommendations for biological work in deep waters are given in Professor Mohr's valuable contribution, and we need not recount them in detail here.

Finally, we are cheered to see that theoretical hydrodynamicists, such as Dr Gill, are taking an interest in assaying to construct theoretical models of the Antarctic Circumpolar Current. We hope both laboratory experiments and more theoretical studies will appear in the next years, providing us with the mental tools necessary for understanding the dynamics of this extraordinary and least understood oceanic current.

SECTION 3

Ocean floor

Discussion leader: L. R. A. Capurro.

Since most studies of the Antarctic have been and are being conducted as pre-planned surveys, scientists are offered little opportunity to pursue important or promising research problems which are revealed in the course of the expedition. Therefore: We urge that National Committees assign sufficient research time in addition to the time required for normal survey operations, so that special problems can be investigated. For example: the seismic reflection profiler frequently records local outcrops of the deep layers of the sediment column. Time must be allowed so that such outcrops can be sampled by coring or dredged and be photographed.

Sea-floor photographs have revealed important evidence of deep-sea currents and provide a possibility of constructing current maps of the sea floor which could be valuable to all oceanographers. Photographs must be oriented, and a compass must be included within each photograph. Standard cameras employed in deep sea work record on miniature 35 mm film. It is extremely desirable that a larger film size (70 mm or 105 mm) be used so that the sediments and benthic life can be better studied. Colour film should be more frequently used.

The paleomagnetic method now allows the accurate dating of events recorded in deep-sea sediments from the last 5-10 million years. The glaciation of Antarctica is indicated by ice rafted debris found in deep-sea cores. Longer cores are needed to penetrate to the pre-glacial sediments so that we can date the beginning of the Antarctic glaciation.

SECTION 4

Coastal waters

Discussion leader: Dr M. W. Holdgate.

Hydrological data are urgently needed for Antarctic coastal waters. Local variations due to melt water dilution and land drainage contamination should be assessed. Tidal and wave records should be obtained more widely.

There is a great need for many more descriptive accounts of Antarctic inshore benthic communities and their vertical zonation.

There is also a great need for critical autecological and physiological studies on key members of the inshore flora and fauna, and for determinations of productivity and energy flow.

Biogeographical studies should be concentrated especially in certain key areas

(such as major submarine ridges), and as far as possible there should be international co-ordination of such collecting programmes.

The much publicized need for more taxonomic specialists and improved taxonomic facilities remains acute and is potentially a limiting factor in several fields of Antarctic marine research.

The microbiology of ocean floor sediments should be developed and methods for securing samples uncontaminated by ship's gear or the upper water column, methods for prevention of changes in dissolved gases and other factors during depressurization, and media more appropriate for cold Antarctic marine conditions should be developed.

The small, newly discovered colonies of *Arctocephalus* in the South Shetland Islands should be proposed for special protection under the Agreed Measures for the Conservation of Fauna and Flora in the Antarctic, and pup counts made annually.

SECTION 5

Pack ice regime

Discussion leader: Dr M. J. Dunbar.

The Section touched on four subjects—sea ice physics, organic production in sea ice, the inter-action of waves and ice, and ice forecasting. Attention was drawn to areas of inter-relation between these studies, and matters in need of research, as follows:

The physical structure of sea ice, which shows great heterogeneity, must have an important bearing on the behaviour of the ice under the stress of waves.

The structure of sea ice, again because of its heterogeneity, offers considerable habitat variety for organisms, and since habitat variety is rare in the Antarctic, especially in the sea, the sea ice deserves detailed study by ecologists, especially in terms of ecosystem diversification.

An investigation should be made of the possible effects of the ice flora upon the productivity in general (in the water mass as a whole). What happens when the ice flora is released into the water below?

About thirty years ago, certain papers by T. C. Barnes, Jahn, and Harvey, suggested that water polymers (tritydol, etc) were beneficial to the growth of plant cells. Interest in this fell when it became clear that the residence time of the polymers in melt-water was very short, but now that plants growing *in ice* are being studied, it is recommended that this matter be taken up again.

The study of the effects of waves on ice, and the reverse, has been neglected; it is recommended that proliferation of such studies be encouraged, and that a suitable instrumentation be developed.

There is a probable relation between the break-up of ice by waves and the productivity of the water, and possibly between wave action and the loss of salt from sea ice; both require study.

The use of plankton, and of life within the ice itself, as an additional help in ice forecasting, should be pursued further; a start was made in the USSR (Dr Bogorov) some years ago. There is a possibility that indication of ice cover and movements might be gained by qualitative and quantitative examination of the microalgae present in the water column beneath the ice, as well as by checks maintained on the condition of the ice matrix layer. Dr Bunt pointed out that the differences in these characteristics between the weak ice year of 1961–62 and the heavy ice conditions in 1962–63 in McMurdo Sound were striking.

Ice forecasting methods need diversification in other directions also, in particular by the use of satellites and the study of variations, annual and seasonal, in the velocity of ocean currents.

It was recommended (Dr Andriashev) that ice terminology should be re-examined,

particularly in view of the discrepancies between current usages in the north and south polar regions.

Suggestion came after the meeting (Dr Tierney) that developments should be made of sensors for micro- "or semi-macro-" physical and chemical studies of the immediate sub-sea ice region. The possible source for such development might well be found in clinical fields or from the related field of space medicine.

The special communities attached beneath ice floes merit close study, and their contribution to the benthos, by settlement, should be assessed.

The distribution of benthos beneath ice shelves should be studied, in the first instance by examination of areas exposed by the calving of icebergs or accessible through rifts, and subsequently from submerged sampling platforms.

The general hydrology close to and under ice shelves needs study particularly in relation to the structure of ice, the growth and dispersal of plankton and the nutrition and dispersal of the benthos.

SECTION 6

Productivity

Discussion leader: R. I. Currie.

Our lack of knowledge of primary production in the Southern Ocean, and in particular of its seasonal variation prevents any realistic assessment of the productivity of the Antarctic.

In productivity studies, special attention must be paid to estimating the importance of ice microflora and to determining the degree of holotrophic growth.

The usefulness of spot observations from ships was emphasized. Properly planned experiments and observations are required to improve our knowledge of the biology of the Southern Ocean. Every attempt should also be made to reach a uniformity of methods.

The importance of krill as a potential utilizable resource was emphasized. It is necessary, however, to obtain better quantitative estimates of its abundance and to know more of its swarming habits. There are several points regarding its life history still needing to be clarified by further observation, particularly in the region of 30° E, and it may be desirable to consider planning an expedition to study these specifically.

EXCHANGE SCIENTISTS IN THE ANTARCTIC, 1965-66

Country of Origin	Name	Subject	Host country
Summer 1965-66			
Belgium	E. E. Picciotto	Glaciology	USA (South Pole-Dronning Maud Land traverse)
	R. Souchez	Geology	USA (McMurdo)
Canada	Sir Charles Wright	Radioscience	USA ("Byrd")
Japan	M. Shima	Geology	USA (McMurdo)
	J. Sugiyama	Biology	USA (McMurdo)
	M. Yamagata	Biology	USA (McMurdo)
New Zealand	P. C. Harper	Ornithology	USA (<i>Eltanin</i>)
	A. Koga	Geochemistry	USA (McMurdo)
	C. Ray	Biology	USA (McMurdo)
Norway	A. Orheim	Glaciology	USA (South Pole-Dronning Maud Land traverse)
Poland	J. Molski	Electronics	USSR (Komsomolskaya)

Country of Origin	Name	Subject	Host country
USA	V. P. Hessler	Ionospherics	USSR ("Vostok")
	W. B. Hughes	Cosmic radiation	New Zealand (Campbell Island)
	J. D. Jacobs	Ionospherics	USSR ("Vostok")
	P. Starke	Meteorology	South Africa (Bouvetøya)
Winter 1966			
Hungary	J. Barat	Aerology	USSR (Mirny)
Poland	R. Czajkowski	Physics	USSR (Mirny)
	A. Kuchcinski	Electronics	USSR (Mirny)
	M. Zalewski	Geophysics	USSR (Mirny)
USA	J. K. Taylor	Electronics	USSR ("Vostok")

PERMANENT WORKING GROUPS OF SCAR

Geodesy and Cartography

(Amendment to *SCAR Bulletin*, No 23, 1966, p 419)

Japan: Dr Y. Harada, Geographical Survey Institute, Ministry of Construction, 1000 7-chome, Kamimeguro, Meguro-ku, Tokyo.

Glaciology

(Amendment to *SCAR Bulletin*, No 23 1966, p 421)

USA: Dr C. R. Bentley, University of Wisconsin, Department of Geology, Geophysical and Polar Research Center, 6021 South Highlands Road, Madison, Wisconsin 53705.

Meteorology

(Amendment to *SCAR Bulletin*, No 23, 1966, p 422)

Japan: Dr J. Kawase, Japan Meteorological Agency, Otemachi, Chiyoda-ku, Tokyo.

Solid Earth Geophysics

(Amendment to *SCAR Bulletin*, No 23, 1966, p 423)

Japan: Professor I. Tsubokawa, Earthquake Research Institute, University of Tokyo, Bunkyo-ku, Tokyo.

Upper Atmosphere Physics

(Amendment to *SCAR Bulletin*, No 23, 1966, p 424)

Japan: Professor T. Nagata, Geophysical Institute, University of Tokyo, Bunkyo-ku, Tokyo.

NOTICE

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Contributions are invited, and should consist of factual notes on the membership, equipment and activities of Antarctic parties; articles on matters of particular interest in connection with these activities are also welcome. Contributions should be sent to the Editor, Scott Polar Research Institute, Lensfield Road, Cambridge, England.

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