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(of Unesco)

Meeting of Experts on Oceanography related to the Dynamics of the Antarctic Ecosystem

Kiel, FRG, 18-19 May 1984

SUMMARY REPORT

This meeting was organized by IOC in conjunction with the second meeting of the SCOR WG-74 on the General Circulation of the Southern Ocean (Kiel, FRG, 15-17 May 1984) as a follow-up of recommendations made by the Fourth Session of the IOC Programme Group for the Southern Oceans (Paris, 7-11 March 1983).

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1. Opening and arrangements for the meeting

The meeting was called to order by Dr. D. Sahrhage, Chairman of the IOC Programme Group for the Southern Oceans (PG/SOC) at 09.00 on 18 May 1984, at the Institut für Meereskunde, Kiel, Federal Republic of Germany. Dr. R.B. Heywood acted as Rapporteur. The Agenda and the List of Participants are given in Annexes I and II respectively.

In his opening the Chairman referred to the discussions of the IOC Programme Group for the Southern Oceans (PG/SOC) during its Fourth Session in Paris, March 1983. The PG/SOC had agreed that it was most desirable to supplement the ongoing oceanographic research in the Antarctic within the BIOMASS programme by additional physical and chemical observations in key areas, such as the large-scale gyres south of the Antarctic Circumpolar Current, the Weddell-Scotia Confluence Zone and related eddies. The PG/SOC had proposed that the scientific aspects for such supplementary studies should be discussed by SCOR Working Group-74, and that IOC should then organize a meeting of oceanographers with interest in these topics and practical experience in Southern Oceans studies, to develop further plans. The Chairman explained that the direct conjunction between the meeting of SCOR WG-74 and the present session provided an excellent opportunity to achieve three main goals:

- to inform the members of SCOR WG-74 of the work and results obtained and planned in BIOMASS activities, particularly for the FIBEX (1980/81) and SIBEX (1983/84, 1984/85) multi-ship expeditions;

- to review the recommendations made by SCOR WG-74 and discuss what oceanographic processes relevant to the BIOMASS objectives, should be studied through international co-operation;

- to develop plans for related sea-going activities.

2. Hydrographic investigations within the framework of biomass

Brief descriptions of the oceanographic research being carried out in the Bransfield Strait, Elephant Island, Scotia Sea and South Georgia areas were presented by Mr. M. Stein and Dr. R.B. Heywood. The picture emerging was one of complex currents, water masses and submarine topography. Dr. J.C. Hureau described the slightly less complicated features of Prydz Bay in the Indian Sector, which is another area of high krill concentration in most years. Four key questions related to the presence of krill and the physical environment, as identified by BIOMASS, were put forward by Dr. S. Rakusa-Suszczewski: What is the relation of krill distribution to water masses, fronts and eddies ? What are the factors determining the development of superswarms ? What happens to krill near the northern limit of its distribution ? What is the explanation for the lack of randomness in zooplankton distribution ?

3. Report of SCOR WG-74 - Status and recommendations for research on the general circulation of the Southern Ocean

Dr. W.D. Nowlin Jr., Chairman of SCOR WG-74, reported that six major topics of research had been identified at the first meeting of the Group held in February 1983:

Interaction with Subtropical Zone
Antarctic Circumpolar Current
Sub-polar Zone
Shelf-Slope Processes
Sea-level Observations
Sea-Air-Ice Interactions

Review papers had been prepared for this second meeting of WG-74 which presented the major gaps in knowledge in the form of a series of questions and recommendations. Deliberations on these questions produced a list of research projects which were recommended for pursuit during the next 5-10 years. Other items included: consideration of the need for a RNODC for the Southern Ocean physical and chemical data; a Ship of Opportunity programme for the Southern Ocean; and Southern Ocean studies using satellite-derived data, including surface drifters.

4. Oceanographic programmes in relation to the dynamics of the antarctic marine ecosystem

A preparatory meeting of BIOMASS observers to the WG-74 meeting identified as the most essential supplement to the ongoing BIOMASS oceanographic research, a quantitative description of the geographic and temporal variation in the contribution of Weddell Sea waters, S.E. Pacific Antarctic and Sub-Antarctic waters, and Bellingshausen Sea waters to the Bransfield Strait and Scotia Sea (and similar contributions to the waters of Prydz Bay), and of the atmospheric forcing involved. The information would form a vital contribution to the on-going study of krill population dynamics. The members of the SCOR WG-74 were asked to comment on the feasibility of supplying this information out of data obtained by research projects already recommended for the Antarctic Circumpolar Current, Sub-polar Zone and Sea-Air-Ice Interactions. The members of the SCOR WG-74 were also asked to comment on the feasibility of producing predictive models based on this data, and of combining such models with other models based on krill abundance and distribution data to provide means of forecasting years and geographic areas of abnormally low krill abundance.

The ensuing debate included clarification of the BIOMASS requirements and explanation of the present limits of physical knowledge, understanding and techniques. Experiments on water transport were considered to be difficult. The SCOR WG-74 had recommended a project of research on the outflow of water from the Weddell Sea gyre, but this may not be carried out within the next 5 years. A specific experiment would have to be designed to meet the BIOMASS requirement. BIOMASS scientists could provide some of the background information necessary for this by regularly monitoring oceanographic conditions within the BIOMASS study areas. Direct

current measurements by moored meter arrays, profiling methods and drifters were advised. Particular attention should also be given to overall wind forcing which was probably the main process involved in the upper 200 metres. The projects recommended by SCOR WG-74 would provide information of general value to BIOMASS research. Similarly BIOMASS research would probably make a contribution to physical oceanography measurements, especially if observations on frontal zones were made regularly on a "ships of opportunity" basis.

The limitations of present day modelling were described. Only single, well defined processes could be examined. Even at this scale the work was restricted by lack of information. The same situation must exist to to a greater degree in biological modelling. Small-scale modelling was worthwhile in both physical and biological oceanography for highlighting serious gaps in knowledge, aiding the understanding of processes and systems, and guiding the design of experiments. However it was premature to consider producing models of the complexity proposed by BIOMASS.

Scientists involved in BIOMASS, then described how the complex bathymetry of the Scotia Ridge makes the measurement of direct currents by moored meter arrays prohibitively expensive. The discussion that followed explored the reliability of the geostrophic current calculation in areas of complex bathymetry, as well as the use of drifters and the calculation of wind-forced surface currents in greater detail.

Particular attention was drawn to the 20-30 fold reduction in krill biomass observed in all areas worked during the first season of SIBEX. The period of observation in the Scotia Arc region extended from August 1983 to March 1984. During a discussion on possible physical causes it was revealed that a considerable amount of unanalysed data collected between 1975 and 1984 was available for the Bransfield Strait, Scotia Sea and South Georgia region. Arrangements would be made for this data to be analysed in an attempt to determine if the physical environment was abnormal during the first year of SIBEX. The analysis would be carried out by a team of BIOMASS and non-BIOMASS scientists. It was agreed that the Chairman of PG/SOC would contact the Convenor of the Group of Specialists on Southern Ocean Ecosystems and their Living Resources (SCOR WG-54) as regards the organisation of this work.

Specific aspects of BIOMASS physical oceanographic research were then discussed in more detail, including the optimum size for study areas and inter-station distances, and the measurement of currents on the meso- and micro- scales. The importance in both instances of using profiling methods and drifters for the direct measurement of currents, and the need to calculate the wind generated component were again stressed. The use of freon or similar tracers to study convective overturning was also strongly advised.

The discussion then focussed on the contribution that could be made to the general field of physical oceanography if BIOMASS research vessels made CTD and XBT profiles across frontal zones when on passage to their research areas. The Chairman of SCOR WG-74 agreed to advise on sampling frequency if planned cruise tracks were forwarded to him through the SIBEX

co-ordinator, Dr. G. Hempel. CTD data collected from the standard stations of the BIOMASS research areas would also be of value in providing information on seasonal and annual variability.

5. Future sea-going activities

Planned Southern Oceans cruises and research were described by the national representatives present. It was agreed that there was a need to improve the dissemination of information on the research being carried out by the various groups working in the Southern Oceans. Regarding this point, the meeting was informed that there was now an expeditionary planning committee for the USA academic fleet of oceanographic vessels, and a regularly updated schedule of activities was available through the Telemail system. At the same time, members of the SCOR WG-74 would be placed on the BIOMASS publication list.

6. Closure

In closing the meeting, the Chairman of PG/SOC thanked all present for contributing to what had been a lively and informative discussion. In particular he thanked the Institut für Meereskunde in Kiel for hosting the session, and Dr. W. Zenk and other staff members of the Institut for their effective assistance. The meeting closed shortly before 13.00 hrs on 19 May 1984.

ANNEX I

AGENDA

1. Opening and arrangements for the meeting.

2. Hydrographic investigations within the framework of BIOMASS.

3. Report of SCOR WG-74. Status and recommendations for research on the general circulation of the Southern Ocean.

4. Oceanographic programmes in relation to the dynamics of the antarctic marine ecosystem.

5. Future sea-going activities.

6. Closure.

ANNEX II

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