

**ARCTIC OCEAN SCIENCES BOARD (AOSB)
Eleventh Session (AOSB-XI)**

**6-10 April 1992
Centre for Cold Ocean Resources Engineering (C-CORE)
Memorial University
St. John's, Newfoundland, Canada**

OPENING OF THE MEETING

Dr. Eileen Buttle, Chairman of the AOSB, opened the meeting in which scientists from nine countries participated, including for the first time a scientist from Poland. Dr. Geoffrey Holland, Director General of the Physical and Chemical Sciences Directorate of Canada's Department of Fisheries and Oceans, welcomed the participants to Canada. Dr. Jack Clark, President of C-CORE, welcomed AOSB to St. John's and to the Memorial University.

ADOPTION OF THE AGENDA

The agenda was modified to include data exchange/dissemination in the discussions on remote sensing in the Arctic.

PRESENTATION OF C-CORE PROGRAMS

Dr. Clark gave a presentation on the programs of the Centre for Cold Ocean Resources Engineering. He summarized some of the Centre's most recent activities related to the sensing ice motion; the impacts of icebergs and ice flows on the sea bottom; the tracking of icebergs and the edge of the ice shelf by using ground wave radar; an expert (?) PC-based system for prediction of icebergs; and the use of acoustic devices to warn off whales from fishing nets.

THE INTERNATIONAL ARCTIC POLYNYA PROGRAM (IAPP)

Last year the Board discussed the IAPP and approved the *Mission Statement and Core Program for the IAPP*. The Mission Statement has been published and will be distributed by the Scientific Coordinating Group (SCG), primarily through the three individual polynya projects-- North Water (NOW), Saint Lawrence Island (SLIP), and Northeast Water (NEW).

The SCG reminded the Board of its decision last year, and of the urgent need at present, for a "glossy" document on the IAPP to be produced by the Board for distribution to the general scientific community.

The World Climate Research Program (WCRP) convened a meeting in June 1991 in Bremerhaven to consider a proposal for an Arctic Climate System Study (ACSYS) (see Agenda Item X below). A major objective of ACSYS is to establish a sound scientific basis for including the Arctic Ocean in modelling of the global climate. The ACSYS meeting recognized that to do so would be very difficult without an understanding of polynya and shelf water processes. Accordingly, the SCG has agreed to interact closely with the scientists planning ACSYS to assure that these two programs are complementary and that measurements of parameters of mutual interest utilize comparable methods based on common standards.

The North Water Polynya Project (NOW)

The overall plan for NOW as presented last year, had to be abandoned due to lack of funding for the logistics. However, it was possible to conduct a two-day field survey in the North Water in May, 1991, from a ship of opportunity. Results of this brief sampling program were extremely interesting, both for the physics and the biology. Temperature-salinity profiles show how variable the polynya is and suggest that the North Water Polynya is driven by sensible heat, not by latent heat as previously thought. Data on phytoplankton and dissolved inorganic nutrients revealed a significant phytoplankton bloom along the Greenland shore and suggested that this bloom moves to the west as the season progresses.

Plans for the immediate future (i.e., the summer of 1993) are to replicate these observations if possible. The main problem concerning the logistics for the NOW project is that the only way to sample these waters during the late winter and early spring period is to enter the polynya before it freezes up in the autumn, as had been explained last year. This requires a ship with major ice-breaking capacity, together with a fuel barge and living quarters. It would be possible to repeat the use of a ship of opportunity at marginal cost (?), but at present, no funds have been identified in Canadian budgets. AOSB members noted the value of obtaining more data on NOW.

Saint Lawrence Island Polynya Project (SLIP)

Efforts to obtain funding for a coordinated U.S. program have not been successful. However, related research activities continue in the Saint Lawrence Island Polynya. Such research includes efforts by scientists from Japan's National Institute of Polar Research (NIPR) with additional work supported by the U.S. National Science Foundation (NSF), and by the U.S. National Oceanic and Atmospheric Administration (NOAA). Cruises to date have been limited summer months, and have included short-term sampling and long-term mooring of such instruments as fluorometers and sediment traps. In addition, the Alaska Synthetic Aperture Radar (SAR) facility is being used to study the seasonal development of polynyas, including SLIP. Winter field work is presently at a minimum due to lack of access to vessels with ice-breaking capability.

Northeast Water Polynya Project (NEW)

A preliminary cruise in the Northeast Water Polynya was conducted in June 1991. This short cruise was mainly for mooring instruments, but also included a small hydrobiological component. It was found that, at that time of the year, the phytoplankton bloom was well advanced and zooplankton had already reproduced. As a consequence, the 1993 cruise of the *R/V Polarstern* has been moved to earlier dates than originally planned.

The first major cruise of the NEW Polynya Project will take place from mid-July through mid-August 1992 on the U.S. vessel *R/V Polar Sea*. This cruise will involve about thirty scientists. The field program will include measurements and/or sampling of the variables (with the exception of mammals and birds) recommended for polynya studies by the SCG (see the *Mission Statement*). In addition, moorings of current meters, sediment traps and fluorometers will be deployed to be recovered in 1993 by the *R/V Polarstern*.

The second major cruise of this project will be from 15 May through 4 August 1993 on board the *R/V Polarstern*. Three organizational meetings were held for this cruise during the last year--two at the Alfred Wegener Institute, Bremerhaven and one at the University of Tennessee. Presently, the cruise is oversubscribed. The Scientific Steering Committee for NEW will ask Group Leaders from each scientific area to consider with their colleagues which applicants would be the most appropriate for the cruise with reference to the *Mission Statement for the IAPP*. Although it is expected that the *R/V Polarstern* will be able to accommodate only a few such projects, the ship may be able to accommodate others in later years. Common methods and techniques will be used on both the *R/V Polar Sea* and *R/V Polarstern* cruises to assure comparability of measurements.

The NEW Polynya Project will also include land-based studies in Greenland that will complement ship sampling. This land program will involve twenty-five to thirty scientists, primarily from the Scandinavian countries.

Polynya-Related Research

Several other studies of circulation and carbon fluxes, including the Winter Greenland Sea Project, will be conducted in the Greenland Sea in 1993 and will be closely coordinated with the NEW studies also to be conducted in 1993.

Recommendation to the AOSB: An International Polynya Workshop

Many studies are underway and being planned under the aegis of the IAPP in the three polynyas originally identified for study--NEW, NOW, and SLIP. U.S. and Japanese scientists are continuing collaborative efforts in the Saint Lawrence Island Polynya. Data from the 1991 preliminary cruise in the NOW Polynya are now available. The 1991 preliminary cruise and the major U.S. effort planned for 1992 in the NEW Polynya are expected to generate substantial new data sets and information.

The SCG recommends that the AOSB convene an international workshop on polynya research immediately prior to the Twelfth Session of the AOSB Meeting in January 1993. The SCG also recommends that this workshop focus on the three polynyas identified by the SCG for initial study--the Northeast Water, the North Water, and the Saint Lawrence Island Polynya.

Such a workshop would have a series of important objectives. First, it would provide an opportunity for scientists to discuss the results of the NEW studies of 1991 and 1992 and to apply these results to planning of the 1993 cruise in the NEW Polynya. Second, it could provide new impetus to development of planning for research on other polynyas, especially NOW and SLIP. Third, it could advance integration of the three IAPP projects and promote the comparability of collected data and results, especially by stimulating the development and use of standard research methods, techniques, and technology in studies of the three polynyas. These objectives should be pursued, in particular, by encouraging participation in the workshop by scientists from the U.S. and Japan.

The Board agreed to sponsor a "Workshop on Arctic Polynyas" with emphasis on NEW, NOW, and SLIP and with the objectives as outlined above. On the basis of the above recommendation from the SCG, the Board asked if it would be possible to convene the Workshop, together with the next session of the AOSB, in the United States. The member from the U.S. agreed, assuming that a mutually agreeable schedule and arrangements could be developed (see Item XX below). It was agreed that scientists actively involved in the Leads Experiment (LEADDEX) should be invited to participate in the Workshop.

Other IAPP Issues

The Board recognized that the limitations on both scientific and financial resources which had been reported indicate that it may not be possible to conduct simultaneous studies of all three polynyas identified by the SCG/IAPP. It was agreed that, while some scientific benefits would likely be lost if the studies are not simultaneous, sequential studies are likely to be the only way to study all three polynyas. The Board encouraged members to assure that at least a minimal suite of observations is undertaken in the NOW and SLIP coincident with the major cruises of the NEW Project in order to obtain at least a general idea of conditions at these two polynyas at the times that major studies of NEW are being made.

THE GREENLAND SEA PROJECT (GSP)

Dr. Peter Wadhams discussed the objectives and aims of the plans for the second intensive field phase of the Greenland Sea Project (GSP '93). He emphasized that the driving force behind planning of GSP '93 is the interannual variability that was observed during the first intensive field phase of the GSP in 1988/89. Dr. Hendrik van Aken reminded AOSB of the results from 1989 as published in *EOS* (Vol. 71 No. 24, pp. 750-751, 754-755). The overall objectives for GSP '93 were outlined in a report of the GSP Planning Meeting held on 5 December 1991 in Copenhagen.

These objectives are to study

- the circulation and water mass characteristics of the Greenland Sea under conditions which are expected to differ from those of the first intensive field phase in 1988/89;
- convective processes from small-scale to meso-scale;
- the sea-ice budget and dynamics, especially in the marginal ice zone of the Greenland Sea and the Isodden in particular;

- air-sea-ice interaction on local and synoptic scales, especially the development of the atmospheric boundary layer;
- spring blooms of the dominant phytoplankton species; and
- spatial and temporal variations in particle fluxes and the fluxes of dissolved substances.

In addition, a major effort will be undertaken to use remote sensing methods and techniques for measurement of sea-ice parameters from both above and below the sea surface.

Primary to the interdisciplinary study of the Greenland Sea is the complete repetition of the circulation and water mass study of 1988/89. The measurement program will include a spatial survey of the Greenland Sea using full-depth CTDs (for temperature and salinity) and rosettes (for salinity, oxygen, tritium, helium, and freons). The zonal section along 75 degrees N will be repeated prior to, during and after the winter 1992/3 convection event. Hydrographic measurements will be made in the regions connecting the Greenland Sea to the Arctic Ocean, the Iceland Sea/Northwestern Atlantic, and the Norwegian Sea. Long-term current measurements will be initiated in summer of 1992 in areas of current enhancement, especially in passages between basins or over sloping bottoms. Studies will be carried out of the Polar and Arctic fronts using suites of instruments.

Studies of convective processes from the small-scale to mesoscale will also be carried out. It was reported that in certain areas convection had been observed, but in those areas bottom waters were not flushed, so the convection did not reach the bottom layer. Areas of convection will be located by mesoscale hydrography in conjunction with satellite-tracked drifting buoys. Convective events of a horizontal scale of less than one-hundred meters will be studied using towed arrays. Deeper measurements of individual plumes will also be carried out. Acoustic experiments will be carried out to obtain plume statistics. Plume kinetics will be obtained from moored ADCPs. Surface temperature and young ice patterns will be studied to determine if they have space and time signatures related to hypotheses on convective plume formation.

The sea ice budget will be another focus of the effort, especially the large bulge which forms in the Isodden (this bulge has developed in ten of the last eleven years). This bulge is mostly young ice and occurs very close to where deep convection occurs. This suggests there may be a relationship between the formation of new ice and deep convection processes. Ice cores from the marginal ice zone (MIZ) and the Isodden will be examined to measure standard ice properties. Both ice-surface and under-ice topography will be obtained and satellite remote sensing will be used to determine the growth and decay of the ice cover. Ice and water surface parameters will also be obtained from profiling passive microwave systems, a lidar, visible and infrared radiometers and airborne XBT-probes.

Studies of air-sea-ice interaction will include an unusual three-vessel program to define the kinematics and dynamics of the atmospheric boundary layer. Time-series observations of spring bloom dynamics and measurements of particle fluxes and fluxes of dissolved substances are also components of the effort.

Remote sensing and ground-based sensing techniques are a high priority as well and use of SAR will be a significant component of many elements of the field program.

The *R/V Valdivia* and *R/V Polarstern* are expected to take the lead in the winter work;

then the *RRS James Clark Ross* and the UK's Defense Research Agency ship, *RNAS Newton* will repeat the work in the May-June period. The *R/V Polarstern*, *J. Hjort*, and *H. Mosby* will conduct additional field studies in July.

A detailed operational plan for the GSP '93 is being prepared under the direction of the Secretary for the GSP, Dr. Eric Buch. A final coordination meeting in the third quarter of 1992 will provide a final review of this plan.

The Board endorsed these planning efforts and encouraged its members to continue support for both the planning and implementation of the GSP '93. It was agreed that the Greenland Sea Project represents an impressive program, especially since formal coordination of the program has been kept to a minimum.

The Greenland Sea Symposium

There will be a Symposium on the "Oceanography and Marine Ecology of the Nordic Seas", 15-17 November 1993 in Hamburg. The core of this Symposium will be presentations and discussions of results of the Greenland Sea Project. Drs. Jens Meincke and Hans-Jurgen Hirche are leading the planning effort for the GSP Symposium and will serve as conveners. The major topics for the Symposium sessions are

- circulation and water masses
- deep convection
- ice-ocean-atmosphere interaction
- water chemistry
- biological productivity and carbon flux
- structure and dynamics of pelagic and benthic communities
- mammals and birds

REMOTE SENSING

It was reported that ERS-1 data is flowing satisfactorily and that the data appears to be of good quality. However, experience with the ERS-1 SAR data is, thus far, so limited that the quality of the data cannot yet be evaluated. The NEW program has a strong remote sensing component, but ERS-1 cannot support the NOW program since this polynya is not within the receiving station coverage for ERS-1. An AVHRR receiving system is available in container form in the Federal Republic of Germany and is expected to be installed on the *R/V Polarstern* during the NEW cruises planned for 1993.

The Program for International Polar Ocean Research (PIPOR) group of PIs met recently and discussed remote sensing needs for the Arctic. Users need SAR data for ice characterization (thus requiring single images with full resolution). They also need such data to determine ice velocities (requiring a series of images over three-to-four days, but at a lower resolution). ESA has agreed to provide such low-resolution images, but may charge full price for them. At 500ECU per image, the cost for a survey of significant size is very large. ESA does not tell prospective users whether others have requested (and thus already paid for) the same image. ESA also does not provide "quick-look" information for ERS-1 SAR data. A request to ESA to make such "quick-look" information available to users, prior to purchase, would be useful.

LEADDEX scientists are being provided with real-time images as they become available.

All such images go to the U.S. National Snow and Ice Data Center for archiving. The Board asked Dr. Leonard Johnson to find out if this Center might be able to assist other Arctic research scientists to obtain needed images. PIPOR provides some coordination to identify needs for ERS-1 data for ice studies, but it is very loosely structured and deals primarily with ERS-1 data at present, even though its mission is wider than that. It was recognized that JERS-1 might, in the future, also provide images useful for Arctic research, in particular SAR coverage of NOW.

The Board agreed that more visibility should be given to the data and images that are available for Arctic research from ERS-1 and other satellites. The Board agreed to encourage Arctic research scientists to develop "user groups" for satellite data and images for use in Arctic research. Such user groups could be modelled on PIPOR which appears to be operating in this area very effectively. These user groups could coordinate their requirements and develop combined requests for ERS-1 images, hopefully thus reducing costs to users. Arctic researchers are also encouraged to use and to support PIPOR within its areas of interest and capability.

The Board decided to distribute a "news sheet" which explains the process(es) for obtaining satellite data and imagery for the Arctic. This news sheet should explain how scientists can make contact with PIPOR or new users groups.

It was noted that a workshop on measurement of "ice extent" from satellites has been scheduled for January 1993 in Japan. It is being convened by SASIFY (stands for?) under the aegis of the "International Space Year (ISY)".

The Board decided to distribute information on this workshop to its Members and other interested Arctic research scientists.

ARCHIVING AND EXCHANGE OF ARCTIC OCEAN DATA

It was suggested that the Board address broader issues related to Arctic Ocean data archiving and exchange. Over the years, Arctic research has required cooperation and thus almost automatically has resulted in exchange of data among interested scientists. However, with the opening of the Arctic to increased research; the introduction of new and more capable technology; and new pressures expected from the policy sector for scientific data, models, etc., with policy implications, it is to be expected that more data will be collected in the Arctic in the future and that archiving and exchange will become more complex and costly.

It was agreed that problems should be expected to develop with respect to the future management of Arctic Ocean data, especially satellite data, although this is a problem which extends to all of ocean sciences and is not limited to the Arctic. Funds available for the management of both *in situ* and satellite data are minuscule compared with the funds provided for getting the satellites up and collecting the *in situ* data.

It was suggested that the "user group" concept might be usefully expanded to include users of *in situ* data as well as remote sensed data. In addition, some such user groups might address operational, rather than research, needs. The Board agreed that it would be useful to identify groups/institutions that are interested in standard oceanographic (including remote sensed) data in the Arctic. Lastly, it was suggested that it might be useful for the Board to approach the Working Committee on International Oceanographic Data Exchange (IODE) of the Intergovernmental Oceanographic Commission (IOC) to explore options for assuring the long-term archiving of Arctic Ocean data.

NANSEN ARCTIC DRILLING PROGRAM (NAD)

Dr. Johnson summarized recent developments under the NAD program. NAD has drawn up its science plan which will be available soon (Polarforschung #) and which has identified the following issues related to marine geology and geophysics in the Arctic Ocean: paleoenvironment; glacial/interglacial carbon cycles; shelf sediment dynamics; tectonic evolution; data compilation; the potential of NAD to contribute to basic research; resources development; and environmental management. NAD has outlined a series of specific program objectives which it intends to address as a matter of priority: completion of the paleoenvironmental record; paleoceanography; structure of major Arctic features and margins; nature and age of Arctic Ocean basement; former productivity levels; former extent and composition of sea ice; and paleo-wind flux.

The first step in improving data collection related to NAD has been to obtain longer cores. Dr. Dieter Fütterer recently obtained 16-meter cores, instead of the 8-meter cores, and continuous seismic profiles, despite the risk of loss of high-cost equipment due to the presence of ice. Multidisciplinary and multi-ship operations are necessary future activities. These are the first steps of a very long-term program to improve understanding of the geology and geophysics of the Arctic.

There have been discussions with the Ocean Drilling Program (ODP) which is considering potential sites for ODP drilling in the Greenland Sea. ODP is considering a series of potential drill sites in the marginal ice zone, including one site north of Svalbard, provided that ice conditions permit. ODP operations may be possible in areas with 40% ice, although ice-breaker support would be required. Ten countries are represented in the NAD and have contributed to setting up a small planning office at Joint Oceanographic Institutions Incorporated, in the U.S. The initial NAD samples from the Lomonosov Ridge indicate cyclicity of deposition in the Arctic, but the nature of the cycles is not clear. Precise dating of the samples is difficult, dateable biological forms are rare and experts differ substantially as to the rates of deposition in the Arctic. Optimum resolution on the order of 500 to 1000 years may be achievable, but better resolution than that may not be possible. There is interest in correlating off-shore marine geological and geophysical studies, especially in the Mackenzie delta region, with planned drilling on land in the Arctic.

NANSEN CENTENNIAL ARCTIC PROGRAM (NCAP)

No new information has been made available to the Board regarding progress in this area. It was indicated that funding has been sought within the Norwegian Government for support of this program.

THE WORLD CLIMATE RESEARCH PROGRAM (WCRP)

The World Ocean Circulation Experiment (WOCE) originally excluded the Arctic from its purview, but may be reconsidering this decision. More importantly, the World Meteorological Organization (WMO) has undertaken a series of actions to develop an Arctic Climate System Study (ACSYS). A scientific committee was set up to develop a scientific plan for ACSYS. The major objectives of ACSYS are

- to develop a sound scientific basis for inclusion of the Arctic in coupled models of global

climate;

- to conduct climate sensitivity studies for various models in the Arctic;
- to plan and promote development of a climate monitoring system for the Arctic, including the present International Arctic Buoy Program (IABP); and
- to consider the interaction of the Arctic region with global climate, including the possible impact(s) of climate change on the Arctic.

It was noted that freshwater studies are an important component of ACSYS and it is intended that ACSYS and the Global Energy and Water Cycle Experiment (GEWEX) be closely coordinated.

The Scientific Plan for ACSYS has been completed by the Scientific Steering Committee. This plan is being submitted to the Joint Scientific Committee (JSC) for the WCRP for its review and approval. If and when this approval is provided, then a Planning/Project Office will be established; an implementation plan for ACSYS will be developed; an "ACSYS Program" will be initiated; scientists will then be invited to prepare and submit proposals to conduct research to implement the program.

With respect to this, it should be noted that the nature and composition of the JSC is likely to change to reflect the IOC's becoming a co-sponsor of the WCRP. It is expected that the terms of reference and membership for the JSC will be broadened specifically to include oceanography.

ARCTIC RESEARCH VESSELS

The international electronic database on research vessel operations, called OCEANIC, has been expanded to include all known Arctic research vessels. This database is now accessible via the ScienceNet electronic mail system. The Board noted that the use of ships of opportunity in the Arctic is more important than in other regions and the numbers of such ships is very small.

Thus, the Board requested that the OCEANIC database for Arctic oceanography be broadened to include ships of opportunity such as icebreakers and supply vessels.

THE EUROPEAN COMMITTEE ON OCEAN AND POLAR SCIENCES (ECOPS) AND THE EUROPEAN SCIENCE FOUNDATION (ESF)

ECOPS will advise the ESF and the EEC on ways and means to stimulate research in ocean and polar sciences. Topics of interest should be of broad interest, require a broad range of support, strengthen European cooperation, and make European capabilities available to partners outside Europe. ECOPS decided to convene a series of workshops, including one on Arctic Ocean dynamics (Bergen, 1990) and one on development of a benthic laboratory (yet to be convened).

As a result of these workshops, a series of five meetings will be held in 1993, each addressing a "theme" which has been identified as a scientific area in which the European countries have existing strengths and intend to focus future research efforts. These meetings will review research in these areas, both underway and planned, and identify opportunities for

additional new projects. These meetings will be followed by a major conference in 1994. The themes are: modelling and prediction of coastal zones; ocean modelling and prediction; ice sheet-climate interaction; biological diversity and productivity in the open ocean; and the deep-sea floor as a changing environment.

SCIENTIFIC COMMITTEE ON OCEAN RESEARCH (SCOR) AND THE INTERNATIONAL COUNCIL FOR EXPLORATION OF THE SEA (ICES)

No reports have been received from SCOR or ICES. The Board has been invited to be represented at the next ICES Meeting. The Board authorized Drs. Malkki and van Aken to represent the AOSB at the 80th Statutory Meeting of ICES. At the last ICES Meeting there was little specific discussion of Arctic Ocean issues. However, there were discussions of the "appropriate" balance between studies of biological, chemical, and physical oceanography. This may lead to changes in the role of the Hydrography Committee.

The WMO and IOC have agreed to co-sponsor development of a Global Climate Observing System (GCOS). They have established a Joint Scientific and Technical Committee to provide oversight for GCOS and a Joint Planning Office at the WMO to support the Committee. The IOC has also decided to develop a Global Ocean Observing System (GOOS) to be supported by a GOOS Planning Office at the IOC in Paris. While a major part of the GOOS will serve as the oceanographic component of the GCOS, the GOOS will also include components to monitor coastal oceans and marine chemical and biological parameters.

The northern Pacific counterpart of ICES, called "PICES", has been formally established. Japan, the U.S., China, and Canada have ratified and are now members; Russia is expected to join shortly and membership is open to other countries. It is expected that PICES will be active in the Bering Sea and will have an interest in adjacent Arctic Ocean regions. The PICES Chairman Prof. Woorks (?) and the secretariat are at the Institute of Ocean Sciences, Sydney, British Columbia.

ELECTION OF OFFICERS

The Board asked Dr. Buttle to serve an additional year as Chairman and elected Dr. Malkki as Vice-Chairman. The Board agreed to consider, in the future, the possibility of changing the term of office of the Chairman from two to three years.

The Board requested the Secretariat to continue to provide staff services for the Board and the Secretary agreed on behalf of the Secretariat.

ARRANGEMENTS FOR THE NEXT MEETING

The Board usually alternates its meeting between North American and Europe and its next meeting would be in Europe; at least two possible locations have been considered--Bremerhaven and The Hague. However, the SCG/IAPP had recommended that the next AOSB meeting be preceded by an AOSB-sponsored workshop on polynyas which would draw together investigators involved in polynya research in the three areas already identified--NEW, NOW, and SLIP. Thus, the arrangements for the next meeting should actually provide for both a polynya workshop and an AOSB meeting.

These meetings should be in January in order to assure full input from the early NEW field studies. In order to encourage the participation of SLIP scientists, the Board decided that the 1993 meeting will be held in the United States at a location to be decided by the host country in consultation with the Chairman. The meetings would run over a one-week period from Monday morning through Saturday morning. The polynya workshop would run from Monday through early Wednesday afternoon and the AOSB would meet from Thursday morning through Saturday morning.

INTERNATIONAL ARCTIC SCIENCE COMMITTEE (IASC)

The IASC was formally constituted in August 1990. It includes a Council and Regional Board. It is non-governmental, but the Board serves to address governmental interests. IASC's membership includes countries bordering the Arctic. Other countries which have demonstrated long-term interest and have conducted programs in the Arctic were also invited to join. Six applied for membership and were accepted: Germany, France, UK, Japan, The Netherlands, and Poland. Dr. Buttle attended the last IASC meeting and reported on AOSB activities, but expressed no specific position regarding formal affiliation between the IASC and the AOSB.

IASC is a scientific body and initially considered convening a series of workshops on important scientific issues. They have decided to host the first such workshop on the Arctic and global change. This workshop will be held later this month just prior to the next meeting of the IASC Council. The Council will consider the report of the global change workshop, as well as a broad range of other scientific issues.

The agenda for the Council meeting includes an item on Arctic ocean research. This was suggested by Prof. Gotthilf Hempel in order to involve the full IASC Arctic countries' membership in the promotion of access, by ocean research vessels, to the Arctic. AOSB is concerned that this initiative might duplicate coordination of ocean research in the Arctic.

The IASC should first develop its strategy; this was the primary task assigned to its executive committee. The IASC will have to address a broad range of scientific problems.

AOSB decided it should cooperate with the IASC but maintain its integrity.

Only a small part of the IASC program will involve ocean research. IASC can be a very valuable forum to bring together scientists from a broad range of disciplines, including the social sciences and medicine. In AOSB's view, IASC should focus on these interdisciplinary activities, while AOSB continues to address the specific ocean-science related issues of interest to the ocean sciences community.

The agenda for the IASC global change workshop provides for a presentation to be made regarding the IAPP, but not on the GSP. If the workshop intends, as planned, to consider the role of the Arctic in global change, then it is essential that the Workshop consider the role of the Greenland Sea and the GSP in particular. Therefore, the Board asked the Secretary to obtain a complete agenda from the organizing committee for the workshop and to assure that the GSP is added to the agenda.

The Board decided to ask Louis Legendre and Jens Meincke to brief AOSB members/scientists who will be participating in the workshop to ensure that the workshop receives complete presentations on both the IAPP and the GSP.

The Board charged the Chairman with representing the AOSB at the upcoming IASC Council meeting and agreed that the Chairman should indicate the Board's willingness to work with, and collaborate with, IASC and keep open the possibility of formal linkages between the IASC and the AOSB.

AOSB MISSION AND STRATEGY

The Chairman led the Board through a detailed discussion of its mission, its strategy and the tactics it might adopt to achieve its strategy. This followed an initial discussion at last year's meeting. The conclusions of the discussion may be summarized as follows.

AOSB Mission: to facilitate Arctic Ocean research by the support of multi-national and multi-disciplinary natural science and engineering programs

AOSB Strategy: to achieve its mission and provide additional value through AOSB involvement by

- 1) encouraging and supporting science-led programs by offering planning, coordination and access to funding and logistics;
- 2) ensuring that information on Arctic Ocean research is exchanged between nations and disseminated to Arctic Ocean scientists in each nation;
- 3) providing networks for Arctic Ocean scientists, for example, on access to facilities/logistics and access to data;
- 4) establishing means of initiating and maintaining long-term data capture systems (via moorings, buoys, satellites, etc.); and
- 5) ensuring that there is interaction, where appropriate, between the international Arctic Ocean science community and those concerned with Arctic policies.

APPENDIX I

Arctic Ocean Sciences Board Eleventh Meeting

Members

Eileen Buttle (Chairman)
Natural Environment Research Council
Polaris House
North Star Avenue
Swindon, SN2 1EU
United Kingdom

Telephone: 0793-41-16-54
Telefax: 0793-41-16-91
Telemail: NERC.SCIENCE.HQ
Telex: 444293 envre g

Dr. Robert W. Corell (Vice Chairman)
(not in attendance)
Geosciences Directorate
National Science Foundation
1800 G Street, NW, Room 510
Washington, DC 20550
U.S.A.

Telephone: 202-357-9715
Telefax: 202-357-9629
Telemail: R.CORELL

Dr. Dieter Fütterer
Alfred-Wegener-Institut für Polar-
und Meeresforschung
P.O. Box 120161
2D-2850 Bremerhaven
Federal Republic of Germany

Telephone: 49-471-4831-200
Telefax: 49-471-4831149
Telemail: ALFRED.WEGENER
Telex: 02 38 696 Polar D

Dr. Preben Gundmandsen
(not in attendance)
Technical University of Denmark
Building 349
DK-2800 Lyngby
Denmark

Telephone: 45-42-881441
Telefax: 45-45-931634
Telemail: P.GUDMANDSEN
Telex: 37529 dthdia dk

Dr. Christian Hjort
Dept. of Quaternary Geology
Lund University
Sölvegatan 13, 5-22362
Lund, Sweden

Telephone: 46-46-107881
Telefax: 46-46-104419

Mr. Geoffrey L. Holland
Director General
Physical & Chemical Sciences Directorate
Department of Fisheries and Oceans
200 Kent Street
Ottawa, Ontario

Telephone: 613-990-0298
Telefax: 613-990-5510
Telemail: OCEANSCIENCE.OTTAWA

Canada K1A 0E6

O.M. Johannesson
(not in attendance)
Nansen Environment Remote Sensing Center
Lysaker
Norway

Dr. Pentti Malkki
Finnish Institute of Marine Research
P.O. Box 33
SF-00931 Helsinki
Finland

Telephone: 358-0-331-044
Telefax: 358-0-331-376
Telex: 125 731 imr sf
Telemail: FIMR.HELSINKI

Dr. Nobuo Ono
(representing Dr. Takao Hoshiai)
Arctic Environment Research Center
National Institute of Polar Research
Kaga 1-9-10, Itabashi-ku
Tokyo 173
Japan

Telephone: 81-3-3962-4711
Telefax: 81-3-3962-5701
Telemail: ARC.NIPR

Prof. Unnsteinn Stefansson
(not in attendance)
The Icelandic Council of Science
Barugata 3, IS-101 Reykjavik
Iceland

Telephone: 354-1-10233/10234
Telefax: 354-1-21331
Telex: 2307 isinfo is

Dr. Hendrik M. van Aken
Netherlands Institute for Sea Research
(NIOZ)
P.O. Box 59
1790 AB den Burg/Texel
The Netherlands

Telephone: 31-2220-69416
Telefax: 31-2220-19674
Telemail: NIOZ.TEXEL

Observers

Dr. Ted E. De Laca
Division of Polar Programs
National Science Foundation
1800 G Street, NW, Room 620
Washington, DC 20550
U.S.A.

Telephone: 202-357-7894
Telefax: 202-357-9422
Telemail: T.DELACA

Dr. John Harwood
Natural Environment Research Council
Sea Mammal Research Unit
c/o British Antarctic Survey
High Cross, Madingley Road
Cambridge CB3 0ET
United Kingdom

Telephone: 44-223-311354
Telex: 817725 BASCAM G
Telefax: 44-223-328927

Dr. Hans-Jurgen Hirche
Alfred-Wegener-Institut für Polar-
und Meeresforschung
P.O. Box 120161
2D-2850 Bremerhaven
Federal Republic of Germany

Telephone: 49-471-4831340
Telefax: 49-471-4831149
Telemail: ALFRED.WEGENER

Dr. Leonard Johnson
Office of Naval Research
800 N. Quincy Street
Code 1125
Arlington, VA 22217-5000
U.S.A.

Telephone: 703-696-4118/4119
Telefax: 703-696-4884
Telemail: L.JOHNSON.ONR

Mr. Slavomir Kwasniewski
Arctic Ecology Group
Polish Academy of Science
Supot 81-967
Powstancow Warszawy Street 55
Poland

Telephone: 48-58-419652
Telefax: 48-58-512130
Telex: 48-58-512785

Dr. Louis Legendre
Department de Biologie
Universite Laval
Quebec, Quebec
Canada, G1K 7P4

Telephone: 418-656-5788
Telefax: 418-656-2339
Telemail: L.LEGENDRE

Dr. E. Lyn Lewis
Institute of Ocean Sciences
Department of Fisheries and Oceans
P.O. Box 6000
Sidney, British Columbia
Canada V8N 4B2

Telephone: 604-477-3772/363-6570
Telefax: 604-363-6746
Telemail: IOS.BC
Telex: 0497281 dfopatbay vic

Dr. Joe Niebauer
Institute of Marine Science
School of Fisheries and Ocean Sciences
University of Alaska, Fairbanks
Fairbanks, AK 99775-1080
U.S.A.

Telephone: 907-474-7832
Telefax: 907-474-7204

Dr. Peter Wadhams
Director
Scott Polar Research Institute
University of Cambridge
Lensfield Road
Cambridge CB2 1ER
United Kingdom

Telephone: 66-223-336542
Telefax: 66-223-336549
Telemail: P.WADHAMS
Telex: 81240 CAMSPL G

Staff

Mr. Louis B. Brown (AOSB Secretariat)
Directorate for Geosciences
National Science Foundation
1800 G Street, NW, Room 510
Washington, DC 20550
U.S.A.

Telephone: 202-357-9809
Telefax: 202-357-9629
Telemail: L.BROWN
Telex: 7401424 nsfo uc

Ms. Clary B. Washington
Joint Oceanographic Institutions Inc.
1755 Massachusetts Avenue, NW,
Suite 800
Washington, DC 20036-2102
U.S.A.

Telephone: 202-232-3900
Telefax: 202-232-8203
Telemail: JOLINC
Telex: 7401433 bake uc

APPENDIX II

Summaries of National Arctic Ocean Science Programs

CANADA

Several factors have combined to act against recent Canadian ocean research activities in the Arctic. The recession has reduced the amount of research funds available in general and, because of the relative higher cost of arctic research, this has resulted in fewer Arctic research projects. Hydrocarbon resource exploration and development activities have also diminished, leading to a drop in priorities and funding for related Arctic research.

Participation in international agreements and the adoption of a national plan for the environment, the Green Plan, have, however, led to a strengthening of research programs in the areas of contaminants, natural resources and wildlife. Arctic climate research is an area of arctic research that is developing significant interest both nationally and internationally and is expected to generate Canadian programs in future years.

One of the disappointments to Canadian Arctic scientists has been the failure to secure funding for the Northwater project. An exploratory program in the Spring of 1991, using a ship of opportunity, yielded some highly interesting results that are reported elsewhere in this report. However, plans for a similar exercise in 1992 have been canceled due to lack of funds.

Canadian scientists are participating in the planning of several cooperative projects such as the Nansen Arctic Drilling (NAD) program, the International Transarctic Section and the Arctic Climate System Study (ACSYS).

In the Department of Fisheries and Oceans, which has the largest federal ocean research program, only about \$10 million was spent on Arctic science last year. Of this total, approximately one-third was devoted to physical oceanography. The absence of ship cruises in the Arctic during the year contributed to the relatively small research budget. Although the budget is likely to increase this year, the rise will be in the areas of contaminants and natural resources.

DENMARK

Danish groups continue their work with the Greenland Sea Project (GSP). A cruise in this area was carried out in cooperation with Icelandic scientists on board the research vessel *Bjarni Sæmundsson*. A great deal of the work has been concentrated on two periods selected for in-depth studies: 25 September to 6 October, and 1 to 15 March. The Oceanographic Department of the Royal Danish Administration of Navigation and Hydrography participated in this cruise. Tethered buoys deployed the previous year in the area between Greenland and Jan Mayen were recovered. Also, CTD measurements were carried out at the stations previously defined in this area and in the Denmark Strait. Material collected during previous cruises have been quality controlled and employed to describe the water mass distribution and its variation through the years of GSP and to describe the horizontal and vertical distribution of the geostrophic current component. Marked variation in the oceanographic conditions have been observed and in particular the Arctic Intermediary Water exhibited large changes. The buoy data collected during the 1988-1991 period are being analyzed and a comparison between measured

and calculated current component have been initiated to determine the barotropic current field in the area.

The Remote Sensing Unit has implemented essential parts of an analysis system for integration of remote sensing data with other data including ground information and data from drifting buoys and meteorological and oceanographic data. The utilization of the system was demonstrated through analysis of data for the two periods of the case studies planned. In addition, the period December 1988 - January 1989 has been studied based on AVHRR and SMM/I data, the later data being studied for the whole winter period 1988/89. This work is part of a cooperative effort with the Jet Propulsion Laboratory, U.S.A. and the Pacific Marine Environmental Laboratory, U.S.A. with a view to study the formation of sea ice and thereby the formation of the Atlantic Deep Water. The Remote Sensing Unit has also been active in the Program for International Polar Ocean Research (PIPOR).

The Danish Hydraulic Institute continued the development of a three-dimensional oceanographic model, including coupling of sub-programs, to obtain a better description of the model and to reduce sources of error. In addition, the Meteorological Department of the Geophysical Institute, Copenhagen University, continues previous work related to the formation of Polar Lows by developing and testing models and by including new satellite data so far only obtainable in the U.S.

The Research Department of the Danish Meteorological Institute concluded the development, implementation and testing of an operational GR-HIRLAM (Greenland High-Resolution Limited Area Model) with a 15-meter spatial resolution working as a fine-mesh model embedded in a larger-scale HIRLAM. The operational PC-based analysis system at the Greenland Ice Branch of the same institute has been used in connection with case studies exploiting AVHRR data. In addition, the analysis of water samples acquired during various cruises in the Greenland Sea continues at Risø National Laboratory. Plans are also being finalized to continue, in 1992, the walrus investigations carried out in 1989 and 1990, with later studies of female walruses and migration patterns to be carried out in connection with the 1993 *R/V Polarstern* cruise.

FINLAND

In the years 1989-1990, the Finnish Institute of Marine Research organized two expeditions to study the hydrography and overflow of the Denmark Strait region. Participants included Swedish, Icelandic and, in the 1990 expedition, also British scientists. A preliminary report on results was presented in EGS 1991. The institute will organize similar expeditions as part of the Nordic WOCE program, scheduled for 1993 and 1997. Sea ice studies of the Arctic ocean were carried out on the Swedish *Oden* expedition to the North Pole in 1991. As a part of the environmental studies on exploitation of natural resources in the Arctic, Finnish scientists have participated in sea-ice studies in the Barents Sea with Russian authorities. Participation in other environmental studies are scheduled for the summer of 1992.

FEDERAL REPUBLIC OF GERMANY

For the Northeast Water subproject of the IAPP a workshop was held in Bremerhaven from February 11 to 13, 1991. A research plan was discussed which was published in summer 1991. In early June, biological and hydrographic spring conditions on the East Greenland shelf were studied during ARK-VIII/1 expedition of *R/V Polarstern*.

Dr. Erik Buch replaced Dr. E. Fahrbach as secretary of the GSP Steering Group. A GSP Workshop was held in Copenhagen, December 4-6, 1991, to discuss scientific results, GSP planning for 1993 and possible future funding by the EC (MAST II). *R/V Polarstern* will participate (February to April) in an intensive field program, planned as a GSP winter study for 1993, in Hamburg--conveners: J. Meincke and H.J. Hirche. Sponsorship is expected from AOSB, IASC and ICES.

R/V Polarstern participated in a major international expedition to the Central Arctic Ocean from August to mid-October 1991. A truly cooperative and extremely successful multidisciplinary scientific program was carried out jointly together with the Swedish icebreaker *Oden* and the US *Polar Star*.

JAPAN

Arctic ocean research in Japan has been carried out at universities and other scientific institutions mainly in the form of international cooperative studies. Biological processes in Arctic polynya areas were studied in the Northern Bering and Chukchi Seas on the *T/S Oshoro-Maru*, July-August 1991. Distributions of phytoplankton, zooplankton and ichthyoplankton were examined in relation to the physical and chemical ocean structure, especially in the area of the Saint Lawrence Island Polynya.

The biological CO₂ pump under the first-year ice has been investigated as a program of the Japan-Canada Complementary Study (1991-1993). The field experiments were carried out in Saroma Lagoon, Hokkaido, during February-March 1992, and will be carried out in Resolute Bay in the Canadian Arctic, during April-May 1992.

Preliminary oceanographic research was conducted at Kongsfjord, Spitzbergen, July-September 1991 as a cooperative study between the Norwegian Polar Institute and the National Institute of Polar Research, Japan. The influx of glacier-melt water into the fjord was estimated from summer temperature, and salinity profiles observed from a combination of a moored buoy and CTD casts.

Three researchers participated the international Arctic Ocean Expedition on board the U.S. *Polar Star*, during August-September 1991.

THE NETHERLANDS

National coordination on Arctic research in the Netherlands has been initiated. In cooperation with Russia, ornithological research on marine birds is being carried out in the White Sea and the Barents Sea. In cooperation with Poland, research on the macro-benthos of the White Sea and near Spitsbergen has been started. Researchers from the Netherlands will participate in the AOSB coordinated IAPP (NEW) as well as the ESF coordinated EPOS II program. A marine geological survey of the Sundstrom Fjord (Greenland) will take place in the summer of 1992. Physical oceanographic data, obtained during cruises in the Greenland Sea during the GSP intensive phase as well as in following years are interpreted in cooperation with scientists from Institut für Meereskunde, Hamburg and Alfred-Wegener-Institut, Bremerhaven. A project on numerical modelling of the deep convection in the Greenland Sea has been started. An ongoing project on the experimental bio-geography of seaweed in the Arctic seas will be extended to the phytoplankton. In cooperation with Russia, research is carried out on the sedimentation of suspended matter in Arctic estuarine environments. In 1991 Dutch scientists participated in a program, carried out in the Lena estuary.

POLAND

The research focus of the Arctic Ecology Group of the Institute of Oceanology, Polish Academy of Sciences is basic and applied ecology of the Arctic--in particular, studies of Arctic marine and coastal ecosystem functioning, ecological mapping of coastal areas, and Arctic marine food webs. Recently there has been work on Franz Josef Land and on the Norwegian, Barents and Greenland Seas with participation in Norwegian, Russian and German projects. Activities planned for 1992 include participation in the Norwegian "Lance" cruise to Storfjorden, Svalbard with macrozooplankton sampling; a cruise to the Barents Sea Archipelagos; and the Severnaia Zemlia Expedition with the Russian Academical Zoological Institute.

The Fresh Water Cap Program is a primary focus of the Group. Its aim is to investigate the influence of the freshwater layer on the Arctic ecosystem and the climate of the European Arctic Seas. Studies will be conducted to determine the causes of the melting of Arctic ice and the increase of freshwater volume in the sea. The possible role of the Greenhouse effect will be examined and the influence this warming would have on the biological and hydro-physical characteristics of the sea. The increase of freshwater volume will be studied on a year to year time scale and the climatic consequence of this increase will also be examined. The program will investigate how the freshwater, oligotrophic layer influences the feeding surface of seabirds. It will also examine the efficiency of the freshwater cap in its role as a thermal insulator between warm atlantic waters and cold air. The inhibitory role the layer plays in regards to plankton mortality and migration will be studied, as will the influence of the layer on primary production in coastal waters. Research will be conducted in three zones--the glacier, the ice pack, and the river mouth.

SWEDEN

To be added

UNITED KINGDOM

There has been a surge of interest in Arctic oceanography in the UK with the possibility of the new ice-strengthened ship *RRS James Clark Ross* operating in the Greenland Sea area in late Spring 1993 in support of the "Scoresby" Project--a multi-disciplinary cruise planned to coincide with the Greenland Sea Project's Second Intensive Field Program in 1993. A remote sensing study of ice fluctuations within the Odden ice tongue is also under way to test a theory for ice-driven haline convective plumes. Planned experiments, viewed as a component of the Winter Greenland Sea Project, comprise winter work in 1993 between the German *R/V Polarstern* and the British *RNAS Newton*, and spring work between *RNAS Newton* and *RRS James Clark Ross*.

During the past year, the Scott Polar Research Institute (SPRI) has carried out work associated with the ESF Polar North Atlantic Margins Program (PONAM), and with the ESF Study of the European Arctic Shelf (SEAS) project.

SPRI has been engaged in the analysis and interpretation of data obtained from under-ice submarine sonar transects of the Arctic Ocean and Greenland Sea. They have also completed work on a joint study of the pilot stages of the International Northern Sea Route Project which used statistics of ice cover and sea route operation to determine the feasibility of extending the navigation season and opening it to western shipping.

The NERC Sea Mammal Research Unit (SMRU) continued its work to determine the range of habitat of Beluga whales and the narwhal. SMRU has been involved in collaborative work in Canada and Norway on the movements and behavior of the hooded seal.

THE UNITED STATES

To be added

APPENDIX III

Acronyms

ACSYS	Arctic Climate System Study
AVHRR	Advanced Very High Resolution Radiometer
ECOPS	European Committee on Ocean and Polar Sciences
ERS-1	Earth Resources Satellite
ESA	European Space Agency
ESF	European Science Foundation
GCOS	Global Climate Observing System
GEWEX	Global Energy and Water Cycle Experiment
GOOS	Global Ocean Observing System
GSP	Greenland Sea Project
IAPP	International Arctic Polynya Program
IASC	International Arctic Science Committee
ICES	International Council for the Exploration of the Seas
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Exchange
ISY	International Space Year
JERS-1	Japanese Earth Resources Satellite
JSC	Joint Scientific Committee
LEADEX	Leads Experiment
MIZ	Marginal Ice Zone
NAD	Nansen Arctic Drilling program
NCAP	Nansen Centennial Arctic Program
NERC	Natural Environment Research Council
NEW	Northeast Water
NIPR	National Institute of Polar Research, Japan
NOAA	National Oceanic and Atmospheric Administration, U.S.A.
NOW	North Water
NSF	National Science Foundation, U.S.A.
ODP	Ocean Drilling Program
PICES	Pacific (northern) International Council for the Exploration of the Seas
PIPOR	Program for International Polar Ocean Research
PONAM	Polar North Atlantic Margins Program
SAR	Synthetic Aperture Radar
SASIFY	
SCG	Scientific Coordinating Committee
SCOR	Scientific Committee on Oceanic Research
SEAS	European Arctic Shelf project
SLIP	Saint Lawrence Island Polynya
SMRU	Sea Mammal Research Unit
SPRI	Scott Polar Research Institute
WCRP	World Climate Research Program
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment

APPENDIX IV

Arctic Ocean Sciences Board (AOSB) Eleventh Session (AOSB-XI)

6-10 April 1992
St. John's, Newfoundland, Canada

AGENDA

Monday, April 6

9:30am - 12 noon
and
2:00pm - 5:30pm Meeting of the Scientific Coordinating Group for the
International Arctic Polynya Program

6:30pm - 8:30pm Reception hosted by C-CORE

Tuesday, April 7

9:30am - 10:00am Opening of the Eleventh Session of the Board
Welcome by the Chairman, AOSB
Welcome by the Department of Fisheries and Oceans and Centre for Cold
Ocean Resources Engineering (C-CORE)

10:00am - 10:10am Adoption of Agenda and Timetable

10:10am - 10:30am Presentation on C-CORE Programs

10:30am - 12:30pm The International Arctic Polynya Program (IAPP)
Report from the Chairman of the Scientific Coordinating Group (SCG)
Reports on Specific Polynya Research Projects
North Water (NOW)
St. Lawrence Island Polynya (SLIP)
Northeast Water (NEW)

12:30pm - 2:00pm Lunch at C-CORE
Demonstration of C-CORE Technologies

2:00pm - 5:30pm The Greenland Sea Project (GSP)
Progress Report on the Analysis of Data and Preparation of Results of the
Field Work Completed
Planning for the Second Scientific Symposium
Planning for the Second Intensive Field Program Scheduled for 1993

7:15pm - 10:00pm	Reception and Buffet at the Crow's Nest Officer's Club
<i>Wednesday, April 8</i>	
9:00am - 10:00am	Remote Sensing Activities Related to Arctic Ocean Research Data Exchange and Dissemination
10:00am - 11:30am	Marine Geological and Geophysical Research in the Arctic Ocean Nansen Arctic Drilling Program (NAD) Nansen Centennial Arctic Program (NCAP)
11:30am - 12 noon	WCRP Research Project in the Arctic International Arctic Buoy Program (IABP) Related Projects Proposed Arctic Climate Systems Study (ACSYS)
12 noon - 12:30pm	Development of a Database for Research Vessel Operations in the Arctic
12:30pm - 2:00pm	Lunch, hosted by Dr. Arthur W. May, President of Memorial University of Newfoundland
2:00pm - 3:00pm	European Committee on Ocean and Polar Sciences--EC/ESF (ECOPS)
3:00pm - 3:45pm	Other Scientific Programs and Activities Related to Arctic Ocean Research Scientific Committee on Oceanic Research (SCOR) International Council for the Exploration of the Sea (ICES)
3:45pm - 4:15	Election of Officers Arrangements for Next Meeting
4:15pm - 5:30pm	Presentations on National Arctic Ocean Research Programs
Evening	Open
<i>Thursday, April 9</i>	
9:30am - 10:30am	National Presentations (continued)
10:30am - 11:30am	Report on Activities of the International Arctic Science Committee
11:30am - 12:30pm	Long-Term Strategy for the AOSB
12:30pm - 1:30pm	Lunch will be hosted by Institute of Marine Dynamics, National Research Council
Afternoon	Tours of Marine Related Facilities

Institute for Marine Dynamics
Ocean Sciences Centre
Northwest Atlantic Fisheries Centre

Friday, April 10

9:30am - 11:00am

Adoption of Report

11:00am

Closing of the Meeting